

# **Comprehensive Performance Test Plan**

**RED Rochester LLC  
Rochester, New York**

**Multiple Hearth Incinerator System  
At Eastman Business Park**

**April 4, 2023 revision 2**

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Date 8/30/2022

*Roy Wood*

I certify under penalty of law that I have personally examined, and am familiar with, the statements and information submitted in this document and all its attachments as they pertain to the practice of engineering. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

Bernard Nee, Chief Technical Officer, RED Rochester LLC  
Date

I certify under penalty of law that this document and all attachments were prepared under my direction and evaluate the information submitted. Based on my inquiry of the person or persons directly responsible for gathering the information required to complete this application, I believe the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

Certifications

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## I - Introduction

RED Rochester, LLC (RED) operates a multiple hearth incinerator (MHI) at its Eastman Business Park facility in Rochester, New York (EPA ID No. NYD980592497). The MHI operates in accordance with the terms and conditions of the Part 373 Permit for Eastman Business Park (DEC Permit # 8-2614-00205/00104) and RED's Title V air permit (DEC Permit # 8-2699-00126/00001) under emissions unit U00008. The MHI is subject to requirements of the hazardous waste combustor (HWC) maximum achievable control technology (MACT) rule, 40 CFR Part 63, Subpart EEE.

In 2008, 2013, and 2018, CPTs were completed, and the results submitted to the agency. Operating limits established from these tests were used to update RED's Title V and RCRA permits as appropriate. The current operating permit limits are based on the latest CPT conducted in 2018. Based on the past test results, a Multipathway Human Health Risk Assessment was completed and approved by the Agency.

As described in CFR Part 63, Subpart EEE the next scheduled CPT test must commence no later than 61 months after the date of commencing the previous comprehensive performance test (63.1207(d)(1)). The 2018 CPT commenced on July 17, 2018. Therefore, the next CPT must commence by August 17, 2023. Accordingly, per 63.1207(e)(1)(i), at least one year before the performance test is scheduled to begin, this test plan must be submitted to the agency. This CPT plan is being submitted so the CPT can occur any time between one year from this submission and August 17, 2023.

A CPT will be performed to demonstrate the ability of the Multiple Hearth Incineration System (MHIS) to meet the performance standards stated in 40CFRPart 63 Subpart EEE and to update permit conditions required to operate. This CPT plan proposes to conduct testing under worst case equipment operating conditions feeding the sludge available on the test day, spiking chlorine and extrapolating metals and ash to their maximum historical concentrations. This test data will be used to demonstrate compliance with all standards in 63.1219, the final standards for hazardous waste incinerators, which are listed below.

### ***§ 63.1219 What are the replacement standards for hazardous waste incinerators?***

**(a) Emission limits for existing sources.** You must not discharge or cause combustion gases to be emitted into the atmosphere that contain:

**(1) For dioxins and furans:**

**(i) For incinerators equipped with either a waste heat boiler or dry air pollution control system, either:**

**(A) Emissions in excess of 0.20 ng TEQ/dscm, corrected to 7 percent oxygen; or**

**(B) Emissions in excess of 0.40 ng TEQ/dscm, corrected to 7 percent oxygen, provided that the combustion gas temperature at the inlet to the initial particulate matter control device is 400 °F or lower based on the average of the test run average temperatures. (For purposes of compliance, operation of a wet particulate matter control device is presumed to meet the 400 °F or lower requirement);**

**(ii)** Emissions in excess of 0.40 ng TEQ/dscm, corrected to 7 percent oxygen, for incinerators not equipped with either a waste heat boiler or dry air pollution control system;

**(iii)** A source equipped with a wet air pollution control system followed by a dry air pollution control system is not considered to be a dry air pollution control system, and a source equipped with a dry air pollution control system followed by a wet air pollution control system is considered to be a dry air pollution control system for purposes of this standard;

**(2)** Mercury in excess of 130 µgm/dscm, corrected to 7 percent oxygen;

**(3)** Cadmium and lead in excess of 230 µgm/dscm, combined emissions, corrected to 7 percent oxygen;

**(4)** Arsenic, beryllium, and chromium in excess of 92 µgm/dscm, combined emissions, corrected to 7 percent oxygen;

**(5)** For carbon monoxide and hydrocarbons, either:

**(i)** Carbon monoxide in excess of 100 parts per million by volume, over an hourly rolling average (monitored continuously with a continuous emissions monitoring system), dry basis and corrected to 7 percent oxygen. If you elect to comply with this carbon monoxide standard rather than the hydrocarbon standard under paragraph (a)(5)(ii) of this section, you must also document that, during the destruction and removal efficiency (DRE) test runs or their equivalent as provided by § 63.1206(b)(7), hydrocarbons do not exceed 10 parts per million by volume during those runs, over an hourly rolling average (monitored continuously with a continuous emissions monitoring system), dry basis, corrected to 7 percent oxygen, and reported as propane; or

**(ii)** Hydrocarbons in excess of 10 parts per million by volume, over an hourly rolling average (monitored continuously with a continuous emissions monitoring system), dry basis, corrected to 7 percent oxygen, and reported as propane;

**(6)** Hydrogen chloride and chlorine gas (total chlorine) in excess of 32 parts per million by volume, combined emissions, expressed as a chloride (Cl<sup>-</sup>) equivalent, dry basis and corrected to 7 percent oxygen; and

**(7)** Except as provided by paragraph (e) of this section, particulate matter in excess of 0.013 gr/dscf corrected to 7 percent oxygen.

The one-time Destruction/Removal Efficiency compliance requirement per 63.1206(b)(7)(i) was documented by the 2001 RCRA Trial Burn that was submitted as data in lieu of the initial CPT, and was approved by the Agency. Therefore, there is no DRE testing required for any subsequent CPTs and no DRE testing or POHC selection included in this CPT plan, since this is a one-time and already completed requirement.

The CPT will consist of:

- Sampling the waste feeds and analyzing for metals ((Hg, Cd, Pb, As, Be, Cr), chlorine, and ash,
- Spiking chlorine,
- Monitoring the MHI operating conditions with installed instrumentation, and
- Sampling and analyzing the gas stream for PM, HCl, Cl<sub>2</sub>, dioxin/furans, CO, metals (Hg, Cd, Pb, As, Be, Cr) and THC

All data necessary to demonstrate compliance with the emissions standards and update the feedrate and operating parameter limits will be collected. Stack gases will be analyzed for. Three test runs will be conducted for each parameter.

Testing and operating conditions during this CPT will be similar to the operating conditions during the 2018 CPT, except for the differences listed below.

- No high temperature test will be run during this CPT because it is not required by CFR Part 63, Subpart EEE. However, the maximum hearth and secondary temperature limits from the previous CPT run in 2018 (current NOC) will be maintained as an operating permit limit in the NOC. This approach was reviewed with DEC Region 8 during the spring of 2022.
- No metals will be spiked. Metals limits will be determined by extrapolation from the CPT waste feed concentrations up to the historical maximum if allowed by the CPT emissions levels as described in CPT plan section 63.1207(f)(1)(x) Metals Extrapolation. This approach was reviewed with DEC Region 8 during the spring of 2022.
- Sludge feedrates will be reduced slightly from 9,000 lb/hr to a target of 8,500 lb/hr to match current load requirements.
- The WESP specific power will be run at a slightly higher specific power level than previous tests, up from 210 KVA/ACFM to a target of 270 KVA/ACFM to be closer to the lowest specific power levels found in recent years during MHI operation. The WESP power level is reduced during the CPT to ensure that fluctuations in power during normal operations do not cause the specific power to drop below the level tested during the CPT. History shows that power during normal operations is much higher than it was during previous CPTs. A specific power level of 270 KVA/ACFM will bring the specific power levels closer, but not too close, to the range of specific power levels that occur during normal operation.

**Table IA** provides emissions levels during the 2001 RCRA Trial Burn data in lieu 2003 CPT testing, and the 2008, 2013, and 2018 CPTs. As seen from this table, all values are below the final HWC MACT standard demonstrating compliance with a significant margin of safety.

**Table IA - Comparison of Standards to MHI Test Results**  
**(All standards except DRE are corrected to 7% O<sub>2</sub>)**

Pollutant	Units	Final Standard (63.1219)	MHI 2001 Trial Burn- Data in Lieu of 2003 CPT	2008 MHI CPT Results	2013 MHI CPT Results	2018 MHI CPT Results
PM	gr/dscf	0.013	0.0033	0.0029	0.0027	0.00032
SVM	ug/dscm	230	220	219	222	5.8
LVM	ug/dscm	92	12	< 20	<26	2.3
Hg	ug/dscm	130	79	< 27	61	74
HCl+Cl <sub>2</sub>	ppmv	32	0.14	< 0.56	<0.61	0.12
D/Fs	ng/DSCM TEQ	0.4 (wet)	0.0034	0.0062	.0035	0.0062
CO	ppmv	100	5	1.5	0.60	<1
THC	ppmv	10	1.4	1.7	<1	0.88
DRE	%	99.99	>99.999	N/A	N/A	N/A

\*N/A – not applicable

The following two sections present information related to the rationale used to develop the Comprehensive Performance Test Plan. They provide an understanding of waste analysis and waste feed to the MHI, the CPT Plan operating conditions, and the engineering design of the MHIS including the Air Pollution Control Equipment (APCE).

Section II of the plan is organized in parallel with the required content of the CPT plan as outlined in 63.1207(f)(1). The general requirements contained in 63.7(c)(2) are addressed as part of 63.1207(f)(1)(iv) Sampling and Monitoring in Section II. Section III describes how each permit limit should be set based on the data collected during the CPT and other information. This third section is key to ensuring that RED and the Agency have a common understanding of the method of converting the test data into permit conditions.

## **II. Required Content of the Plan (63.1207 (f)(1))**

### **63.1207(f)(1)(i & ii) MHI Analysis of Each Feedstream**

**Requirement:** 63.1207(f)(1)(i) An analysis of each feedstream, including hazardous waste, other fuels, and industrial furnace feedstocks, as fired, that includes:

(A) Heating value, levels of ash (for hazardous waste incinerators only), levels of semivolatile metals, low volatile metals, mercury, and total chlorine (organic and inorganic); and

(B) Viscosity or description of the physical form of the feedstream;

(ii) For organic hazardous air pollutants established by 42 U.S.C. 7412(b)(1), excluding caprolactam (CAS number 105602) as provided by §63.60:

(A) Except as provided by paragraph (f)(1)(ii)(D) of this section, an identification of such organic hazardous air pollutants that are present in each hazardous waste feedstream. You need not analyze for organic hazardous air pollutants that would reasonably not be expected to be found in the feedstream. You must identify any constituents you exclude from analysis and explain the basis for excluding them. You must conduct the feedstream analysis according to §63.1208(b)(8);

(B) An approximate quantification of such identified organic hazardous air pollutants in the hazardous waste feedstreams, within the precision produced by analytical procedures of §63.1208(b)(8); and

(C) A description of blending procedures, if applicable, prior to firing the hazardous waste feedstream, including a detailed analysis of the materials prior to blending, and blending ratios.

(D) The Administrator may approve on a case-by-case basis a hazardous waste feedstream analysis for organic hazardous air pollutants in lieu of the analysis required under paragraph (f)(1)(ii)(A) of this section if the reduced analysis is sufficient to ensure that the POHCs used to demonstrate compliance with the applicable DRE standards of this subpart continue to be representative of the most difficult to destroy organic compounds in your hazardous waste feedstreams;

The MHIS is designed to treat solid waste generated from the on-site wastewater treatment plant (King's Landing). Solid waste fed to the MHIS consists of a combination of dewatered wastewater treatment sludge and dewatered wastewater grit. Dewatered sludge is the primary component. The dewatered sludge is a mix of sludge from the primary clarification process (settling) and the secondary treatment process (settling basins follow aeration basins) that are dewatered together. The dewatered sludge filter cake is 75-85% water although it has the appearance and handling

characteristics of a solid and not that of a liquid or wet sludge. Dewatered grit is composed of plastic chips, and other solid debris separated from the incoming wastewater.

The grit is added to the feed conveyor when it is available in combination with the sludge. The grit is a small fraction of the total feed and is never fed without the sludge. Sludge and grit are fed to the conveyor simultaneously and all sampling results are based on samples of the combined as-fed waste stream taken from the conveyor.

The wastewater treatment and dewatering processes result in dewatered sludge that tends to be homogenous. There are no special blending processes utilized.

The following data is summarized from recent years using analytical results from the approved waste analysis plan.

**Table 1** - MHIS Inorganic Feed Analysis Results Summary, provides recent historical analytical data for the inorganic feed constituents obtained consistent with the current Feedstream Analysis Plan. Data for the most recent five years, 2017 - 2021 is provided for the CPT metals, chlorine, heating value, and moisture. Since a significant reduction in ash occurred when the power boilers were switched from primarily coal-fired to primarily natural gas-fired, only the more representative 2019-2021 data is included for the ash. The feed going to the MHIS is sampled once per month if the MHI is operating that month. Samples are taken over a 12-hr period consistent with the MHI's Waste Analysis Plan. Averages, standard deviations, maximum, and minimum values for each compound are included in the table.

RED conducts an annual analysis for 66 organic compounds that could be present in the MHI sludge per the RCRA Waste Analysis Plan. 25 of these compounds are Hazardous Air Pollutants (HAPs). Eight of these 25 compounds were detected in at least one of the five samples analyzed between 2017 and 2021. **Table 2a** - Organic HAPs Detected, provides the maximum value detected in any of these five samples for each of these eight compounds. Six of the eight values were below the Practical Quantitation Limit (PQL) as noted on the table. Organic HAPs that were undetected in all five of these samples taken from 2017 – 2021 are listed in Table 2b – Undetected Organic HAPs. The Method Detection Limit (MDL) varied with samples for a specific compound, but the minimum MDL for any sample for each compound is also shown in Table 2b. The heat content of the eight sludge samples analyzed for heat content were all less than the Method Reporting Limit, which varied with the samples, but was 500 BTU/lb or greater.

## **63.1207(f)(1)(iii) Engineering Description**

**Requirements:** 63.1207(f)(1) (iii) A detailed engineering description of the hazardous waste combustor, including:

- (A) Manufacturer's name and model number of the hazardous waste combustor;
- (B) Type of hazardous waste combustor;
- (C) Maximum designs capacity in appropriate units;
- (D) Description of the feed system for each feedstream;
- (E) Capacity of each feed system;
- (F) Description of automatic hazardous waste feed cutoff system(s);
- (G) Description of the design, operation, and maintenance practices for any air pollution control system; and
- (H) Description of the design, operation, and maintenance practices of any stack gas monitoring and pollution control monitoring systems;

This section presents a detailed engineering description of the Multiple Hearth Incinerator System. The MHIS consists of the multiple hearth incinerator, the secondary combustion chamber, the air pollution control equipment, an induced draft (ID) fan, a discharge stack, and a stack plume suppression system. Also included in this section is a description of the liquid spiking system to be used during the test program.

A flow diagram of the entire MHIS is presented by **Drawing E095XX-310-025**, which includes flue gas and water flows. A detailed Process and Instrumentation (P&I) diagram is shown in **Drawing E095XX-770-003**.

### **Multiple Hearth Incinerator (MHI)**

The MHI, Serial No. 74445, was manufactured by Envirotech System, Inc. The MHI as shown in **Figure 1**, Building 95 Multiple Hearth Incinerator, is an eight-hearth (0 to 7) unit. The unit was designed to treat up to 20,000 lb/hr of sludge. The sludge is fed to the #1 hearth by a screw conveyer system. Drying of the feed occurs on hearths # 1 and # 2. Burning or combustion of the feed takes place on hearth levels # 3, # 4, and # 5. Remaining ash cools down on levels # 6 and # 7 and is discharged at the bottom of the unit.

Waste feed proceeds from one hearth level down to the next and the feed is distributed across each hearth with a rotating rabble arm. Depending on which hearth level the rabble arm is located, the blades are pitched inward or outward to promote gradual waste feed movement to the center or outside wall of the MHI. The rabble arm also breaks up the waste feed allowing uniform heat distribution through the waste feed layer. The residence time for the waste feed inside the hearth, before it is "ashed" out in the bottom, is approximately one to two hours (10-20 minutes in each hearth) depending on the rabble arm speed.

Natural gas is used as needed as auxiliary fuel to support the combustion temperatures inside the hearth. Non-contact cooling air is introduced at the bottom of the unit and flows through the center of the rotating hollow shaft and may either be discharged fully to atmosphere or partially returned to

the # 6 hearth to provide air below the burning zone. Combustion/flue gases exit from the top of the zero hearth and are sent to the SCC for further destruction of organics and hydrocarbons.

**Table 3**, Multiple Hearth Incinerator Details, provides the construction details of the MHI. The specifications of the burners are listed in **Table 4**, MHI Burners' Specifications.

### **Secondary Combustion Chamber (SCC)**

Organics present in the flue gases exiting from the MHI are destroyed in the SCC. The SCC operates at temperatures and residence times sufficient to meet regulatory requirements for DRE of organic compounds in the waste feed. Previously established operating permit limits will be demonstrated during the CPT. No wastes are fed directly to the SCC.

The SCC specifications are listed in **Table 5**, SCC Specifications. Burner specifications are given in **Table 6**, SCC Burner and Blower Specifications. **Drawings 095XX-312-017-Sheet 11** (SCC general arrangement) and **E095XX-310-025** (process flow diagram) include the dimensions used in calculating residence time.

### **Waste Feeds to MHI**

Sludge from the primary and secondary wastewater treatment plant is pumped from one of the four holding tanks (three (3) 50,000 gallon and one (1) 100,000 gallon) for dewatering. The dewatered sludge drops into the bunker conveyor that moves the sludge to the horizontal portion of the elevating conveyor. Grit, from the grit chamber can be added to the sludge on the sludge conveyor. The elevating bunker conveyor lifts the sludge and grit onto a conveyor system and across the belt weigh scale system. It drops from the conveyor into a screw auger, which feeds the sludge into the # 1 hearth.

### **Combustion Air and Fuel to MHI**

Up to 15,000 scfm of combustion air is provided to the MHI by a 100 horsepower (hp) fan. Additional combustion air is provided by a second blower with a rating of 2,500 scfm at 7 inches of static pressure and 5 hp.

Commercially available natural gas is fed to the MHI at the rate of up to 12,400 cfh at 3.5 psig. MHI burner specifications are given in **Table 4**, MHI Burners' Specifications. A maximum heat load of 32 MMBTU/HR is available at the MHI. The MHI burners can also be retrofitted to use # 2 fuel oil in the event of a protracted emergency during which natural gas is not available. In the event of an automatic waste feed cutoff, natural gas will continue to be used to maintain the combustion

temperature inside the hearth and the secondary combustion chamber (SCC) above the permit limit for at least two hours to ensure that the sludge remaining in the hearth is burned out.

**Drawing 095XX-770-003** shows combustion air and natural gas flows to the MHI. The drawing also provides details of the MHI instrumentation.

### Auxiliary Fuel and Air to SCC

The SCC burner combustion air is provided from a blower. The SCC burner and blower specifications are listed in **Table 6**, SCC Burner and Blower Specifications. Natural gas is fed to the SCC through a burner rated at 22 MM Btu/hr. The available maximum heating load to the MHI and SCC combined is 54 MMBTU/HR.

### Auxiliary Waste Feed to SCC

No wastes are fed to the SCC. The feeds to the SCC consist of the exhaust gases from the MHI, natural gas and auxiliary combustion air provided by a blower as referenced in **Table 6**, SCC Burner and Blower Specifications.

### Feed Locations

**Table 7** identifies the locations where the various fuel (natural gas) and waste feeds (sludge and grit) are introduced to the system. Generally, combustion is largely maintained by the heat content of the waste feed. Auxiliary natural gas is fed to the MHI as needed to maintain the desired temperature. In the SCC, natural gas is used to elevate the temperature of the MHI flue gases in order to complete the destruction of organics.

### Automatic Waste Feed Cutoff System

The Distributed Control System (DCS) includes an automatic waste feed cutoff (AWFCO) system that stops the hazardous waste feed when the control system records an operating condition outside the limits necessary to comply with permit conditions. The parameter Continuous Monitoring Systems (CMS) and the Continuous Emissions Monitoring Systems (CEMS) described in this plan are integrated with the AWFCO system. Each AWFCO parameter has an alarm and alarm message associated with it that audibly sounds and logs in the control room when the interlock set point for a parameter is approached. The DCS compares the instantaneous and/or calculated rolling average values, depending on the parameter averaging time requirements, to the corresponding parameter interlock set point. Upon reaching an interlock set point, the DCS activates a shutoff command to stop the hazardous waste feed. In addition, an AWFCO will be initiated if the DCS detects BAD data quality for more than 30 seconds of any calculated hourly or longer rolling average. Bad data quality occurs when the lower or upper range limits of any CMS instrument are exceeded or when other data

processing failures occur. Additional AWFCO trips occur if any CMS instrument measurement DCS software is turned off or sends an invalid data input.

**Table 8** contains the MHIS Notification of Compliance (NOC). The column *NOC Limit with AWFCO* shows which parameters currently initiate AWFCOs. The same parameters are expected to require AWFCOs after the new NOC is submitted based on this CPT, although the new limits and AWFCOs will be based on the CPT parameter values demonstrated during this CPT as discussed in Section III, Permit Limits.

### Air Pollution Control Equipment (APCE)

Flue gases leaving the SCC enter the APCE where particulates, metals and acid gases are removed in staged equipment consisting of: a quench chamber, a packed bed condenser/scrubber, an entrainment separator, a variable throat venturi, and a WESP. Design specifications and limits for these devices are contained in **Table 9**, APCE Specifications. The various emission control processes of the APCE are described in the following sections.

The hot flue gases from the SCC are first quenched to adiabatic saturation temperature in the quench chamber. Quench water is once-through secondary treatment effluent from the wastewater treatment plant. The quench water is continuously discharged from the quench bottoms sump and returned to the wastewater treatment plant to prevent build-up of suspended and dissolved solids.

The condenser, also using once through secondary treatment effluent water, is a countercurrent flow packed scrubber equipped with a structured packing that resists build up and plugging. As gases pass through the packed section, they will be sub-cooled and water vapor condensed. In the condensation process, fine particles are formed which further act as nuclei to promote the growth of larger particles which are more easily collected downstream by the venturi scrubber. The cooled gases exit the condenser through a mist eliminator and enter the venturi scrubber. Process and instrumentation details for the quench and condenser are shown in **Drawing 095XX-770-005**.

The venturi is an inertial impaction device where the gases containing particles are accelerated into the high velocity 'throat' area. At the throat, water injected from above is sheared into millions of droplets, which collide and encapsulate the gas particles. Particle collection efficiency is directly related or proportional to the pressure drop across the throat and it is inversely proportional to the size of the particle contained in the gas stream. As the gas flow varies through the scrubber, a damper in the throat can be manually or automatically modulated to maintain a constant pressure drop. The venturi differential is calculated by the DCS once every second by subtracting the inlet pressure (PT 1097) from the outlet pressure (PT 1091). The scrubber water is supplied by the wastewater secondary treated effluent (STE), which makes up a recycle stream feeding the venturi and the entrainment separator.

The gases and droplets containing particles exit the venturi and enter into the entrainment separator where water droplets are separated from the gas stream. More secondary treatment effluent water is used to clean the separator. Liquid that drains into the sump below is recycled back to the venturi. The pH of the recycled liquid is monitored and remaining acid gases are neutralized. Suspended and

dissolved solids build-up is controlled by a continuous blow down loop. Process and instrumentation details for the venturi and entrainment separator are shown in **Drawing 095XX-770-006**.

**Drawings 095XX-312-018-Sheets 3 and 4** respectively, show the plan and elevation arrangements for the quench, condenser, venturi, and entrainment separator.

Gases from the entrainment separator pass through a wet electrostatic precipitator (WESP). The WESP is a final 'polishing' device that removes submicron particulate matter not captured by the venturi. Particulate laden gas flows into the region between discharge and collecting electrodes where they are charged by a high intensity corona. The charged particles are driven electrostatically to the grounded collecting electrodes. Electrodes are periodically flushed with water to remove collected matter. All APCE drains and overflows discharge into an existing sump from which they are pumped back into the wastewater treatment plant for treatment. **Drawing E095XX-770-006** contains the process and instrumentation details for the WESP.

Treated gas exits from the WESP through an ID fan, then through a silencer in the discharge duct, and is dispersed to the atmosphere by a stack. The ID fan inlet damper is automatically adjusted to control the MHI draft. In addition, the draft can be controlled by changing the fan speed by the use of a variable frequency drive (VFD). Specifications for the ID fan, motor and the VFD are shown in **Table 10**, ID Fan and Motor Specifications.

A plume suppression burner reheats stack gases to approximately 175 degree F in order to create adequate gas exit velocity for dispersion. Reheating also minimizes plume formation. A differential pressure element mounted in the stack measures exhaust gas flow. Details of the stack and plume suppression system are provided in **Table 11**, Stack and Plume Abatement System. Sampling ports are installed in the exhaust stack at rooftop and sub-roof levels and are shown in **Drawing E095XX-319-014**. A complete process flow diagram is shown in **Drawing E095XX-310-025**.

## Air Pollution Control System (APCS) Maintenance Practices

The APCS maintenance is performed according to the following procedures.

The following is done on an **annual basis**:

1. Instrumentation is calibrated.
2. Motors, controls and starters are cleaned and inspected.
3. Fan and pump bearings, couplings, and impellers are checked for wear and replaced if necessary. Impeller clearances are checked. Fan mechanical linkages are checked for proper operation. Pump mechanical seals are checked for leaks.
4. Ductwork, fan housing, welds and structural support are inspected for damage, corrosion and solids buildup and cleaned or repaired as needed.
5. Nozzles and drainage lines and piping are checked for damage and plugging and cleaned or replaced as needed.
6. Manual valves are checked for proper operation.
7. WESP electrical insulators are cleaned and inspected for cracks, chips, or tracking marks and are replaced as needed.
8. Heat trace is checked visually and for proper functioning.

The following is done on a **semiannual basis**:

1. WESP inlet blower fan filters are cleaned.
2. Bearings are cleaned, inspected, replaced if necessary and repacked with grease.
3. WESP insulator compartment heater is cleaned and inspected. The resistance of each heater element is checked and replaced as needed.

The following is done on a **quarterly basis**:

1. Induced draft WESP air filters are cleaned.
2. WESP nozzles are inspected for wear and replace if needed.
3. Quench spray nozzles are cleaned, inspected and replaced if needed.
4. Scrubber water strainer is cleaned.

## Fugitive Emissions Control

Fugitive emissions to the atmosphere are controlled during normal operation by the negative draft maintained throughout the MHIS. An alarm for positive MHI pressure warns the operator in the control room if the process or system momentarily fails to maintain the desired negative pressure set point. In the event of the loss of negative draft, waste feed will be automatically cutoff. All MHIS equipment access doors, inspection openings, and the ductwork leading to the stack following the discharge of the ID fan are sealed with bolted flanges or otherwise secured.

## Ash Discharge

Ash is discharged from the # 7 hearth through a chute that feeds a crusher. From the crusher, the ash enters an educator and is pneumatically conveyed to an ash bin located on the fourth floor of the building. There are two sets of crushers/educators; the ash is conveyed through one

crusher/educator while the other serves as a backup. There are level indicators on the ash bin that are tied to the DCS to allow timely transfer of the ash to an enclosed transfer trailer outside the building. Ash is transferred based on a timer every 45 minutes. Ash can also be transferred automatically when the bin level reaches 50%. There is an ash bin high-level alarm that shuts down the MHI and feed system. Also, the transfer trailer is equipped with a level indicator. The transfer trailer is later emptied into Super Sacks for shipment to an off-site smelter for precious metals reclamation.

## **Monitoring**

The key operating parameters used to demonstrate control of the MHI are in the NOC, which is provided in this plan as **Table 8**. The Continuous Monitoring Systems (CMS) Performance Evaluation Test Plan (PETP) (**Appendix 3**), provides detail on all these operating parameters instruments as well as their testing and calibration procedures. All process input, sub-system interaction and remote equipment control needed to operate the MHIS are located in and coordinated through the Distributed Control System (DCS) in the control room, which is described in more detail in the CMS PETP. The control room is staffed by trained personnel when the MHIS is operating. Remote sensors and transducers are field mounted throughout the MHIS and interface with the DCS.

## **Continuous Emissions Monitoring Systems**

Carbon monoxide (CO) and oxygen are continuously monitored on the multiple hearth incinerator stack. Details of the design, operation, calibration, and testing of these CEMS are contained in the attached Continuous Emissions Monitoring System (CEMS) Performance Specification Test (PST) Plan (**Appendix 4**). Maintenance practices for these CEMS are listed below by the maintenance frequency.

**Daily:**

1. Span and zero tests are run automatically to ensure that the instrument response is within acceptable limits. Calibration is performed anytime the daily check is out of specification or for any other reason to question the calibration (e.g., instrument maintenance)
2. Check CEMS data on DCS in control room to make sure CEMS is operating and daily calibration check was performed and passed.

**Weekly:**

1. Inspect sample lines and sample conditioning system for proper function. Check system flows and pressure. Repair or replace parts as needed.

**Monthly:**

1. Inspect sample conditioner peristaltic pump. Repair or replace parts as needed.
2. Check heated umbilicals and probe for proper temperature. Repair or replace parts as needed.
3. Visually inspect sample lines/connections. Repair as needed.

**Quarterly:**

1. Absolute Calibration Audit test is run.
2. Visually inspect valves, fittings, and electrical connections.

**Semi-Annually:**

1. Replace peristaltic pump tubing on sample conditioner
2. Check CO diagnostics per vendor specifications.

**Annually:**

1. Replace sample conditioner pump and TECO CO pump diaphragms.
2. Replace infrared source in CO monitor.
3. Replace filters at analyzers.
4. Perform Relative Accuracy Test (alternative RA per waiver from the agency).

**Biannually (2 years):**

1. Replace sample probe filter.

## **63.1207(f)(1)(iv) Sampling and Monitoring Procedures**

**Requirement:** *63.1207(f)(1) (iv) A detailed description of sampling and monitoring procedures including sampling and monitoring locations in the system, the equipment to be used, sampling and monitoring frequency, and planned analytical procedures for sample analysis;*

This section describes the procedures that will be followed during the field sampling of the Comprehensive Performance Test program. Throughout the overall program, sampling, analysis and monitoring procedures will be in accordance with all applicable Federal and State protocols including QA/QC directives. Unless otherwise stated, all methods will be from 40 CFR 60, Appendix A or SW-846. Any deviations that occur from the specified protocols will be fully documented in the final report.

As presently configured, the Comprehensive Performance Test program will entail conducting three test runs at each of two different operating conditions. **Table 12**, Sampling Summary for the CPT provides a summary of the sampling parameters and methods planned for the Comprehensive Performance Test. Sampling locations are shown in **Figure 2**, Sampling Locations.

### **Sampling Locations**

A diagram of the MHI exhaust stack, along with gas sampling locations, is shown in **Figure 3**, Multiple Hearth Incinerator Exhaust Stack, Sampling Ports & Monitoring. The stack is 42 inches in diameter. **Figure 3** also includes a cross sectional area of the stack showing the sampling points to be sampled by the various trains during a run. The sampling locations and points were determined in accordance with 40 CFR Part 60 Appendix A, Methods 1 and 2. Sampling will be conducted at 8 points on each traverse for a total of 16 sampling points during a run. The gaseous measurements for THC, and CO<sub>2</sub> will be conducted from single points in the stack.

### **Process Stream Sampling**

The conveyor system feeding the MHI is located on the third floor of Building 95 (see **Figure 2** and Engineering Description). The sludge is conveyed horizontally using a drag-link system to a drop chute where an auger screw system is employed to feed the sludge to the MHI. The sludge samples will be collected from the sludge conveyor. A plastic cup is positioned in the center of the conveyor and a sample of sludge is picked up in the cup. The cup is emptied into a glass container, which is maintained cold in ice throughout the test run. Sludge samples are collected at 15-minute intervals throughout a test run and placed in the glass container. After the run is completed, the sludge is manually blended and a single composite sample is obtained for analysis. This methodology is similar to the one described in Chapter 9 of SW-846 Test Methods for Evaluating Solid Waste.

## **Flue Gas Sampling**

The flue gas sampling shall consist of running multiple sampling trains simultaneously to collect the required emissions test data. Once a sample probe is inserted into the stack, the open space around the probe will be filled to as great an extent as possible with a packing material. Towels will be utilized to fill this open space in order to eliminate inleakage of ambient air into the stack flue gas. A brief description of the activities that will be performed in running each of these trains and the CEMS is provided in the next few subsections.

### **Method 26A Train for Halogens**

A halogen train will be utilized following Method 26A. A schematic diagram of the sampling train to be used for Halogens is shown in **Figure 4**. These samples will be collected from the lower ports.

Sampling will be conducted isokinetically from sixteen (16) points (eight (8) points on each traverse) for at least eight (8) minutes per point. Each test run will be at least one hundred twenty eight minutes (128) long and will collect in excess of seventy-five (75) cubic feet of stack gas. Sampling will be conducted across two perpendicular stack diameters at the points indicated in **Figure 3**.

Leak checks on the sampling train will be performed before the start of a test run, during port changes, and after each sampling run. In the event that any portion of the train is disassembled and reassembled (e.g., filter change), leak checks will be performed prior to disassembling the train and once again after the train is reassembled. All leak checks and leakage rates will be documented on the applicable field data sheets. The acceptance criteria for a leak check is  $\leq 0.02$  cfm at the highest vacuum obtained during the run or,  $< 4\%$  of the average test run sampling rate, whichever is less. If a leak is detected during the leak check at port change or the end of the run, the run will be voided and repeated.

Sample recovery will be conducted as described in Method 26A.

### **Method 5 and 29 Train for Particulate Matter, Multiple Metals**

A combined particulate and multiple metals train will be utilized following Method 5 and 29. A schematic diagram of the combined sampling train to be used for particulate matter and metals is shown in **Figure 5**.

Sampling will be conducted isokinetically from sixteen (16) points (eight (8) points on each traverse) for at least three (3) minutes per point. Each test run will be at least sixty minutes (60) long and will collect in excess of thirty (30) cubic feet of stack gas. Sampling will be conducted across two perpendicular stack diameters at the points indicated in **Figure 3** from the ports above roof level.

Leak checks on the sampling train will be conducted at the same frequency and following the same procedure as described for Method 26A above and will be subject to the same acceptance criteria.

The sample train leak checks and leakage rate will be documented on the field test data sheet for each respective run.

### **Method 23 PCDD/PCDFs**

A Method 23 train will be used for the collection of PCDD/PCDF. The use of Method 23 is allowed if approved per 40CFR63.1208(b)(1). See II.xv. (63.1207(f)(1)(xv)) below for a discussion of the reasons why Method 23 is appropriate for this CPT. A schematic of the Method 23 sampling train is shown in Figure 6. The sample train will consist of a heat-traced probe with a borosilicate buttonhook nozzle; an attached thermocouple and S type pitot tube. The glass probe will be maintained at a temperature of 250 °F +/- 25 °F. After the probe, the gas will pass through a heated glass fiber filter. Downstream of the heated filter, the sample gas will pass through a water-cooled module, then through a sorbent module containing the XAD-2 sorbent resin. The XAD module, which will be kept at a temperature below 20 °C, will be followed by a series of four impingers. The XAD inlet temperature will be monitored to ensure that the proper temperature is maintained. The first impinger, which will act as a condensate reservoir will be connected to the outlet of the XAD module and will be modified with a short stem so that the sample gas will not bubble through the collected condensate. The first impinger will be empty. The second and third impingers will each contain 100 mls of HPLC Grade or better water and the fourth impinger will contain a pre-weighed amount of silica gel. All connections within the train will be either glass or Teflon; no sealant greases will be used. The impingers will be followed by a pump, a dry gas meter, and a calibrated orifice meter.

Sampling will be conducted isokinetically with readings of the flue gas parameters recorded at every sampling point during the traverse. In the event that isokinetic sampling cannot be maintained due to a high-pressure drop through the sampling train, the train will be shut down and the problem will be corrected. In the event that steady operation cannot be maintained, or there are fluctuations in the monitored gas parameters, the testing will be suspended until these conditions are stabilized. Sampling will be conducted at sixteen (16) sampling points (eight (8) points on each traverse) for at least eleven (11) minutes per point to ensure that a minimum of two and a half (2.5) cubic meters will be collected during a run. Each of these runs will be a total of one hundred eighty (180) minutes long.

Leak checks on the sampling train will be conducted at the same frequency and following the same procedure as described for Method 26A above and will be subject to the same acceptance criteria. The sample train leak checks and leakage rate will be documented on the field test data sheet for each respective run.

Following completion of each test run, the Method 23 train will be transported to a recovery area on-site. Recovery will be conducted as prescribed in Method 23. An attempt will be made to conduct the sample cleanup in an area out of the direct sunlight.

## **Continuous Emission Monitoring**

The installed plant-site CEMS will measure CO and O<sub>2</sub> in the exhaust stack. A Performance Specification Test (PST) will be conducted prior to the execution of the Comprehensive Performance Test. The CEMS Performance Specification Test is included as **Appendix 4**. Utilization of the site CEMS for gathering the CO and O<sub>2</sub> emissions data during the Comprehensive Performance Test will eliminate the need for additional instrumentation at the site and eliminate redundancy. The O<sub>2</sub> data from the site CEMS will be used to correct Comprehensive Performance Test emissions data to 7% O<sub>2</sub>. The measured Comprehensive Performance Test CO data will be used as a component in calculating molecular weight of the stack gas for each respective Comprehensive Performance Test run and to verify process emissions relative to proposed permit conditions. A schematic of the site CEMS is shown in the CEMS Performance Specification Test Plan. A daily zero and span check will be performed on the CEMS to verify accuracy. The CEMS data will be considered equivalent to method 10 and 3A based on the successful completion of the PST.

Data from the CO & O<sub>2</sub> monitors will be recorded by the plant installed CEMS data acquisition system (DAS). Data from the THC and CO<sub>2</sub> monitors will be recorded by the test team's DAS. For the test team DAS, data will be recorded to the computer's hard-drive during each run in six-second intervals. In between runs, an operator will back up the data either electronically (thumb drive, floppy disk, CD) or by hard copy in the event that the information on the computer should become irretrievable. Clock times between the two DAS's will be synchronized before the start of testing.

All calibration, drift and response time checks will be performed on the reference systems as described in the applicable methods (25A and 3A). The response time determined during the PST will be used for the plant CEMS.

The THC and CO<sub>2</sub> measurements will be performed using monitors that are co-located with the site CEMS or housed in a CEMS trailer provided by the source test team. The decision between co-location and the trailer will be left to the source test team and will be based on logistics and efficiency. The sampling procedures employed for THC, and CO<sub>2</sub> will be consistent with EPA 40 CFR 60 Appendix A. Methods 25A, and 3A, respectively.

If the monitors are co-located, slipstreams of the site CEMS' sample before (for THC) and after (for CO<sub>2</sub>) conditioning will be used. If a CEMS trailer is used to house the THC and CO<sub>2</sub> monitors, the monitoring system will consist of three subsystems: sample acquisition/conditioning, sample analysis, and a data acquisition system.

The trailer based CEMS' sample acquisition/conditioning unit will be designed to deliver a representative sample of the stack gas stream to the sample analysis subsystem. A stainless steel probe will be placed at a representative point in the stack. A monitoring port will be selected and a multipoint traverse will be conducted over the stack cross section. A sample point will be chosen for probe placement, which best represents the average of the readings recorded by the CEMS during the traverse. The probe will be attached to a heated filter box, which contains a Gellman type filter to remove any heavy particulate matter present in the gas stream. After passing through the filter, the flue gas will pass through a heated sample line to a condenser to remove any moisture present in

the gas stream. The flue gas will then be directed to a manifold system, which in turn will direct a portion of the gas to all of the analyzers with the exception of the THC analyzer. Just upstream of the condenser, a "T" will be placed in the line and a second heated sample line will be attached at this point. This heated line will be connected directly to the back of the hydrocarbon analyzer. This special modification is required to avoid the possibility of some organic compounds condensing out in the condenser resulting in a reduced THC concentration.

## Sample Custody

As outlined in USEPA SW-846, Section 9.2.2.5, chain of custody forms will be used to trace the possession and handling of all samples from time of collection through analysis. **Table 13**, Sample Preservation and Holding Times presents sample preservation and holding times. Also, the following items will be utilized:

- a) Sample Bottles - The samples will be collected and stored in appropriate containers and capped with TEFLON-lined closures when specified.
- b) Sample Labels - All sample containers will be labeled and will include a sample number, name of collector, date, time, place of collection, description, and associated hazard labels.
- c) Sample Seals - All sample bottles will be sealed to prevent tampering prior to analysis.
- d) Chain of Custody Record - A chain-of-custody form will be filled out and will accompany all samples.
- e) Sample Analysis Request Form - As part of the chain-of-custody form or on a separate form, each sample will have a sample analysis request sheet that accompanies the sample to the lab and explains which analyses are required.
- f) Shipment of Samples - Samples will be marked showing the liquid level and carefully packed and shipped to prevent breakage, spillage, or tampering during shipment. Samples requiring refrigeration will be packed in an ice cooler.
- g) Receipt of Samples - The laboratory will log in all samples received. Handling/receipt of samples will be recorded on the chain-of-custody form.

In cases where data are being collected by continuous monitors (i.e., CO, CO<sub>2</sub>, and O<sub>2</sub>) charts will be labeled to identify the start and stop times of Comprehensive Performance Test runs and retained.

## Glassware Preparation

Sample train glassware and sample containers will require specialized cleaning to avoid contamination of the sample from the collection containers or sampling equipment. Cleaning procedures for the sample train glassware is summarized below. Wherever possible, sample containers will be purchased pre-cleaned to specified EPA standards.

- Method 5 and Method 26A Particulate/Halogen glassware and containers: hot tap water rinse, hot soapy water wash, tap water rinse, DI water rinse, acetone rinse, air dry.
- Method 23 glassware and containers: hot tap water rinse, soapy water wash, tap water wash, DI water rinse, chromic acid rinse, hot water rinse, DI water rinse, acetone rinse, and air dry. XAD traps and filters will be pre-cleaned following the procedures outlined for PCDD/PCDF sampling under Method 23.
- Multiple Metals Train: hot tap water rinse, hot soapy water rinse, DI water rinse, 10% nitric acid soak, through DI water rinse, air dry.
- Final rinses of sampling glassware will be conducted using organic-free DI water having equivalent quality <sup>3</sup> ASTM Type II water (ASTM D1193-77).

## **Sample Media Preparation**

All reagents to be used will be checked to minimize the probability of using contaminated solvents. This check will include the use of pesticide grade or better solvents from the same lot and the collection of the appropriate number of blanks. All filters will be desiccated and properly tare-weighed prior to use. The XAD traps and filters to be used in the PCDD/PCDF sampling trains will be supplied to sampling crews just prior to the field effort by the laboratory. The XAD traps and filters will be conditioned and be subject to QA/QC in accordance with the procedures in SW-846. The XAD traps will be pre-spiked with the appropriate surrogate compounds by the laboratory prior to shipping to the field.

## **Other Pre-sampling Activities**

Site set-up will be the final pre-sampling activity. This task will involve moving the sampling equipment to the vicinity of the sampling area. During set-up, preliminary measurements will be taken to determine flue gas moisture and flow rate. Preliminary flue gas moisture will be determined in accordance with 40 CFR Part 60 Appendix A Method 4. Preliminary flow rate measurements will be conducted following 40 CFR Part 60 Appendix A, Methods 1 and 2. This data will be used to calculate the appropriate nozzle size and sample flow rates to be used to accomplish isokinetic sampling. A cyclonic flow check will be conducted during these preliminary measurements to verify the absence of cyclonic flow. The cyclonic flow check will be included in the final report.

## **Calibration Procedures and Frequencies**

All sampling equipment will be calibrated as prescribed in the methods provided in 40 CFR Part 60 Appendix A, SW 846 Test Methods, applicable ASTM protocols and applicable guidance documents.

All sampling equipment to be used for this program will be calibrated prior to being mobilized to the site. Calibration procedures will follow guidelines provided in the EPA document entitled "Quality Assurance Handbook for Air Pollution Measurement Systems; Volume III - Stationary Source Specific Methods" (EPA-600/4-77-027b). All calibrations will be performed prior to and at the conclusion of the Comprehensive Performance Test.

- **Probe Nozzles** - Using a micrometer, measure the inside diameter of the nozzle to the nearest 0.025 mm (0.001 in). Make measurements at three separate places across the diameter and obtain the average of the measurements. The difference between the high and low values should not exceed 0.1 mm (0.004 in). Post-test check - inspect for damage.
- **Pitot Tubes** - measure for appropriate spacing and dimensions or calibrate in a wind tunnel. The rejection criteria are provided on the calibration sheet. Post-test check - inspect for damage.

- **Thermocouples** - Verify against a mercury-in-glass thermometer at three points including the anticipated measurement range. Acceptance limits are – impinge +/- 2 degrees F, dry gas meter +/- 5.4 degrees F, stack temperature +/- 1.5%.
- **Dry Gas Meters** - Calibrate against a wet test meter. Acceptance criteria - pre-test  $Y_i = Y +/- 0.2$ ; post-test  $Y = +/- 0.05Y_i$ .
- **Mettler Balance** - Service and certify annually by the manufacturer. Prior to obtaining first weights confirm accuracy by placing a known S-type weight on the balance.
- **Calibration of Continuous Emission Monitors** - At a minimum, both the transportable and site CEMS will be calibrated as prescribed in 40 CFR 60 Appendix A.

## **Analytical Procedures**

This section describes the analytical protocols, which will be used to analyze the samples collected during the Comprehensive Performance Test Program. Samples of the process streams and flue gas will be submitted to a Laboratory accredited under the National Environmental Laboratory Accreditation Program (NELAP) for analysis. **Table 13**, Sample Preservation and Holding Times, identifies the appropriate sample preservation and holding times for each parameter. **Table 14**, Analytical Summary for the CPT, presents a summary of the target analytes and analytical methods to be used for the analysis of the flue gas and process stream samples.

### **Process Stream Samples**

The waste feed samples will be analyzed for the following parameters: ash, heating value, moisture, target metals (As, Be, Cr, Cd, Pb & Hg) and total chlorine. Please see **Table 14** for a specific listing of analytical methods. A listing of the expected detection limits for the process stream parameters are contained in **Table 15**, Anticipated Detection Limits of Waste Feed.

### **Metals**

Process stream samples will be digested by SW-846 Method 3050B for arsenic, beryllium, cadmium, chromium, and lead and then measured using SW-846 Method 6010B. However, occasionally, certain matrices are not amenable to the preparative procedure resulting in the need for procedural modifications and use of alternative procedures. For example: (1) use of a reduced sample size which results in elevated detection limits; (2) addition of small quantities of sulfuric acid in Method 3051 to aide dissolution; and (3) elimination of HCl from Methods 3051. The above modifications are employed if the sample matrix causes foaming or incomplete digestion. The need for these modifications can generally be determined only during sample preparation. Mercury in the process streams will be digested and measured using SW-846 Method 7471A.

## **Ash**

The waste feed samples will be analyzed for ash content following ASTM 3174-89. Under this method, a weighed aliquot of the sample will be placed inside a crucible. The sample will be placed in a furnace and heated to 750°C and then allowed to cool. The resulting sample will then be weighed to obtain an ash determination.

## **Heating Value**

The waste feed samples will be analyzed for heating value following ASTM Method D2015. Under this method, an aliquot of the waste feed will be placed in an adiabatic bomb calorimeter. The material will be combusted and the resultant change in temperature will be recorded.

## **Moisture**

Moisture in the waste feed samples will be determined using ASTM method D2216 by establishing the loss of weight of the sample when heated under controlled conditions of temperature, time and atmosphere.

## **Total Chlorine**

The waste feed samples will be prepared for total chlorine analysis according to SW-846 Method 5050. Chloride analysis will be performed on an aliquot from each sample using SW-846 Method 9056.

## **Flue Gas Sample Analysis**

The flue gas samples will be analyzed for the following parameters: particulate, total chlorine, metals (As, Be, Cr, Cd, Pb & Hg), and PCDD/PCDF. Please see **Table 15**, for a listing of specific analytical methods to be used. Detection limits compared to the compliance standards are contained in **Table 16**, Anticipated Detection Limits of Flue Samples. This subsection outlines the analytical procedure to be employed when analyzing the flue gas samples collected from the various trains during the Comprehensive Performance Test.

## **Particulate Gravimetric Analysis**

Clean pre-weighed filters provided by the NELAP Laboratory will be used to capture the particulate as part of Method 29. The filters and rinses used to recover samples in the field will be submitted to the same Laboratory for gravimetric analyses. Reagent blanks will be submitted along with the test samples. The filters and recovery rinses will be dried to determine total particulate weight gain following the procedure spelled out in Method 5.

## **Halogen**

Analysis of the exhaust stack gas impinger samples will be performed for HCl, and Cl<sub>2</sub> determination via ion chromatography following SW-846 Method 9057. In the event that serious interferences are encountered with the IC analysis, EPA Method 325.2 (colorimetric procedure) will be employed.

## **PCDDs and PCDFs**

The concentration of PCDD/PCDF in the stack gas will be determined through the analysis of the PCDD/PCDF train sample using procedures from Method 23. Collected samples will consist of separate containers for the front-half rinse, particulate filter and XAD resin. The samples will be extracted following the procedures delineated in Method 23 & 8290.

Analysis for 2,3,7,8-TCDD and TCDF and the tetra- through octa-chlorinated PCDD/PCDF homologues will be performed on the flue gas samples. Quantification of the following PCDD/PCDF will be performed using HRGC/HRMS procedures detailed in the Method 8290:

<b>PCDDs</b>	<b>PCDFs</b>
2,3,7,8-TCDD	2,3,7,8-TCDF
Total TCDD	Total TCDF
1,2,3,7,8-peCDD	1,2,3,7,8-PeCDF
Total PeCDD	2,3,4,7,8-PeCDF
1,2,3,4,7,8-HxCDD	Total PeCDF
1,2,3,6,7,8-HxCDD	1,2,3,4,7,8-HxCDF
1,2,3,7,8,9-HxCDD	1,2,3,6,7,8-HxCDF
Total HxCDD	2,3,4,6,7,8-HxCDF
1,2,3,4,6,7,8-HpCDD	1,2,3,7,8,9-HxCDF
Total HpCDD	Total HxCDF
OCDD	1,2,3,4,6,7,8-HpCDF
	1,2,3,4,7,8,9-HpCDF
	Total HpCDF
	OCDF
<b>Total PCDD</b>	<b>Total PCDF</b>

## **Multiple Metals**

Samples from the multiple metals train will be analyzed for the following metals: arsenic, beryllium, cadmium, chromium, nickel, lead, and mercury. The analytical procedure shall be conducted as described in the method. The applicable portions of the train will be subjected to an acid digestion or an acid-microwave digestion procedure (SW 846 Method 3050B or 3051) with subsequent analysis by CVAA analysis for mercury following Method 7470 and for all other metals by ICAP following Method 6010B from SW-846.

## **Quality Assurance/Quality Control**

Applicable Quality Assurance/Quality Control (QA/QC) protocols will be adhered to ensure the production of useful and valid data throughout the Comprehensive Performance Test. The QA/QC checks and procedures described in this section represent an integral part of the overall sampling and analytical scheme.

## **Stack Test Team**

In addition to the QA/QC procedures detailed in the following sections, the sampling crews will consist of skilled and experienced engineers, scientists, and technicians. At least one member of the sampling team will be a Qualified Source Testing Individual (QSTI).

## **Oversight and Observation**

The performance of the stack test team will be monitored by Company representatives familiar with source testing to ensure adherence with procedures and guidelines. In addition, the date and schedule of the testing will be communicated to the NYS DEC so that they too can monitor the performance of stack test team, the spiking contractor and operations during the CPT.

## **Analytical Laboratory**

All of the testing performed for this CPT will be performed by a NELAP certified Laboratory. This will help to ensure that the analytical data generated is of the highest quality.

## **Precision**

Precision is defined as the degree of mutual agreement among individual measurements made under prescribed conditions. Three sampling runs will be performed at each operating condition, and a comparison of their results will ensure their validity.

## **Accuracy**

Accuracy is the degree of agreement of a measurement to an accepted reference or true value. The accuracy of the Comprehensive Performance Test data will be determined from analysis of samples spiked with a known concentration. The use and applicability of sample spikes are specified by the analytical reference method and NELAP protocols.

## **Completeness**

Completeness is defined as the percent of samples judged to be valid compared to the total number of samples collected. Completeness will be reported as the percentage of all measurements judged to be valid. Every attempt will be made to ensure that all data generated will be valid data. The objective is to have 100 percent of the data valid.

## **Representativeness and Comparability**

Representativeness is defined as "the degree to which data accurately and precisely represents the characteristics of a population, the parameter variations at a sampling point, process conditions, and environmental conditions."

Comparability is defined as "expressing the confidence with which one data set can be compared to another set of data collected under similar conditions". It is recognized that the usefulness of the data is also contingent upon meeting the criteria for representativeness and comparability. Wherever possible, reference methods and standard sampling procedures will be used. The

representativeness QA objective is that all measurements be representative of the media and operation being evaluated. The detailed requirements for flue gas sampling for particulate, HCl, Cl<sub>2</sub>, metals, and PCDD/PCDF, given in their respective methods will be followed to ensure representative sampling of the gas stream. Grab samples of the waste feed will be made every fifteen minutes for Condition 1 and 10 minutes for Condition 2, to ensure that representative samples of this stream is collected.

The comparability QA objective is that all data resulting from sampling and analysis be comparable with other representative measurements on this or similar processes operating under similar conditions. The use of published sampling and analytical methods and standard reporting units will aid in ensuring the comparability of the data.

### **Internal Quality Control Checks**

Quality control checks are performed to ensure the collection of representative samples and the generation of valid analytical results on these samples. These checks are specified by the reference methods and the NELAP accrediting body (NYSDOH).

### **Data Collection and Sampling QC Procedures**

QC checks for the process data collection and sampling aspects of this program will include, but not be limited to, the following:

1. Use of standardized checklists and field notebooks to ensure completeness, traceability, and comparability of the process information and samples collected.
2. Strict adherence to the sample traceability procedures and reference procedures.
3. Submission of field-biased blanks.
4. Leak checks of sample trains before, during port change and after sample collection.

### **Sampling Equipment QC Checks and Frequency**

Calibration of the field sampling equipment will be performed prior to and at the conclusion of the field sampling effort. Copies of the calibration sheets will be provided to the field team leader for on-site reference, and included with the project file. Calibrations will be performed as described in the EPA publication "Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III, Stationary Source Specific Methods".

Leak checks will be conducted in accordance with the protocol called out for each method. Leak checks will be conducted prior to, during port change and at the conclusion of sample collection.

## **Sample Collection QC Checks**

Field blanks of reagents and collection media (deionized water, filters, impinger solutions, XAD traps etc.) will be placed in appropriately cleaned and sized sample containers in the field and handled in the same way as actual field samples, to provide a QC check on sample handling.

Sample collection QC checks will be as follows:

- One blank particulate/halogen train
- One blank multiple metals train
- One blank PCDD/PCDF train
- One PCDD/PCDF audit sample from EPA (if provided)

## **Analytical QC Procedures For Samples To Be Analyzed In The Laboratory**

The Quality Control program for laboratory analysis makes use of a number of different types of QC samples to document the validity of the generated data. The following types of QC samples will be used during the program.

### **Method Blanks**

Method blanks will be provided with the various sample sets. These blanks are portions of analytical reagents, filters, sorbent media and recovery reagents set aside and not transported to the field. Method blanks will be obtained for each reagent and sampling media lot.

### **Calibration Check Samples**

One of the working calibration standards is periodically used to check that the original calibration is still valid.

### **Laboratory Control Samples (LCS)**

Control Samples (LCS) - These samples are generated from spikes prepared independently from the calibration concentrates. The LCS is used to establish that an instrument or procedure is in control. An LCS is normally carried through the entire sample preparation and analysis procedure also.

### **Matrix Spikes**

Samples are spiked with the analyte of interest and then analyzed to determine a percent recovery. It is anticipated that these analyses would assess the results of actual analyses of individual samples during the entire Comprehensive Performance Test program.

The percent recovery of each matrix spike will be calculated as noted in the reference method. All values that fall outside the QC limits described in the analytical method will be noted. It is anticipated that some of the recovery values will be outside of the QC limits due to matrix interferences. The following guidelines will be used:

1. All recovery data will be evaluated to determine if the QC limits are appropriate and if a problem may exist even though the limits are being achieved (e.g., one compound that is consistently barely within the lower limit).
2. All recovery data that are outside the established limits are re-evaluated. This re-evaluation will include an independent check of the calculation.
3. Corrective action will be performed if any of the following are observed:
  - a) All recovery values in any one analysis are outside the established limits,
  - b) Over 50% of the values for a given sample set are outside limits, or
  - c) One compound is outside the limits in over 50% of the samples.

The results of these quality control procedures will be included in the final report.

### **Quality Control of Sorbents**

The filters and XAD resin traps for the PCDD/PCDF train shall be provided to field crew by the contracted laboratory after having completed the required pre-cleaning steps.

The quality and cleanliness of the XAD will be verified by GC/MS. After the traps have been prepared, the laboratory will spike the XAD traps with the appropriate surrogate compounds. These surrogate compounds shall consist of a carbon 13 form of tetrachlorobenzene and five surrogate PCDD/PCDF compounds.

### **Performance Audits**

The sampling, analysis, and data handling segments of a project are checked in a performance audit. If available at the time of the CPT, an accredited audit sample provider (AASP) will provide samples in the range of the estimated concentration for analysis and complete the independent quality assessment as provided by 40CFR63.7(c)(2)(iii). Five audit samples will be obtained from the AASP:

1. Method 29 multi-metals on glass fiber filter
2. Method 29 multi-metals in an impinger solution
3. Method 29 mercury on paper filter
4. Method 29 mercury in an impinger solution
5. Method 26A hydrogen chloride in impinger solution

Following analysis of the audit samples by the same laboratory using the same procedures used for the field samples, results will be reported to the AASP as required under 40CFR63.7(c)(2)(iii) for the performance assessment and reporting.

## **Preventative Maintenance**

Preventive maintenance and calibration of equipment and instruments helps to assure accurate measurements from field and laboratory instruments.

All equipment that is scheduled for field use will be cleaned and checked prior to calibration. Once the equipment has been calibrated, sample trains are assembled and leak checked in order to reduce problems in the field. An adequate supply of spare parts will be taken to the field to minimize downtime from equipment failure.

The portable CEM systems are operated and maintained in accordance with the applicable manuals. Maintenance is performed on a regularly scheduled basis prior to use in the field and includes, but is not limited to, purging of sample lines, checking pump oil and belts, cleaning rotameters or other sample flow monitoring devices, checking sample capillaries and mirrors, etc.

Routine maintenance procedures are critical for ensuring the continuous, trouble-free operation of the portable CEMs in adverse environments.

The laboratories will calibrate and maintain their instrumentation in accordance with the instrument manufacturers' specifications and appropriate methods as well as certifications prescribed by NYS.

## **Data Reduction, Validation, and Reporting**

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

### **Field Data Reduction**

Standardized data sheets will be used to record field-sampling data. The data collected from each train will be reviewed in its entirety in the field by the Field Team Leader and at least one other field crewmember. Errors or discrepancies will be noted in a field notebook. The field team leader has the authority to institute corrective actions in the field. If necessary, the project manager will also be consulted for resolution if the situation warrants and the appropriate RED representative will be notified of the situation.

### **Laboratory Analysis Data Reduction**

Analytical results will be reduced to concentration units specified by the analytical procedure, using the equations given in the analytical procedures. If units are not specified, data from the analysis of liquid samples will be reported in units of mg/l. Data from the analysis of solid samples will be reported as mg/Kg. All waste feed sample data will be reported on a dry basis. Data from the

analysis of gas samples will be reported as ug/ft<sup>3</sup>. This value will be calculated by dividing the total weight of the substance by the volume of the gas sampled.

A determination will be made as to whether a sample value is significantly different from its associated blank. The sample is different from the blank if:

$$(\text{measured sample}) - (\text{mean blank value}) > 3 \times \text{blank Std. Dev.}$$

If the sample is determined to be different from the blank, then the emission value is blank corrected by subtracting the mean blank value from the measured sample value. If the sample cannot be distinguished from the blank, the measured value is not blank corrected.

### **Emission Data Reduction**

The following subsection describes the calculations to be employed to calculate the emission rates of each of the pollutants being sampled.

### **Particulate Emissions Testing Data Reduction**

Calculations for determining flow rates, moisture contents, isokinetics and particulate emissions will be made using a computer software program. This program uses the calculation procedures and equations specified in USEPA Methods 2, 4, and 5.

### **HCl Data Reduction**

Calculations for HCl concentrations will be calculated from ion chromatography (IC) data as:

$$C_{\text{HCl}} = M_{\text{HCl}} / V_{\text{m(std)}}$$

where:

$C_{\text{HCl}}$  = flue gas concentration of HCl, corrected to standard conditions, g/dscm

$M_{\text{HCl}}$  = total mass of HCl in the sample (ug)

$$= (S-B) \times V_{\text{sample}} \times 36.46 / 35.453$$

S = analysis of sample (ug Cl/ml)

B = analysis of blank (ug Cl/ml)

35.45 = molecular weight at Cl

36.46 = molecular weight of HCl

$V_{\text{m(std)}}$  = dry gas meter volume at standard conditions (dscm)

## **Cl<sub>2</sub> Data Reduction**

Calculations for Cl<sub>2</sub> concentrations will be calculated from ion chromatography (IC) data as:

$$C_{\text{Cl}_2} = M_{\text{Cl}_2}/V_m(\text{std})$$

where:

$C_{\text{HCl}}$  = flue gas concentration of Cl<sub>2</sub>, corrected to standard conditions, g/dscm

$M_{\text{Cl}_2}$  = total mass of Cl<sub>2</sub> in the sample (ug)

$$= (S-B) \times V_{\text{sample}} \times 70.91/35.453$$

S = analysis of sample (ug Cl/ml)

B = analysis of blank (ug Cl/ml)

35.45 = molecular weight at Cl

70.91 = molecular weight of Cl<sub>2</sub>

$V_m(\text{std})$  = dry gas meter volume at standard conditions (dscm)

## **Multiple Metals Data Reduction**

Metals emissions will be calculated according to the protocol outlined in "Methodology for Determination of Metals Emissions in Exhaust Gases from Hazardous Waste Incineration and Similar Combustion Processes." The following equations apply:

Total mass of each metal in the sample:

$$M_t = (M_{fh} - M_{fhb}) + (M_{bh} - M_{bhb})$$

where:

$M_t$  = Total mass of each metal collected in sample train (g)

$M_{fh}$  = Metal in front half fraction (g)

$M_{fhb}$  = Metal in front half reagent blank (g)

$M_{bhb}$  = Metal in back half reagent blank (g)

Metals Emission Rate:

$$R = M \times Q_{\text{std}} \times 1440 \times 1 \times 10^{-6} / V_m(\text{std})$$

where:

R = Metal emission rate (g/day)

M = Total metal in sample (ug)

$Q_{\text{std}}$  = Stack gas volumetric flow (dscm)

$V_m(\text{std})$  = gas sample volume (dscm)

1440 = min/day

$$1 \times 10^{-6} = \text{g/ug}$$

## **Data Validation**

Data validation is the process of filtering data and accepting or rejecting it on the basis of sound criteria. Supervisory and QC personnel will use validation methods and criteria appropriate to the type of data and the purpose of the measurement. Records of all data will be maintained, even that judged to be an "outlying" or spurious value. The persons validating the data will have sufficient knowledge of the technical work to identify questionable values.

Field sampling data will be validated by the Field Team Leader based on his or her judgment of the representative ness of the sample, maintenance and cleanliness of sampling equipment and the adherence to approved, written sample collection procedure.

Analytical data will be validated by the subcontractor laboratory QC personnel using criteria spelled out by the reference methods and NELAC. Results from the field and laboratory method blanks, replicate samples and internal QC samples will be used to further validate analytical results.

Analytical results on field blanks and surrogate spikes are valuable for validation of sample collection also. QC personnel will review all subcontractor laboratory raw analytical data to verify calculated results presented. The following criteria will be used to evaluate the field sampling data:

- Use of approved test procedures
- Proper operation of the process being tested
- Use of properly operating and calibrated equipment
- Leak checks conducted before, during port change and after tests
- Use of reagents that have conformed to QC specified criteria
- Use of NBS traceable protocol #1 CEM calibration gases
- Proper traceability maintained

The criteria listed below will be used to evaluate analytical data:

- Use of approved analytical procedures
- Use of properly operating and calibrated instrumentation
- Precision and accuracy achieved should be comparable to that achieved in previous analytical programs and consistent with the objectives stated in the Comprehensive Performance Test Plan.

## **Identification and Treatment of Outliers**

Any point which deviates from others in its set of measurements will be investigated; however, the suspected outlier will be recorded and retained in the data set while it is investigated. One or both of the following tests will be used to identify outliers.

Dixon's test for extreme observations is an easily computed procedure for determining whether a single very large or very small value is consistent with the remaining data. The one-tailed t-test for difference may also be used in this case. If more than one outlier is suspected in the same data set, other statistical sources will be consulted, and the most appropriate test hypothesis will be used and documented.

Since an outlier may result from unique circumstances at the time of sample analysis or data collection, those persons involved in the analysis and data reduction will be consulted. This evaluation may provide an experimental reason for the outlier to determine its effect on the conclusions. In many cases, two data sets will be reported, one including and one excluding the outlier. In summary, every effort will be made to include the outlying values in the reported data. If the value is rejected, it will be identified as an outlier, reported with its data set, and its omission noted.

## **63.1207(f)(1)(v), (vi), (vii) Test Schedule, Protocol and Operating**

**Requirement:** *63.1207(f)(1)(v) A detailed test schedule for each hazardous waste for which the performance test is planned, including date(s), duration, quantity of hazardous waste to be burned, and other relevant factors;*

*(vi) A detailed test protocol, including, for each hazardous waste identified, the ranges of hazardous waste feedrate for each feed system, and, as appropriate, the feedrates of other fuels and feedstocks, and any other relevant parameters that may affect the ability of the hazardous waste combustor to meet the emission standards;*

*(vii) A description of, and planned operating conditions for, any emission control equipment that will be used;*

## Test Schedule

RED plans to execute the Comprehensive Performance Test following the approval of the Comprehensive Performance Test Plan.

A tentative schedule to conduct the test program is as follows:

- Day 1 Test crew arrives on-site, participates in safety orientations and sets equipment to conduct test, RED completes final preparation activities for the Comprehensive Performance Test.
- Day 2 Conduct Runs # 1 and # 2.
- Day 3 Conduct Run # 3.
- Day 4 Pack and ship samples from the site and demobilize test equipment.

A detailed breakdown of each of the testing days is provided in **Table 17**, CPT Test Schedule. The test schedule presented in these tables does not account for unforeseen test delays due to sampling or process equipment failure and inclement weather. Regardless of the cause for any test delay, normal testing procedures will be resumed at the earliest possible opportunity. Depending on the type and duration of any delay, a test run/condition may be resumed from the point the testing was delayed or from the beginning. An on-site decision will be made in cooperation with any Agency observer(s) present regarding which re-start protocol will be followed.

## Test Protocols

This section discusses the details of the Comprehensive Performance Test execution. The operating conditions for which the unit will be tested represent the "worst case" in terms of waste feed composition, waste feed rates, combustion temperatures, combustion gas flow rates, thermal inputs, and APCE parameters as required by 40CFR63.1207(g). By demonstrating compliance with the HWC MACT standards, future permitted operating permit conditions can be verified.

**Table 18**, CPT Target Operating Conditions, lists the proposed CPT operating conditions. Operating conditions for both the combustion system and the air pollution control system are included in this table.

The objective will be to demonstrate particulate, dioxin/furan, metals HCl/Cl<sub>2</sub>, CO, and THC emissions of the MHI. The test will be conducted at a minimum hottest hearth temperature of about 1500 degrees F and a minimum secondary temperature of about 1600°F while spiking chlorine in the form of NaCl to achieve 7.7 lb/hr of total Cl feed. During this condition, the waste feed will consist of typical sludge and grit at 8,500 lbs/hr wet sludge. Chlorine will be added as 12 lb/hr of non-iodized

NaCl to the feed conveyor downstream of the point where the sludge samples are collected. These are the conditions that will maximize the air emissions. Three test runs will be conducted.

### **63.1207(f)(1)(viii) Shutdown Procedures**

**Requirement:** *63.1207(f)(1) (viii) Procedures for rapidly stopping the hazardous waste feed and controlling emissions in the event of an equipment malfunction;*

Waste feed will be stopped manually in the event of an emergency unless the AWFCO procedures described in the engineering description have not already automatically shut off the waste feed. If possible, the waste will be burned out at a controlled rate with natural gas. If that is not possible, the procedures in **Table 19** will be followed. If the induced draft fan must be stopped, the emergency natural draft by-pass stack on the SCC will be opened. This stack is sufficiently tall to vent and disperse MHI gases directly into the atmosphere. This will prevent fugitive emissions from escaping either into the building or at ground level.

### **63.1207(f)(1)(ix) Residence Time**

**Requirement:** *63.1207(ix) A determination of the hazardous waste residence time as required by §63.1206(b)(11)*

The residence time calculation for the waste in the multiple hearth is contained in **Table 20**. The table shows two rabble speeds, a maximum rabble arm speed of 2.1 rpm that will be used during the CPT and a typical minimum rabble speed of 1 rpm. Based on the planned rabble operation during the CPT of 2.1 rpm, the residence time of the sludge will be 62 minutes. Therefore the hearth must be operated for a minimum of 62 minutes under CPT conditions before testing begins to ensure that steady state operation is occurring, although a 2 hour duration under the designed operating conditions will be followed as discussed in Section II.xii.

### **63.1207(f)(1)(x) Metals Extrapolation**

**Requirement:** *63.1207(f)(1)(x) If you are requesting to extrapolate metal feedrate limits from comprehensive performance test levels under §§63.1209(l)(1)(v) or 63.1209(n)(2)(vii):*

- (A) A description of the extrapolation methodology and rationale for how the approach ensures compliance with the emission standards;*
- (B) Documentation of the historical range of normal (i.e., other than during compliance testing) metals feedrates for each feedstream;*
- (C) Documentation that the level of spiking recommended during the performance test will mask sampling and analysis imprecision and inaccuracy to the extent that the extrapolated feedrate limits adequately assure compliance with the emission standards;*

RED proposes to extrapolate feedrates for semi-volatile metals, low volatile metals, high volatile metals (Hg), up to the maximum constituent levels found in the sludge from 2017-2021. RED proposes to spike chlorine as has been done in the past, but no extrapolation of chlorine is requested.

RED proposes to extrapolate feedrates for ash up to the maximum constituent levels found in the sludge from 2019-2021. This allows RED to feed at the maximum sludge feedrate with the normal concentration of metals and ash during the CPT and extrapolate emissions to the level predicted at the maximum historical feedrates. Extrapolation of metals will eliminate the spiking chemicals required (and potential extra materials for later disposal) and reduce emissions during the CPT, while still allowing the permit limit to be set at the maximum sludge constituent concentrations as long as the extrapolated CPT emissions are below the emissions standard with a margin of safety. Spiking ash is difficult due to the volume required. When coal was burned in the boilers, coal ash was intentionally sewerered for the CPT to elevate the ash concentration. Without coal in the boilers, the ash concentrations are lower, but the amount of ash that would have to be spiked could be as high as 480 lb/hr (up to 10,000 lb. for the entire CPT), a difficult logistical challenge. This requires finding a suitable material, purchasing or otherwise obtaining the ash, feeding it into the sewer since there is not a good means to add this large volume of material directly to the feedstream, and ensuring the added ash arrives at the right time and ends up in the sludge. Additionally sampling and possibly extra addition of ash would then be needed within 24 hours of the test. Extrapolation of ash up to the maximum 2019-2021 concentration will eliminate this difficulty and extra waste created from spiking ash.

RED proposes to extrapolate up to the maximum historical feedrate (except no extrapolation for chlorine is requested) as long as the extrapolated emissions are less than or equal to 90% of the MACT emissions standard. Table 21 below compares the emissions results from the 2018 CPT with the emissions standards. All the emissions were less than 10% of the standard except mercury, which was 57% of the standard, so the emissions with extrapolation are expected to be well below the standard, providing a significant margin of safety.

Although all emissions are predicted to be below the standard even when extrapolated to the maximum feedrate, should the emissions be below the standard, but the extrapolated emissions be above 90% of the standard, the extrapolated feedrate would be capped at the feedrate that would extrapolate to 90% of the standard.

Table 21 – Comparison of 2018 MHI CPT Emissions with 63.1219 Emissions Standards

Pollutant	July 2018 Test Result	63.1219 Limit	% of Limit	Units
Dioxin/Furans	0.0062	0.4	1.6%	ng TEQ/dscm @ 7% O <sub>2</sub>
Mercury	74	130	57%	ug/dscm @ 7% O <sub>2</sub>
Semi Volatile Metals - Cadmium and Lead (Combined)	5.8	230	3%	ug/dscm @ 7% O <sub>2</sub>
Low Volatile Metals - Arsenic, Beryllium, and Chromium (Combined)	2.3	92	3%	ug/dscm @ 7% O <sub>2</sub>
Total Hydrocarbons	0.88	10	9%	ppm @ 7% O <sub>2</sub>
Carbon Monoxide (Condition 1 and 2)	<1	100	<1%	ppm @ 7% O <sub>2</sub>
Total Chlorine (HCl plus Cl <sub>2</sub> )	0.12	32	0.4%	ppm @ 7% O <sub>2</sub>
Particulate Matter (Condition 1)	0.00026	0.013	2.0%	gr/dscf @ 7% O <sub>2</sub>
Particulate Matter (Condition 2)	0.00032	0.013	2.5%	gr/dscf @ 7% O <sub>2</sub>

The proposed extrapolation approach will ensure that the allowable feedrates will not create emissions that exceed the emissions standards. Removal efficiency does not change significantly with metals feedrate, as documented by Hinshaw (Hinshaw, G.D., Murowchick, P. S., Oranzi, R. F. "Parametric Testing of Metals Emissions from the Du Pont Experimental Station Hazardous Waste Incinerator", 1993 Incineration Conference Proceedings, pp. 823-831, May 1993, Knoxville, TN). In fact in the draft Technical Support Document for HWC MACT Standards, Volume III, Evaluation of Metals Emissions Database to Investigate Extrapolation and Interpolation Issues, April 1997, EPA concluded that system removal efficiencies increase slightly with increasing feedrates. Thus, actual emissions at maximum feedrates will be less than or equal to the emissions extrapolated using the removal efficiencies calculated at the lower CPT constituent feedrates. Because metals removal efficiencies increase with feedrate (emissions decrease per gram of metal fed), this extrapolation will ensure that the actual emissions are below the standard.

The Agency approved extrapolation in the 2008, 2013, and 2018 CPTs for the MHI, although only 30% extrapolation above the CPT feedrate was requested. RED proposes to use the same type of approach approved for the previous CPTs and outlined below, but extrapolate up to the maximum historical feedrate:

1. RED proposes to feed sludge at the maximum sludge feedrate with the actual concentration of metals and ash that are present in the testing days' sludge. (See Table 1 for the recent historical range and Table 22 which compares 2018 CPT constituent feedrates with the recent historical feedrates from Table 1.) Chlorine will be spiked in the form of NaCl, but there will be no extrapolation of chlorine.

2. CPT average constituent concentrations, feedrates, actual emissions rates, and removal efficiencies will be determined using the average of the three runs
3. Extrapolation can be considered as long as the emissions rate associated with each constituent is less than 90% of the emissions standard.
4. Divide each constituent sludge maximum 2017-2021 concentration (Max C) described in #2 above, except ash, by the test feedrate constituent concentration (Feed C) from Table 1 to determine the desired extrapolation factor (EF).
5. For ash, divide each constituent maximum 2019-2021 concentration described in #2 above, by the Constituent concentration from Table 1 to determine the determine the desired extrapolation factor. (Note that sludge ash concentrations dropped significantly with the switch of the Eastman Business Park power boilers' fuel from primarily coal to primarily gas. Therefore 2017-2018 ash levels are no longer representative of future ash concentrations and will not be used as part of the ash concentration dataset to determine maximum permitted ash levels.)
6. Multiply the average test emissions rate (TER) for each constituent by the corresponding desired extrapolation factor determined in #3 above to determine the extrapolated emissions rate (EER). Divide this extrapolated emissions rate (EER) for each constituent by the emissions standard to determine the extrapolated emissions fraction (EEF) of the standard. If the EEF is less than or equal to 0.9 (an extrapolated emissions of less than 90% of the emissions standard), then the maximum constituent concentration times the sludge feedrate will be used to determine the permitted feedrate for that constituent. If the ratio is greater than 0.9, then the maximum constituent feedrate cannot be used to determine permitted feedrate of that constituent.
7. If a constituent cannot be extrapolated to its historical maximum by #7 above, divide 0.9 by the extrapolated emissions fraction (EEF) of the standard from #7 above to determine the allowable fraction (AF) of maximum constituent feedrate (Max C). The permitted feedrate limit is determined by multiplying the test sludge feedrate times the allowable fraction (AF) times the Max C. This will allow the feedrate to be extrapolated to the level that would result in an emissions level of 90% of the standard.

If a constituent is not detected in the feed, it will be counted as zero, so the measured feedrate will be below the actual feedrate, a conservative approach to setting the feedrate limit. Should no emissions be detected, RED will assume that the actual emissions are at the detection limit, a conservative approach to determining the emissions. **Table 17** shows the anticipated detection limits of the flue gas samples. These limits are far below the emissions standard. If nothing is detected in the emissions, extrapolation from these detection limits will be far below the emissions standard. Therefore, the constituent's feedrate limits determined using extrapolation would ensure compliance with the emissions standards.

### **Example Calculation-**

Determine Feedrate Limit for SVM given the following **data**:

Historical Max SVM (Max C) = 41 ug/g from Table 1

CPT average Sludge Feedrate (SF) = 9,000 lb/hr

CPT average SVM concentration (Feed C) = 18 ug/g (This is the SVM historical average from Table 1, so a most likely SVM CPT concentration)

CPT SVM average test emissions rate (TER) = 5.8 ug/dscm @ 7% O<sub>2</sub> (For this example, this emissions rate from the 2018 CPT is used). If metals are not spiked and fed at a lower rate, the 2023 CPT emissions rate would be expected to be less than this 2018 CPT value used in this example.

SVM emissions standard (ES) = 230 ug/dscm @ 7% O<sub>2</sub>

**Calculations** (only the steps that apply to this SVM case are shown.)

Step #4 - Extrapolation Factor (EF) = Max C/Feed C = 41/18 = 2.3

Step #7 – Extrapolated Emissions Rate (EER) = EF \* TER = 2.3\* 5.8 ug/dscm @ 7% O<sub>2</sub> = 13 ug/dscm @ 7% O<sub>2</sub>

Step #7 – Extrapolated Emissions Fraction (EEF) = EER/ES = 13/230 = .06

Since the EEF = .06 < 0.9 (extrapolated emissions are only 6% of the standard), the Max C can be used to set the feedrate limit.

SVM Feedrate Limit = Max C \* SF = 41/1000000 \* 9,000 lb/hr \*454 g/lb = 167 g/hr

The SVM limit is based on 12 hr = 167 g/hr \*12 = 2010 g/12 hr

(Note that this SVM feedrate is about 67% of the current permit limit using historical maximum SVM concentration from 2017 – 2021 because the SVM concentration has dropped somewhat in the last 5 years.)

### **63.1207(f)(1)(xi) Natural Gas Constituents**

**Requirement:** *63.1207(f)(1) (xi) If you do not continuously monitor regulated constituents in natural gas, process air feedstreams, and feedstreams from vapor recovery systems under §63.1209(c)(5), you must include documentation of the expected levels of regulated constituents in those feedstreams;*

RED burns natural gas in the MHIS, but does not burn any process air streams or feedstreams from vapor recovery systems. Natural gas does not contain a measurable amount of metals, ash or chlorine. **Appendix 1** contains documentation of this fact. It includes an MSDS for natural gas and some other engineering documents that show the contents of natural gas. None of the constituents of concern for this CPT are listed in this documentation.

### **63.1207(f)(1)(xii) System Conditioning**

**Requirement:** *63.1207(f)(1)(xii) Documentation justifying the duration of system conditioning required to ensure the combustor has achieved steady-state operations under performance test operating conditions, as provided by paragraph (g)(1)(iii) of this section;*

**Table 20**, Residence Time, shows that the time required for waste feed to travel through the multiple hearth incinerator is 62 minutes at the rabble arm speed that will be run during the CPT.

The other element of interest is the APCS recycle water system. Calculations assuming the recycle tank is a perfect stirred tank shows 51 minutes to reach steady state, while calculations assuming perfect plug flow show 116 minutes to reach steady state. The actual tank is somewhere in between these two extremes, probably closer to a stirred tank. However, the time to reach steady state is no greater than 116 minutes. These calculations are shown in **Appendix 2**.

The schedule (Table 17) calls for spiking and running under the CPT operating conditions for 2 hours before the test data collection begins. This is greater than the time required to reach steady state in either the MHI or the APCS recycle tank.

### **63.1207(f)(1)(xiii) NA**

**Requirement:** *63.1207(f)(1)(xiii) For cement kilns with in-line raw mills, if you elect to use the emissions averaging provision of this subpart, you must notify the Administrator of your intent in the initial (and subsequent) comprehensive performance test plan, and provide the information required by the emission averaging provision;*

This provision is not applicable to the MHIS because it is not a cement kiln.

### **63.1207(f)(1)(xiv) NA**

**Requirement:** *63.1207(f)(1)(xiv) For preheater or preheater/precalciner cement kilns with dual stacks, if you elect to use the emissions averaging provision of this subpart, you must notify the Administrator of your intent in the initial (and subsequent) comprehensive performance test plan, and provide the information required by the emission averaging provision;*

This provision is not applicable to the MHIS because it is not a cement kiln.

### **63.1207(f)(1)(xv)**

**Requirement:** *63.1207(f)(1)(xv) If you request to use Method 23 for dioxin/furan you must provide the information required under §63.1208(b)(1)(i)(B);*

**§63.1208(b)(1)(i) (B)** Method 23, provided in appendix A, part 60 of this chapter, after approval by the Administrator.

**(1)** You may request approval to use Method 23 in the performance test plan required under § 63.1207(e)(i) and (ii).

**(2)** In determining whether to grant approval to use Method 23, the Administrator may consider factors including whether dioxin/furan were detected at levels substantially below the emission standard in previous testing, and whether previous Method 23 analyses detected low levels of dioxin/furan in the front half of the sampling train.

**(3)** Sources that emit carbonaceous particulate matter, such as coal-fired boilers, and sources equipped with activated carbon injection, will be deemed not suitable for use of Method 23 unless you document that there would not be a significant improvement in quality assurance with Method 0023A.

RED believes the MHI meets the requirements for the use of Method 23 because previous testing has shown that the levels of dioxin were well below the requirement. As shown in Table IA, the levels during the 4 previous MACT comprehensive compliance tests under worst case conditions were 1.6% or less of the dioxin/furan (D/F) standard. Additionally, the levels of D/Fs during all confirmatory tests (2011, 2015, and 2020) were less than 1% of the standard. For the most recent Method 0023A test, the 2015 confirmatory test, the total D/F detected in the front half of the sampling train were less than 0.1% of the standard. This confirms that not only were total D/Fs well below the standards, but very low levels were in the front half of the sampling train. This means there will be no significant difference in results if the additional funds are spent to analyze the front half separately. Additionally, the MHI is not the type of source identified in (3) above, coal burning or carbon injection, likely to have a lot of carbonaceous material. The MHI has a highly efficient secondary combustion chamber that combusts any carbonaceous material coming from the multiple hearth, and the MHI was demonstrated to have a high DRE level in the previous DRE testing (>99.999%) and low particulate emissions (<26% of the standard) for all previous compliance tests.

### **63.1207(f)(1)(xvi) NA**

**Requirement:** *63.1207(f)(1)(xvi) If you are not required to conduct performance testing to document compliance with the mercury, semivolatile metals, low volatile metals, or hydrogen chloride/chlorine gas emission standards under paragraph (m) of this section, you must include with the comprehensive performance test plan documentation of compliance with the provisions of that section.*

This requirement is not applicable to the MHIS because RED plans to conduct a CPT to verify compliance with all the emissions standards.

### **63.1207(f)(1)(xvii) NA**

**Requirement:** *63.1207(f)(1)(xvii) If you propose to use a surrogate for measuring or monitoring gas flow rate, you must document in the comprehensive performance test plan that the surrogate adequately correlates with gas flow rate, as required by paragraph (m)(7) of this section, and §63.1209(j)(2), (k)(3), (m)(2)(i), (n)(5)(i), and (o)(2)(i).*

This requirement is not applicable to the MHIS because RED is not requesting to use a surrogate for monitoring or measuring gas flow rate.

### **63.1207(f)(1)(xviii) Alternative Monitoring Requests**

**Requirement:** *63.1207(f)(1)(xviii) You must submit an application to request alternative monitoring under §63.1209(g)(1) not later than with the comprehensive performance test plan, as required by §63.1209(g)(1)(iii)(A).*

Eastman Kodak Company (previous owner and operator) previously submitted several alternative-monitoring petitions that were approved by the Agency. RED believes that these previous approvals will continue to apply when setting permit conditions under this current CPT. RED also submitted an ash feedrate extrapolation alternative monitoring petition that was approved by EPA. **Table 23**, MHIS Approved Alternative Monitoring Provisions, is the list of alternative monitoring provisions that have been approved by the Agency. RED plans to use these approved alternative monitoring petitions to set the required operating conditions in the Notification of Compliance.

### **63.1207(f)(1)(xix)**

**Requirement:** *63.1207(f)(1)(xix) You must document the temperature location measurement in the comprehensive performance test plan, as required by §§63.1209(j)(1)(i) and 63.1209(k)(2)(i).*

Temperature is measured at five locations for the purpose of establishing combustion temperature limits using the CPT data – two in hearth #3, one in hearth #4 and two in the secondary combustion chamber. Because the fire and maximum temperature can move up and down the hearth, the hearth (#3 or #4) with the hottest average temperature from the CPT will be used to set the minimum and

maximum hearth temperatures. The secondary temperature represents a second compliance parameter.

Thermocouple locations were chosen by the designer of these combustion systems to best represent the temperature for each of the hearths and the secondary combustion chamber. Note that there are two thermocouples in hearth # 3 that are averaged to determine the hearth # 3 temperature. There are also two thermocouples in secondary combustion chamber that are also averaged to determine the secondary combustion chamber temperature. The specific locations of the hearth thermocouples are described in **Table 24** and the attached Drawing Number 095XX-770-003. The specific location of the secondary combustion chamber thermocouples are also described in **Table 24** and shown on the attached Drawing Number 095XX-770-004.

### **63.1207(f)(1)(xx) NA**

**Requirement:** *63.1207(f)(1)(xx) If your source is equipped with activated carbon injection, you must document in the comprehensive performance test plan:*

- (A) The manufacturer specifications for minimum carrier fluid flow rate or pressure drop, as required by §63.1209(k)(6)(ii); and*
- (B) Key parameters that affect carbon adsorption, and the operating limits you establish for those parameters based on the carbon used during the performance test, if you elect not to specify and use the brand and type of carbon used during the comprehensive performance test, as required by §63.1209(k)(6)(iii).*

This is not applicable because the MHIS is not equipped with activated carbon injection.

### **63.1207(f)(1)(xxi) NA**

**Requirement:** *63.1207(f)(1)(xxi) If your source is equipped with a carbon bed system, and you elect not to specify and use the brand and type of carbon used during the comprehensive performance test, you must include in the comprehensive performance test plan key parameters that affect carbon adsorption, and the operating limits you establish for those parameters based on the carbon used during the performance test, as required by §63.1209(k)(7)(ii).*

This is not applicable because the MHIS is not equipped with a carbon bed system.

### **63.1207(f)(1)(xxii) NA**

**Requirement:** *63.1207(f)(1)(xxii) If you feed a dioxin/furan inhibitor into the combustion system, you must document in the comprehensive performance test plan key parameters that affect the effectiveness of the inhibitor, and the operating limits you establish for those parameters based on the inhibitor fed during the performance test, if you elect not to specify and use the brand and type of inhibitor used during the comprehensive performance test, as required by §63.1209(k)(9)(ii).*

This is not applicable because the MHIS does not feed a dioxin inhibitor into the combustion system.

### **63.1207(f)(1)(xxiii) NA**

**Requirement:** *63.1207(f)(1)(xxiii) If your source is equipped with a wet scrubber and you elect to monitor solids content of the scrubber liquid manually but believe that hourly monitoring of solids content is not warranted, you must support an alternative monitoring frequency in the comprehensive performance test plan, as required by §63.1209(m)(1)(i)(B)(1)(i).*

This is not applicable because the MHIS scrubber liquid solids content is not monitored manually.

### **63.1207(f)(1)(xxiv)**

**Requirement:** *63.1207(f)(1)(xxiv) If your source is equipped with a particulate matter control device other than a wet scrubber, baghouse, or electrostatic precipitator, you must include in the comprehensive performance test plan:*

- (A) Documentation to support the operating parameter limits you establish for the control device, as required by §63.1209(m)(1)(iv)(A)(4); and*
- (B) Support for the use of manufacturer specifications if you recommend such specifications in lieu of basing operating limits on performance test operating levels, as required by §63.1209(m)(1)(iv)(D).*

RED operates a wet electrostatic precipitator. The Agency approved an alternative monitoring petition to use specific power and power to ensure proper performance of the WESP as described in **Table 23**.

The quench system is a gas cooling system and not a particulate control device. RED operates it above the minimum flow rate and minimum outlet temperature described in the NOC shown in **Table 8**. This ensures that the APCS operates according to design to obtain good particulate removal. RED will operate the quench at the minimum flow rate shown in **Table 18** during the CPT to ensure that future performance will be as good or better than the performance demonstrated during the CPT.

### **63.1207(f)(1)(xxv) NA**

**Requirement:** *63.1207(f)(1) (xxv) If your source is equipped with a dry scrubber to control hydrogen chloride and chlorine gas, you must document in the comprehensive performance test plan key parameters that affect adsorption, and the limits you establish for those parameters based on the sorbent used during the performance test, if you elect not to specify and use the brand and type of sorbent used during the comprehensive performance test, as required by §63.1209(o)(4)(iii)(A); and*

This is not applicable because the MHIS does not have a dry scrubber.

### **63.1207(f)(1)(xxvi) Handling of Non-Detects**

**Requirement:** *63.1207(f)(1) (xxvi) For purposes of calculating semi volatile metal, low volatile metal, mercury, and total chlorine (organic and inorganic), and ash feedrate limits, a description of how you will handle performance test feedstream analytical results that determines these constituents are not present at detectable levels.*

RED will assume that any constituents that are not detected in the feedstream are not present and will use a value of zero for those constituents. This will provide the lowest, most conservative constituent feedrate calculations.

### **63.1207(f)(1)(xxvii) NA**

**Requirement:** *63.1207(f)(1)(xxvii) Such other information as the Administrator reasonably finds necessary to determine whether to approve the performance test plan.*

This is not currently applicable because the administrator has not requested any additional information to date.

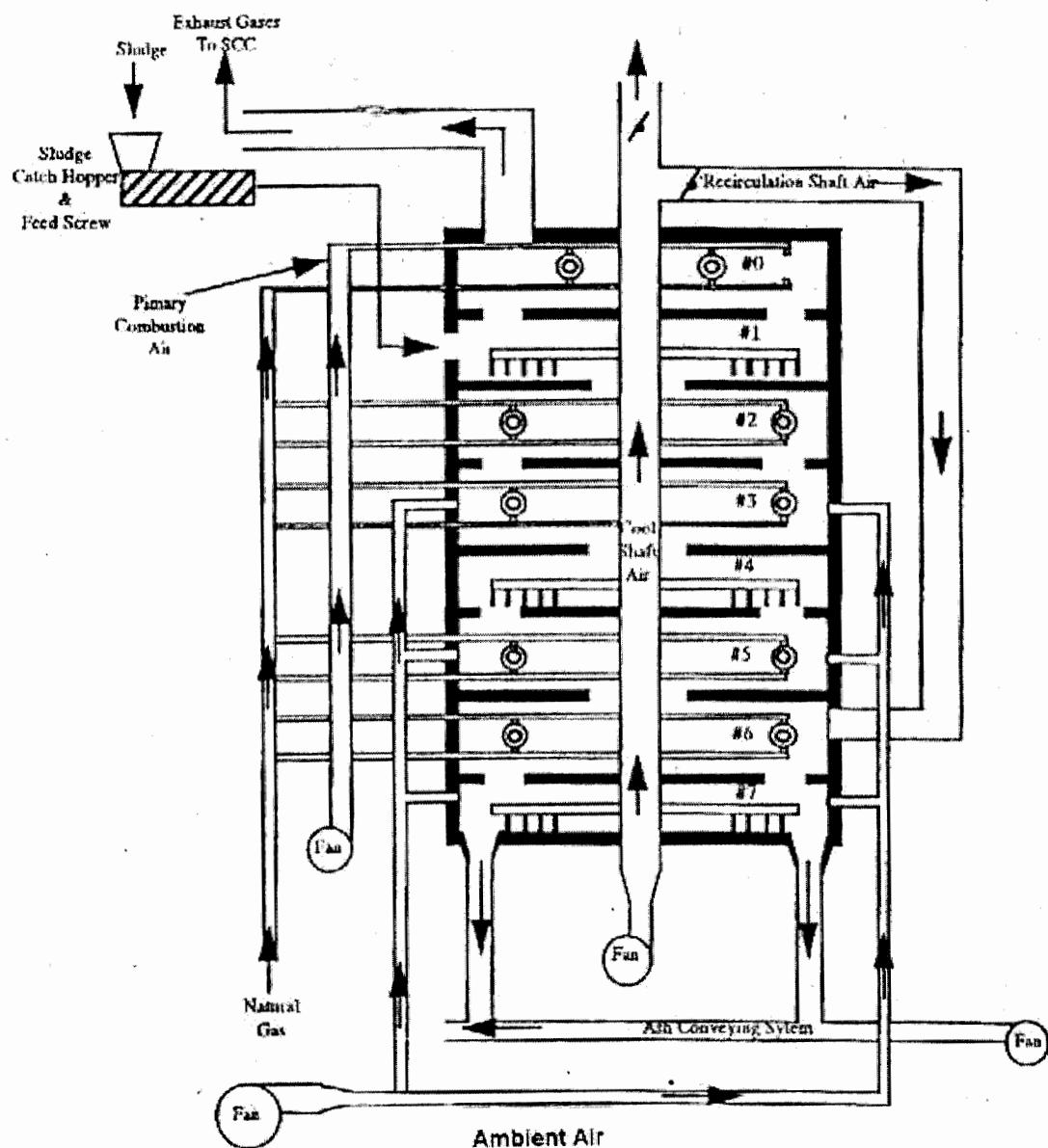
### **III - Permit Conditions**

**Table 25**, Setting Operating Parameter Limits, contains a specific description of how each MHIS operating parameter limit will be set using the CPT data. The mechanisms for setting each limit are consistent with the HWC MACT requirements and the alternative monitoring petitions that have been approved by the Agency and the 63.1207(f)(1)(x) Metals Extrapolation procedure in this CPT plan. For most conditions this approach is consistent with the mechanism used to set the operating parameter limits for previous Notifications of Compliance with these HWC MACT standards.

Because no additional DRE test is being run for this test, the minimum hottest hearth temperature and minimum secondary combustion chamber temperature permitted can be no lower than the values demonstrated in the initial CPT as shown in **Table 25**. Since no maximum temperature test is required by CFR Part 63, Subpart EEE nor being run in this CPT, the maximum hearth and secondary temperature limits from the previous CPT run in 2018 will be maintained.

Because the HWC MACT rule is self-implementing, RED will use the approach outlined in **Table 25** of the CPT. Any concerns with this approach should be included in comments on the CPT plan that are supplied to RED before the CPT is approved. This will allow RED to make any required modifications to the plan and the operating conditions consistent with the future operating requirements.

**Figure 1**



\* Not All Hearth Levels Are Shown With Rabbie Arms To Allow Burner Details To Be Illustrated.

**Figure 2** Building 95 Multiple Hearth Incinerator.

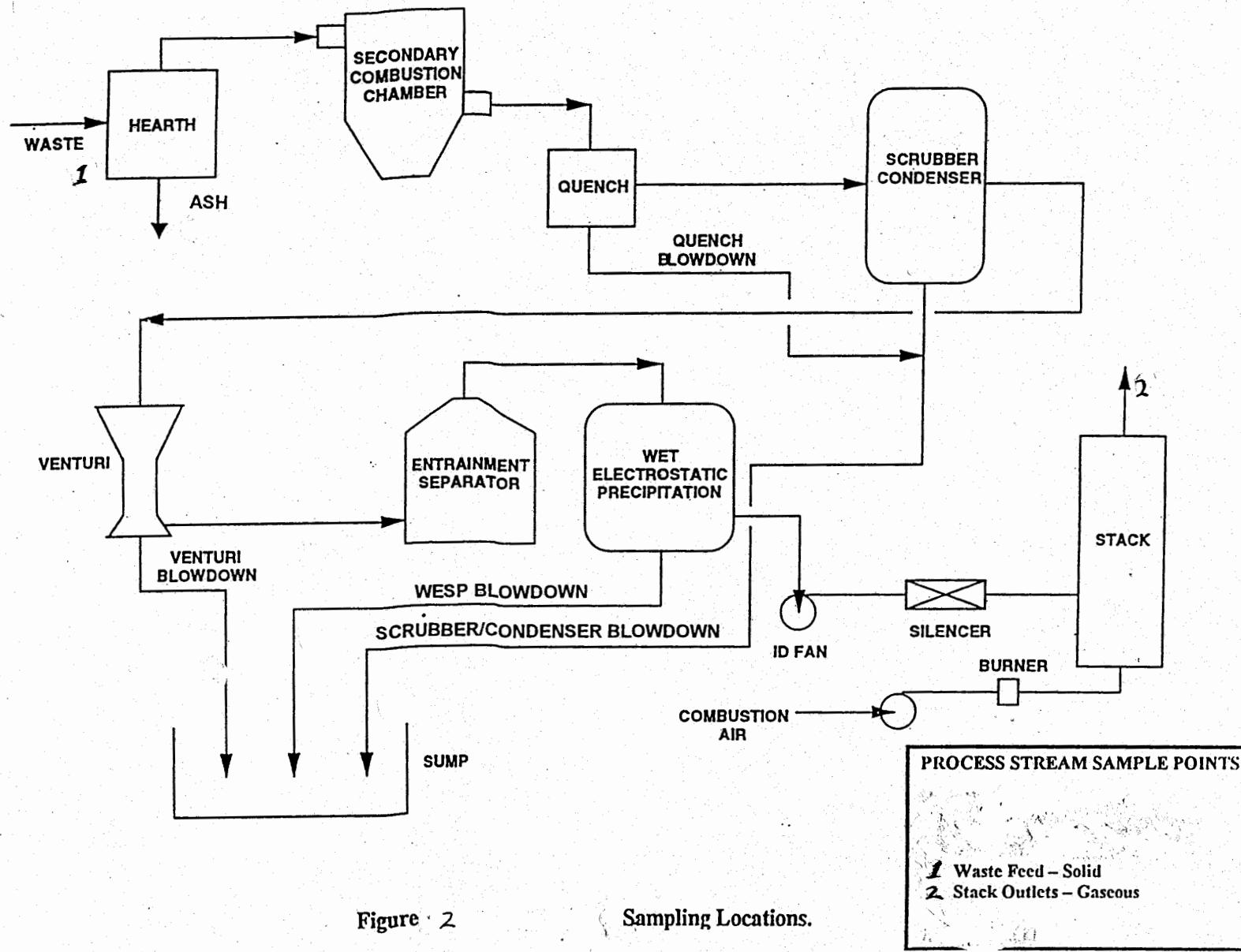
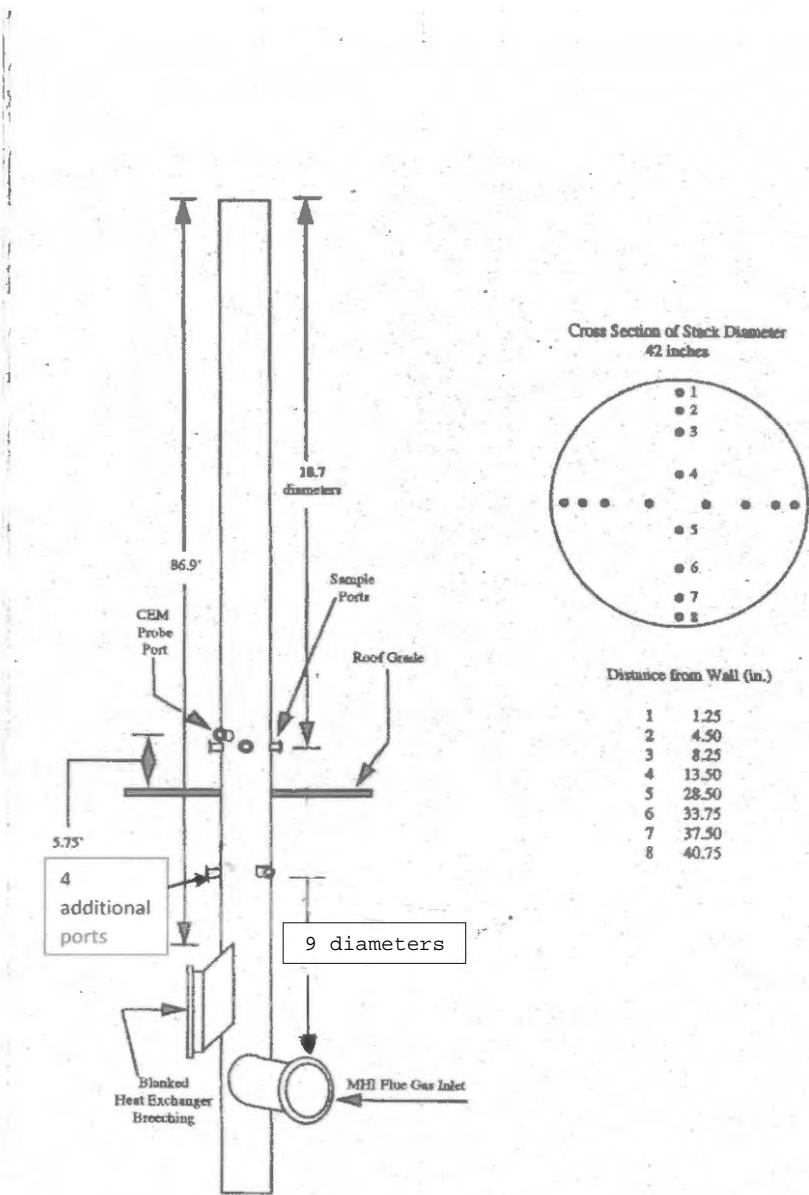


Figure 2

Sampling Locations.

Figure 2

**Figure 3**



**Figure 3. Multiple Hearth Incinerator Exhaust Stack, Sampling Ports & Monitoring.**

**Figure 4 - Method 26A Sampling Train**

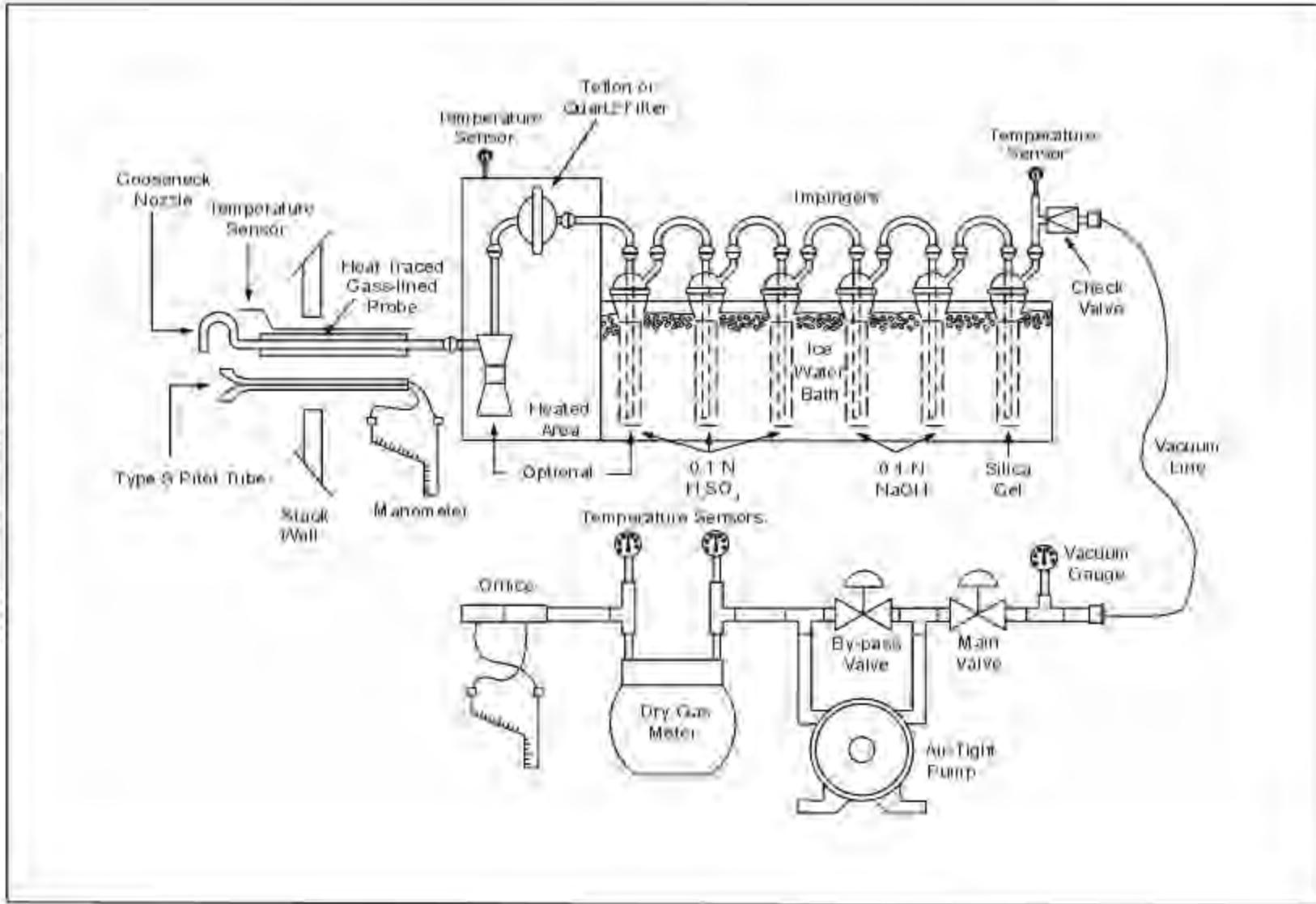
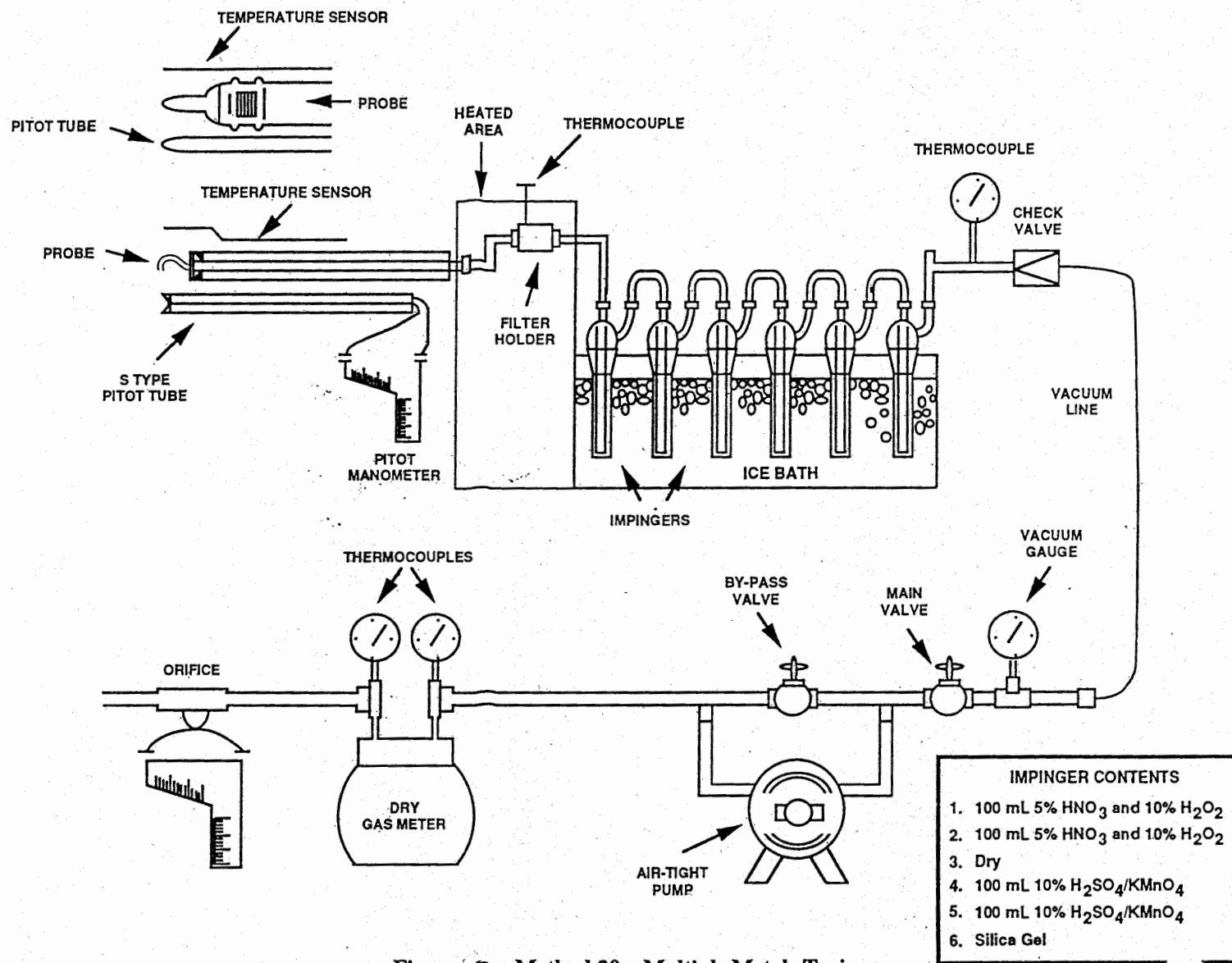
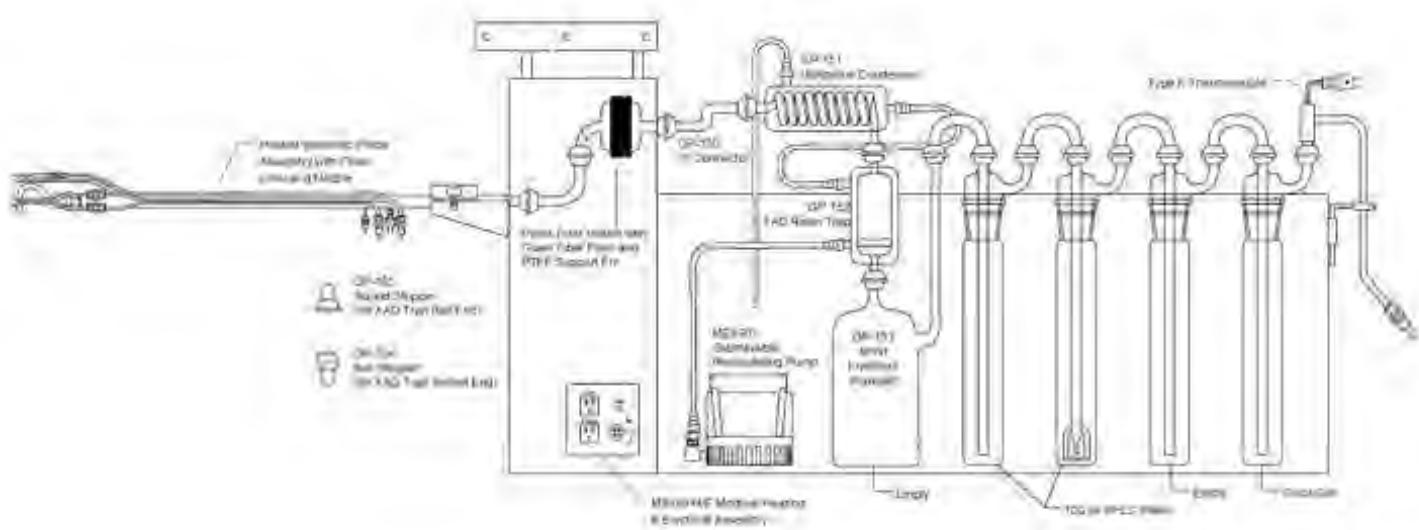


Figure 26A-1. Sampling Train

**Figure 5****Figure 5** Method 29 – Multiple Metals Train

**Figure 6**  
**Method 23 – PCDD/PCDF**



## Appendix I

### Natural Gas Material Safety Data Sheet

Material Safety Data Sheet(MSDS)

Page 1 of 3

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**Material Safety Data Sheet**

This data sheet addresses our most frequently asked questions concerning the identity information, health and safety issues, and chemical characteristics for natural gas. If you have any questions about the materials presented in this document, contact your local Large Volume Sales Representative.

IDENTITY (AS USED ON LABEL AND LIST)	CAS NUMBER
Natural Gas - Distribution	8006-14-2

**Section I**

Address (Number, Street, City, State and Zip Code) 6161 Oak Tree Blvd - Suite 200 Independence, Oh 44131	Emergency Telephone Number 1-800-521-4400
	Telephone Number For Information (216) 736-5100
	Revised 2/94 Superseded 10/2/86

**Section II - Hazardous Ingredients/Identity Information**

Methane	70-99%
Ethane	1-12%
Propane	0-3%
Butane & Higher Hydrocarbons	0.03-2%
Inert (Such as Nitrogen, Carbon Dioxide & Helium)	0-6%
Trace of odorant to impart a distinctive odor (Tetrahydrothiophene)	3-15 PPM sulfur by weight

**Section III - Physical/Chemical Characteristics**

BOILING POINT	SPECIFIC GRAVITY (H <sub>2</sub> O = 1)	
Methane	-259 F (Normally in gaseous state)	N/A
VAPOR PRESSURE (mm Hg.)	MELTING POINT	
N/A		N/A
VAPOR DENSITY (AIR=1)	EVAPORATION RATE (BUTYL ACETATE=1)	
0.55-0.65		N/A

SOLUBILITY IN WATER  
Negligible

APPEARANCE AND ODOR  
Colorless, perhaps odorless & tasteless gas without odorants (Sulfur-like smell with odorant)

**Section IV - Fire and Explosion Hazard Data**

FLASH POINT (METHOD USRD) N/A - Flammable Gas	FLAMMABILITY LIMITS	LFL	UFL
		5%	15%

EXTINGUISHING MEDIA  
Dry chemical, CO<sub>2</sub>, Halon (Dry chemical is recommended)

SPECIAL FIRE FIGHTING PROCEDURES  
Shut off gas supply

Cool surroundings with water spray to prevent ignition of other combustibles

**UNUSUAL FIRE AND EXPLOSION HAZARDS**

Mixtures of natural gas and air in certain proportions can result in an explosive mixture; auto ignition temperature in air 1000 degrees F.

**Section V - Reactivity Data**

STABILITY	UNSTABLE	CONDITIONS TO AVOID
	STABLE	X

**INCOMPATIBILITY (MATERIALS TO AVOID)**

N/A

**HAZARDOUS DECOMPOSITION OR BYPRODUCTS**

Incomplete combustion yields carbon monoxide

HAZARDOUS POLYMERIZATION	MAY OCCUR	CONDITIONS TO AVOID
	WILL NOT OCCUR	X

**Section VI - Health Hazardous Data**

ROUTE(S) OF ENTRY:	INHALATION?	SKIN?	INGESTION?
	X		

**HEALTH HAZARDS (ACUTE AND CHRONIC)**

TLV - Simple Asphyxiant - Natural gas is non-toxic; however, it acts as a simple asphyxiante by displacing or partially displacing the air required to support life.

CARCINOGENICITY:	NTP?	EARL MONOXICAPITIS?	OSHA REGULATIONS?
	N/A	N/A	N/A

**SIGNS AND SYMPTOMS OF EXPOSURE**

Rapid respirations &amp; air hunger from breathing air displacement.

**MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE**

If breathing is stopped, administer CPR and seek medical attention.

**EMERGENCY AND FIRST AID PROCEDURES**

Remove victim to fresh air, and if breathing has stopped, begin mouth-to-mouth resuscitation.

**Section VII - Precautions for Safe Handling and Use****STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED**

Evacuate area; provide optimum explosion-proof ventilation. Shut off supply, remove or eliminate ignition sources; minor leaks can be detected with soap solution applied at suspected leak points; never use flame to detect presence of Methane.

**WASTE DISPOSAL METHOD**

N/A

**PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING**

Store cylinders in well ventilated, low fire-risk area.

**OTHER PRECAUTIONS**

Follow general safety procedures for handling and storing compressed gas cylinders  
- No Smoking, Fire, Matches.

**Section VIII - Control Measures****RESPIRATORY PROTECTION (SPECIFY TYPE)**

Use Self-Contained Breathing Apparatus.

VENTILATION	LOCAL EXHAUST Natural	SPECIAL N/A
	MECHANICAL (GENERAL) Air Mover safe for explosive atmospheres.	OTHER N/A

PROTECTIVE GLOVES	EYE PROTECTION
None Normally Needed	Eye Shield (Goggles)
OTHER PROTECTIVE CLOTHING OR EQUIPMENT	
Where gross eye/skin contact may be a problem, wear/use appropriate protective equipment.	
WORK/HYGIENIC PRACTICES	
Use good personal hygiene practices.	

**Comparison of Relative Emissions Rates**  
**Lb/million BTU**

Substance Emitted*	Orimulsion	Oil/Gas	Compliance Coal	#6 Fuel Oil (1% Sulfur)	Natural Gas
SO <sub>2</sub> (Sulfur Dioxide)	0.235	0.80	1.20	1.10	0.0006
NO <sub>x</sub> (Oxides of Nitrogen)	0.15	0.28	0.45	0.30	0.20
Particulate Matter (PM)	0.02	0.06	0.03	0.08	0.005
VOCs (Volatile Organic Compounds)	0.002	0.0018	0.002	0.002	0.0014

\* Emission limit ranges for the above Fuels are based on a typical existing electric utility steam generating unit Vintage 1970's.

**Natural Gas:**

PM, SO<sub>2</sub> and NO<sub>x</sub> emissions are uncontrolled.

**No. 6 Fuel Oil:**

PM and SO<sub>2</sub> emissions are uncontrolled. NO<sub>x</sub> emissions controlled with low NO<sub>x</sub> burners.

**Compliance Coal:**

0.7 – 1% low sulfur coal. NO<sub>x</sub> emissions controlled with combustion controls such as low NO<sub>x</sub> burners.

**Oil/Gas:**

Based on 70% oil/ 30% gas utilization of fuels without the existence of electrostatic precipitators (ESPs). NO<sub>x</sub> emissions controlled with combustion controls such as low NO<sub>x</sub> burners.

**Orimulsion:**

PM emissions controlled at 94% removal efficiency and SO<sub>2</sub> emissions controlled at 95% removal efficiency. NO<sub>x</sub> emissions controlled at 75% removal efficiency with low NO<sub>x</sub> burners combined with boiler rebum modifications.

**Question #1: What is the Theoretical Gross and Net Heating Values of natural gas?**

**Net Heating Value is**      **911 Btu per cubic foot**  
**8,110 Kcal per cubic meter**

**Question #2: What is the theoretical flue gas analysis of natural gas (assuming 83% CH<sub>4</sub> and 16% C<sub>2</sub>H<sub>6</sub>)?**

**Answer:** Under perfect air/fuel ratio ( $10.56 \text{ ft}^3$  of air to  $1 \text{ ft}^3$  of natural gas), the flue gas analysis is:

2.14 ft<sup>3</sup> of H<sub>2</sub>O  
1.15 ft<sup>3</sup> of CO<sub>2</sub>,  
8.39 ft<sup>3</sup> of N<sub>2</sub>

**In a dry flue gas, this composition is:**

12.1% CO<sub>2</sub>  
0.0% O<sub>2</sub>  
88.0% N<sub>2</sub>

This information is taken from the North American Combustion Handbook, second addition.

## Appendix 2

### Steady State in the Recycle Water Cleaning System

The venturi/separator recycle water system operates somewhere between plug flow and perfectly mixed system. Therefore the time required to reach the new steady state conditions after a change is calculated using both plug flow equations, which is 48 minutes, and mixed tank equations which is 110 minutes. Since there is some mixing in the tank even though it is not a stirred tank, the time is longer than 48 minutes. Since the mixing in the tank is not perfect (there is no mixer) the time is less than 110 minutes, so these two calculations bracket the actual values that the system will take to reach steady state. Since Kodak proposes spiking for 2 hours before starting the TB/CPT testing, the recycle water system will have reached steady state before testing.

#### System Data and Volume Calculations

The only recycle water cleaning system in the multiple hearth system is the venturi sprays which are removed in the separator and collected in the venturi/separator recycle tank. Per drawing V095XX-312-018 the tank has an outside diameter of 9 feet 3/8 inches with a wall thickness of 3/16 inch to give a tank internal diameter of 9 feet.

The return piping is insignificant in terms of time, but is shown in the calculation for completeness. There is approximately 32 feet of 4 inch ID piping and 16 feet of 3 inch ID piping between the recycle tank and the venturi.

The TB/CPT will be run at 30 inches recycle tank level and 25 gpm venturi blowdown flow rate and 190 gpm venturi sprays recycle flow rate.

$$\text{Volume} = \pi D^2 h / 4$$

D= vessel diameter

H= tank height or pipe length

$$\text{Recycle tank volume} = 3.14 \times (9 \text{ ft})^2 \times 2.5 \text{ ft} / 4 = 159 \text{ ft}^3 \times 7.48 \text{ gal}/\text{ft}^3 = 1190 \text{ gal}$$

$$\text{Return piping} = 3.14 \times (1/3 \text{ ft})^2 \times 32 \text{ ft} / 4 + 3.14 \times (1/4 \text{ ft})^2 \times 16 \text{ ft} / 4 = 2.59 \text{ ft}^3 \times 7.48 \text{ gal}/\text{ft}^3 = 19 \text{ gal}$$

#### Plug Flow Steady State Calculations

For plug flow the following equation determines the time that it takes water to go through the entire system and hence reach the concentration entering the system.

Time = Volume/flowrate

Return piping is plug flow.

Time = 19 gal/ 190 gal/min = 0.1 minute

If the recycle tank was plug flow:

Time = 1190 gal/ 25 gal/min = 47.6 min.

For a plug flow tank, total system time to turnover to the new conditions is 47.7 minutes.

### Mixed Tank Steady State Calculations

If the tank was a perfectly mixed stirred tank and there is no accumulation or loss of liquid in the system, the time to steady state is represented by the following set of equations. The convention is used that when the concentration has changed by 90% from the initial value to the final value, the system is considered to have reached steady state.

V= tank volume

C<sub>i</sub> = concentration entering tank system (from venturi/separator liquid)

C<sub>o</sub> = concentration leaving tank system (blowdown concentration)

C<sub>a</sub> = initial tank concentration

C<sub>b</sub>= concentration of the new venturi/separator liquid produced by the spiked steady state incineration system.

F = flowrate leaving the tank system (blowdown flowrate)

t = time

The outlet concentration is the average concentration in the system by definition since it is a perfectly mixed tank. The change in the outlet concentration is the difference between the quantity of material coming into the tank system and the quantity leaving:

$$\frac{dC_o}{dt} = (C_i F - C_o F)/V$$

or rearranging:

$$\frac{dC_o}{dt} = (C_i - C_o)F/V$$

$$\frac{dC_o}{(C_i - C_o)} = (F/V)dt$$

Integrating from t=0 when the spiking begins to time = t

$$\int \frac{dC_o}{(C_i - C_o)} = \int (F/V)dt$$

$$-\ln(C_i - C_o) = Ft/V + k$$

To solve for the constant k, set t = 0

$$k = -\ln(C_b - C_a)$$

$$-\ln(C_i - C_o) = Ft/V - \ln(C_b - C_a)$$

August, 2001

2

Multiplying by  $-1$  gives:

$$\ln(C_i - C_o) = -(Ft/V + \ln(C_b - C_a))$$

Raising to the exponential:

$$C_i - C_o = e^{-(Ft/V + \ln(C_b - C_a))}$$

Rearranging:

$$C_i - C_o = (C_b - C_a)e^{-(Ft/V)}$$

Defining the steady state goal by the convention that when the concentration has changed by 90% from the initial value to the final value, the system is considered to have reached steady state, or the remaining difference is only 10%:

$$C_i - C_o = 0.1(C_b - C_a)$$

Inserting the steady state definition equation into the last mixed tank equation gives:

$$0.1(C_b - C_a) = (C_b - C_a)e^{-(Ft/V)}$$

Rearranging gives:

$$e^{-(Ft/V)} = 0.1$$

Taking the natural log and rearranging gives:

$$t = -V \ln(0.1)/F$$

$$t = (-1190 \text{ gal}) (-2.3)/25 \text{ gal/min}$$

$$t = 109.6 \text{ minutes for the tank to reach steady state}$$

Adding the 0.1 minutes of time in the piping, gives 109.7 minutes for the venturi/separator tank system to reach steady state.

Note that if the recycle tank level is increased from 30 to 31.8 inches (as proposed for the CPT), it increases the tank volume and hence the residence time by about 6%, making the steady state residence time 116 min (116 min for stirred tank and 51 min for plug flow). Hence, 120 minutes (2 hours) is an adequate duration to achieve steady state at 31.8 inches in the recycle tank.

**RED Rochester, LLC ,**

**CONTINUOUS EMISSION MONITORING SYSTEM  
PERFORMANCE SPECIFICATION TEST PLAN**

*Prepared for:*

RED-Rochester, LLC

*Prepared by:*

GHD  
Rochester, New York 14650

Prepared March 20, 2020  
Reviewed and Determined To Be Current May 5, 2022

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## **TABLE**

Table 1. CEMS Performance Criteria.....	1-14
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**SECTION 1.0****PROJECT DESCRIPTION****1.1 Purpose**

RED-Rochester, LLC (RED) operates a Multiple Hearth Incinerator (MHI). The MHI is a major component of the King's Landing Wastewater Treatment Plant (KLWWTP) located on the Genesee River in Rochester, New York. RED is in the process of planning and conducting a confirmatory performance test to show compliance with the Hazardous Waste Combustor Maximum Achievable Control Technology (HWC MACT) standards for the unit. The MHI includes a continuous emission monitoring system (CEMS) that monitors stack gas concentrations of carbon monoxide (CO) and oxygen (O<sub>2</sub>). RED operates these monitors in accordance with the requirements outlined in 40 CFR Part 266 Subpart H Section 104 and Volume V of the Hazardous Waste Incineration Guidance Series, Guidance on PIC Controls for Hazardous Waste Incinerators, which is also consistent with the Performance Specification 4B in 40 CFR Part 60. As prescribed in these requirements, a Performance Specification Test (PST) must be performed on the CEMS to certify it for use.

RED has selected a contractor to conduct a PST to evaluate the operation of the O<sub>2</sub> and CO CEM system. The certification tests will be performed in accordance with the specifications cited in 40 CFR Part 60, Appendix B, Performance Specification 4B, "Specifications and test procedures for carbon monoxide and oxygen continuous monitoring systems in stationary sources" as required by the HWC MACT. The PST will include calibration drift, alternative relative accuracy (based on June 20, 2003 EPA approval of RATA alternative), absolute calibration audit, and response time tests. The test procedures and performance criteria specified in Performance Specification 4B are similar and as stringent to those specified in 40 CFR Part 266, Appendix IX, Section 2.0. Therefore, demonstrating compliance with Performance Specification 4B will be considered equal to demonstrating compliance with 40 CFR Part 266, Appendix IX, Section 2.0.

This test plan is intended to outline the procedures and the QA/QC objectives that will be followed during the CEMS PST. The contractor selected by RED will be responsible for conducting the calibration drift test utilizing procedures and data sheets as outlined in this plan. The same contractor will be responsible for reviewing the drift test data and conducting the alternative relative accuracy, absolute calibration audit and response time tests along with producing the final certification report. During all testing performed, the MHI will be maintained at greater than 50 percent of normal load.

## **1.2 Performance Specification Testing**

Brief descriptions of the tests that will be performed during the PST are provided below. A summary of the performance criteria that will be demonstrated during the CEMS performance evaluation test is provided in Table 1.

### ***1.2.1 Calibration Drift (CD)***

The calibration drift (CD) test will be performed to demonstrate the stability of the CEM calibration over time. The CD is defined as the deviation of the CEM output readings from the established reference value after a stated period of operation during which no unscheduled maintenance, repair or adjustment took place. If any adjustments are made to the CEM zero and/or calibration settings, the appropriate data will be recorded prior to performing the adjustment to allow for the calculation of the CD.

Following an initial calibration, the CO and O<sub>2</sub> monitors will be challenged every 24 hours for 7 consecutive days with a low level (zero) and a high level (span) certified calibration gas. The calibration gas will be introduced into the sampling system as close to the sampling probe outlet as practical and will pass through all CEM system components used during normal monitoring. The CEM response for each "challenge" will be recorded when a stable reading is

obtained and subtracted from the respective reference value (calibration gas) to determine the CD. The CD of the CO monitor will be calculated using the following equation (eq 1-1):

$$CD_{CO} = (|R - A| / S) * 100 \quad (\text{eq 1-1})$$

where:

- CD<sub>CO</sub> = Percent calibration drift,  
R = Reference value of zero or high level calibration gas introduced into the monitoring system,  
A = Actual monitor response to calibration gas,  
S = Span of the instrument.

The CD of the O<sub>2</sub> monitor will be calculated using the following equations (eq 1-2):

$$CD_{O_2} = |R - A| \quad (\text{eq 1-2})$$

where:

- CD<sub>O<sub>2</sub></sub> = Calibration drift,  
R = Reference value of zero or high level calibration gas introduced into the monitoring system,  
A = Actual monitor response to calibration gas.

To meet the specifications for the low range and high range CO monitors, the differences shall not exceed 3% of the span (6 ppm and 90 ppm, respectively) for six out of seven consecutive test days. The CD for the O<sub>2</sub> monitor shall not exceed 0.5% O<sub>2</sub> absolute on any of the designated seven days. Sample data sheets for the low CO, high CO and O<sub>2</sub> tests are provided in Exhibits 1-1, 1-2, and 1-3, respectively.

### **1.2.2 Absolute Calibration Audit (ACA)**

The absolute calibration audit (ACA) test will be performed to document the accuracy and linearity of the monitoring equipment over the entire measurement range. The absolute

calibration audit is used to calculate calibration error (CE). CE is defined as the difference between the concentration indicated by the CEM and the known concentration of the EPA Protocol I calibration gas.

Each monitor will be challenged three non-consecutive times EPA Protocol I cylinder gases at three measurement points within the ranges specified in Exhibit 1-4. The calibration gases will be introduced into the sample system as close to the sampling probe outlet as practical and will pass through all CEM system components used during normal monitoring. The difference between the instrument response and the reference value (certified gas) will be calculated after each run and the resulting three differences will be averaged to determine the CE at each measurement point. The CE of the CO monitor will be calculated using the following equation (eq 1-3):

$$\text{CE}_{\text{CO}} = |d_{\text{avg}} / S| * 100 \quad (\text{eq 1-3})$$

where:

$\text{CE}_{\text{CO}}$  = Percent calibration error,

$d_{\text{avg}}$  = Mean difference between CEMS response and the known reference concentration,

S = Span of the monitor.

The CE of the O<sub>2</sub> monitor will be calculated using the following equation (eq 1-4):

$$\text{CE}_{\text{O}_2} = |d_{\text{avg}}| \quad (\text{eq 1-4})$$

where:

$\text{CE}_{\text{O}_2}$  = Calibration error

$d_{\text{avg}}$  = Mean difference between CEMS response and the known reference concentration.

To meet the specifications for the low range and high range CO monitors, the CE shall not exceed 5% of the span value at all three measurement points (10 ppm and 150 ppm)

respectively for each range). The CE for the O<sub>2</sub> monitor shall not exceed 0.5% O<sub>2</sub> absolute at all three measurement points. Sample data sheets to be used during this test are given in Exhibits 1-5 and 1-6 for the CO and O<sub>2</sub> monitors respectively.

### ***1.2.3 Response Time (RT)***

The response time (RT) test will be performed to document the response rate of the monitoring equipment to a step change in the system input value. The RT is defined as the time interval between the start of an abrupt change in the system input and the time when the data recorder displays 95 percent of the final value. The response time test will determine the system upscale response time and downscale response time.

A zero level calibration gas will be introduced to the system as close to the sample probe as practical. After the system output has stabilized (no change greater than 1 percent of full scale range for 30 seconds), the zero gas will be turned off and a high level calibration gas will be introduced to the system. The time required to reach 95 percent of the final stable value at this new condition will then be determined (upscale response time). High-level calibration gas will then be turned off and the low level gas put back on. The time required to reach 95 percent of the final stable value at this condition will be determined (downscale response time). The entire procedure will be repeated three times to determine the mean upscale and downscale response times. The longer of the two mean values will be considered the system response time. The response time for either the CO or the O<sub>2</sub> monitor shall not exceed 2 (two) minutes. A sample data sheet to be used in this test is provided in Exhibit 1-7.

### ***1.2.4 Alternative Relative Accuracy (ARA)***

The relative accuracy (RA) test will be performed to assess the accuracy and to validate the calibration technique of the MHI CEMS. The B-95 MHI CO Monitors have been granted a

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waiver for the RA due to low levels of carbon monoxide created during normal operation of the incinerator (per June 20, 2003 letter to Kodak from Randy Braun, Acting Chief, Monitoring and Assessment Branch, EPA, Region II.). The alternative RA involves performing a complete system check including light source, receiver, timing functions, data reduction, recorder, heaters, and filters. The Oxygen Monitors will be tested against a reference system to determine the RA of the oxygen measurement.

## **1.3 Project Organization and Schedules**

### ***1.3.1 Project Organization***

Exhibit 1-8 shows specific duties of each team member. A RED representative will coordinate MHI operations and will be the communications link between MHI operations and personnel performing the PST.

### ***1.3.2 Schedules***

The following schedule is intended for conducting the PST on the MHI CEM system. The PST will be conducted within 45 days prior to the commencement of the dioxin/furan stack sampling Confirmatory Test.

<b>Day</b>	<b>Activity</b>
<b>Day 0</b>	Begin 7-day Calibration Drift Test
<b>Day 1</b>	Continue Calibration Drift Test
<b>Day 2-6</b>	Conduct Oxygen Relative Accuracy Test Conduct Response Time Test Conduct Alternative Relative Accuracy Test Conduct Absolute Calibration Audit

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<b>Day 7</b> <b>With CT Final report</b>	Continue Calibration Drift Test Complete 7-day Calibration Drift Test Submit final report on the PST
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**Exhibit 1-1. Sample Data Sheet for Conducting CO Calibration Drift Tests****Primary CO Analyzer Calibration Drift Test Results**

Test Dates:

Analyzer Make and Model: TECO Model 48i

Analyzer Serial Number: 0619317382

Range : Low

CO Span: 200 ppmv

CEMS Data Channel: CD\_CO\_LO

Low Level Gas

Day	Date	Time	Calibration Value (ppmv)	Monitor Response (ppmv)	Absolute Difference (ppmv)	Percent of Span
0						
1						
2						
3						
4						
5						
6						
7						

Range : High

CEMS Data Channel: CD\_CO\_HI

CO Span: 3000 ppmv

High Level Gas

Day	Date	Time	Calibration Value (ppmv)	Monitor Response (ppmv)	Absolute Difference (ppmv)	Percent of Span
0						
1						
2						
3						
4						
5						
6						
7						

$$\text{Calibration Drift} = (\text{ABS}(\text{Monitor Response} - \text{Calibration Value}) / \text{CEM SPAN}) * 100$$

---

**Exhibit 1-2. Sample Data Sheet for Conducting the O<sub>2</sub> Calibration Drift Tests****Primary O<sub>2</sub> Analyzer Calibration Drift Test Results**

Test Dates:

Analyzer Make and Model: Servomex Model 1440

Analyzer Serial Number: 3517

CEMS Data Channel: O<sub>2</sub>O<sub>2</sub> Span: 25 %bv

Day	Date	Time	Calibration Value (ppmv)	Monitor Response (ppmv)	Absolute Difference (ppmv)
0					
1					
2					
3					
4					
5					
6					
7					

Calibration Drift = (ABS(Monitor Response - Calibration Value))

---

**Exhibit 1-3. CEM Calibration Error Concentration Ranges for Tier I**

<b>Measurement Point</b>	<u><b>CO, ppm</b></u>		<b>O<sub>2</sub>, percent (0-25 %)</b>
	<b>Low Range (0-200 ppm)</b>	<b>High Range (0-3000 ppm)</b>	
1	0-40	0 - 600	0 - 2
2	60 – 80	900 - 1200	8 - 10
3	140 – 160	2100 - 2400	14- 16

Source: Performance Specification 4B, 40 CFR Part 60 Appendix B

**Exhibit 1-4. Sample Data Sheet for Conducting the CO Absolute Calibration Audit**

**RED-Rochester, LLC**  
**B-95 MHI Continuous Emissions Monitoring System**  
**480 Maplewood Drive, Rochester, New York, 14652**  
**Absolute Calibration Audit**  
**Carbon Monoxide Low Concentration Channel**

**Primary CO Analyzer**  
**TECO Model 48i**      **Serial Number 0619317382**

	Run Number	Monitor Response (ppmv)	Difference		
			Low (ppmv)	Mid (ppmv)	High (ppmv)
<b>Channel Span</b>	1-LOW	0.0			
200 ppmv	2-MID		0.0		
	3-HIGH			0.0	
<b>DAS Channel ID</b>	4-MID		0.0		
CD_CO_LO	5-LOW	0.0			
	6-HIGH			0.0	
	7-LOW	0.0			
	8-MID		0.0		
	9-HIGH			0.0	
	Mean Difference Absolute	0.00	0.00	0.00	
	Calibration Error (% of span)	0.00%	0.00%	0.00%	

Result: The analyzer passed the Absolute Calibration Audit.

Audit performed by:

USEPA Protocol 1 Gases			
Manufacturer	Cylinder #	Expiration Date	Concentration (ppmv)

**Pass/Fail Reference:**

The pass/fail criteria reference is United States Environmental Protection Agency Performance Specification 4B, Specifications and Test Procedures for Carbon Monoxide and Oxygen Continuous Monitoring Systems in Stationary Sources, Section 4.4. "The mean difference between the CEMS and reference values at all three test points (see Table I) must be no greater than 5 percent of span value for CO monitors and 0.5 percent for O<sub>2</sub> monitors".

**Exhibit 1-5. Sample Data Sheet for Conducting the O<sub>2</sub> Absolute Calibration Audit**

**RED-Rochester, LLC**  
**B-95 MHI Continuous Emissions Monitoring System**  
**480 Maplewood Drive, Rochester, New York, 14652**  
**Absolute Calibration Audit**  
**Oxygen Concentration Channel**

**Primary O<sub>2</sub> Analyzer**  
**Servomex Model 1440      Serial Number 3517**

	Run Number	Monitor Response (%bv)	Difference		
			Low (%bv)	Mid (%bv)	High (%bv)
<b>Channel Span</b>	1-LOW		0.00		
25 %bv	2-MID			0.00	
	3-HIGH				0.00
<b>DAS Channel ID</b>	4-MID			0.00	
O2	5-LOW		0.00		
	6-HIGH				0.00
	7-LOW		0.00		
	8-MID			0.00	
	9-HIGH				0.00
	Calibration Error (%O <sub>2</sub> )		0.00%	0.00%	0.00%

Result: The analyzer passed the Absolute Calibration Audit.

Audit performed by:

<b>USEPA Protocol 1 Gases</b>			
Manufacturer	Cylinder #	Expiration Date	Concentration (%bv)

**Pass/Fail Reference:**

The pass/fail criteria reference is United States Environmental Protection Agency Performance Specification 4B, Specifications and Test Procedures for Carbon Monoxide and Oxygen Continuous Monitoring Systems in Stationary Sources, Section 4.4. "The mean difference between the CEMS and reference values at all three test points (see Table I) must be no greater than 5 percent of span value for CO monitors and 0.5 percent for O<sub>2</sub> monitors".

**Exhibit 1-6. Sample Data Sheet for Conducting the Response Time Tests****Primary CO and O2 Analyzer Response Time Test Results**

Test Date:

CO Analyzerr Make and Model: TECO Model 48i  
O2 Analyzer Make and Model: Servomex Model 1440Serial Number: 0619317382  
Serial Number: 3517**RESPONSE TIME DATA**

	CO Monitor Low	CO Monitor High	O2 Monitor
Run Number	Time 95 % (sec)	Time 95 % (sec)	Time 95 % (sec)
1- UPSCALE			
2- DOWNSCALE			
3- UPSCALE			
4- DOWNSCALE			
5- UPSCALE			
6- DOWNSCALE			
MEAN UPSCALE RT			
MEAN DOWNSCALE RT			
CEM RESPONSE TIME (Average Minutes)			

**Low Cal Gas:**CO Upscale 95%: ppm      O2 Upscale 95%: %  
CO Downscale 5%: ppm      O2 Downscale 5%: %**High Cal Gas:**CO Upscale 95%: ppm  
CO Downscale 5%: ppm**Procedural Note:** Response times were captured manually using a stopwatch.**Performance Specification:** CEM RT  $\leq$  2 minutes

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**Exhibit 1-7. Test Member Assignments and Responsibilities**

<b>Assignment</b>	<b>Responsibilities</b>
<b>Team Leader</b>	Coordinate tests with RED and NYSDEC site personnel Coordinate collection of CEMs data
<b>CEM Operator</b>	Operate instrument system Reduce data and prepare daily reports Monitor CEMs calibration drift tests

**Table 1. CEMS Performance Criteria <sup>a</sup>**

<b>Monitor/Test</b>	<b>Performance Criteria</b>	<b>Reference</b>	<b>Notes</b>
<b><u>Carbon Monoxide Monitor</u></b>			
Calibration Drift	≤ 3 % of span	PS 4B, 4.2	For 6 out of 7 days; low and high range
Calibration Error	≤ 5 % of span	PS 4B, 4.4	At all three test points
Response Time	≤ 2 minutes	PS 4B, 4.5	Longest of the upscale and downscale averages or 5 ppm, whichever is greater
Relative Accuracy	PASS	PS 4B, 4.3  (PS 4A, 2.5)	
<b><u>Oxygen Monitor</u></b>			
Calibration Drift	≤ 0.5 % O <sub>2</sub>	PS 4B, 4.2	For 7 consecutive days
Calibration Error	≤ 0.5 % O <sub>2</sub>	PS 4B, 4.4	At all three test points
Response Time	≤ 2 minutes	PS 4B, 4.5	Longest of the upscale and downscale averages or 1.0% oxygen, whichever is greater
Relative Accuracy	≤ 1 Absolute % of the RM Mean	PS 4B, 4.3  (PS 3, 2.3)	

PS - Performance Specification, RM - Reference Method

<sup>a</sup> Original reference for performance criteria is Performance Specification 4B.

**SECTION 2.0****FACILITY DESCRIPTION****2.1 Kings Landing Wastewater Purification Plant Overview**

The KLWWTP site at Eastman Business Park is located at the base of the Genesee River gorge along the west bank. The primary function of the plant is biological treatment of process wastewater resulting from EBP site manufacturing operations. The treatment process begins with a “grit” removal system (GRS) where large debris is removed from the plant influent. From the GRS, the influent is directed to three primary treatment clarifiers, two aeration basins and trickling filters, then to three secondary treatment clarifiers where the activated sludge is removed to holding tanks. After the sludge reaches the holding tanks, polymer is added to condition the sludge to a density consistent with centrifuge dewatering requirements. The centrifuge reduces the water content of the sludge to about 80%. From the centrifuge, the resulting sludge cake is dropped to a link-grate conveying system, a vertical conveyor and then to a final link-grate conveyor and auger feed system located at hearth No. 1 MHI system. Grit is also fed to the MHI at a point in the link-grate conveyor between the centrifuge and the vertical sludge conveyor and the resulting combined stream is actually fed to the hearth.

**2.2 MHI Description**

The MHI, located in Building 95 of the facility, is a refractory lined 8-hearth unit (0-7) installed in 1975 and manufactured by Envirotech Corporation. The zero hearth, located at the top of the unit, is a non-feed hearth equipped with two series/size 6422 North American natural gas burners, two. Hearth levels 2,3,5 and 6 are also equipped with North American series/size 6422 burners, two burners/level.

Hearth levels 1 and 2 are commonly termed as drying levels. Levels 3, 4 and 5 are combustion hearths and levels 6 and 7 are termed as cooling hearths. Sludge/grit feed begins at hearth level-1 and cascades through the various drying, combustion, and cooling hearth levels to a

pneumatic ash collection system. The sludge proceeds from one hearth level to the next and its distribution across each hearth is accomplished with a rotating rabble arm. Depending on which hearth level the arm is located, the blades of the arm are pitched inward or outward to promote gradual sludge movement to the center or outside wall of the MHI. Also, the arm serves to break up the sludge allowing uniform heat distribution through the sludge layer.

### **2.3 Air Pollution Control Equipment**

From the zero hearth, the exhaust gases are thermally treated in a secondary combustion chamber (SCC) and passed to a quench chamber where the gases are cooled, large particulate matter is removed and acid gases are removed. The gases are then passed through a counter-current condenser/absorber followed by a variable throat venturi scrubber where the majority of solid/gaseous pollutants are removed. Afterward the gases pass through an entrainment separator to remove pollutant-laden moisture and on to a wet electrostatic precipitator where the final pollutant cleanup phase occurs. From this point, the cleaned gas stream is drawn through an induced draft fan to a plume abatement burner and to a stainless steel (SS) exhaust stack which extends 70 feet above roof grade.

## SECTION 3.0

### CONTINUOUS EMISSIONS MONITORING SYSTEM DESCRIPTION

#### 3.1 CEM System Overview

The MHI CEM is an extractive system designed to continuously measure CO and O<sub>2</sub> levels in the exhaust gases of the MHI. These measurements are made downstream of the air pollution control equipment before exiting to the atmosphere. Major components of the CEM system include an *in situ* sampling probe positioned in the MHI exhaust stack, a heated probe control box and sample transport line for maintaining the flue gas sample above dew-point, a sample conditioning system for cooling and drying the sample, a sample/system controller, and a CO and O<sub>2</sub> gas analyzer. The CEM system also includes a data acquisition system (DAS) for data collection, system control, and data reporting/storage. The DAS performs necessary calculations, system diagnostics, calibration commands, and identifies system alarm modes. A drawing of the CEM system is illustrated in Exhibit 3-1. Stored on-site is a Quality Assurance Project Plan designed specifically for the CEM system and its application at the MHI site.

#### 3.2 Probe Description

The sample probe is comprised of a 3-inch SS pipe having an internal heating winding capable of maintaining probe components above moisture and acid dew-points, >300°F. Within the winding is a 1-inch sintered Inconel filter extending approximately two thirds along the center. Also, a SS calibration gas transport line is located between the winding and the filter that extends approximately three quarters down the length of the probe. The probe filter is intended to remove particulate matter ≥10 µm in size and performs the first step in cleaning/conditioning of the sample stream. The calibration line is designed to transport cylinder gases to the end of the probe, thus, allowing system integrity to be assessed starting at the probe tip. The probe is positioned on the mounting flange at a 4-degree downward slope to allow condensate to flow back into the process gas stream.

### **3.3 Probe Control Box & Sample Transport Line Description**

The probe control box houses a surge tank that is utilized during probe blow-back cleaning procedures, a three-way ball valve to control the purge air flows, and a heater for maintaining control box components at approximately 80 °F. All electrical and pneumatic sample line junctions, located between the probe and the CEM control system, are contained within the control box.

Two sample lines are employed to convey the extracted stack sample from the probe to the CEM flow control system. The first and longest of these, measuring approximately 100' in length, is a FURON Model #2262 bundled umbilical line located between the probe control box and the CEM flow control system. This line is comprised of an outer polyethylene protective jacket covering a layer of fiberglass insulation and thermal barrier containing five 3/8" TEFILON tubes, a ¼" copper tube, three thermocouple leads, a single heating element, and the electrical leads necessary to supply power to components of the sample probe and probe control box. Only two of the TEFILON tubes are utilized for CEM operation at one time, one for sample transport and the other for conveying calibration gas to the probe. The remaining three tubes are spares used only in the event of tube failure or future monitoring requirements. The copper tube is used to convey plant air at a rate of 5.0 scfm to allow blow-back of the sample probe. One of the three thermocouple leads is used for controlling temperature of the umbilical line spanning the flow controller and probe control box. The two remaining leads are used to regulate temperature of the umbilical line spanning the probe and probe control box and heater winding of the probe. The heating element travels the length of both umbilical lines and provides a thermostatically regulated heat source of ≥ 200 °F.

The umbilical line connect the probe and probe control box is approximately 5' in length. This line is different in that it contains only two of the original three thermocouples leading up to the probe control box and two SS sample and calibration gas transport lines. Also, only two of the original power leads are utilized and are specific to probe heating. One of the

thermocouples is used to regulate probe temperature while the other regulates temperature of the line.

### **3.4 System Flow Description Within the Cabinet**

A sample pump provides the motive force for drawing a sample stream from the exhaust stack, through a sample conditioning system, final particulate filter, sample flow control system, and continuous analyzers.

Sample conditioning is performed employing a thermoelectric Baldwin Environmental Model 5210 sample chiller. This unit utilizes the Peltier principle to cool a gas stream to a constant moisture dew point of 35 °F. Simply put, the Baldwin conditioner acts as a heat exchanger whereby heat is transferred from one ceramic or metallic surface to another using dissimilar semiconductor materials. Upon cooling the gas stream, water vapor is condensed and collected in a condensate removal system equipped with a peristaltic pump for water removal. Next, the gas stream passes through a filter assembly and then is monitored for vapor slip employing an electronic water breakthrough sensor.

The flow control system regulates sample stream, calibration gas, and purge air flows/pressures throughout the CEM system. A series of rotometers and pressure indicators are utilized to control sample stream and calibration gas distribution to each system analyzer and excess gas is vented to the atmosphere. The sample pump and conditioning, along with purge air and calibration frequencies, are monitored and managed by the ESC Model 8816 data logger.

### **3.5 Analyzer Descriptions**

#### ***3.5.1 Carbon Monoxide Analyzers***

Carbon monoxide (CO) is measured by a Thermo Environmental, Model 48i, NDIR, gas filter correlation (GFC) analyzer. A Backup CO monitor is also installed. This monitor is also a Thermo Environmental, Model 48i. Both analyzers are microprocessor based units having dual-range measurement capability. Design measurement concentration ranges are 0 - 200 ppm, low end, and 0 - 3,000 ppm, high end. The GFC technology utilizes an infrared (IR) energy source which is passed through a rotating CO and a nitrogen ( $N_2$ ) filter and narrow bandpass interference filter to a multiple optical pass cell. At this point, absorption of the radiated IR source occurs and remaining IR exits the cell to an IR detector.

The purpose of the CO gas filter is to produce a reference beam, which can't be attenuated any further by CO in the sample cell. The  $N_2$  gas filter produces an uninhibited measurement beam, which is easily absorbed by CO in the cell. By modulating the chopped IR source in this manner, an amplitude related to the CO concentration in the sample cell is allowed. Subsequently, the GFC provides a system which is not influenced by the presence of other gases such as  $CO_2$  and is specific to CO only.

#### ***3.5.2 Oxygen Analyzers***

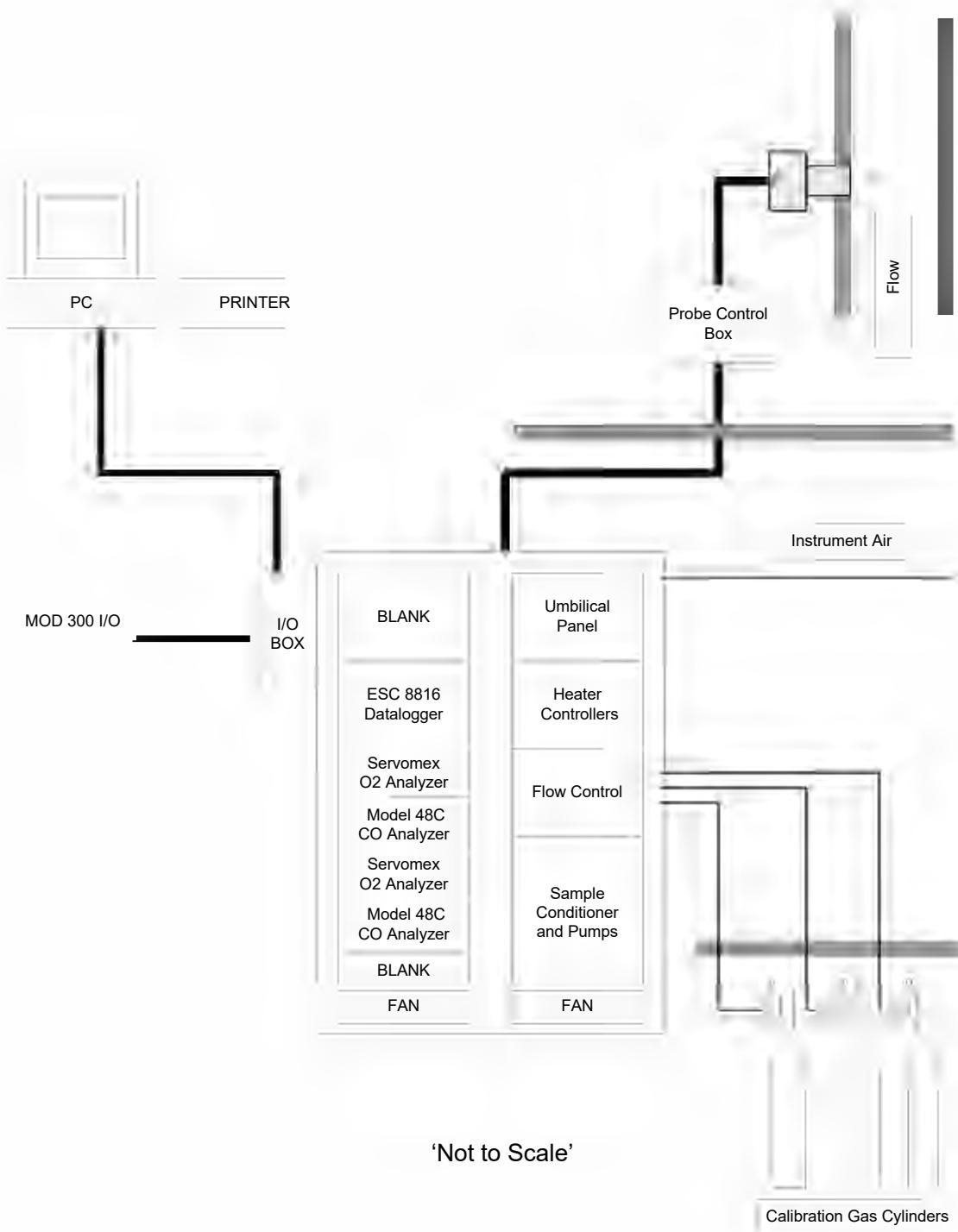
Oxygen ( $O_2$ ) is measured using a Servomex Series 1440 unit, having a measurement range of 0%-25%. A backup Servomex 1440 series oxygen analyzer is also installed on the system. The measurement technology used in these units is based on magneto-dynamics. When sample gas is introduced,  $O_2$  molecules are characteristically drawn to a magnetic field generated within the measurement cell. As  $O_2$  molecules build and change in concentration, the partial pressure of the  $O_2$  changes causing deflection of a dumbbell type micro-balance. An electromagnetic current is produced through a platinum wire surrounding the dumbbell which acts as a

feedback to provide a counter force equal to the deflection. As a result, the amount of pressure required to restore the dumbbell to its original state is proportional to the O<sub>2</sub> concentration in the sample cell.

### **3.6 Data Acquisition System Description**

The MHI CEM uses an ESC data logger to collect data from the analyzers, control calibration gas solenoids, monitor system alarms, and communicate with the plant distributed control system (DCS). A Windows based PC is used to manage the data and configuration of the data logger. The ESC Datalogger calculates and stores all data for calibration drift, as well as correcting CO to 7% O<sub>2</sub>. The data logger scans the CEM analyzer 4-20 mA outputs at least once every 15 seconds. This data is then used to calculate a one minute average which is stored in the data logger. Each one minute average is then used to calculate a rolling 60 minute average. Once every two minutes the polling computer ‘polls’ the data logger to retrieve the one minute averages which are then stored in a database on the PC. This data is backed up regularly on a writable CD or other suitable storage device. The data logger provides outputs for interfacing the CEM system to the plant MOD300 DCS in order to allow interlocking of the MHI operating conditions. These outputs include analog signals for O<sub>2</sub> and CO corrected to 7% O<sub>2</sub>, a rolling 60 minute average of the corrected CO and digital outputs for high corrected CO, low O<sub>2</sub>, calibration status, calibration failure, and CEM system trouble alarm.

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**Exhibit 3-1. CEM System Diagram**

**SECTION 4.0****SAMPLING LOCATIONS****4.1 Sampling Locations*****4.1.1 Dimensions***

Performance Specification 4B suggests that the sampling point be located:

- 2 equivalent duct diameters downstream from the nearest control device, point of pollution generation or other point at which a change in the pollutant concentration or emission rate may occur.
  
- 0.5 equivalent duct diameters upstream from the effluent exhaust or next control device.

The MHI CEM probe will be located in the MHI exhaust stack at a point downstream of the air pollution control equipment. The exhaust stack extends  $\approx$ 70 ft above the Building 95 roof plane and is 3.5 ft in diameter. The MHI CEM sample probe port will be located 8 inches above the sampling ports for the reference test methods and 5.75 ft above roof level to allow easy access to probe and probe control box components. Also, the number of duct diameters downstream and upstream of any potential exhaust gas flow disturbances will be 6.3 and 18.7, respectively. Orientation of the probe will be in a downward direction ( $\approx$ 4°) facing the exhaust gas flow and extending 1.8 ft. to the centroidal region of the stack cross-section.

***4.1.2. Stratification Checks***

Stratification is defined as a difference in concentration greater than ten percent between the duct center and any point greater than one meter from the duct wall. The stratification test is not applicable to this source because the duct is only 42 inches in diameter and therefore none

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of the test points is greater than one meter from the side of the duct. Therefore the stratification test will not be performed as part of the PST.

## SECTION 5.0

### ALTERNATIVE RA TEST PROCEDURES

The following is the procedure for conducting the alternative relative accuracy test. This procedure will be performed by personnel designated by RED. The alternative RA will be performed during the seven day drift test, most likely near the end of the test (day six or seven). The alternative RA procedure specifies that the entire CEMS must be checked, including light sources, filters, heaters, and timing functions. The following is a list of items that will fulfill this obligation and verify the accurate operation of the CEMS.

**CO Analyzers Diagnostics:** Record the following analyzer diagnostic parameters to insure they fall within acceptable operational values: Internal Temperature, Bench Temperature, Optical Bench Pressure, Sample Flow, Bias Voltage, Sample/Reference Ratio, AGC Intensity, Motor Speed.

**DAS and Data reduction:** Use the CO Monitor Zero and Full scale function to make sure the DAS is reading zero and full scale for both channels. The Oxygen monitor can only be checked with Calibration gases (no diagnostic capabilities). Manually calculate CO corrected to 7% oxygen, and check RHA channel calculations. Compare to recorded values to make sure calculations are correct.

**Datalogger:** Review DAS data to make sure the zero and full scale data was recorded properly.

**Heaters:** Check the temperature controllers for malfunction

**Chiller/Sample Pump:** Check the chiller and sample pump for malfunction

**Filters:** Check the filter on the chiller for water slip, inspect others

In addition to the inspections listed above, an Absolute Calibration Audit will be performed as part of the alternative RA test.

## **SECTION 6.0**

### **SAMPLE IDENTIFICATION**

For this program, no samples will be taken for shipping to a laboratory for analysis. All data will be collected and processed on-site and therefore a sample labeling scheme and a chain of custody procedure for samples will not be necessary.

## **SECTION 7.0**

### **QUALITY ASSURANCE/QUALITY CONTROL**

#### **7.1 DATA COLLECTION and FORMS**

Section 1 of this Test Plan presented the standardized forms that will be used to record the monitoring data. All forms will be filled in by the technician performing the work. The completed forms filled out by the technician will be reviewed by the second crewmember for completeness in the field prior to becoming part of the project file.

The bulk of the data collected during the CEM certification test will be processed onsite in one of RED's computers for reporting purposes.

Data validation is the process of reviewing data and accepting or rejecting it on the basis of sound criteria. Supervisory and QC personnel will use validation methods and criteria appropriate to the type of data collected and to the purpose of the measurement.

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

- Use of approved test procedures;
- Proper operation of the process being tested;
- Use of properly operating and calibrated equipment;
- Use of EPA Protocol 1 CEM calibration gases for the ACA
- Proper completion of the data sheets.

#### **7.2 CEMS**

The MHI CEMS will be calibrated in accordance with the procedures outlined in 40 CFR Part 60, Appendix B, Performance Specification 4B. At a minimum, a successful daily calibration check will be completed the morning of the scheduled Alternative RA test. The Alternative RA test will be performed during the CD period.

March 20, 2020

Section 6.0

Revision: 0

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