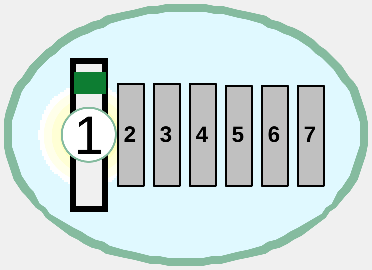
Hazardous Waste Combustion Unit Permitting Manual



COMPONENT 1

How To Review A Trial Burn Plan

U.S. EPA Region 6 Center for Combustion
Science and Engineering

Tetra Tech EM Inc.

COMPONENT ONE

HOW TO REVIEW A TRIAL BURN PLAN

JANUARY 1998

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ABBREVIATIONS AND ACRONYMS

acfm	Actual cubic feet per minute
APCS	Air pollution control system
ASTM	American Society for Testing and Materials
AWFCO	Automatic waste feed cutoff
BIF	Boiler and industrial furnace
Btu/hr	British thermal units per hour
Btu/lb	British thermal units per pound
CEMS	Continuous emissions monitoring system
CERI	Center for Environmental Research Information
CKD	Cement kiln dust
Cl_2	Chlorine gas
40 CFR	Title 40, Code of Federal Regulations
CO	Carbon monoxide
COPC	Contaminant of potential concern
CSA	Cross sectional area
DRE	Destruction and removal efficiency
dscfm	Dry standard cubic feet per minute
EPA	Environmental Protection Agency
ESP	Electrostatic precipitator
FID	Flame ionization detector
ft^3	Cubic feet
°F	Degrees Fahrenheit
g/hr	Grams per hour
gpm	Gallons per minute
HCl	Hydrogen chloride
HHV	High heating value
HRU	Heat recovery unit
HWF	Hazardous waste fuels
HWDF	Hazardous waste derived fuels
IWS	Ionizing wet scrubber
kcal/kg	Kilocalories per kilogram
kVA	Kilovolt Amperes
kWh	Kilowatt hour
lb/hr	Pounds per hour
lb/min	Pounds per minute
LHV	Low heating value
MACT	Maximum achievable control technology
MB	Megabyte
MMBtu/hr	Million British thermal units per hour
O_2	Oxygen
OSWER	Office of Solid Waste and Emergency Response
PCB	Polychlorinated biphenyl
PCC	Primary combustion chamber
PCDD/PCDF	Polychlorinated dibenzo-p-dioxin/polychlorinated dibenzofuran
PFD	Process flow diagram

PIC	Product of incomplete combustion

ABBREVIATIONS AND ACRONYMS (Continued)

PM	Particulate matter
POHC	Principal organic hazardous constituent
ppm	Parts per million
ppmv	Parts per million by volume
P&ID	Piping and instrumentation diagram
PSD	Particle size distribution
psig	Pounds per square inch gauge
QA/QC	Quality assurance/quality control
QAPP	Quality assurance project plan
RBP	Risk burn plan
RCRA	Resource Conservation and Recovery Act
SCC	Secondary combustion chamber
SDA	Spray dryer absorbers
SOP	Standard operating procedures
SRE	System removal efficiency
SVOC	Semivolatile organic compound
TBP	Trial burn plan
TBR	Trial burn report
THC	Total hydrocarbon
TID	Technical Implementation Document
TOC	Total organic carbon
TOX	Total organic halogen
U.S. EPA	U.S. Environmental Protection Agency
VOC	Volatile organic compound
WESP	Wet electrostatic precipitator

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U.S. EPA 1998. "Protocol for Screening Level Ecological Risk Assessment at Hazardous Waste Combustion Facilities." Center for Combustion Science and Engineering, Multimedia Planning and Permitting Division, U.S. EPA Region 6. Dallas, Texas. EPA-R6-098-003. January.

1.0 OVERVIEW OF TRIAL BURN PLAN

Regulations: No regulations are applicable to this section of the manual.

Guidance: No specific references are applicable to this section of the manual.

Explanation: This section is not required by regulation and may not be a part of all trial burn plans (TBP); however, inclusion of this section in a TBP is recommended (see the U.S. EPA Region 6 generic TBP included as Attachment A). This section should present general facility information, the purpose for submitting the TBP, and the organization of the TBP.

General facility information should include the facility name, contact, address, and telephone number; U.S. Environmental Protection Agency (EPA) identification number; the name of the person responsible for trial burn; and his or her company name, address, and telephone number.

The four most common purposes for submitting a TBP include the following:

- New facilities seeking a permit to operate hazardous waste combustion units, such as an incinerator, cement kilns, or boiler and industrial furnaces (BIF)
- Existing facilities operating under interim status
- Existing permitted facilities seeking permit modifications, and
- Existing facilities seeking renewal of hazardous waste permits

A TBP is a critical part of a Resource Conservation and Recovery Act (RCRA) Part B permit application. Therefore, the remaining sections of this component are referred to by their Part B Permit application section (for example, Section D-5a—Justification for Exemption) as listed in the checklist for Review of Federal RCRA Permit Applications included as Attachment B to Component 3 of this manual. These section listings also correspond to sections in the U.S. EPA Region 6 generic TBP. A TBP is usually required to be submitted as a stand-alone document. A stand-alone document is suggested because the TBP may be revised more than once before it is finalized and it would be convenient for both the applicant and the reviewer to be able to review the document separately from the permit application. It would be useful, for example, that the section, table, and figure numbering be independent from that of the permit application. In addition, the TBP should contain all information associated with the combustion unit and should not refer to other sections in the permit application.

Check For: The reviewer of the TBP should check for the following information:

- ☐ General facility information
  - ☐ Facility name
  - ☐ Contact
  - ☐ Address
  - ☐ Telephone number
  - ☐ U.S. EPA identification number
- ☐ Person responsible for trial burn operations
  - ☐ Company name
  - ☐ Address
  - ☐ Telephone number
- ☐ Risk assessment information
  - ☐ Principal business and primary production processes
  - ☐ Normal and maximum production rates
  - ☐ Type of waste storage and treatment facilities
  - ☐ Type and quantity of wastes stored and treated
  - ☐ Type of air pollution control system (APCS)
  - ☐ Energy consumption and production rates (for example, British thermal units per hour [Btu/hr], kilowatts per hour [kWh], cubic feet of natural gas per minute, or pounds of steam per hour)
- ☐ Purpose of the TBP
  - ☐ New facility seeking a permit to operate hazardous waste combustion units, such as an incinerator, cement kilns, or BIF
  - ☐ Existing facility operating under interim status
  - ☐ Existing permitted facility seeking permit modifications
  - ☐ Existing facility seeking renewal of hazardous waste permit
- ☐ Is the TBP a stand-alone document?
- ☐ Does the TBP contain separate sections with the following information:
  - ☐ A detailed engineering description of the incinerator, cement kiln, or BIFs for which the permit is sought, in accordance with Title 40 Code of Federal Regulations (CFR) Parts 270.62(b)(2)(ii)(A through J) and 270.66(c) (see Section 3.1.1)
  - ☐ An analysis of each waste or mixture of wastes to be burned for physical characteristics and chemical constituents that are believed to be present in the wastes and for those listed in 40 CFR Parts 270.62(b)(2)(i)(A through D) and 270.66(c)(1) and (2) (see Section 3.1.1.1)

- ☐ A detailed description of sampling and monitoring procedures in accordance with 40 CFR Parts 270.62(b)(iii) and 270.66(c)(4), including sampling and monitoring locations in the system, the equipment to be used, sampling and monitoring frequency, and planned analytical procedure for sample analysis (see Section 3.1.2)
- ☐ A detailed test schedule for each test condition for which the trial burn test is planned in accordance with 40 CFR Parts 270.62(b)(iv) and 270.66(c)(5), including date(s), duration, and type and quantity of waste to be burned (see Section 3.1.3)
- ☐ A detailed test protocol for each test condition identified in accordance with 40 CFR Parts 270.62(b)(v) and 270.66(c)(6), including the temperature range, type of waste, waste feed rate, combustion gas velocity, use of auxiliary fuel and any other relevant parameters that will be varied to affect the destruction and removal efficiency (DRE) of the combustion unit (see Section 3.1.4)
- ☐ A description of and planned operating conditions in accordance with 40 CFR Parts 270.62(b)(vi) and 270.66(c)(7) for any emission control equipment which will be used (see Section 3.1.5)
- ☐ Procedure for rapidly stopping waste feed, shutting down the combustion unit, and controlling emissions in the event of an equipment malfunction in conformance with 40 CFR Parts 270.62(b)(vii) and 270.66(c)(8) (see Section 3.1.6)
- ☐ Any other information as the writer reasonably finds necessary to approve the TBP in accordance with 40 CFR Parts 270.62(b)(viii) and 270.66(c)(9)

A trial burn plan may also be submitted as a test plan for the collection of data for—or in conjunction with—a risk assessment. In these cases, the TBP may be referred to as a "risk burn plan" (RBP). Information that may be collected as part of a risk assessment is identified throughout the combustion unit permitting manual, and is described in detail in Section 2.10 of Component 3.

Example Situation: Lois and Clark of Metropolis were selected to review the TBP for XYZ Chemicals (XYZ). As the initial step in the review process, Lois checks the general facility information provided by XYZ as follows:

"XYZ Chemicals (XYZ), is located on Tennessee State Highway 79 North in Pike County near the town of Clarksville, Tennessee. Appendix A shows the location of the facility on the U.S. Geological Survey topographic map for Pleasant Hill West, Tennessee/Kentucky. XYZ operates a wet process cement kiln that uses hazardous waste-derived fuels (HWDF) to supplement the normal coal/coke fuel. AB Company (ABC) functions as an on-site HWDF supplier. Facility contact information is provided in the following table.

Facility Name	**XYZ Chemicals**
Facility Address	Highway 79 North P.O. Box 67 Clarksville, Tennessee 37201
Facility Contact/Phone	Mr. Bill Boom, Plant Manager (615) 555-1191
HWDF Facility Name	AB Company
HWDF Facility Address	Highway 79 North P.O. Box 69 Clarksville, Tennessee 37201
HWDF Facility Contact Phone	Mr. Ted McMahon, Facility Manager (615) 555-1892

"XYZ currently operates as a RCRA interim status facility that complies with BIF regulations outlined in 40 CFR Part 266 Subpart H. The purpose of the TBP is to seek hazardous waste permit for the cement kiln at XYZ. The trial burn will be conducted to demonstrate compliance with performance standards and to provide data necessary to establish operating limits while feeding HWDF."

Example Action: Lois reviews this section and finds useful information concerning the facility and purpose of the TBP submittal. However, she does not find a discussion on how the document is organized (by section) or a summary of section content. She recommends inclusion of an organizational and content summary to facilitate TBP review. Lois adds this item to the list requiring additional information from the facility.

Notes: ____

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2.0 REVIEWING SECTION D-5a—JUSTIFICATION FOR EXEMPTION

Regulations:

40 CFR Part 264.340(b) and (c)
40 CFR Part 266.100(b)(1-4)
40 CFR Part 270.19(a)

Guidance:

U.S. EPA. 1983. "Guidance Manual for Hazardous Waste Incinerator Permits." Office of Solid Waste and Emergency Response (OSWER). Washington, D.C. July. Section 2.1.3, Pages 2-6 through 2-15.

U.S. EPA. 1987. "Permitting Hazardous Waste Incinerators." *Seminar Publication.* Center for Environmental Research Information (CERI). Cincinnati, Ohio. EPA/625/4-87/017. September. Pages 75 through 78.

U.S. EPA. 1992. "Technical Implementation Document (TID) for EPA's Boiler and Industrial Furnaces (BIF) Regulations." OSWER. Washington, D.C. EPA/530/4-92/11. March. Section 1.2.3, Pages 1-2 and 1-3.

Explanation:

Facilities operating a hazardous waste combustion unit seeking exemption from conducting a trial burn should provide justification for such exemption. Several specialized exemptions and waivers are available for permits. These are exemptions based primarily on combustion unit design, waste feed characteristics, and the intent to burn hazardous wastes. Referenced guidance documents discuss the various RCRA exemptions, waivers, and petitions for hazardous waste combustion units. If the U.S. EPA Regional Office or authorized state permitting agency determines a facility to be exempt, then a DRE trial burn will not be required. However, it is current U.S. EPA Region 6 policy that facilities will not be exempt from submitting a RBP and conducting a risk burn test.

Check For:

The TBP reviewer should check for the following information:

- ☐ Waste analysis information
- ☐ Waste sampling and analysis method (SW-846)
- ☐ Applicant's justification for seeking exemption
    - ☐ Hazardous wastes being burned exhibit one or more of the following characteristics: ignitability, corrosivity, or reactivity (combustion units burning wastes exhibiting toxicity characteristics are not exempt).
    - ☐ Waste contains insignificant concentrations (less than 100 parts per million [ppm]) of hazardous constituents listed in Appendix VIII of 40 CFR Part 261.
    - ☐ Used oil is being burned for energy recovery.
    - ☐ Gas burned is being recovered from hazardous or solid waste landfills for energy recovery.

☐ Hazardous wastes being burned are exempted from regulation under 40 CFR Parts 261.4 and 261.6(a)(3)(v-viii). These include materials that are not solid wastes, nonhazardous solid wastes, treatability study samples, and fuels produced from refining of hazardous wastes.

☐ Hazardous wastes being burned are subjected to special requirements for conditionally exempt small quantity generators under 40 CFR Part 261.5.

☐ Coke ovens only burning decanter tar sludge from coking operation (K087 waste).

☐ Hazardous waste is being processed in smelting, melting, and refining furnaces solely for metal recovery.

☐ Small-quantity hazardous waste burners. Quantity limits are established as a function of stack height under 40 CFR Part 266.108.

Example Section: Lois and Clark review XYZ Company's Part B permit application and come across a statement seeking exemption from conducting trial burn for one of the boilers because it burns only ignitable wastes generated at the facility. Clark reads the following section providing the justification for exemption:

"The boiler at XYZ Company is a captive unit, and it is used only for thermal destruction of in-process wastes from the facility. In-process waste is considered a listed waste solely because of its ignitability (Hazard Code I). In-process waste contains insignificant concentrations (less than 100 ppm) of Appendix VIII constituents."

Example Comments: Despite the facility's valid justification for exemption, Clark thoroughly reviews the supporting documentation to verify whether the (1) combustion unit is used for combustion of wastes other than in-process wastes; (2) waste sampling procedures follow at least U.S. EPA's standard operating procedures (SOP), if not more stringent procedures; (3) wastes burned in the combustion unit are analyzed for all constituents that may potentially be present; and (4) U.S. EPA analytical methods are used for waste analysis. Based on the review, Clark determines that the XYZ Company has a valid justification for exemption from conducting trial burn, however, he still sees the need for conducting a risk burn test to ensure that operation of the unit will be protective of human health and the environment. Clark notifies XYZ Company that a DRE test would not be required but prepares a comment requesting the facility conduct a risk burn under U.S. EPA Omnibus Authority, see 40 CFR Part 270.32(b)(2).

Notes: ______________________________

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3.0 REVIEWING SECTION D-5b—TRIAL BURN

Regulations: 40 CFR Part 270.19(b)
40 CFR Part 270.22(a)

Guidance: No specific references are applicable to this section of the manual.

Explanation: This section should summarize information presented in the following subsections. This will provide the reader with an idea on the contents presented in the ensuing sections. These sections include:

- New combustion unit start-up/shakedown performance
- TBP

Although not required by the regulations, inclusion of this section is recommended to facilitate the TBP review.

Check For: The TBP reviewer should check for the following information:

- ☐ Subsections of Section 3.0 should be included in the TBP
  - ☐ TBP (see Section 3.1)
  - ☐ New combustion unit conditions (see Section 3.2)

Example Sections: The following subsections provide BIF startup/shakedown operating conditions and an engineering description of the combustion system, and describe the testing program designed to meet performance requirements of RCRA regulations and U.S. EPA guidance.

Example Comment: Not applicable to this section of the manual.

Notes: ____
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3.1 REVIEWING SECTION D-5b(1)—TRIAL BURN PLAN

Regulations: 40 CFR Part 270.19(b)
40 CFR Part 270.22(a)

Guidance: No specific references are applicable to this section of the manual.

Explanation: The following subsections summarize the information typically provided within a TBP.

Check For: Refer to Subsections 3.1.1 through 3.1.7 for specific guidance.

Example Sections: Lois reads the following brief introductory paragraph provided in this section of a TBP. The following TBP discusses engineering details of the XYZ Company, combustion system and outlines trial burn operating conditions, sampling and monitoring procedures, and analytical methods that will be used to establish operating parameters for the final permit.

Example Comments: Lois notes that (1) this paragraph adequately introduces the information to be presented and (2) all of the necessary subsections have been included in the TBP. She continues with her review.

Notes: ____
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3.1.1 Reviewing Section D-5b(1)(a)—Engineering Description of the Combustion Unit

Regulations:

40 CFR Part 270.62(b)(2)(ii)
40 CFR Part 270.62(b)(2)(ii)(A)
40 CFR Part 270.66(c)(3)

Guidance: U.S. EPA. 1997. "Generic Trial Burn Plan." Center for Combustion Science and Engineering. Pages D-5.1 through D-5.24.

Explanation: This section should introduce Subsections 3.1.1.1 through 3.1.1.13. It should generally contain, or refer to, written equipment specifications, process flow diagrams (PFD) and piping and instrumentation diagrams (P&ID) (see Attachment B), equipment arrangement, and process control logic diagrams.

If the unit is custom-designed to meet the requirements of the facility, the TBP should provide the name and location of the companies that designed the process and supplied equipment for the combustion unit. The TBP should also contain the manufacturer's design and operations manual for the combustion unit. The TBP should contain design basis calculations concerning size, heat release, temperature, and APCS performance. The "Check For" items identified below should be incorporated in the TBP. It is recommended that this information be presented under this section heading.

Check For: The TBP reviewer should check for the following information:

☐ Written equipment specifications

☐ PFDs

☐ P&IDs

☐ Equipment arrangements

☐ Process control logic diagrams

☐ Preparer of engineering diagram and specifications

☐ Site development contractor

☐ Contractor for construction and equipment installation

☐ Date of installation

☐ Manufacturer's operation and maintenance manuals

☐ Fabricator shop drawings

- ☐ Construction quality assurance (QA) report from an independent engineer

- ☐ Design basis calculations

  - ☐ Size
  - ☐ Heat release
  - ☐ Temperature
  - ☐ APCS performance

Example Sections: Refer to the referenced sections of the U.S. EPA Region 6 generic TBP.

Example Comment: Not applicable to this section of the manual.

Notes: ____________________

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3.1.1.1 Reviewing Section D-5b(1)(a)(1)—Description of Combustion Unit

Regulations: 40 CFR Parts 270.62(b)(2)(ii)(B) and (C)
40 CFR Parts 270.66(c)(3)(i-iii)

Guidance: U.S. EPA. 1997. "Generic Trial Burn Plan." Center for Combustion Science and Engineering. Pages D-5.1 through D-5.24.

U.S. EPA. 1998. "Protocol for Human Health Risk Assessment at Hazardous Waste Combustion Facilities." EPA-R6-098-002. Section 2.2.2.

Explanation: This section should include shape, orientation, dimensions, cross-sectional area, and volume of the primary combustion chamber (PCC). If the combustion unit has a secondary combustion chamber (SCC), the same information for the SCC should be included. If burner, combustion, and cross-over sections of combustion chambers are of varying dimensions and cross sections, each of these sections should be described. Waste and gas residence time in combustion chambers should be provided. For rotary kilns, rotational speed should be included.

Check For: The TBP reviewer should check for the following information:

☐ Shape (cylindrical or rectangular)

☐ Outside diameter (feet or meters)

☐ Inside diameter (feet or meters)

☐ Thickness of refractory lining (inches or centimeters)

☐ Length (feet or meters)

☐ Height or width (feet or meters)

☐ Cross-sectional area (CSA; square feet or square miles) (inside diameter by length or height, or width by length)

☐ Orientation (horizontal, vertical, or inclined)

☐ Slope, if inclined (degrees or inches or feet)

☐ Rotational speed (revolutions per minute) for rotary kilns

☐ Volume (cubic feet or cubic meters)

☐ Cooled surface area (cubic feet or cubic meters)

☐ Residence time (seconds)

☐ When discussing residence times, the TBP should state the associated gas flow or waste feed rates

☐ Whether volume of cross-over duct, between the PCC and SCC, is included in the calculation of SCC residence time

☐ Information for risk assessment:

  ☐ Summary of past operating data indicating the frequency and duration of combustion unit leaks
  ☐ Information regarding the probable cause of all combustion unit leaks
  ☐ Summary of procedures in place to monitor or minimize fugitive emissions resulting from combustion unit leaks

☐ Brief discussion of :

  ☐ Wastes burned
  ☐ Technique by which wastes are fired into the PCC and SCC
  ☐ Ash handling
  ☐ How combustion gases will be handled
  ☐ Typical combustion gas flow rate
  ☐ Safety measures observed during operation of combustion unit

Example Situation: Clark reads the *Description of Combustion Unit* section of the RBP as follows:

"The front-end feed train takes appropriate bulk solid wastes through weigh hoppers into a rotary kiln by either a hydraulic ram or a drag feed unit. Nozzles and burners on the faceplate of the kiln provide injection points for various pumpable waste streams.

The kiln is designed to operate at a maximum heat release of 25 x 10^6 Btu/hr.

The hot ash conveyor is of the metallic-pan type. Inert ash residues are carried up the conveyor for discharge into roll-off boxes.

The SCC is a vertical, refractory-lined afterburner. It has one SCC burner and is designed to operate between 1,800°F and 2,400°F."

Example feed end of a combustion unit, showing waste feed guns

Example Action: The description of the combustion unit lacks detail. Neither dimensions nor residence times are provided for the rotary kiln or the SCC. Kiln slope and rotational speed are also not provided. Clark prepares a comment requesting the facility revise this section to include dimensions, CSAs, volumes, kiln and SCC residence times, kiln rotational speed and slope, and residence time calculations.

Notes: ____

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3.1.1.2 Reviewing Section D-5b(1)(a)(2)—Nozzle and Burner Design

Regulations: 40 CFR Part 270.62(b)(2)(ii)(H)

Guidance: U.S. EPA. 1997. "Generic Trial Burn Plan." Center for Combustion Science and Engineering. Pages D-5.1 through D-5.24.

Explanation: A combustion unit that burns liquid waste will typically either (1) use the waste as a fuel through the burner (if the waste has a high heating value [HHV]), or (2) atomize waste into a combustion chamber fired by a burner operating on an auxiliary fuel (if the waste has a low heating value [LHV]). RCRA regulations and guidance generally regard the heating value that separates these two is 5,000 Btu/lb. In some cases, this definition may be an oversimplification. Generally, burner specifications, desired flame temperature, and desired flame shape will determine the type of waste material fed through a certain type of burner.

Liquid fuel "burners" consist of devices ranging from plain liquid atomizers to equipment that is designed to atomize and mix the atomized liquid with stoichiometric amounts of air for combustion. Depending on the design, the mixing in such system ranges from very poor to good. A HHV waste (greater than 8,000 British thermal units per pound [Btu/lb]), can be burned easily in a good burner or combustor that provides good liquid atomization and good mixing, but it will be difficult to burn in a burner that cannot provide at least one of these requisites.

Proper atomization of low heating value LHV waste into a high-temperature gas stream containing adequate excess oxygen (O_2) can oxidize hydrocarbons in the steam. Atomization can be achieved by (1) pressure loss of the liquid across the nozzle, known as mechanical atomization, or (2) the use of a second fluid (usually air or steam) at pressure to provide atomizing energy.

Most nozzles designed to atomize viscous liquids use a pneumatic fluid steam, compressed air, or nitrogen to properly break up the viscous stream into droplets that can be carried into the combustion zone. Nozzle-type burners can satisfactorily burn wastes with heating values of about 2,500 kilocalories per kilogram (kcal/kg; equal to 4,500 Btu/lb) and above without auxiliary fuel.

Check For: The TBP reviewer should check for the following information:

☐ PCC and SCC burner identification (manufacturer and model number), specifications, and drawings (there is no need to identify burners that are not used for waste injection).

☐ PCC and SCC burner type

☐ Burners location

☐ Burner size (Btu/hr)

☐ Atomizing fluid pressure (Provide explanation if different from design specifications)

☐ Type of atomizing fluid (steam, compressed air, or nitrogen)

☐ Waste viscosity
(this information may be presented in the waste characteristics section)

☐ Particle size and quantity of solids in waste
(this information may be presented in waste characteristics section)

☐ Minimum heating value of PCC and SCC burners

☐ Heating value of the waste (kcal/kg or Btu/lb)
(this information may be presented in waste characteristics section)

☐ Heating value of auxiliary fuel (kcal/kg or Btu/lb)

☐ Excess air levels used by burners (percent)

☐ Burner pressure

☐ Internal flow areas

☐ Turndown ratio

☐ Flame safety controls

☐ Pilot mechanism

Example Situation: Lois reads the *Nozzle and Burner Design* section of the TBP as follows:

"Two liquid waste injectors in the lower (primary) combustion chamber simultaneously inject high- and low-Btu liquids. Spraying Systems AE-5 dual fluid nozzles, rated at 72 to 425 gallons per hour, are used for waste atomization.

Solids are fed to the lower chamber with a pneumatic ram feeder. The chamber has a pneumatically operated, electrically interlocked airlock charging door."

Example Action: Lois finds the description very brief and inadequate. Based on the information provided, Lois cannot determine nozzle locations, whether they are internally or externally atomized, the atomizing medium, and the range of viscosities under which the nozzles can optimally atomize liquid wastes. Above all, she finds the description lacking information related to size, atomization pressure, and the design heating value for the burner. Based on the information, she cannot determine if the Spraying Systems AE-5 represents the manufacturer or model number. Lois asks the facility for a more detailed description of burner system components and operations and lists the information required for a complete review.

Notes: ____

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3.1.1.3 Reviewing Section D-5b(1)(a)(3)—Auxiliary Fuel System Description (Type/Feed)

Regulations: 40 CFR Part 270.62(b)(2)(ii)(D)

Guidance: U.S. EPA. 1997. “Generic Trial Burn Plan.” Center for Combustion Science and Engineering. Pages D-5.1 through D-5.24.

Explanation: Natural gas and fossil fuel are commonly used as auxiliary fuels in combustion units. Auxiliary fuels are used in the PCC and SCC to compensate for the LHV of the wastes. When wastes and auxiliary fuels are fired from a common burner, the total heating value of the mixture should be above the minimum heating value of the burner to maintain desired combustion conditions in combustion zones.

Check For: The TBP reviewer should check for the following information:

☐ Auxiliary fuel type

☐ Whether auxiliary fuel is used to heat the combustion chamber before waste is introduced (if so, provide the desired preheat temperature)

☐ Auxiliary fuel source

☐ How the source auxiliary fuel supplies to the burners

☐ Auxiliary fuel burner rating and capacity

☐ Auxiliary fuel heating value

☐ Whether the burner is dedicated to firing auxiliary fuel or also fires wastes

☐ Heating value of the wastes to be fired in the burner
(this information is also presented in the waste characteristics section)

☐ Whether the combined heating value of the waste and fuel mixture exceeds the minimum heating value of the burner (if the burner is used to fire wastes and auxiliary fuel)

☐ Whether the natural gas supply is adequately regulated to provide the required ignition, pilot, and fuel gas

☐ Whether each burner gas supply line is provided with independent monitors, controls, interlocks, and fail-safe device, as required by the National Fire Protection Agency (if more than one burner is used)

Example Situation: Clark reads the *Auxiliary Fuel System Description* (Type/Feed) section of the TBP as follows:

"The rotary kiln contains a combination fuel oil/waste burner. This dual-purpose burner is rated at 26 million Btu/hr (MMBtu/hr) and has a firing capacity of 3 gallons per minute (gpm) for fuel oil or 6 gpm for waste feeds. The burner does not fire fuel oil and waste simultaneously. The kiln contains two pumpable sludge lances that are interchangeably steam, air, or nitrogen atomized; however, no sludge will be used during this trial burn.

"During permitted operating conditions (for example, temperatures above 1,600°F), waste liquid will be fired through the kiln burner. Fuel oil will be fired during heat up and low temperature periods for operation. Fuel oil and waste liquid feed rates are both continuously recorded.

"The SCC unit is equipped to burn either liquid waste or fuel oil through two 46 MMBtu/hr burners. Each burner is rated at a maximum of 150 pounds per minute (lb/min) waste feed. The minimum combustion temperature maintained in the SCC will be 2,200°F while burning polychlorinated biphenyls (PCB)."

Example Action: Clark finds no design data for sludge lances in the kiln. Also, Clark discovers that the sludge lances will not be used during the trial burn. In his letter to the company, Clark requests that the facility provide design data for sludge lances and conduct a sludge lance demonstration before lances are allowed to function during normal operations.

Notes: ____
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3.1.1.4 Reviewing Section D-5b(1)(a)(4)—Description of Waste Heat Recovery Unit

Regulations: 40 CFR Part 260.10

Guidance: U.S. EPA. 1997. "Generic Trial Burn Plan." Center for Combustion Science and Engineering. Pages D-5.1 through D-5.24.

Explanation: If applicable, the TBP should include a description of the waste heat recovery unit (HRU). An HRU may be an integral part of the combustion unit design—as in the case of a boiler—or may be a secondary energy recovery device (such as an economizer or air preheater). For a combustion unit to be defined as a boiler, the PCC (or SCC) and HRU must be of integral design; that is, the combustion chamber and the primary energy recovery section(s) (such as materials and superheaters) must be physically formed into one manufactured or assembled unit. Boilers are typically classified by either the method of heat transfer (water-tube, fire-tube, or cast-iron boilers) or the fuel-firing system that is used (stoker-fired or suspension-fired). Exhibit 3.1.1.4-1, see page 1-21, presents a process schematic of a waste heat recovery unit attached to an incinerator.

Check For: The TBP reviewer should check for the following information:

☐ HRU type

☐ Manufacturer name and model number

☐ Construction materials

☐ Dimensions, CSA, and volume of the HRU

☐ Brief description of HRU operations

☐ HRU combustion gas residence time

☐ Design and anticipated steam generation rates, if applicable (lb/hr and pounds per square inch gauge [psig] steam °F)

☐ Design and anticipated air preheating capacity, if applicable (include air flow rates and temperature gradient)

☐ HRU design standards

☐ Unit from which heat is recovered (PCC or SCC)

☐ Combustion gas temperature at HRU entry and exit

Example Situation: Lois and Clark read the *Description of Waste Heat Recovery Unit* section of the TBP as follows:

"The facility uses a forced-draft horizontal chamber combustion process fume and liquid waste incinerator and waste heat boiler to thermally destroy vapor-phase and liquid wastes generated in the production process. The process operates 24 hours per day, 5 days per week. The incinerator and waste heat boiler system operate continuously during the process.

"Combustion Engineers of Beverly Hills, California, supplied the incinerator and boiler system in 1974. A waste heat boiler was incorporated into the process to recover a portion of the energy content of the hot combustion gases.

"The incinerator and waste heat boiler are installed in series and are located outdoors on an elevated platform.

"Crossover ducting connects the discharge end of the combustion chamber to the waste heat boiler."

Example Action: Lois and Clark note that this section lacks a general description of the boiler, including its design, type, dimensions, steam production rate and pressure, construction materials, and volume or gas-phase residence time. It fails to describe the temperature of the gas entering or exiting the boiler. There is no discussion on controls or emergency shutoff conditions, and this section mentions only that the boiler is connected to the combustion chamber. Lois adds these items to the list that requires additional information from the facility. Clark becomes concerned about the gross inadequacies of the TBP and decides to issue the facility an administrative order.

Notes: ____

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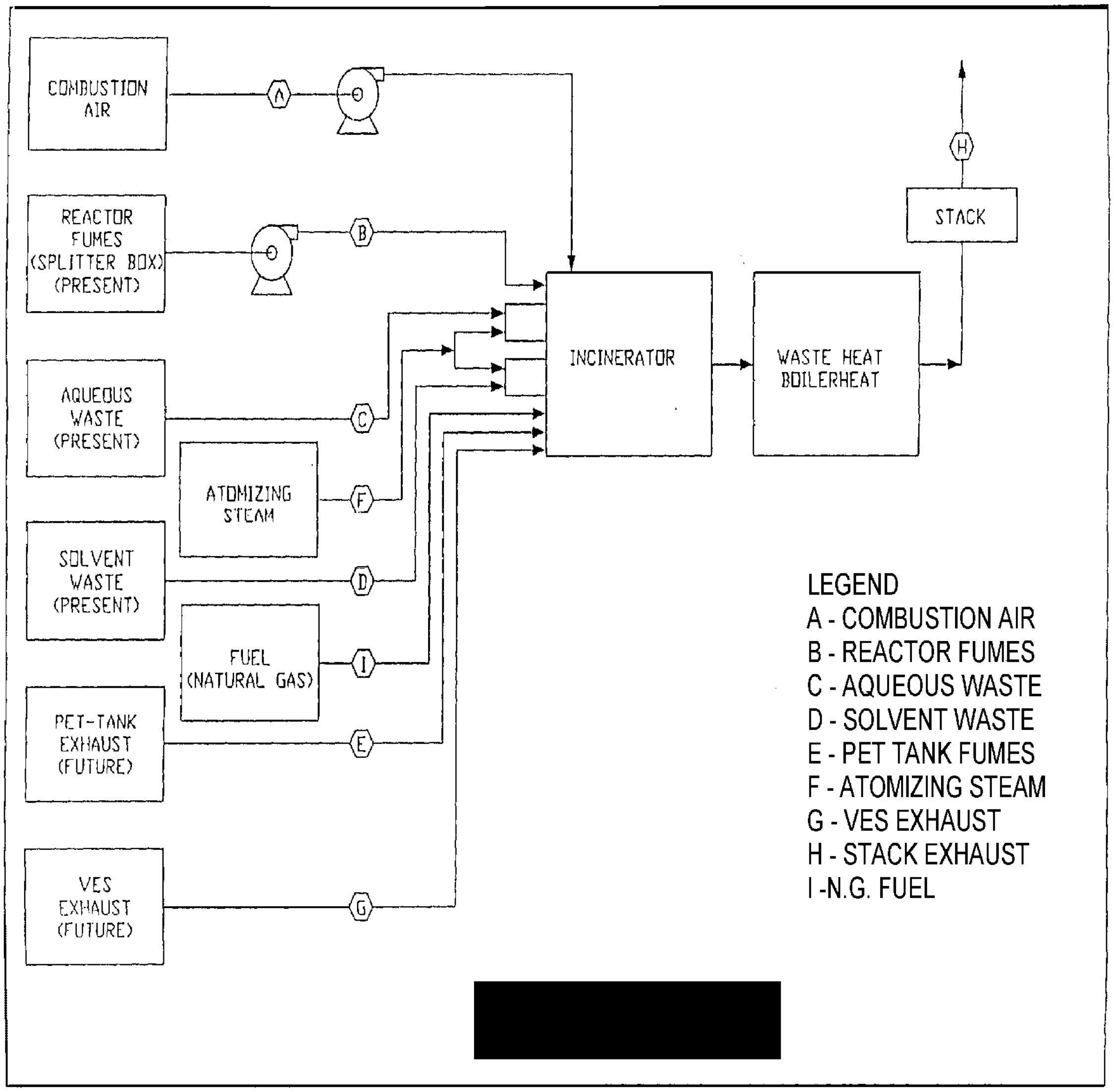
EXHIBIT 3.1.1.4-1
PROCESS SCHEMATIC OF WASTE HEAT RECOVERY UNIT



[redacted]

3.1.1.5 Reviewing Section D-5b(1)(a)(5)—Prime Mover Capacity

Regulations: 40 CFR Part 270.62(b)(2)(ii)(E)

Guidance: U.S. EPA. 1992. "Technical Implementation Document for EPA's BIF Regulations." OSWER. Washington, D.C. EPA-530-R-92-011. March. Pages 4 through 9.

U.S. EPA. 1997. "Generic Trial Burn Plan." Center for Combustion Science and Engineering. Pages D-5.1 through D-5.24.

Explanation: Combustion units can be fired under positive (forced-draft), negative (induced-draft), or balanced (forced- plus induced-draft) pressures. Forced-draft pressure is typically used unless the facility is equipped with an APCS. Because high-efficiency APCSs often results in high-pressure drops, a balanced-draft system is often used. This configuration prevents the PCC from operating under excessive positive pressure, thereby overcoming flow restrictions in the APCS. Maintaining the proper pressure in the chamber is important for equipment safety and for controlling fugitive emissions.

Check For:

☐ Prime mover type (centrifugal fan or equivalent)

☐ Mode of prime mover operation, such as induced-draft (negative pressure), forced-draft (positive pressure), or balanced systems

☐ Fan speed actual cubic feet per minute (acfm) (design and operating conditions)

☐ Air density (a function of gas temperature, absolute pressure, and molecular composition)

☐ Fan differential (total, velocity, and static)

☐ Fan power

☐ Prime mover capacity (vacuum pressure [inches of water column])

☐ Prime mover horsepower

☐ Volumetric flow capacity (acfm)

☐ Gas temperature (°F)

☐ Minimum combustion temperature and residence time

☐ Amount and distribution of combustion air

Example Situation: Clark reads the *Prime Mover Capacity* section of the RBP as follows:

"Downstream of the demister, two induced-draft fans (one for each scrubber train) provide the draft needed to overcome the pressure drop through the hydrochloric acid (HCl) scrubber and ionizing wet scrubber (IWS) units and maintain the incinerator system at a slight negative pressure to prevent fugitive emissions. The fans discharge into one 90-foot-high stack."

An ionizing wet scrubber used to remove HCl

Example Action: This section is inadequate. Clark asks that the facility indicate the manufacturer of the prime mover and expand this section to include all pertinent information.

Notes: ______________________________

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3.1.1.6 Reviewing Section D-5b(1)(a)(6)—Waste Feed System Description

Regulations:

40 CFR Part 270.62(b)(2)(ii)
40 CFR Part 270.66(c)(3)(iv) and (v)

Guidance:

U.S. EPA. 1992. “Technical Implementation Document for EPA’s BIF Regulations.” OSWER. Washington, D.C. EPA-530-R-92-011. March. Pages 4-4 and 4-5.

U.S. EPA. 1997. “Generic Trial Burn Plan.” Center for Combustion Science and Engineering. Page D-5.1 through D-5.24.

U.S. EPA. 1998. “Protocol for Human Health Risk Assessment at Hazardous Waste Combustion Facilities.” EPA-R6-098-002. Section 2.2.1.

Explanation:

To ensure thorough review and evaluation of the proposed waste feed system, this section should provide a complete, detailed description of the system and operation. This information is also used to determine potential fugitive emissions from the system for inclusion in the risk assessment. Wastes are fed into the combustion unit in a batch or a continuous mode. Feed mechanisms are diverse. Liquid wastes are often pumped into combustion units through a nozzle. A conveyor or gravity system may be used to feed solid wastes in bulk or in containers. The waste feed rate can be monitored in various ways, depending on feed type encountered. Feed rates of constituents, such as metals, total chlorine gas (Cl_2) and HCl, and ash, are monitored by knowing the concentration of the constituent in each feed stream and continuously monitoring the flow rate of each feed stream.

Solid hazardous wastes are generally held and mixed in staging areas under negative pressure. Exhaust gases from this area are either used as combustion air in the combustion unit or passed through a carbon adsorption filter.

Check For:

The TBP reviewer should check for the following information:

☐ Type of waste material fed to the PCC, or SCC (HHV or LHV liquid wastes, solid wastes, and sludge)

☐ Continuous or batch mode

☐ Waste source

☐ Processes that generate wastes

☐ Waste storage areas

☐ Description of blending procedures, if applicable, before firing (mixers, external recycling pumps, or air or steam spargers)

- ☐ Methods used to manage vent gases from waste storage tanks (exhausted to the incinerator chamber, treated separately, or released directly to the atmosphere). This section should also identify the following:
  - ☐ Number of vents
  - ☐ Estimated flow rate or emission rate from each vent
  - ☐ Methods for calculating flow or fugitive emission rates
  - ☐ Methods for controlling, monitoring, and verifying calculated flow or emission rates
- ☐ Identification of all components in the storage and feed system (tanks, pump, mixers, piping, valves, and nozzles), including the following details for each such device:
  - ☐ Number and location
  - ☐ Construction materials
  - ☐ Estimated fugitive emission rate
  - ☐ Method for calculating, controlling, and monitoring fugitive emission rates
- ☐ Measures taken to prevent blockage of nozzles used in firing wastes, if liquid wastes are known to contain some solids
- ☐ Pumps used to transport wastes from storage units to the combustion unit (such as progressive-cavity, gear, or diaphragm pumps)
- ☐ Construction material and size of pumps and ducts
- ☐ Methods of monitoring waste feed rate
- ☐ Method of transferring wastes from storage unit to combustion unit
- ☐ Feed rate of each waste burned

Example Situation: Lois reads the *Waste Feed System Description* section of the TBP as follows:

"The front-end feed train takes appropriate bulk solid waste through weigh hoppers into a rotary kiln by either a hydraulic ram or a drag feed unit.

Wastes—containerized in plastic, steel, or fiber drums or fiber boxes—are fed into the kiln through a hydraulically activated side port on the ram feeder unit and a gravity-fed auxiliary feed conveyor on the upper level of the ram feeder unit. Maximum Btu content per charge will not exceed 2 million, and a maximum of 4,000 lb/hr of containers will be fed during trial burn tests.

Nozzles and burners on the faceplate of the kiln provide injection points for various pumpable waste streams.

The heart of the system is the rotary kiln, which is designed to operate from 1,500 to 2,000°F. All of the nonliquid and aqueous wastes and some of the liquid organic wastes are combusted in the kiln.

The rotary kiln faceplate is provided with a variable flame-length burner equipped with air atomization and combustion air nozzles. Other nozzles found on the faceplate include those for high and low Btu and direct injection. The kiln is designed to operate at a maximum heat release of 25 MMBtu/hr.

The SCC is a vertical, refractory-lined afterburner. It has one burner and is designed to operate from 1,800 to 2,400°F. The SCC burner is designed to release a maximum of 30 MMBtu/hr."

Example Action: Lois notes that this section is inadequate and incomplete in many areas. For example, the statement that nozzles and burners provide injection points for "various" pumpable streams is too broad; it should define "pumpable stream" and describe physical and chemical characteristics. This section should also provide information on "direct injection."

She further notes that this section does not discuss waste storage areas, waste blending practices, liquid storage tank vents, construction materials, or how wastes are piped to the rotary kiln. It does not describe nozzles and burners, drawings, maximum particle size in liquid streams, or flow meters, nor does it discuss regulating the total flow of liquids or burner management. It also does not discuss how waste feed rate is monitored to control temperature in the rotary kiln or SCC.

Finally, this section mentions a burner but fails to discuss its type or how temperature is maintained in the SCC. Although a figure in the plan indicates that the SCC has a natural gas-fuel oil burner and a high-Btu organic liquid burner, the text discussed neither. Lois asks that the facility revise this section based on her review comments.

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3.1.1.7 Reviewing Section D-5b(1)(a)(7)—Ash Handling System

Regulations: 40 CFR Part 270.62(b)(2)(ii)
40 CFR Part 270.66(c)(3)

Guidance: U.S. EPA. 1997. "Generic Trial Burn Plan." Center for Combustion Science and Engineering. Pages D-5.1 through D-5.24.

U.S. EPA. 1998. "Protocol for Human Health Risk Assessment at Hazardous Waste Combustion Facilities." EPA-R6-098-002. Section 2.2.1, Page 2-2.

Explanation: Ash generated during the combustion process will exit the combustion chamber as either bottom ash or particulate matter (PM). In the case of a cement kiln, ash collected in the APCS is referred to as CKD. Because incinerators designed to burn solids and cement kilns will generate significant amounts of bottom ash, they are generally equipped with ash disposal chutes. Liquid injection incinerators often produce very small amounts of bottom ash, which are usually removed in the APCS. Although current RCRA regulations do not address the quality of incinerator residue (the degree of complete combustion of ash leaving the kiln), many state and local regulatory agencies require that combustion units operate in a manner that prevents an ash disposal problem. To comply with state and local regulations, facilities may be required to routinely analyze this ash prior to its ultimate disposal.

One of the main concerns about the ash handling system is that fugitive emissions will be generated during the removal of bottom ash from the combustion chambers. The increased emission rate of chemicals of potential concern (COPC) due to fugitive emissions needs to be estimated in order to complete the risk assessment. Fugitive emissions should be minimized or eliminated by sealing or tightly connecting the combustion chamber openings to the roll-off or other containers used in collecting ash. In addition, the seals or connections should be inspected regularly to identify leaking seals for potential fugitive emissions.

Check For: The TBP reviewer should check for the following information:

☐ Description of ash handling system

☐ Specific design details or precautions taken to control fugitive emissions during ash discharge

☐ Procedures for replacing roll-off containers

☐ Whether the rotary kiln can be operated without interruption during replacement of roll-off containers

☐ Roll-off container capacity

☐ Anticipated rate of ash generation based on total feed rate of ash in total feed streams

☐ Ash disposal as hazardous or nonhazardous waste

☐ Estimated fugitive emission rate

☐ Methods and frequency of monitoring fugitive emissions

☐ Maximum ash feed rate

Example Situation: Lois and Clark read the *Ash Handling System* section of the TBP as follows:

"The solids furnace is a refractory-lined rotary kiln that operates at a typical speed of 0.5 to 0.25 unit(s). It is normally maintained above a -0.2-inch water column draft and has a minimum exit temperature of about 1,500°F. The actual operating temperature will be determined during the trial burn. Solids contained in 30-gallon fiber drums are loaded onto a conveyor that empties into the charge end of the kiln by a chute equipped with a guillotine door. Ash is collected in bulk bins in a concrete pit below the kiln and transferred for cooling before being tested and approved for landfilling on site."

Example Action: This section indicates that ash is collected in bulk bins in a concrete pit below the kiln, but does not provide adequate information on operations and management of the ash handling system. It does not indicate (1) bin size, (2) how fugitive emissions are controlled during ash discharge from the kiln, (3) whether bins are closed, (4) how often bins are replaced, (5) whether the kiln stops rotating during bin replacement, and (6) ash generation rate (for example, in pounds per hour). Lois and Clark ask that the facility to revise this section to include information pertaining to operation and management of the ash handling system.

Notes: ____

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3.1.1.8 Reviewing Section D-5b(1)(a)(8)—Automatic Waste Feed Cut Off Description

Regulations:

40 CFR Part 266.102(e)(2)(ii)(A,B,C)
40 CFR Part 270.62(b)(2)(ii)(F)
40 CFR Part 270.66(c)(3)(vi)

Guidance:

U.S. EPA. 1989. "Handbook—Guidance on Setting Permit Conditions and Reporting Trial Burn Results." EPA/530/R-89/019. January. Table 2-1, Page 11.

U.S. EPA. 1997. "Generic Trial Burn Plan." Center for Combustion Sciences and Engineering. Pages D-5.1 through D-5.24.

U.S. EPA. 1998. "Protocol for Human Health Risk Assessment at Hazardous Waste Combustion Facilities." Center for Combustion Sciences and Engineering. EPA-R6-098-002. Section 2.2.3.

Explanation:

To ensure that out-of-compliance operations are kept to a minimum, combustion units are required to have automatic waste feet cutoff (AWFCO) systems that engage immediately when operating conditions deviate from those established during the trial burn test. AWFCO systems should be in place during the startup-shakedown phase, and trial burn. The facility should specify limits for various parameters that would affect combustion operations during excursions, including the following:

- The purpose of the trial burn is to set and adjust operating limits. The TBP requirements must include procedures for rapidly stopping the feed of waste to the combustion unit so that the trial burn will not present a hazard to human health or the environment. AWFCO's are not specifically required to be activated during a trial burn, but are an integral part of the operating permit, and therefore need to be considered. AWFCO limits in place during the trial burn may not be the same as those used prior to or following testing.

- Although AWFCO limits are necessary to minimize out-of-compliance operations, its occurrence is undesirable, because it may contribute to PIC emissions, safety problems, and increases in fossil fuel use. Therefore, AWFCOs are minimized by using prealarms on specified parameters followed by corrective actions taken by operating personnel.

AWFCOs are typically established for a number of general and site-specific parameters determined during the trial burn test; however, some regulatory agencies may also establish AWFCOs based on monitoring and reporting requirements. The facility may also propose additional AWFCO limits based on equipment manufacturer specifications and recommendations.

Check For: The TBP reviewer should check for the following information:

☐ Minimum and maximum temperature measured at each combustion chamber exit

☐ Maximum carbon monoxide (CO) emissions measured at the stack or other appropriate location

☐ Maximum flue gas flow rate or velocity measured at the stack or other appropriate location

☐ Maximum pressure in PCC and SCC

☐ Maximum feed rate of each waste type to each combustion chamber

All facilities should establish limits for, and continuously monitor, the following:

☐ Maximum production rate for BIFs

☐ Maximum total hydrocarbon (THC) concentrations, if THC emissions are monitored

☐ Minimum differential pressure across particulate venturi scrubber

☐ Minimum liquid-to-gas ratio and pH to wet scrubber

☐ Minimum caustic feed to dry scrubber

☐ Minimum kilovolt Amperes (kVA) settings for electrostatic precipitators (wet/dry) and kVA settings for IWS

☐ Maximum pressure differential across baghouse

☐ Minimum flow rate of liquid to IWS

Facilities should establish limits for the following as they apply to the facility:

☐ AWFCO testing frequency

☐ How each parameter is monitored and how the AWFCO system is triggered during an excursion

☐ O_2 levels for correcting CO measurements

☐ Prealarm system operation and its relation to the AWFCO system (for example, parameters monitored, monitoring frequency, and conditions under which prealarm system readings trigger the AWFCO system [two or three consecutive, 15-second parameter readings that exceed an established or permitted limit])

☐ CO levels

☐ THC levels

☐ O_2 levels

☐ Production capacity

☐ Combustion chamber temperature

☐ Hazardous waste feed flow rate

☐ Flue gas flow rate

☐ PM control device inlet temperature

☐ Other APCS parameters
(these parameters are generally used as pre-alarm indicators)

☐ Recognition of monitoring parameters and various groups recommended by U.S. EPA for interlock with AWFCO and with records of operation

☐ Process Upset Information

  ☐ Historical operating data demonstrating the frequency and duration of process upsets and the associated combustion unit conditions or operating parameters at the time of the upset
  ☐ Cause of each process upset
  ☐ Estimates of process upset emission rates and background information on each upset
  ☐ Description of a reasonable process upset or failure (including primary or secondary process and APCS controls and interlocks to substantiate this scenario)
  ☐ Description of typical operating procedures for the combustion unit

Example Situation: In reviewing the *Automatic Waste Feed Cutoff Description* section of the TBP for a preheater calciner cement plant, Clark reads as follows:

"To start and maintain hazardous waste feed flow to a kiln, the following conditions must be met. The interlocks must remain satisfied, or shutdown of hazardous waste fuel (HWF) flow to the kiln will occur.

- Kiln induced draft fan must be operating
- Kiln drive must be operating
- Kiln feed V-ball must be open to “A” or “B”
- Total kiln feed rate must be less than 256 tons per hour
- Supplemental fuels flow rate must be less than 43 gpm
- Raw mill baghouse inlet temperature must be less than 366°F
- Alkali bypass baghouse inlet temperature must be less than 436°F
- Fourth-stage gas inlet temperature must be less than 1,691°F
- Raw mill baghouse differential pressure must be greater than 6 inches of water column
- Alkali bypass baghouse differential pressure must be greater than 2.95 inches of water column
- Stack exhaust gas opacity must be less than 20 percent
- Corrected CO must be less than 1,169 ppm by volume (ppmv)
- Corrected THC must be less than 20 ppmv
- Either the primary or backup continuous emissions monitoring system (CEMS) must be “on line”
- Either the primary or backup THC monitor ignition must be lit
- Minimum combustion chamber temperature (for containers)

If any of the following conditions approach the present AWFCO limit, an alarm alerts the control room operator of conditions that may lead to an AWFCO if left unattended.

These include the following:

- Total kiln feed rate
- Supplemental fuels flow rate
- Raw mill baghouse inlet temperature
- Alkali bypass baghouse inlet temperature

- Fourth-stage gas inlet temperature
- Raw mill baghouse differential pressure
- Alkali bypass baghouse differential pressure
- Stack exhaust gas opacity
- Corrected CO
- Corrected THC”

Example Action: Clark notes that this section, in large part, is incomplete; the following information should be added:

- The total, maximum HWF rate should be specified. The TBP currently specifies only the pumpable HWF rate. The total feed rate must include the rate at which canisters will be injected into the kiln. Though the text states elsewhere that the canisters represent less than 1 percent of the total HWF rate, the maximum feed rate for these canisters should still be specified.
- CO and THC concentration limits should be described as being on a dry basis and corrected to 7 percent O_2.
- A number of AWFCO parameters need to be specified, including:
  - The upper limit on combustion gas flow rate; direct measurement of the gas flow should be provided, if possible,
  - The minimum combustion temperature,
  - The maximum combustion temperature, and
  - The maximum combustion chamber pressure.
- The preset points for the alarm system should be specified. Additionally, specific corrective measures to be taken when the prealarm system is triggered should be identified.
- An explanation of test procedures that will be implemented should an AWFCO occur during the trial burn. This explanation should include, at a minimum, the following:

  - A statement that the minimum combustion chamber temperature will be maintained during the AWFCO for as long as waste remains in the kiln and information on how this will be achieved.
  - The logic that will be used to determine when a restart of waste feed is appropriate after an AWFCO is caused by an instantaneous parameter reading.
  - How the waste feed will be restarted. If the process is manual, the text should state this and provide the step-by-step process for restart. If the process is automated, the computer logic should be outlined.
- A description of the relationship between the trial burn operating conditions and the AWFCO settings during the trial burn. The description should demonstrate that AWFCO settings are sufficiently close to the operating envelope to prevent undue hazards to human health and the environment, but far enough from the envelope not to produce excessive AWFCOs during the trial burn.
- An explanation of how trial burn results will be used to establish AWFCO set points following the trial burn.
- A description of AWFCO system preventative maintenance and testing procedures.

Clark asks that the facility revise this section to include the requested parameters, descriptions, procedures, and rationale.

Notes: ____

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3.1.1.9 Reviewing Section D-5b(1)(a)(9)—Stack and Continuous Emission Monitoring Systems

Regulations:
40 CFR Part 60, Appendix A
40 CFR Part 266, Subpart H and Appendix IX
40 CFR Part 270.62(b)(2)(ii)(G)
40 CFR Part 270.66(c)(3)(viii)

Guidance: U.S. EPA. 1992. "Technical Implementation Document for EPA's BIF Regulations." OSWER. Washington, D.C. EPA-530-R-92-011. March. Pages 4-1, 6-1, and 6- 2.

U.S. EPA. 1997. "Generic Trial Burn Plan." Center for Combustion Science and Engineering. Pages D-5.1 through D-5.24.

Explanation: CO and O_2 (and, if applicable, THC) should be continuously measured during the startup and shakedown phases and trial burn, as well as continuously thereafter. Continuous emissions monitoring of CO and O_2 must comply with performance specifications in Section 2.1 of Appendix IX to the BIF Rule. Performance specifications provide criteria that the monitoring system must meet. Requirements for daily calibrations are also addressed in performance specifications.

Check For: The TBP reviewer should check for the following information:

- ☐ Parameters continuously monitored (CO, O_2, and sometimes THC)
- ☐ CEM equipment or analyzer manufacturer name and model number
- ☐ CO, O_2, and THC monitoring method
- ☐ Whether CEMS equipment will meet performance specifications
- ☐ Most recent CEMS certification results
- ☐ CEMS functions
  - ☐ Continuous measurement
  - ☐ AWFCO system activation
  - ☐ Remote display of stack gas composition and CEMS operational status
  - ☐ Automatic and manual calibration of sampling and analysis trains
  - ☐ Automatic recording and printing of stack gas composition
  - ☐ Alarm activation when there is a CEMS malfunction
- ☐ Location of CEMS analyzers and system instrumentation
- ☐ Description of degree of equipment redundancy, if applicable

☐ Brief description of CEMS operations

☐ Calibration procedures

☐ Calibration frequency (daily, weekly)

☐ Data corrections and reporting (concentrations of CO and THC in stack gas must be continuously corrected to a dry gas basis and to 7 percent O_2)

☐ Monitoring of CO and O_2 in the bypass duct (for process cement kilns with preheaters or precalciners)

Example Situation: Lois and Clark read the *Stack and Continuous Emission Monitoring Systems* section of the TBP as follows:

"CEMS probes are located in the duct between the bypass-induced draft fan exhaust and the stack. CEMS equipment consists of several gas analyzers, a supporting sample acquisition system, and a computer data display and reporting system. This CEMS is supplied by AB Company and consists of:

- A probe with a heated external ceramic filter
- A temperature-controlled sample transport line
- A constant-volume gas sample pump
- A THC analyzer: there are two analyzers, one is always on line while the other is in standby mode
- A gas conditioning system with condensate pumps
- A gas analyzer, infrared CO analyzer: there are two analyzers, one is always on line while the other is in standby mode
- Data storage modules, Model DSM-3260
- A personal computer with 8 megabytes (MB) of random access memory and a 500-MB hard drive
- An environmental data acquisition and reporting software

"CEMS - Process Description

"The sample probe extracts a gas sample from the bypass fan exhaust duct. This probe is temperature-controlled to 325°F. Gas is drawn down an electrically heated sample transport line. A portion of the gas enters the THC analyzer. The remainder of the gas is conditioned and any condensate removed. The resulting dry gas flows into the CO and O_2 gas analyzers. Raw data from each analyzer is sent to the data storage module, and any required calculations are completed. The resultant output goes to the display and data reporting computer, where it is compared to appropriate present limits resulting in 'No action,' 'Alarm,' or 'shutdown of hazardous waste feed to kiln,' in accordance with applicable restrictions."

The description of the CEMS equipment should include the location and configuration of the sampling probe located at the stack.

Example Action: Lois and Clark realize that the CEMS equipment description is incomplete and they note that the following should be included:

- Specific U.S. EPA method procedures associated with the operation of each CEMS.

- For the parameters to be monitored, the following information, for each instrument should be provided in a table: instrument type, manufacturer, model number, range, accuracy, drift, reproducibility, response time, and calibration frequency both prior to and during the trial burn.
- Specific reference to appropriate TBP sections that contain more details, such as the equipment manual and drawings, on the CEMS equipment and locations. This information should clarify whether the CEMS is monitoring downstream of the points where the bypass duct rejoins the main gas flow. If the CEMS is not located downstream of this point, additional monitoring equipment will be required.

- Information on certification of analyzers and performance specification tests required under 40 CFR Part 266, Appendix IX and 40 CFR Part 60, Appendix B.

Lois also notes that the CEMS process description is both incomplete, unclear, and that it should include the following:

- The frequency of parameter sampling and monitoring.

- A clearer description of the flow stream to the analyzers. A figure supporting this description should be included.

- Specific references to the appropriate sections of the TBP that contain more details on monitoring methods and control configuration.

Based on their review comments, Lois and Clark request that the facility revise the CEMS equipment and process descriptions.

Notes: ____

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3.1.1.10 Reviewing Section D-5b(1)(a)(10)—Air Pollution Control Systems

Regulations:

40 CFR Parts 266.102(e)(2), (3), (4), and (5)
40 CFR Part 270.62(b)(2)(ii)(G)
40 CFR Part 270.66(c)(3)(vii)

Guidance:

U.S. EPA. 1997. "Generic Trial Burn Plan." Center for Combustion Science and Engineering. Pages D-5.1 through D-5.24.

U.S. EPA. 1998. "Protocol for Human Health Risk Assessment at Hazardous Waste Combustion Facilities." EPA-R6-098-002. Section 2.2.4.

Explanation:

The APCS on a combustion unit removes acid gases (commonly HCl) and PM. Because industrial waste streams vary, so do APCSs. APCSs are used either independently or in combination, depending on whether it is necessary to control PM, acid gas, or both. RCRA regulations require that any hazardous waste combustion unit that emits HCl at a rate greater than 1.8 kilograms per hour and PM at a rate of 0.08 grains per dry square cubic foot be corrected to 7 percent O_2.

There are critical operating parameters that effect the efficiency of the device for each of the devices listed below. These critical operating parameters are aspects of the APCS that (1) can be continuously monitored and (2) are indicators of pollutant removal efficiency. Some examples follow:

- Cyclones - pressure drop and gas velocity effect the collection and removal efficiency of the device.

- Fabric filters - gas-to-cloth ratio affects the particulate removal efficiency as does the differential pressure across the bags.

- Quench system - gas velocity effects quenching and large particle removal, quench water temperature, and flow effects system efficiency.

- Gas conditioner - poor gas conditioning adversely effects the removal of particulates and can cause emission violations.

- Venturi scrubbers - the differential pressure across the venturi determines particle size removal efficiencies.

- Wet scrubbers - scrubber water pH determines acid gas neutralization capability. Pressure drop across the scrubber determines contrast potential of pollutants with scrubber media.

- Electrostatic precipitator (ESP) - gas flow rate and applied voltage are critical to efficient operation and solids removal, as is the particle loading rate.

- Induced-or forced-draft fan - the fan must be capable of inducing a draft throughout the unit or of supplying sufficient combustion air for complete oxidation of organic compounds.

A limit on maximum temperatures at the inlet to the APCS must be established based upon operating conditions during both the dioxin and furan and metals emissions testing. This maximum inlet temperature should be reproduced as closely as possible during the PIC emissions testing.

Maximum inlet temperature to dry APCS is important for both metals and dioxin and furan emissions. For metals, high inlet temperatures can cause poor collection efficiency because a larger portion of the metals may be in the vapor phase. For dioxins, high inlet temperature can cause an increase in surface catalyzed dioxin and furan formation. At inlet temperatures between 450°F and 750°F, dioxin and furan emissions can increase by a factor of 10 for every 125°F increase in temperature.

Check For: The TBP reviewer should check for the following information:

☐ APCS type and components

☐ Cyclones (used mainly as a prefiltering process for removing larger particles)

  ☐ Manufacturer name and model number
  ☐ Cyclone device location in the APCS
  ☐ Cyclone chamber shape (conical or cylindrical)
  ☐ Construction material
  ☐ Gas entry (tangential or axial)
  ☐ Gas velocity
  ☐ Pressure drop
  ☐ Inlet gas temperature
  ☐ Removal efficiency
  ☐ Brief description of cyclone design and operation
  ☐ Smallest particle that could be removed effectively
  ☐ Inspection and maintenance procedures
  (for wall corrosion, leakage, particle deposits, and plugging)

☐ Fabric filters or baghouses

  ☐ Manufacturer name and model number
  ☐ Brief description of fabric filter design and operation
  ☐ Housing dimensions and construction materials
  ☐ Fabric specification (fabric type and weave)
  ☐ Inlet gas temperature
  ☐ Filter type and size
  ☐ Gas velocity or flow rate

  - ☐ Differential pressure
  - ☐ Gas-to-cloth ratio
  - ☐ Smallest particle that could be removed effectively
  - ☐ Filter cleaning procedure (pulse jet, shaker, sonic, or reverse air systems)
  - ☐ Cleaning frequency
  - ☐ Inspection and maintenance (for correct tensioning and conditions, such as tears, holes resulting from abrasion, and dust accumulation on the surface)

A typical baghouse

- ☐ Quench system

  - ☐ Manufacturer and model number
  - ☐ Purpose of quench system
  - ☐ Quench method
  - ☐ Removal efficiency (Latent heat)
  - ☐ Combustion gas velocity
  - ☐ Combustion gas inlet and outlet temperature
  - ☐ Quench water supply capacity
  - ☐ Quench water temperature
  - ☐ Water feed rate
  - ☐ Total recycle flow rate, if applicable
  - ☐ Management of condensate and excess water
  - ☐ Description (shape, dimensions, CSA, and volume) of quench liquid collection system, if applicable
  - ☐ Quench liquid recycling procedures, if fluid is being recycled
  - ☐ Management of quench liquid recycling residues
  - ☐ Ultimate treatment and disposal of quench liquid

☐ Gas conditioner

Flue gas conditioning (cooling, humidification, and reagent injection) is required before particle removal in low-temperature devices, such as baghouses, cold ESP, and wet scrubbers.

- ☐ Manufacturer name and model number
- ☐ Conditioner purpose
- ☐ Dimensions and CSA
- ☐ Construction material
- ☐ Gas conditioning technique (air dilution, heat exchanger, water quench, and radiation and convection duct cooling)
- ☐ Inlet and outlet gas temperature
- ☐ Volumetric flow rate of flue gas
- ☐ Air dilution technique

    - Dilution air volumetric flow rate
    - Dilution air blower capacity

- ☐ Heat exchanger technique

    - Heat exchanger type (gas-to-gas or gas-to-liquid)
    - Cooling fluid (air or liquid)

☐ Venturi scrubbers

- ☐ Manufacturer name and model number
- ☐ Scrubber purpose
- ☐ Removal efficiency
- ☐ Construction material
- ☐ Gas inlet temperature
- ☐ Scrubber water flow rate
- ☐ Spent scrubber water management
- ☐ Differential pressure across scrubber
- ☐ Gas flow rate
- ☐ Influent and effluent pH for scrubber solution
- ☐ Liquid-to-gas ratio
- ☐ Inspection and maintenance (for prevention of corrosion and scaling on all scrubber internal surfaces, excessive dust buildup, nozzle damage, plugging, and fluid leakage)
- ☐ Scrubber blowdown frequency

☐ Wet scrubbers

- ☐ Manufacturer name and model number
- ☐ Wet scrubber purpose

  - ☐ Wet scrubber type (tray tower, packed tower, free jet, or ionized)
  - ☐ Brief description of scrubber
  - ☐ Pressure drop across scrubber
  - ☐ Concentration and pH of scrubbing slurry
  - ☐ Liquid-to-gas ratio using gas and slurry flow rate
  - ☐ Solids accumulation within the scrubber
  - ☐ Induced-draft fan power
  - ☐ Reagent preparation system (slurry solution) operation
  - ☐ Inlet and outlet gas temperatures
  - ☐ Dewatering process
  - ☐ Spent scrubber solution management and disposal
  - ☐ Inspection and maintenance (for leaks, scaling, corrosion, and erosion problems)

- ☐ ESP

  - ☐ Manufacturer name and model number
  - ☐ Brief description of ESP design and operation
  - ☐ ESP general configuration (wire or rod discharge electrode)
  - ☐ ESP type (tubular, wire-to-plate, or flat plate)
  - ☐ Gas volume flow rate
  - ☐ Particle loading
  - ☐ Gas temperature
  - ☐ Removal efficiency
  - ☐ Dimensions
  - ☐ Construction materials
  - ☐ Specific collection area
  - ☐ Aspect ratio (length-to-height)
  - ☐ Wire-to-plate spacing
  - ☐ Wire (or rod) diameter
  - ☐ Operating voltage
  - ☐ Current
  - ☐ Sparking rate
  - ☐ Particle dislodging procedure (mechanical rapping devices or water)
  - ☐ Wet electrostatic preciptator (WESP) water flow rate
  - ☐ WESP volumetric flow rate of intermittent wash down sprays used to remove material that adheres to collector surfaces
  - ☐ Performance monitoring (opacity meter)
  - ☐ Inspection and maintenance procedures (for cleaning carbon deposits on plates, power supplies, monitors, electrode conditions, and electrical connections)

- ☐ Information required for the control of cement kiln dust (CKD)

  - ☐ CKD physical data, including PSD and density

    - ☐ CKD chemical data, including organic and inorganic analytical tests similar to those used for sampling combustion gases
    - ☐ CKD recycling rate (to the process)
    - ☐ Ambient air monitoring data
    - ☐ CKD management, transportation, storage, and disposal methods
    - ☐ Contaminant procedures, including fugitive dust prevention measures and the area of exposed CKD
    - ☐ Meteorological data, including wind speed, and precipitation

- ☐ Induced- or forced-draft fan

    - ☐ Manufacturer name and model number
    - ☐ Fan purpose
    - ☐ Fan type
    - ☐ Construction materials
    - ☐ Dimensions
    - ☐ Design specifications

        - Volumetric flow rate
        - Temperature
        - Pressure
        - Horsepower

- ☐ Stack

    - ☐ Stack dimensions and CSA
    - ☐ Construction materials

- ☐ Description of stack gas recycling system, if applicable

- ☐ Description of scrubber liquid recycling system

Example Situation: Lois reads the *Air Pollution Control Devices* section of the TBP as follows:

“The clinker exiting the kiln is about 2,300°F and falls into a grate-type cooler to reduce its temperature. The temperature is reduced by blowing air through the hot clinker. In turn, some of the hot air generated in this process is drawn through the kiln to be used as combustion air. Gases produced during the combustion process are drawn through the kiln and preheated by an induced draft fan. As these gases leave the preheater, they are drawn by another fan through the raw mill to heat and dry the raw feed of the mill. However, before they exit the perimeter, hot gases pass through a spray tower, where the temperature is regulated before it enters the raw mill (or main baghouse if the mill is bypassed). After gases exit the raw mill, the dust-laden gas stream is cleaned by a Buell baghouse, Model 56-RM-12, and contains a total cloth area of 173,000 square feet. Collected dust is recycled back to the raw feed storage silos, and the cleaned gas stream is exhausted first through the induced draft fan and then through the main stack."

Example Action: Lois finds this discussion to be confusing and inadequate and believes that the following items should be addressed:

- A more detailed description of flow streams and relationships between the raw mill baghouse, the main baghouse, the spray tower, the main stack, and any bypass stack. The purpose of the spray tower should be defined. A PFD and P&ID should be included in the TBP to support each of the items.

- A discussion of the effects of bypassing the raw mill on the overall performance of the APCS. The flow configuration that will be used during the trail burn also should be identified.

- Identification of operating parameters for the APCS, including gas flow rates, gas inlet temperature, bag cleaning cycles (frequency and duration), and pressure drop.

- A discussion of how test conditions represent worst-case conditions.

Additional information on the baghouse should be provided. This information should include (1) air-to-cloth ratios; (2) bag-to-bag spacing; (3) bag length; (4) number of separate compartments within the baghouse; (5) method of compartment isolation; (6) method of cleaning and frequency; (7) source of any compressed air used to clean the bags; and (8) bag fabric. To clarify and complete the APCS discussion, Lois asks that the facility revise this section based on her comments.

Notes: ______________________________

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3.1.1.11 Reviewing Section D-5b(1)(a)(11)—Construction Materials

Regulations: 40 CFR Part 270.62(b)(2)(ii)(I)

Guidance: U.S. EPA. 1997. "Generic Trial Burn Plan." Center for Combustion Science and Engineering. Pages D-5.1 through D-5.24.

Explanation: To ensure thorough evaluation of the proposed combustion unit, this section should provide a complete list of combustion unit components along with design specifications and parameters for each component. Specifically, this section should describe construction materials, thickness, and temperature ratings of shell and internals for the following:

- PCCs
- SCCs
- Tertiary combustion chambers
- High-temperature ducting between PCCs and SCCs
- Quench tank
- Induced draft fan housing
- APCS
- Stack
- Induced draft fan wheel
- Other equipment associated with the combustion unit

Check For: The TBP reviewer should check for the following information:

- ☐ Construction materials
    - ☐ Outer shell (ordinary steel or alloys)
    - ☐ Inner shell (refractory materials, such as fireclay, alumina, silica, chromium, magnesite, and other oxides)

- ☐ Thickness of outer shell and refractory
- ☐ Refractory conductivity
- ☐ Temperature ratings of shell and internals

Example Situation: Clark reads the *Construction Materials* section of the TBP, as follows:

“Following is a list of major process equipment for the hazardous waste incinerator and scrubber system, including:

Rotary Kiln

Manufacturer	Bartlett-Snow
Size	External: 12 feet diameter x 17 feet long Internal: 10.5 feet diameter x 16.5 feet long
Heat Duty	35 million BTU/hr
Volume	1,429 cubic feet (ft^3)
Material	Refractory-lined steel

Afterburner

Manufacturer	Combustion Engineering, Inc.
Size	13 feet wide x 14 feet high x 28.6 feet long
Volume	7,422.25 cubic feet (ft^3)
Unit Capacity	131,000 ft^3/min at 2,300°F

Absorber/Cooler

Manufacturer	Ceilcote Co.
Height	26 feet 4 inches
Diameter	11 feet
Material	Fiber-reinforced plastic

Stack

Height	100 feet
Lining	Fiber-reinforced plastic
Diameter	7 feet ID at base and 5 feet ID at discharge”

Example Action: While this section provides a list of major process equipment and some specification/parameter information, it does not provide the conductivity of the refractory used in the PCC and SCC and temperature ratings of the outer and inner shells. Clark asks that the facility revise this section to include this information.

Notes:

3.1.1.12 Reviewing Section D-5b(1)(a)(12)—Location and Description of Temperature, Pressure, and Flow Indicators and Control Devices

Regulations: 40 CFR Parts 264.345(a) and (b)
40 CFR Part 270.62(b)(2)(ii)(J)

Guidance: U.S. EPA. 1997. "Generic Trial Burn Plan." Center for Combustion Science and Engineering. Pages D-5.1 through D-5.24.

Explanation: Combustion unit regulations require continuous monitoring of combustion temperature, waste feed rate, combustion gas flow rate, and CO concentrations in the stack gas. Monitoring of key process parameters should be continuous. Temperature is usually monitored by using thermocouples protected in a thermowell.

Thermocouple location in the combustion chamber significantly affects the accuracy of temperature readings. Typically, thermocouples are located at the gas exit in the chamber.

Combustion chamber pressure is monitored to ensure correct operation of the combustion unit and to prevent fugitive emissions. Many combustion units are operated under draft conditions (less than atmospheric pressure). This ensures that combustion gases do not exit the chamber before passing through the APCS.

Instruments used to monitor pressure are known as differential pressure gauges, differential pressure transducers, or draft gauges. Pressure gauges are usually located across the hood of a rotary kiln. However, they can be located across the entire combustion chamber or kiln. The gauges are accurate, and maintaining draft conditions is normally not an operating problem.

Waste flow rate is monitored by using devices appropriate for the physical and chemical nature of the waste. A mass flow meter is generally used for liquid; these devices are typically very accurate, and require minimum maintenance. Flow meters may be located anywhere between the waste feed tank and the combustion unit; however, it is desirable to measure the flow rate in the feed line as near as possible to the combustion unit and after any T's in the piping.

Positive displacement pumps are used when viscous wastes, such as sludges, are pumped into the combustion chamber. Accuracy is affected by waste characteristics and maintenance. Solids can be monitored as the weight of discrete units pushed into the kiln or as solids fed by using a weigh-belt conveyor. Weigh-belt conveyor accuracy is acceptable for most applications.

Combustion gas velocity is monitored after the scrubber. The device most often used is an annubar, which must be calibrated frequently and is susceptible to corrosion and plugging. Combustion gas flow rate, which is usually a permit condition, is calculated using the gas velocity.

Control devices could include items such as (1) valves in the feed line, (2) burner blowers controlling combustion air, (3) steam valves used for steam atomization of specific wastes, and (4) other devices used to control feed rates and ensure safe operation.

Check For: The TBP reviewer should check for the following information:

- ☐ Equipment description
- ☐ Device locations
- ☐ Equipment accuracy
- ☐ Equipment maintenance
- ☐ Equipment compatibility with use

Example Situation: Lois and Clark read the *Location and Description of Temperature, Pressure, Flow Indication, and Control Device* section of the TBP as follows:

"Critical Process Measurements—The measurement and control of waste flows, kiln and SCC outlet temperatures, combustion gas analysis, and velocity are the parameters that are most critical to efficient, in-specification performance of the incinerator train. Consequently, 'state-of-the-art,' yet field-proven instruments are used to measure these process variables.

"Liquid waste flows are measured by using Coriolis mass flow transmitters. These devices are relatively immune to variations in density, viscosity, and solids content; therefore, they lend themselves well to this type of application.

"Kiln outlet temperatures are measured by using dual redundant narrow-band infrared pyrometers, which send independent analog signals to the control console. SCC outlet temperatures are measured by using dual redundant thermocouples. The area supervisor uses a selector switch to select one of the two signals to be used in the monitoring and control loop. Output signals from both pyrometers are continuously monitored and compared. If there is a sustained, significant difference between the two signals, an alarm will alert the operator of potential failure of one of the pyrometers.

"Combustion gas is analyzed by using in-situ and extractive-type sensors. Optical analyzers are used to monitor the opacity, and nondispersible infrared units are used to analyze CO and HCl. A flame ionization detector (FID) is used to monitor THC. A zirconium oxide cell is used to measure O_2.

"Stack gas velocity is an indication of the gas residence time in the SCC, which is critical to the complete thermal destruction of waste materials. Therefore, stack gas velocity is measured by using dual redundant thermal dispersion flow transmitters. One signal is selected to be displayed and interlocked, but both signals are continuously monitored and compared. A sustained, significant deviation will cause an alarm to alert the operator of the possible malfunction of one of the transmitters."

Example Action: This section should present the optimum range of the liquid waste flow meter, in addition to calibration data displaying error on both sides of optimum. It should also present the type of thermocouples used and the temperature range in which they are used. Lois finds the comment about a "sustained, significant difference" to be unacceptable. If a difference exists of more than 2 to 3 percent in dual redundant readings, something is wrong and it must be corrected immediately.

Clark makes a similar notation regarding "sustained, significant deviation" in the stack gas velocity monitor. This is a permit condition that cannot be allowed to exceed certain limits. Lois and Clark request that the facility revise this section and specify a value for the difference between the two readings that will be considered unacceptable.

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3.1.1.13 Reviewing Section D-5b(1)(a)(13)—Combustion Unit Start-Up Procedures

Regulations: 40 CFR Part 264.345(c)
40 CFR Part 270.62(b)(2)(viii)

Guidance: U.S. EPA. 1997. “Generic Trial Burn Plan.” Center for Combustion Science and Engineering. Pages D-5.1 through D-5.24 and D-5.44.

Explanation: During startup and shutdown of a combustion unit, hazardous waste must not be fed into the combustion unit unless it is within operating conditions (such as temperature and air feed rate) specified in the permit.

Check For: The TBP reviewer should check for the following information:

☐ Technique for bringing the combustion unit to full operating conditions (firing fossil fuel, such as natural gas or pulverized coal)

☐ Whether the hazardous wastes are being fed to the combustion unit before it is brought to full operating conditions

☐ Facility’s definition of full operating conditions

☐ Whether the unit is in compliance with all regulatory limits before it burns hazardous wastes

☐ Time required for startup

☐ Startup sequence (the APCS should be started first, and the waste system should be started last)

☐ Specific procedures for startup of utilities, APCS, boiler system, SCC train, and the rotary kiln

☐ Discussion of how the combustion unit is brought up to permitted operating conditions

☐ Fuel source used for startup

☐ Documented start-up procedures for ancillary equipment

☐ Estimated time required to reach permitted operating conditions for introduction of hazardous waste

Example Sections: See Section 3.2.1 of this component for specific example sections.

Example Comments: See Section 3.2.1 of this component for specific example comments.

Notes:

3.1.2 Reviewing Section D-5b(1)(b)—Sampling, Analysis, and Monitoring Procedures

Regulations:

40 CFR Part 266.62 (b)(2)(I)(A-D)
40 CFR Part 270.62 (b)(2)(iii)
40 CFR Part 270.66(c)(4)

Guidance: U.S. EPA. 1997. "Generic Trial Burn Plan." Center for Combustion Science and Engineering. Pages D-5.24 through D-5.34.

Explanation: To assist the reviewer to better evaluate the feasibility of sampling, analysis, and monitoring procedures, this section should state the objectives of the proposed sampling program. Generally, objectives of a trial burn sampling programs are to collect analytical data that will allow the calculation of constituent feed rates; estimate APCS removal efficiencies; document CO, O_2, and other constituent emission rates; and determine the fate of principal organic hazardous constituents (POHC) fed to the system.

This section should also discuss whether the facility intends to spike wastes fed into the combustion unit. Organic chlorine is spiked into waste feeds either to maximize the volatility of metals or to demonstrate compliance with RCRA emissions and removal efficiency requirements for HCl and Cl_2. Also, compounds such as naphthalene and chlorobenzene may be spiked as POHC. The concentration of the spiking compound in waste feed should be presented in the TBP.

Check For: The TBP reviewer should check for the following information:

☐ Sampling program objectives

☐ Spiking compounds used, if any

☐ Spiking purpose

☐ Concentration of spiking compounds in waste feed

Example Sections: During the review of a TBP, Lois notes that the facility proposes to measure POHC (carbon tetrachloride) DRE by (1) sampling the waste feed for total HCl and Cl_2, elemental analysis, density, heating value, and ash content; and (2) collecting stack gas samples using U.S. EPA Methods 0050 for HCl and Cl_2 and U.S. EPA Method 0031 for volatile organic compounds (VOC).

Example Comments: This is not adequate. To measure DRE, the facility must propose waste feed analysis that can quantitatively measure the concentration of each POHC in the waste feed. The proposed sampling program will only qualitatively measure the carbon tetrachloride in the waste feed by measuring total HCl and Cl_2. Lois requests that the facility include VOC analysis of the waste feed samples using U.S. EPA Method 8260.

Notes: ____

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3.1.2.1 Reviewing Section D-5b(1)(b)(1)—Sampling Locations and Procedures

Regulations: 40 CFR Part 270.62(b)(2)(iii)
40 CFR Part 270.66(c)(4)

Guidance: U.S. EPA. 1997. "Generic Trial Burn Plan." Center for Combustion Science and Engineering. Pages D-5.24 through D-5.34.

Explanation: This section should discuss sampling locations and procedures during the trial burn test and normal operations. It should include sample types to be collected (waste feed, scrubber blow down, combustion residues, and flue gas emissions), frequency at which they are collected, sampling locations, and sampling procedures. Sampling locations should be presented in a process flow diagram. The location of temporary CEMS can be shown separately or as part of the stack gas sampling for each auxiliary fuel source, a sampling location should be identified. In lieu of sampling auxiliary fuels, a facility may rely on certified analyses for these feed streams, if applicable, and if appropriate data is available from the supplier.

Procedures for collecting samples at each location are usually summarized in a table that also includes sampling frequency and reference methods. Process grab samples for volatile organic analysis are collected and packaged separately in the field. Samples for other analysis are composited in the field and shipped to the laboratory. Waste feed samples should be collected at 15-minute intervals.

Reference should also be made in this section to the trial burn quality assurance project plan (QAPP). Additional sampling procedure information is discussed in Component 2 of this manual.

Check For: The TBP reviewer should check for the following information:

- ☐ Sample types

  - ☐ Auxiliary fuels (for example, fuel oil or natural gas)
  - ☐ Raw materials (for example, slurries, raw mixes, or shale)
  - ☐ Waste feed
  - ☐ Scrubber blow down
  - ☐ Combustion residues
  - ☐ Flue gas emissions
  - ☐ Grab samples
  - ☐ Composite samples

- ☐ Sampling locations

- ☐ Sampling procedures and reference methods

- ☐ Sampling frequency

☐ Sample storage conditions

☐ Sample packaging and shipment

Example Situation: In reviewing the *Sampling Locations and Procedures* section of the TBP, Lois and Clark read as follows:

“Five locations have been identified for the collection of process and fuel samples. These locations include the slurry feed, HWDF, tire-derived fuels, coal and coke, and CKD. These samples will be collected to (1) demonstrate compliance with required performance standards, (2) prepare mass balance incorporating stack gas emission data, and (3) calculate DRE and metals and chlorine system removal efficiencies. Sampling points are described below:

“Slurry Feed: The sampling point is located at the ‘test tank’ at the feed point to the kiln. The samples will be analyzed for metals, VOCs, and ash content.

“Coal and Coke: The sampling point is located at the feed belt to the coal/coke mill. The samples will be analyzed for metals, VOCs, heating value, and ash content.

“TDF: The sampling point is the TDF storage pile. The samples will be analyzed for metals, heating value, and ash content.

“HWDF-Liquid: The sampling point is located on the feed line to the kiln downstream of the mass flow meter. The samples will be analyzed for metals, heating value, and ash content.

“CKD: The sampling point is located in the bottom of the screw conveyor used to transfer CKD from the bucket elevator to the waste storage bin. The samples will be analyzed for metals and VOCs.

“All process samples will be collected by personnel trained in proper sampling techniques and chain-of-custody procedures. Samples will be logged by time and a unique identifying number. Process and fuel sampling will be overseen by a process sampling coordinator. This individual will also be responsible for compositing all process and fuel samples at the end of a given run and splitting these composites into the proper sampling containers. This individual will also interface with the stack gas sampling quality assurance and quality control (QA/QC) coordinator.

“Exhibits 3.1.2.1-1 and 3.1.2.1-2 present process and fuel sampling frequency and analysis.”

Example Action: Lois notes several deficiencies in this section. The facility has proposed sampling frequencies for kiln slurry, coal and coke, HWDF, CKD, and TDF that appear to be arbitrary. Also, several of the proposed frequencies differ from the frequency recommended in the guidance (for example, every 15 minutes during each run of the trial burn test). The TBP should discuss the relationship between sample frequency and representativeness and demonstrate that sampling various feed streams at proposed frequencies will adequately capture temporal variations in composition, thereby ensuring representativeness of all samples. Alternatively, frequencies should be changed to "every 15 minutes during each run of the trial burn."

The sampling frequency for HWDF, specified as "four per hour," deviates semantically from U.S. EPA guidance. To avert possible misinterpretations, this frequency should be "every 15 minutes during each run."

In comparing table data, Clark discovers that the fuel stream sampling program summarized in Exhibit 3.1.2.1-1, page 1-58, is inconsistent with the fuel stream analytical program presented in Exhibit 3.1.2.1-2, page 1-59. Specifically, single composite samples described in Exhibit 3.1.2.1-1 are not appropriate for multiple analyses described in Exhibit 3.1.2.1-2. It is not standard practice to composite volatiles samples in the field, as implied by Exhibit 3.1.2.1-1. Exhibit 3.1.2.1-1; therefore, should be revised to include all of the discrete samples needed for individual analyses identified in Exhibit 3.1.2.1-2. Clark asks that the facility revise this table based on his comments.

The heading "Physical/Chemical Characterization" is ambiguous. Clark asks that the facility revise the table to include the complete list of parameters comprising the physical and chemical characteristics determinations (such as heating value, specific gravity, and viscosity) and suggests that adding footnotes could accomplish this revision.

The heading "Chlorinated Principal Organic Hazardous Constituents" is also unclear. This does not specify an analytical method, but a type of compound. Clark requests that the table be revised to specify the U.S. EPA-approved analytical method that will be used to test each type of sample.

Notes: ______________________________

EXHIBIT 3.1.2.1-1

SUMMARY OF PROCESS AND FUEL STREAM SAMPLING

Sampling Location	Description	Sampling Frequency	Testing Frequency
1	Kiln Slurry Feed	Hourly	Composite per test run
2	Coal and Coke	Hourly	Composite per test run
3	Hazardous Waste Derived Fuel	4 per hour	Composite per test run
4	Cement Kiln Dust	Hourly	Composite per test run
5	Tire-Derived Fuel	Daily	Composite per test day

EXHIBIT 3.1.2.1-2

SUMMARY OF PROCESS AND FUEL STREAM ANALYSES

Sampling Location	Description	Chlorine	Metals	Physical Chemical Characteristics	Chlorinated Principal Organic Hazardous Constituent
1	Kiln Slurry Feed	+	+		+
2	Coal and Coke	+	+	+	+
3	Hazardous Waste Derived Fuel	+	+	+	+
4	Cement Kiln Dust	+	+		+
5	Tire-Derived Fuel	+	+	+	+

3.1.2.2 Reviewing Section D-5b(1)(b)(2)—Analytical Procedures

Regulations: 40 CFR Part 270.62(b)(2)(i)
40 CFR Parts 270.66(c)(1) and (2)

Guidance: U.S. EPA. 1997. "Generic Trial Burn Plan." Center for Combustion Science and Engineering. Pages D-5.24 through D-5.34.

Explanation: This section should present analyses planned for trial burn samples and analytical methods to be used for laboratory analyses. A table should be included showing various constituents to be analyzed for each sample matrix and type, analytical method, and detection or practical quantitation limits. Methods used for analysis should follow U.S. EPA protocols. This section should also identify laboratories used for sample analysis.

Trial burn protocols for collection of risk assessment data will need to address waste analysis and QA/QC procedures for completely characterizing the risk burn wastes, fuel, raw materials, and spike materials. Data equivalent to, or superior than, the following should be generated:

- Quantification of total metals feed rates for arsenic, beryllium, cadmium, chromium, silver, barium, mercury, lead, antimony, thallium, nickel, selenium, copper, iron, aluminum, and zinc
- Proximate analysis, or a comparable evaluation, to determine physical properties including moisture, percent solids, as, heating value, and viscosity or physical form, as well as to determine approximate chemical properties including total organic carbon (TOC), total organic halogens (TOX), and elemental composition
- Survey analysis, or a comparable evaluation for: (1) total organic content; (2) organic compound class types; and (3) major organic components
- Directed, quantitative analysis for POHC analysis to demonstrate DRE

Check For: The TBP reviewer should check for the following information:

☐ Sampling parameters for each sample collected

☐ Analytical method for sample analysis (some common methods are listed)

  ☐ U.S. EPA Methods 6010 or 7000-series for metals (including mercury)

  - ☐ U.S. EPA Method 8260 for target VOCs (U.S. EPA Method 5041 for target VOCs from the U.S. EPA Method 0031 emissions sampling train)
  - ☐ U.S. EPA Method 8270 for target semivolatile organic compounds (SVOC) and PCBs
  - ☐ U.S. EPA Method 8290 for polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF)
  - ☐ U.S. EPA Method 9057 for HCl and Cl_2

☐ Sample quantitation limit for each analyte

☐ Name and address of laboratory conducting sample analysis

☐ Metals analysis results

☐ Proximate analysis results

☐ Survey analysis results

☐ Quantitation of POHC in waste streams

Example Situation: Lois reads the *Waste Characterization* section of the TBP as follows:

"Wastes proposed for the test burn represent the actual wastes that will be burned. Because the incinerator is operated for commercial purposes, the physical and chemical properties of wastes received for incineration vary considerably from day to day.

Exhibit 3.1.2.2-1, see page 1-63, shows waste feed methods and properties of the wastes to be used in the test burn. These represent the typical chemical and physical properties of wastes that are incinerated. Essentially, all combustible hazardous compounds listed in 40 CFR Part 261, Appendix VIII, may be combusted during normal operations. Furthermore, any Appendix VIII compound may be present in each type of waste shown in Exhibit 3.1.2.2-1.

Example Action: Lois recognizes that general characteristics of waste streams presented in Exhibit 3.1.2.2-1 are representative of waste stream variability anticipated during normal commercial operations. For general characterization purposes, waste characteristics identified are sufficient to determine whether the waste feed stream proposed for the trial burn test are representative of normal waste feed.

Although it is difficult for a commercial facility to inventory enough waste to conduct the trial burn test, Lois asks that the facility identify the specific waste feed mixture that will be used during the trial burn test and provide a description of how this waste stream is representative of worst-case (DRE test) or normal (risk burn) operations. For testing of a captive combustion unit, waste characterization is much less complicated and the facility should provide detailed analyses of each waste feed stream.

Notes:

EXHIBIT 3.1.2.2-1

PROPOSED WASTES

Feed Method	Ram feeder or auxiliary feeder	Ram feeder or drag feeder	High Btu liquid to kiln	High Btu liquid to Secondary Combustion Chamber	Aqueous injection
Feed Rate (lb/hr)	4,000	9,000	1,500	2,000	3,000
Type of Waste	Containerized solids	Bulk solids	High Btu liquid	High Btu liquid	Aqueous waste
Waste Description	POHC and solids	POHC and solids	Organic liquid	POHC and organic liquid	Contaminated water
Waste Properties					
Heating Value (Btu/lb)	1,000 to 5,000	<1,000	~7,500	~9,500	<1,000
Water (%)	<20	<20	<20	<10	<90
Ash (dry basis) (%)	30-80	>80	10 to 50	<5	<10
Chlorine (wet basis) (%)	3.5	1.5	3	3.5	0
Heat Input Rate (10^6 Btu/hr)	3.0 to 15.0	<12.0	11.25	14.25	0
Cl Input Rate (lb/hr)	140	135	45	52	0

Notes:

Btu	British thermal unit
lb/hr	Pounds per hour
Btu/lb	British thermal units per pound
POHC	Principal organic hazardous constituent
<	Less than
~	Approximately

3.1.3 Reviewing Section D-5b(1)(c)—Trial Burn Schedule

Regulations: 40 CFR Part 270.62(b)(2)(iv)
40 CFR Part 270.66(c)(5)

Guidance: U.S. EPA. 1997. "Generic Trial Burn Plan." Center for Combustion Science and Engineering. Page D-5.34.

Explanation: The trial burn schedule should project the timeline for activities to be conducted before, during, and after the trial burn. The duration of trial burn activities is important when considering oversight activities and personnel moving in and out of the site. The quantity of waste needed for trial burn testing should be presented, with an amount of waste specified as a contingency for unplanned delays.

Check For: The TBP reviewer should check for the following information:

☐ Daily activity schedule (see Section 3.1.3.1)

☐ Total estimated duration of the trial burn (see Section 3.1.3.2)

☐ Quantities of waste and spiking materials planned for testing (see Section 3.1.3.3)

Example Sections: Sections 3.1.3.1, 3.1.3.2, and 3.1.3.3 reference a section from a RCRA TBP for schedule, duration, and quantity.

Example Comments: Brief comments regarding this section are presented in Sections 3.1.3.1, 3.1.3.2, and 3.1.3.3. The reviewer should verify that the schedule is reasonable, the duration of each test does not exceed safe work conditions, and a sufficient quantity of wastes is available.

Notes: ____

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3.1.3.1 Reviewing Section D-5b(1)(c)(1)—Schedule

Regulations:

40 CFR Part 270.62(b)(2)(iv)
40 CFR Part 270.66(c)(5)

Guidance:

U.S. EPA. 1985. "Practical Guide - Trial Burns for Hazardous Waste Incinerators." Office of Research and Development. November. Section IV, Pages 31 through 41.

U.S. EPA. 1987. "Permitting Hazardous Waste Incinerators. *Seminar Publication.*" Center for Environmental Research Information. EPA/625/4-87/017. September. Pages 18 and 19.

U.S. EPA. 1997. "Generic Trial Burn Plan." Center for Combustion Science and Engineering. Page D-5.34.

Explanation:

During preparation of the TBP, it is difficult to firmly identify test dates; the actual test date will be contingent on several factors, including the length of time for regulatory agency review and approval of the plan, process and operating schedules, weather conditions, and test team availability. However, the TBP should provide a tentative timeframe for testing. To assist the reviewer in evaluating the feasibility of the proposed trial burn date, the schedule should contain the approximate time required for initial setup, actual trial burn testing, and cleanup activities.

Check For:

The TBP reviewer should check for the following information:

☐ Schedule for setup, testing, and cleanup

☐ Scheduled start and stop times for each sampling train and sampling run

☐ Time required for setup

☐ Time required for combustion unit preconditioning

☐ Time required for testing or actual trial burn testing

☐ Time required for sample cleanup after the trial burn

☐ Time required for sample analysis and reporting of analytical data

☐ Time required for preparation and submittal of final report

Example Sections:

Lois reviews the following statement: "Exhibit 3.1.3.1-1, see page 1-67, presents the overall schedule for the trial burn. Exhibit 3.1.3.1-2, see page 1-68, shows daily activities conducted during a test run."

Example Comments: Overall, Lois decides that the schedule provides a good framework under which to operate. The overall schedule covers the important elements, including the date for submittal of the final trial burn test report. However, although the daily schedule includes time for setup, testing, and, sample cleanup, the information is too generic. A daily schedule should include detailed start, stop, and duration information for each sampling train and sampling run. Additionally, Lois notes that this schedule is based on the assumption that the facility and test equipment operate without significant difficulty or major equipment malfunction, and therefore does not provide adequate contingency schedules. Lois notes that a pretest meeting will have to be conducted daily to discuss important aspects of the test, including acceptable working hours each day and the latest time during a test day that a sampling run will be started. Experience has indicated that no new runs should be started after sundown, unless multiple shifts are planned.

Notes: ____

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EXHIBIT 3.1.3.1-1

EXAMPLE OVERALL TRIAL BURN SCHEDULE

Day	Activity
+60 ptt	Conduct mini-burn at elevated fume flow. Determine particulate emissions and general system performance.
30 ptt	Conduct maintenance on entire system. Rebuild necessary components, and install new refractory as wear requires; install new burner parts as needed. Clean boiler tubes.
10 ptt	Conduct pre-test site review with regulatory officials. Conduct necessary performance specification tests on CEMs.
1	Test team arrives on site and scaffolding is set up. Sampling ports are checked, and all sampling equipment is set up. Operations trailer is established.
2	Risk Burn - Test Condition 1 - Runs 1 and 2
3	Risk Burn - Test Condition 1 - Run 3
4	DRE Burn - Test Condition 2 - Runs 1 and 2
5	DRE Burn - Test Condition 2 - Run 3; remove test equipment, prepare all necessary chain-of-custody forms, and ship samples to analytical laboratories. Exit site. Trial burn is complete.
95	Submit Trial Burn Report (TBR) to State Permitting Agency and U.S. EPA Regional office (90 days after trial burn completion).

Notes:

ptt	Pre-trial burn testing

EXHIBIT 3.1.3.1-2

EXAMPLE DAILY TRIAL BURN SCHEDULE

0600 - 0800

This is the pre-test equilibrium period. Feed prepared liquid waste with spiked POHC and vapors at designated trial burn rates. Facility should have enough liquid waste available for at least 24 hours of consecutive operation at the proposed feed rates.

0800 - 1900

Maintain rates of waste feeds and POHC spike and begin test sampling. Conduct three sampling regimes under each test condition.

3.1.3.2 Reviewing Section D-5b(1)(c)(2)—Trial Burn Duration

Regulations:

40 CFR Part 270.62(b)(2)(iv)
40 CFR Part 270.66(c)(5)

Guidance:

U.S. EPA. 1992. "Technical Implementation Document for EPA's BIF Regulations." OSWER. EPA-530-R-92-011. March. Page 5-3.

U.S. EPA. 1997. "Generic Trial Burn Plan." Center for Combustion Science and Engineering. Page D-5.34.

Explanation:

A trial burn typically consists of a series of tests at one or more conditions. The number of test conditions and number of runs for each test condition affect the duration of the trial burn test.

A trial burn test (or combination of tests) should be conducted for each set of operating conditions under which the facility requests to be permitted. Three runs should be conducted for each test condition. All runs of a test condition should be conducted under identical, nominal operating conditions. In general, each run of a test condition should be passed for the test to be considered successful—and for the facility to be permitted to operate at those conditions. The duration of the test will be affected by the number of runs a facility proposes to conduct each day. This may be one run per day for a test condition involving multiple complicated stack sampling trains, or three runs per day for a test condition where only an U.S. EPA Method 0050 train measures PM, HCl, and Cl_2. Other facilities may choose to sample continuously for 24 hours per day.

Facilities will often conduct multiple tests during the trial burn to develop all applicable permit operating conditions. For example, facilities will usually perform minimum and maximum temperature tests, because decreasing temperatures tend to decrease organic chemical destruction, and increasing temperatures tend to increase metals emissions because of an increase in volatility. These tests, if successful, will determine temperature boundaries between which the facility can operate in compliance with the standards for DRE, and metal emissions standards. Facilities may also conduct risk burn testing at conditions representative of normal operations. The test results collected for these conditions may be used to conduct the risk assessment for the facility. During a trial burn, a facility's general strategy is to operate under conditions that will yield a broad range of permit operating conditions.

Check For:

The TBP reviewer should check for the following information:

☐ Number of test conditions

☐ Number of trial burn runs planned at each test condition

☐ Number of replicate sampling runs during each run

☐ Sampling time during each sampling run

☐ Anticipated time for establishing steady operation under process test conditions

☐ Total time for each test run under the proposed operating conditions

Example Sections: Lois and Clark review Exhibit 3.1.3.1-1, see page 1-67, which presents the overall schedule for the trial burn. Exhibit 3.1.3.1-2, see page 1-68, shows daily activities conducted during a test run.

Example Comments: Clark determines that Exhibit 3.1.3.1-1, see page 1-67, clearly presents the overall planned trial burn duration and pretest activities. However, he believes that the table should be more detailed and show the estimated sampling duration for each sampling method used during the trial burn. He also notes that the table does not show the different stack sampling methods to be used during the trial burn and that the duration must always include at least three runs under each condition. If testing becomes more complicated with long sampling times, one run per day should be scheduled. Few combustion units typically plan more than one run per day unless only a limited number of sampling trains—for example, an U.S. EPA Method 0050 sampling train for PM, HCl, and Cl_2 are all that is required.

Notes: ____

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3.1.3.3 Reviewing Section D-5b(1)(c)(3)—Quantity of Waste to Be Burned

Regulations: 40 CFR Part 270.62(b)(2)(iv)
40 CFR Part 270.66(c)(5)

Guidance: U.S. EPA. 1992. "Technical Implementation Document for EPA's BIF Regulations." EPA-530-R-92-011. OSWER. March. Page 5-3.

U.S. EPA. 1997. "Generic Trial Burn Plan." Center for Combustion Science and Engineering. Page D-5.34.

Explanation: To ensure that adequate supplies of waste and spiking compound are on hand, the facility should evaluate the duration of sampling runs and the overall expected duration of the trial burn. The facility should also estimate the quantity of waste to be set aside as a contingency supply.

Check For: The TBP reviewer should check for the following information:

☐ Estimated duration of waste feed during the trial burn

☐ Waste feed rate (for each waste type)

☐ Total volume of each waste required for the trial burn

☐ Amount of POHC spiking compound required for the trial burn

☐ Amount of ash surrogate required for trial burn

☐ Safety factor in estimation of total waste feed

☐ Methods of disposing of any wastes and spiking compounds remaining after trial burn

The U.S. EPA Region 6 generic TBP included as Attachment A includes examples of these calculations.

Example Sections: Clark reads the following table that presents an estimate of the quantity of liquid and vapor waste required to conduct a trial burn based on 14 hours per test day of feeding and 4 test days.

Stream	Quantity Required per Test Day
Aqueous	1,680 gallons
Solvent	84 gallons

Stream	Quantity Required per Test Day
Vapor—low flow Vapor—high flow	252,000 standard cubic feet 420,000 standard cubic feet

Example Comments: Clark notes that the proposed quantity of waste does not discuss contingency material. If there is a delay in stack sampling or problems with plant operations, the combustion unit should be kept operating at test conditions to maintain steady state conditions. This requires that a contingency amount—generally 50 percent—of consistent waste material be readily available. For facilities where the waste feed includes large amounts of liquid waste, such as the aqueous waste in this example, storage for this contingency waste should also be addressed.

Clark requests that the TBP identify quantities of waste needed for both the actual test and as a contingency. Without this discussion, a complete technical review is difficult to conduct.

Notes: ____

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3.1.4 Reviewing Section D-5b(1)(d)—Test Protocols

Regulations:

40 CFR Part 270.62(6)(2)(v)
40 CFR Part 270.66(c)(6)

Guidance:

U.S. EPA. 1997. "Generic Trial Burn Plan." Center for Combustion Science and Engineering. Pages D-5.35 through D-5.41.

U.S. EPA. 1998. "Protocol for Human Health Risk Assessment at Hazardous Waste Combustion Facilities." EPA-R6-098-002. Section 2.3.1.

Explanation:

This section examines waste characteristics, POHC selection, operating conditions, and other issues related to acceptable permit conditions. It also discusses organic chlorine and feed metals and their removal by the APCS.

If the trial burn is conducted under only worst-case conditions (that is, a low and high temperature test during which DRE and metals system removal efficiency (SRE) are demonstrated, respectively), then emission rates used in the risk assessment should be the lower of either (1) the maximum emission rate value for all test runs or (2) the 95th percentile emission rate value for all test runs conducted at the worst-case conditions. If those emission rates are determined to be protective, the worst-case conditions should be established in the permit as not-to-be exceeded minimum and maximum conditions.

If a risk burn test is conducted under normal operating conditions, then emission rates used in the risk assessment should be the lower of either (1) the maximum emission rate value for all test runs or (2) the 95th percentile emission rate value for all test runs conducted at the normal conditions. If those emission rates are determined to be protective, the normal operating conditions should be established in the permit as baseline conditions around which the unit should operate a high percentage of the time. See Component 7—How to Prepare Permit Conditions for a discussion on using risk burn test results to set permit limits.

Overall, the facility should evaluate the impact on dioxin and furan formation from each of the variables described in the following subsections. Specifically, each TBP or RBP should include:

- A description of any combustion unit-specific operating conditions that may contribute to the formation of dioxins

- Any information regarding background PCDD and PCDF concentrations, and a comparison of these concentrations to concentrations expected from the combustion unit, determined by modeling or available sampling information

- Information regarding the concentration of sulfur, fluorine, and bromine in the combustion unit feed materials

Check For:	See Subsections 3.1.4.1 through 3.1.4.11 of this component for specific “check for” items.
Example Sections:	For each of the subsections in this part of Component 1, an example section is presented for the specific topic. All examples are from actual TBPs submitted to U.S. EPA.
Example Comments:	Comments on each topic covered by this section are presented in Subsections 3.1.4.1 through 3.1.4.11 of this component.

Notes: ______________________________

3.1.4.1 Reviewing Section D-5b(1)(d)(1)—Waste Characterization

Regulations: 40 CFR Part 270.62(b)(2)(i)
40 CFR Parts 270.66(c)(1) and (2)

Guidance: U.S. EPA. 1983. "Guidance Manual for Hazardous Waste Incinerator Permits." OSWER. July. Section 3.1, Pages 3-1, through 3-4.

U.S. EPA. 1997. "Generic Trial Burn Plan." Center for Combustion Science and Engineering. Pages D-5.35 through D-5.41.

Explanation: Waste characterization of the hazardous wastes to be treated in the combustion unit are discussed in Section C of the Part B permit application (see Section 5.0 of Component 3 of the manual) and in the introduction to Section D-5 of the TBP. The TBP should summarize relevant combustion parameters for wastes to be treated during normal operation.

Trial burn protocols for collection of data will need to address waste analysis and QA/QC procedures for completely characterizing the trial burn wastes, fuel, raw materials, and spike materials. Data equivalent to, or superior than, the following should be generated:

- Quantification of total metals feed rates for arsenic, beryllium, cadmium, chromium, silver, barium, mercury, lead, antimony, thallium, nickel, selenium, copper, iron, aluminum, and zinc
- Proximate analysis, or a comparable evaluation, to determine physical properties including moisture, percent solids, heating value, and viscosity or physical form, as well as to determine approximate chemical properties including TOC, TOX, and elemental composition
- Survey analysis or a comparable evaluation for: (1) total organic content; (2) organic compound class types; and (3) major organic components, using analysis for VOCs, SVOCs, PCBs, and PCDD/PCDF using standard analytical methods
- Directed, quantitative analysis for POHCs to demonstrate DRE

Check For: Hazardous waste characterization should include the following parameter testing:

☐ Btu content

☐ Halogen content

☐ Water content

☐ Ash content

☐ Viscosity

☐ Specific gravity

☐ Sulfur content

☐ Metals content

☐ VOC, SVOC, PCB, and PCDD/PCDF analysis results

☐ POHC content

☐ Metals analysis results

☐ Proximate analysis results

☐ Survey analysis results

☐ Quantitation of POHC in waste streams

Example Situation: Lois and Clark review the waste characterization discussion in the facility's TBP:

"The wastes proposed for the test burn have been selected to represent the actual wastes that will be burned. Because the incinerator is operated for commercial purposes, the physical and chemical properties of wastes received for combustion vary considerably from day to day.

"Exhibit 3.1.2.2-1, see page 1-63, shows the waste feed methods and properties of the wastes to be used in the test burn. These represent the typical chemical and physical properties of wastes that are incinerated. Essentially, all combustible hazardous compounds listed in 40 CFR Part 261, Appendix VIII, may be combusted in normal operations. Furthermore, any Appendix VIII compound may be present in each type of waste shown in Exhibit 3.1.2.2-1, see page 1-63."

Example Action: Is this a satisfactory discussion of waste characterization? In large part, yes. Because this example is for a commercial operation, the general characteristics of waste streams presented in Exhibit 3.1.2.2-1 are representative of waste stream variability anticipated during normal operation. For general characterization purposes, waste characteristics identified will be sufficient for the reviewer to determine whether the waste feed streams, proposed for the trial burn test are representative of normal waste feeds.

Although it is difficult for a commercial facility to inventory enough waste to conduct the trial burn, Lois and Clark request that the facility identify the specific waste feed mixture that will be used during the trial burn test and descriptive of how this waste stream is representative of worst case (DRE test) or normal operations (risk burn).

For testing of an on-site hazardous waste combustion unit, waste characterization is much less complicated, and the facility should provide detailed analyses of each waste feed stream.

Notes:

3.1.4.2 Reviewing Section D-5b(1)(d)(2)—Principal Organic Hazardous Constituent Selection Rationale

Regulations: 40 CFR Part 270.62(b)(4)
40 CFR Part 270.66(e)

Guidance: U.S. EPA. 1983. “Guidance Manual for Hazardous Waste Incinerator Permits.” OSWER. Washington, D.C. Section 3.1; Pages 3-1 through 3-4. July.

U.S. EPA. 1989. “Handbook: Guidance on Setting Permit Conditions and Reporting Trial Burn Results.” EPA/625/6-89/019. January. Pages 22 through 23.

U.S. EPA. 1992. “Technical Implementation Document for EPA’s Boiler and Industrial Furnace Regulations.” EPA-530-R-92-011. OSWER. March. Pages 10-13 and 10-14.

U.S. EPA. 1997. “Generic Trial Burn Plan.” Center for Combustion Science and Engineering. Pages D-5.35 through D-5.41.

Explanation: POHCs are compounds that the facility proposes for trial burn demonstration of the required DRE, which is 99.99 percent for hazardous wastes and 99.9999 percent for dioxins and furans. The permitting authority provides input as to the appropriateness of the proposed POHCs. Criteria for POHC selection are discussed in detail in U. S. EPA 1989 Guidance in Setting Permit Conditions.

Historically, there has been confusion relative to the terms POHCs, PICs, and organic chemicals. Recent guidance defines the term “PIC” to encompass any organic species emitted from the stack, regardless of the origin of the compounds. Risk assessments are generally concerned with the health risks posed by emissions from the facility. It makes little difference with respect to risk if the organic compound was formed from a compound specified as a POHC, or if it formed from other materials added to the combustion device.

Check For: The TBP reviewer should check for the following information:

- ☐ Compounds selected as POHCs
- ☐ Basis for selecting POHCs
    - ☐ Degree of difficulty of destruction of organic constituents
    - ☐ Concentration or mass of 40 CFR Part 261, Appendix VIII organics in the waste feed, based on waste analysis
    - ☐ Surrogate POHCs

☐ Whether POHCs selected can be measured by reliable and conventional techniques

☐ Whether POHCs are potential PICs of the fuels, hazardous wastes, or other POHCs

☐ Whether the operation or product of the facility might be upset

☐ Feedable and meterable

☐ Not dangerous to handle (for example, unstable or acutely toxic POHCs are not typically recommended)

Example Situation: Lois and Clark read the POHC selection rationale section of the TBP as follows:

"The incinerator is operated for commercial purposes and burns a wide variety of chemical wastes in solid and liquid form; therefore, a fully flexible permit is preferable for this facility. Accordingly, the criteria for selection of POHCs for a test burn should be based on the assumption that any Appendix VIII compound may be fed into the incinerator. The criteria used in selection of the POHCs that will demonstrate the incinerator's performance include incinerability and other theoretical considerations that designate compounds on the basis of being difficult to burn.

"The heat of combustion approach to POHC selection is based on equilibrium theories that state that the primary concern in elevating the difficulty in destroying a compound is the amount of energy needed to complete the combustion process (with water, CO_2, and, in some cases, an acid gas as final combustion products). However, a POHC selection now exists that is based on thermal stability in nonflame laboratory tests. This approach, which considers chemical structure stability, is based on the assumption that the primary concern is a temperature at a specified residence time required to achieve the DRE in laboratory tests. Besides the incinerability rankings, the following additional criteria have been considered in the selection of POHC:

- High relative abundance in the waste materials.

- Gases have been excluded, because the incinerator is not equipped to feed gaseous waste feeds. However, it can feed aerosol cans as part of the containerized solids.

- Compounds selected as POHCs are stable enough to allow for conventional volatile organic sampling train or Modified U.S. EPA Method 5 sampling and analytical techniques.

- Compounds selected as POHCs are sufficiently available to allow an adequate quantity for trial burn demonstration purposes.

"Because none of the waste types currently received is in a gaseous state at ambient temperature, this criterion was excluded from further consideration in the POHC selection process. Also, compound stability should not be a concern because most of the hazardous constituents normally occurring in waste materials received are sufficiently stable to allow the use of conventional sampling and analytical methodologies.

"Availability can be a serious concern in POHC selection because (1) the operation depends on its customers for its supply of waste materials, and (2) this supply is far less consistent than is typical for an incineration facility intended to handle wastes generated by only one source or company. Of the remaining criteria, relative abundance is considered to be most important if selected POHC are to be representative of actual hazardous compounds commonly found in various waste streams received.

"Alternatively, if difficulty in destruction is considered to be most important, those compounds that exhibit the highest ranking on the incinerability or kinetics list should be selected as POHCs. These will most accurately demonstrate the incinerator's ability to achieve a 99.99 percent DRE on the most difficult to destroy. They will thereby demonstrate the incinerator's ability to destroy any of the Appendix VIII compounds. Ideally, those compounds that are abundant in the waste feed and have a relatively high ranking on the incinerability list should reasonably satisfy both criteria and should, therefore, be selected as POHCs.

"As a result of discussions between the facility and regulators, POHC selection for the test burn will meet the aforementioned criteria and will also address the U.S. EPA's current concern regarding the incinerator's ability to demonstrate an effective DRE on constituent compounds contained in the feeds.

"Target POHC selected for testing the incinerator should include one volatile compound and two semivolatile compounds. These POHCs will be spiked into the waste fed to the incinerator. Compounds selected are:

- Monochlorobenzene (volatile POHC)
- Hexachloroethane (semivolatile POHC)
- Naphthalene (semivolatile POHC)

"All selected POHCs can meet the abundance criteria. Hexachloroethane is ranked sixth on the U.S. EPA incinerability list (based on heat of combustion). Monochlorobenzene and naphthalene are ranked in Class I of the thermal stability list. Other 'naturally occurring' Appendix VIII constituents that may be present in any of the waste stream types are as follows:

- Dichloromethane

- Chloroform
- Trichloroethene
- 1,1,1-Trichloroethane
- Methyl ethyl ketone
- Methyl isobutyl detone
- Xylene
- Toluene
- Benzene

"A 99.99 percent DRE for selected POHCs will adequately demonstrate the incinerator's ability to achieve a similar DRE for any of the Appendix VIII compounds. The sampling and analytical methods are adequate to demonstrate these DREs."

Example Action: Both Lois and Clark are largely satisfied with this section. This section highlights an important aspect regarding the two ranking schemes used by U.S. EPA. While the heat of combustion approach is not as popular as in the past (because the least incinerable compounds are now controlled by the Montreal Protocol and are not available), this approach is still widely used. However, the TBP fails to target native POHCs in waste streams routinely treated by the facility. Although spiking injects target compounds into the incinerator, Lois asks the facility to modify the TBP to target a few compounds native to the waste for demonstrating DRE and characterizing normal emissions for the risk burn.

The TBP mentions nothing about metals addition or analysis. The permit writer should address this on a case-by-case basis. The facility in this case stated that it was not obligated to test for metals because it was not a BIF facility. Although no clear regulations exist concerning metals for commercial incinerators, metals analysis should be considered for each facility, in accordance with BIF regulations.

Additionally, although the facility chose not to (or did not need to) describe the availability of proposed waste feed streams, some facilities may present a discussion regarding the economic availability of certain POHCs. This type of issue should be addressed on a case-by-case basis for each facility because a POHC should not cost an inordinate amount to obtain and use in a test burn.

Notes: ____

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3.1.4.3 Reviewing Section D-5b(1)(d)(3)—Operating Conditions

Regulations: 40 CFR Part 270.62(b)(2)(v)
40 CFR Part 270.66(c)(6)

Guidance: U.S. EPA. 1983. "Guidance Manual for Hazardous Waste Incinerator Permits." OSWER. July. Section 2.4.2, Pages 2-41 through 2-44.

U.S. EPA. 1997. "Generic Trial Burn Plan." Center for Combustion Science and Engineering. Pages D-5.35 through D-5.41.

U.S. EPA. 1998. "Protocol for Human Health Risk Assessment at Hazardous Waste Combustion Facilities." EPA-R6-098-002. Section 2.4.2.

Explanation: This section should discuss selection of combustion system operating conditions during the trial burn. This section of the TBP is extremely important because the conditions under which the combustion unit is operated during the trial burn will become operating restrictions that will be a part of the final operating permit. The intent of the facility should be to select conditions that provide a maximum degree of flexibility for future operations. This flexibility is generally achieved by testing under worst-case conditions; for example, (1) maximum expected waste feed rate, (2) maximum expected POHC concentration, (3) maximum expected waste ash content, (4) maximum expected waste chlorine content, and (5) minimum expected combustion temperature. To fully demonstrate the combustion unit DRE under a variety of conditions, it may be necessary to conduct more than one series of tests during the trial burn.

Because a facility may not want to conduct a risk assessment based on these worst case conditions, some facilities that treat very consistent, homogeneous waste streams (for example, captive on-site units) may also choose to conduct a risk burn at normal operating conditions in order to collect data to be used to conduct the risk assessment (it is not anticipated that commercial hazardous waste TSDFs will be eligible for this option, see Component 3). In this case the facility should propose additional permit conditions that can ensure the facility operates the combustion unit within a reasonable range surrounding the "normal" conditions under which the risk assessment data were collected. See Component 7—How to Prepare Permit Conditions for further discussion on permit limits.

Check For: Information for the test condition demonstrating worst-case metals emissions should include the following:

- ☐ Maximum PCC temperature
- ☐ Types of wastes (high Btu; low Btu; solid, sludge or liquid)
- ☐ Waste feed rates to the PCC and SCC

☐ Maximum ash content in wastes

☐ Maximum chlorine feed rate

☐ Maximum metals feed rates

☐ Worst-case APCS operating parameters

☐ Maximum combustion gas velocity

Information for the test condition demonstrating DRE of PCC should include the following:

☐ Maximum liquid and waste feed rate in the PCC and SCC

☐ Maximum ash content in liquid waste feed

☐ Minimum PCC and SCC temperature

☐ Maximum combustion gas velocity

☐ Maximum organic chlorine content in waste streams

☐ POHC fed to the PCC and SCC

☐ Worst-case APCS operating parameters

☐ PIC formation and emission rates

Information for normal operating test conditions (risk burn):

☐ Average PCC temperature

☐ Types of wastes (high Btu, low Btu, solid, sludge, or liquid)

☐ Waste feed rates to the PCC and SCC

☐ Ash content in wastes

☐ TOC feed rate

☐ PIC formation and emission rates

☐ Average SCC temperature

☐ Average combustion gas velocity

Example Situation: In reviewing the *Operating Conditions* section of the TBP, Clark reads as follows:

“The purpose of the test is to demonstrate that all applicable emission limits can be met by operating the unit under worst-case operation conditions.

“As presented earlier, two separate operating conditions are proposed for testing. Day 1 is the higher temperature condition that should be used to evaluate metals emissions. On Day 2, where lower operating temperatures are proposed, this operating condition should provide a conservative estimate of DRE.

“Establishing approximate stabilization of metals and chlorine in the kiln is important to the accuracy of the test. The operation does not return PM to the kiln.

“About 2 to 3 hours prior to the start of testing on Day 1, the kiln system will be stabilized with metals and chlorine. This will be accomplished by maintaining a feed rate to the kiln prior to testing, which is equivalent to the feed rate of chlorine and metals specified for testing. For DRE testing on Day 2, POHCs will be fed to the kiln at the rates specified. Exhibit 3.1.4.3-1, see page 1-86 summarizes key process parameters, proposed feed rates, and the expected operating parameters during the test period. Any deviations from the plan will be noted and explained in TBRs.

“To assess chlorine and metals emissions from the kiln at elevated temperatures, the test condition on Day 1 will fire 100 percent waste fuel as a worst-case scenario. Waste fuel will be fired at the approximate rate indicated in Exhibit 3.1.4.3-1. The company will collect data from the product discharge (hot end 2,500 to 3,000°F) of the kiln and the feed end (cold end 700 to 1,000°F) of the kiln to determine which is the best indicator of combustion zone temperature. Hot-end combustion zone measurement will be made with an optical pyrometer that measures infrared emissions. Because an optical pyrometer is subject to interferences “such as flame pattern variation or dust loadings,” a thermocouple will be installed at the kiln gas exit in the discharge duct work prior to any dilution air introduction to concurrently measure kiln exit temperature. Because thermocouples directly measure temperature, less fluctuation is expected to occur. Based on a review of the final data, the company will determine which is the best indicator of combustion zone temperature. The operating temperature of the unit will be maximized at about 2,500°F at the hot end. All surrogate material will be fed to the unit through the waste fuel line.

“To assess organic POHCs DRE from the kiln at lower operating temperatures, the test condition on Day 2 will again use 100 percent waste fuel as a worst-case scenario. The operating temperature of the unit, as measured in the wall, will be minimized (1,800°F hot end). Other operating parameters are shown in Exhibit 3.1.4.3-1. All spike material will be fed to the unit through the waste fuel line.”

Example Action: Clark notes three major problems in this section: (1) no indication exists that PCDD/PCDF testing will be conducted; (2) the proposal to conduct all three runs of a test condition in 1 day is unreasonable; and (3) this discussion fails to demonstrate that the proposed POHC feed rate will result in POHC emission rates needed to calculate the projected 99.999 percent DRE (see Exhibit 3.1.4.3-1). In addition, the acceptable combustion zone temperature indicator will be the one that is acceptable to the permit writer and the relevant regulatory agency, not just to the facility. Clark asks the facility to address each of these issues and to provide more detail regarding the relationship of proposed operating conditions to the overall test purpose and the type of information that each test condition will provide to support proposed permit conditions.

Notes: ____

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EXHIBIT 3.1.4.3-1

EXAMPLE TEST OPERATING PARAMETERS

Stream	Units	Operating Conditions		Quantity for Test (pounds)
		Day 1	Day 2	
Toluene	lb/hr (DRE)	-	1,340 (99.999)	28,070
Tetrachloroethylene	lb/hr (DRE)	25.0	25 (99.999)	1,049
1,2,4 Trichlorobenzene	lb/hr (DRE)	-	0.4 (99.999)	8.4
Arsenic	lb/hr	1.08	-	22.6
Beryllium	lb/hr	0.26	-	5.4
Cadmium	lb/hr	2.84	-	59.5
Chromium VI	lb/hr	2.32	-	48.7
Lead	lb/hr	30.94	-	649.7
Waste Fuel	lb/hr	4,650.0	3,000	160,650
Maximum production rate	tons/hr	14	-	NA
Minimum production rate	tons/hr	-	9	NA
APCS temperature	°F	<450	<450	NA
Lime injection rate	lb/hr	<400	<400	NA
Baghouse Delta P	inches w.c.	3.0	3.0	NA
Carbon monoxide	ppm	<100	<100	NA

Notes:		
	APCS	Air pollution control system
	DRE	Destruction and removal efficiency
	°F	Degrees Fahrenheit
	lb/hr	Pounds per hour
	NA	Not applicable
	ppm	Parts per million
	ton/hr	Tons per hour
	w.c.	Water column
	-	Not applicable

3.1.4.4 Reviewing Section D-5b(1)(d)(4)—Waste Constituents

Regulations: 40 CFR Part 270.62(b)(2)(i)
40 CFR Part 270.66(a)(4)

Guidance: U.S. EPA. 1997. "Generic Trial Burn Plan." Center for Combustion Science and Engineering. Pages D-5.35 through D-5.41.

Explanation: The waste feed must be sampled and analyzed in accordance with 40 CFR Parts 264.13, 270.19, and 270.11(k). Specifically, waste feed must be analyzed for heating value, viscosity (if liquid), and the hazardous organic constituents listed in 40 CFR Part 261, Appendix VIII. Analysis is required for (1) any of the 300 constituents in Appendix VIII, which may be reasonably expected to be present for waste characterization; or (2) selected constituents from the trial burn list. There are many other parameters that may be useful to more fully characterize the waste.

Physical analysis gives information on physical characteristics and general chemical composition of the waste, including the following: heating value, viscosity, ash content, TOC, moisture content, solid content, and elemental composition.

RCRA regulations require waste characterization for heating value and viscosity. Ash content is generally required as an indicator of inorganic loading and other factors that may affect the amount of particulate generated. TOX is needed to determine HCl removal efficiency. Although other analyses are not required, they may be of value to the combustion unit operator in characterizing waste feed and operating the combustion unit.

A major objective of the trial burn is to measure the DRE of selected POHC. To do this, the sampling and analysis program must measure the input and output rates of the POHC. In addition to quantitating the native POHC in the input/output streams, it is also necessary to conduct analyses for speciated VOCs and SVOCs to determine (1) the feed rate Appendix VIII compounds fed to the unit and (2) the potential emission rate for any PICs formed within the combustion unit.

For combustion units with multiple feed mechanisms, it may not be possible to maximize each waste feed type simultaneously during one test condition. Therefore, more than one DRE, dioxins and furans, and PIC test conditions may be needed to maximize different waste feed types during different test conditions.

Check For: The TBP reviewer should check for the following information:

☐ American Society for Testing and Materials (ASTM) method for physical parameters

☐ U.S. EPA approved methods for organic analysis (many found in SW-846)

☐ Appendix VIII analytical results

☐ POHC quantitation results

☐ Regulated metals content of input streams and combustion gases

☐ Ash content of input material

☐ Chlorine/chloride content of input material

☐ Analytical scan of hazardous constituents in feed and combustion gas for risk burns

☐ Viscosity of liquid feed materials

☐ Heat content of feed materials

☐ POHC content of ash, baghouse dust, and blowdown water

☐ Metals content of ash, baghouse dust, and blowdown water

Example Situation: Lois reads the *Waste Constituents* section of the TBP as follows:

“The liquid waste feed for the combustion unit consists of condensed vapors from the reactors. The fraction of these vapors that remain in the vapor state is also burned in the combustion unit. This section (1) describes wastes to be combusted, (2) identifies and quantitatively estimates any hazardous constituents present in the waste, and (3) recommends POHCs to use in demonstrating combustion unit performance.

“The liquid waste feed contains aqueous and organic phases. Hazardous constituents that must be considered for a trial burn are specified in 40 CFR Part 261, Appendix VIII. Many of these constituents can be eliminated from further consideration as POHCs based on knowledge of the waste feed composition and process operations.

“The TBP presents results of analyses completed on samples of the liquid aqueous waste and waste solvent. Exhibit 3.1.4.4-1, see page 1-90, presents estimated concentrations of hazardous organic constituents in the mixed waste. Of the hazardous organic constituents identified, seven compounds “acetones, 1,4-dioxane, phenol, chlorobenzene, allyl alcohol, acrolein, and styrene” were found at concentrations exceeding minimum levels greater than 100 ppm. Exhibit 3.1.4.4-2, see page 1-91, summarizes characteristics of the mixed waste feed.”

Example Action: While generally pleased with this section, Lois asks that the facility provide additional information regarding any POHC spiking that will be conducted during the trial burn test, including (1) proposed storage containers (2) metering systems, and (3) point of entry into the system. Lois finds the waste analysis presentation in the tables to be acceptable; some facilities will resist analyzing test waste in such detail. Although not presented here, the appendices present metal analyses, most of which contain negligible values. This section; however, does not address or identify the sampling and analytical methods used to identify the hazardous constituents, nor is it clear whether the facility will conduct comprehensive sampling and analysis for speciated VOCs and SVOCs. Lois asks that the facility clarify these issues in the revised version of the TBP.

Notes: ____________________

EXHIBIT 3.1.4.4-1

SUMMARY OF HAZARDOUS ORGANIC CONSTITUENTS IN LIQUID WASTE FEED

Hazardous Organic Constituent	Concentration (mg/L)	Heat of Combustion (kcal/g)
1,4-Dioxane	830 to 10,000	6.41
Chlorobenzene	0 to 400	6.6
Acrolein	130 to 170	6.96
Acetone	1,900 to 14,300	7.36
Allyl alcohol	5,900 to 10,000	7.75
Phenol	96 to 117	7.78
Styrene	0 to 8,000	10.07
Toluene	0 to 130,000	10.14
Xylene	0 to 5,000	10.25
Ethyl benzene	0 to 9,000	10.28

Notes:		
	kcal/g	kilocalories per gram
	mg/L	milligrams per liter

EXHIBIT 3.1.4.4-2

SUMMARY OF ESTIMATED WASTE FEED CHARACTERISTICS

Parameter	**Value**
Ultimate Analysis (weight percent)	
Carbon	5-7
Hydrogen	9-11
Oxygen	79-83
Chlorine	<0.83
Nitrogen	<0.30
Phosphorus	<0.01
Sulfur	<0.02
Physical Parameters	
Higher heating value (Btu/lb)	0 to 1,300
Viscosity (centipoise)	1.0 maximum
Ash content (weight percent)	negligible

Notes:

Btu/lb	British thermal unit per pound
<	Less than

3.1.4.5 Reviewing Section D-5b(1)(d)(5)—Combustion Temperature Ranges

Regulations: 40 CFR Part 270.62(b)(2)(v)

Guidance: U.S. EPA. 1983. “Guidance Manual for Hazardous Waste Incinerator Permits.” OSWER. July. Section 3.1; Pages 2-41 through 2-44.

U.S. EPA. 1992. “Technical Implementation Document for EPA’s BIF Regulations.” EPA-530-R-92-011. OSWER. March. Page 4-9.

U.S. EPA. 1997. “Generic Trial Burn Plan.” Center for Combustion Science and Engineering. Page D-5.35 through D-5.41.

U.S. EPA. 1998. “Protocol for Human Health Risk Assessment at Hazardous Waste Combustion Facilities.” EPA-R6-098-002. Section 2.4.2.

Explanation: The TBP should indicate anticipated operating temperature ranges in the PCC and SCC for all tests. A maximum combustion chamber temperature must be established during the metals test condition. Maximum combustion temperature is an important parameter with respect to metal emissions. A minimum combustion chamber temperature must be established during the POHC spiking test. Minimum combustion temperature impacts organic compound destruction.

If a facility chooses to conduct a risk burn, the RBP should discuss the combustion temperature range expected during the risk burn test, including a demonstration of the representativeness and a detailed comparison of this “normal” range to the maximum and minimum values.

Check For: The TBP reviewer should check for the following information:

- ☐ PCC operating temperature range
    - ☐ Proposed minimum value
    - ☐ Proposed maximum value
    - ☐ Proposed normal value
- ☐ SCC operating temperature range
    - ☐ Proposed minimum value
    - ☐ Proposed maximum value
    - ☐ Proposed normal value

Example Section: Lois reads the *Combustion Temperature Ranges* section of the TBP as follows:

"This TBP will involve three test conditions, with three runs under each condition, to establish organic DRE, metals emission rates, PIC formation, and the HCl and Cl_2 emission rates. PM will also be measured as part of each run.

The three test conditions will be as follows:

1. Afterburner temperature—2,000°F (Metals SRE Condition)
   - Maximum heat release rate attainable at 2,000°F
   - Maximum solids loading attainable in the kiln with stack opacity constraints
   - Constant air rate (based on induced-draft fan amps)
   - Maximum aqueous feed waste attainable at heat release rate
2. Afterburner temperature—1,800°F (DRE Test Condition)
   - Maximum system heat release attainable at 1,800°F
   - Maximum solids loading attainable in the kiln with stack opacity constraints
   - Maximum solids heat release rate in the kiln
   - Constant air rate (based on induced-draft fan amps)
   - Maximum aqueous feed waste attainable at heat release rate
3. Afterburner temperature—1,900°F (Risk Condition)
   - Maximum heat release rate attainable at 1,900°F
   - PIC emission rates
   - Average solids loading
   - Average air rate
   - Average aqueous feed waste, using worst-case waste"

Example Comment: This section makes it clear to Lois that the facility plans to conduct the trial burn at three different afterburner temperatures. The higher temperature test will be for metals emissions, the lower temperature will be for DRE testing, and the third test will be used for the risk assessment.

Notes:

3.1.4.6 Reviewing Section D-5b(1)(d)(6)—Waste Feed Rates

Regulations: 40 CFR Part 270.62(b)(2)(v)
40 CFR Part 270.66(c)(3)(v)

Guidance: U.S. EPA. 1992. "Technical Implementation Document for EPA's BIF Regulations." EPA-530-R-92-011. OSWER. March. Pages 4 through 9.

U.S. EPA. 1997. "Generic Trial Burn Plan." Center for Combustion Science and Engineering. Pages D-5.35 through D-5.41.

Explanation: The TBP should specify feed rates for each of the wastes that the facility proposes to burn during and after the trial burn.

Check For: The TBP reviewer should check for the following information:

☐ Solid waste feed rates

☐ Liquid waste feed rates

☐ Thermal capacity of the combustion unit to handle proposed feed rates

☐ Ability of the APCS to meet HCl and Cl_2 emission rate limits based on the proposed Cl_2 feed rate

☐ Other feed streams

Example Sections: Exhibit 3.1.4.6-1, see page 1-95, is an example of one table submitted to meet the requirements of this section.

Example Comments: Exhibit 3.1.4.6-1, see page 1-95, presents the planned waste feed rates for the two proposed test conditions. However, Lois determines that the TBP did not explain why specific rates were chosen or used. Lois requests that this section should describe (1) how the waste feed rates have been determined and (2) why specific wastes were used. Lois asks that this information be included as footnotes to the table or as a text discussion in Section D-5b(2)(e)(6). Alternatively, this section can refer to this information if it is presented in sufficient detail in another section of the TBP.

Notes:

EXHIBIT 3.1.4.6-1

WASTE FEED RATES, HEAT INPUT, AND AVERAGE CHLORINE INPUT

Waste Feed Rate (lb/hr)	Test 1	Test 2
Liquid injection blend	3,332	2,228
Liquid injection auxiliary blend	3,078	3,600
Aqueous	10,228	4,560
Secondary Combustion Chamber blend	632	7,772
Kiln east blend	1,232	366
Kiln alkyls blend	1,078	574
Kiln sludge	NA	1,002
Kiln solids	3,198	7,182
TOTAL ALL FEEDS	22,778	20,284
Waste Heat Input (MMBtu/hour)	**Test 1**	**Test 2**
Blend	92.71	68.29
Aqueous	1.02	0.46
Sludge	NA	8.49
Solids	0.84	18.00
TOTAL ALL FEEDS	94.57	95.24
Chlorine Input	**Test 1**	**Test 2**
Chlorine in Feed	10.24	12.91

Notes:		
	MMBtu	Million British thermal units
	NA	Not Applicable
	lb/hr	Pounds per hour

3.1.4.7 Reviewing Section D-5b(1)(d)(7)—Combustion Gas Velocity Indicator

Regulations: 40 CFR Part 270.62(b)(2)(v)

Guidance: U.S. EPA. 1992. "Technical Implementation Document for EPA's BIF Regulations." OSWER. EPA-530-R-92-011. March. Pages 4 through 9.

U.S. EPA. 1997. "Generic Trial Burn Plan." Center for Combustion Science and Engineering. Page D-5.35 through D-5.41.

Explanation: The TBP should specify the method and location of measuring combustion gas velocity. Combustion gas flow rate measured at the stack is usually a good indicator of combustion gas velocity. Other indicators that may be used include combustion air feed rate and fan operating conditions.

Maximum combustion gas velocity must be demonstrated during the PM, metals, and HCl and Cl_2 demonstrations to ensure maximum particulate and metals carryover to the APCS and the greatest challenge for the APCS. Likewise, maximum combustion gas velocity is needed during the DRE test condition to ensure minimum residence time in the combustion chamber. Therefore, to the extent possible, the facility should maintain the same maximum combustion gas velocity during all of the performance standards and emissions demonstrations.

Check For: The TBP reviewer should check for the following information:

- ☐ Indicator of combustion gas velocity
  - ☐ Measurement of gas flow rate at stack (direct method)
  - ☐ Measurement of restriction of pressure drop across flow, such as venturi chamber or orifice plate (indirect method)
  - ☐ Combustion chamber pressure (indirect method)
  - ☐ Rate of combustion air feed to the combustion system
  - ☐ Induced draft fan operating conditions (indirect method)

Example Situation: Lois and Clark read the *Combustion Gas Velocity Indicator* section of the TBP as follows:

"Stack gas velocity is an indication of the gas residence time in the SCC, which is critical to complete thermal destruction of waste materials. Therefore, stack gas velocity is measured with dual redundant thermal dispersion flow transmitters. One signal is selected to be displayed and interlocked, and both signals are continuously monitored and compared. A sustained, significant deviation will cause an alarm to alert the operator of the possible malfunction of one of the transmitters."

Example Action: Clark has identified several deficiencies in this section. This section provides no manufacturer information or information on how the device works. Based on trial burn results, there will be a maximum stack gas flow rate that is not to be exceeded. When the transmitter senses that the gas flow rate is nearing this limit, it should alarm the operator and be interlocked to the high-Btu liquid feed to reduce the flow rate of this material. Stack gas flow rate is important in developing a complete operating envelope and controlling operations. Another control is to limit the induced-draft fan amps to the maximum level demonstrated during the successful trial burn. The language in the example is weak, and alarm settings—triggered by “sustained, significant deviation”—are too vague to be technically reviewed. Clark asks that the facility revise this section to include a complete discussion of (1) manufacturer information, (2) operating principles (for example, how does the device calculate flow, what does it measure, what values does it produce), (3) calibration information, (4) prealarm settings, and (5) system interlocks.

Notes: ____

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3.1.4.8 Reviewing Section D-5b(1)(d)(8)—Waste Feed Ash Content

Regulations: 40 CFR Part 270.62(b)(2)(v)
40 CFR Part 270.66(c)(3)(v)

Guidance: U.S. EPA. 1983. "Guidance Manual for Hazardous Waste Incinerator Permits." OSWER. July. Section 2.1.2, Pages 2-5 through 2-7.

U.S. EPA. 1997. "Generic Trial Burn Plan." Center for Combustion Science and Engineering. Pages D-5.35 through D-5.41.

Explanation: To assist in developing permit conditions, waste feed ash content should be determined. The ash content of a waste is used to (1) evaluate potential slag formation, (2) assess particulate removal requirements of the APCS, and (3) determine whether the system is capable of handling ash. Ash content in liquid wastes is minimal to none; therefore, ash surrogates, such as $CaCl_2$, will be added to the waste feed to establish permit conditions. This parameter does not apply to cement kilns or lightweight aggregate kilns because the normal raw materials fed to these devices have a high ash content.

To fully evaluate the impact of ash content on the system, the facility should provide information regarding (1) ash variability in the waste feed, (2) potential effects of ash on the combustion unit and APCS, (3) overall particulate emission rates, and (4) soot blowing activities (boilers).

Permit limits on maximum ash feed rate will be established based upon the ash feed rate during the PM emissions determination and during the dioxin and furan testing. Ash feed rates should also represent reasonable worst-case conditions during the PIC testing. Separate permit limits may be established for and from atomizable feeds versus total ash feed rate.

Check For: The TBP reviewer should check for the following information:

☐ Ash content of all waste streams and its variability

☐ Surrogates used for establishing permit conditions with liquid waste streams

☐ Anticipated ash content permit conditions

☐ Analytical method for determining ash content

☐ Maximum ash feed rate

☐ Soot blowing procedures and frequency

Example Sections: Exhibit 3.1.2.2-1, see page 1-63, shows the ash content of each waste stream to be used in the trial burn. These are ranges based on previous experience; however, ash is a parameter that will be determined for each waste incinerated.

Example Comments: Exhibit 3.1.2.2-1 describes the ash content for each proposed waste stream. Although ash is not a regulatory requirement, it is generally required as an indicator of inorganic loading and other factors that may affect the amount of PM generated. Ash content may also affect the operation of the combustion unit burner or APCS. Additionally, the facility should ensure that ash content is determined using only U.S. EPA and ASTM analytical methods.

Notes: ____

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3.1.4.9 Reviewing Section D-5b(1)(d)(9)—Auxiliary Fuel

Regulations: 40 CFR Part 270.62(b)(2)(v)
40 CFR Part 270.66(c)(3)(iv)

Guidance: U.S. EPA. 1983. "Guidance Manual for Hazardous Waste Incinerator Permits." OSWER. Washington, D.C. July. Section 4.1.2. Pages 4-5 through 4-11.

U.S. EPA. 1997. "Generic Trial Burn Plan." Center for Combustion Science and Engineering. Pages D-5.35 through D-5.41.

Explanation: Auxiliary fuels are used to preheat PCCs to a desired operating temperature and to supplement heating value for complete combustion of hazardous wastes. Auxiliary fuels are also used to burn combustion gases in SCCs. Auxiliary fuels that are generally used include natural gas, pulverized coal, and other fossil fuels.

Check For: The TBP reviewer should check for the following information:

☐ Type of auxiliary fuel

☐ Purpose of auxiliary fuel (such as preheating PCC and supplementing heating value)

☐ Source of auxiliary fuel

☐ Auxiliary fuel feed rate

☐ For natural gas, a certificate of analysis indicating the metal (particularly mercury) and chlorine content of the fuel

Example Situation: Lois reads the *Auxiliary Fuel* section of the TBP as follows:

"Natural gas will be used as auxiliary fuel in the PCC and SCC. For the trial burn, high-Btu liquid waste will be fired in the PCC and SCC. During normal operation, natural gas may be fired in the PCC or SCC, if needed to maintain temperature."

Example Action: Although this section indicates that the facility will use natural gas and hazardous wastes to generate the desired heating value, Lois notes that it does not specify when hazardous wastes will be introduced. Hazardous wastes can only be introduced after achieving optimum temperature; nonhazardous fuels can only be used to preheat and achieve desired temperature. In addition, this section does not identify auxiliary fuel source, location, feed rate, or certificate of analysis. Lois asks the facility to revise this section based on her comments.

Notes: ____

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3.1.4.10 Reviewing Section D-5b(1)(d)(10)—Organic Chlorine Content

Regulations:

40 CFR Part 266.102(e)(5)(I)(c)
40 CFR Part 270.62(b)(2)(v)
40 CFR Part 270.66(c)(1)(i)

Guidance: U.S. EPA. 1997. "Generic Trial Burn Plan." Center for Combustion Science and Engineering. Pages D-5.35 through D-5.41.

Explanation: To ensure efficient scrubber operation, Cl_2 content should be determined by sampling and analysis of the waste feed in accordance with the referenced regulations. Analysis is performed for several parameters, but determination of organic Cl_2 content is important, because it affects the generation of acid gases. These gases must be neutralized and/or removed before being discharged to the atmosphere.

For DRE, PCDD/PCDF, and PIC determinations, chloride levels and other halogens of concern in the waste feed (for example, bromine, fluorine, and iodine) should be maintained at "worst-case" levels during trial burn tests and risk burn tests

A high halogen content may locally deplete the available hydroxide radicals which are necessary for complete destruction of organics and may lead to excessive amounts of polyaromatic hydrocarbons or halogenated organics being formed in addition to the possibility of Cl_2 emissions. Generally, those halogenated organics, which include PCDDs/PCDFs may represent the most toxic PICs.

Check For: The TBP reviewer should check for the following information:

☐ Analytical results for total Cl_2

☐ Use of ASTM and EPA-SOET analytical methods

☐ Any QA/QC procedures associated with the analysis

Example Situation: Lois and Clark read the *Organic Chlorine Content* section of the TBP as follows:

"The following table summarizes the frequency, number, type, size (or quantity), and source (or collection point) of all samples to be collected during each test burn. The test sample matrix presented in the table also lists proposed sampling and analytical method(s) for each sample. It is organized by sample type and analytical parameters. The matrix presented in this table represents the sample collection scheme for one test run (that is, the number of samples collected during one 2-hour test run only).

Waste Stream	Parameter	Analytical Method
High-Btu liquid	Total organic Cl_2	ASTM D808/D4327 or E442
Aqueous waste	Total organic Cl_2	ASTM D808/D4327 or E442
Containerized waste	Total organic Cl_2	ASTM D808/D4327 or E442
Bulk solid waste	Total organic Cl_2	ASTM D808/D4327 or E442
Kiln ash	Total organic Cl_2	ASTM D808/D4327 or E442"

Example Action: Lois and Clark agree that the text and table adequately address the requirements for this section. Additional testing is not required, because information presented in the waste characterization section of TBP indicates that other halogens are not of concern at this facility.

Notes: ____

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3.1.4.11 Reviewing Section D-5b(1)(d)(11)—Metals

Regulations:

40 CFR Part 266.102(e)(5)(I)(a)
40 CFR Part 270.62(b)(2)(v)
40 CFR Part 270.66(c)(1)(i)

Guidance:

U.S. EPA. 1992. "Technical Implementation Document for EPA's BIF Regulations." OSWER. EPA/530/R-92/11. March. Section 2.2, Page 2-2.

U.S. EPA. 1997. "Generic Trial Burn Plan." Center for Combustion Science and Engineering. Page D-5.35 through D-5.41.

Explanation:

Facilities can use any one or a combination of three approaches to determine the feed or emission rate for any regulated metal. These approaches, referred to as "tiers," range from a simplified analysis based on conservative assumptions (Tier I) to a site-specific analysis based on detailed facility information and air dispersion modeling (Tier III). It is acceptable to use a combination of tiers to comply with standards for individual metals.

The Tier I approach, which is the simplest but most conservative approach, limits stack metals emissions based on the hourly feed rate of individual metals into the combustion unit assuming all of the metals fed to the unit are emitted. The Tier II approach limits stack emission rates of individual metals based on stack emissions testing. The Tier III approach limits stack emission rates on the basis of site-specific air dispersion modeling, stack sampling, and metals feed rates. Compliance with Tiers II and III is confirmed by stack sampling. A combination of Tiers I and III, referred to as adjusted Tier I, is used to back-calculate maximum emission rates for individual metals. These emission rates then become the adjusted feed rate limits, assuming that all metals fed to the combustion unit partition to the exhaust gases (no removal).

Component 7 - How to Prepare Permit Conditions includes further discussion on metals testing during the trial burn.

Check For:

The TBP reviewer should check for the following information:

☐ Tier I, Tier II, Tier III, adjusted Tier I evaluations

☐ Approach followed in determining metals feed or emission rates

☐ Feed rate for each metal

☐ Metal solution concentrations have been correctly calculated and that the proper valence for chromium is tested

Example Situation: Clark reads the *Tier III Metals* section of the TBP as follows:

"The company proposes to meter lead, arsenic, beryllium, cadmium, and hexavalent chromium into the HWF. Other BIF metals—mercury, antimony, barium, silver, and thallium—have been assessed against Tier III dispersion criteria and have been found not to exceed reference air concentrations contained in BIF regulations, even when no removal is credited to the kiln system.

"In accordance with EPA's Technical Implementation Document for BIF Regulations (EPA 1992), metal compounds have been selected to be consistent with the form of the metals in the HWF, whenever possible. HWF is typically a blend of organic and aqueous wastes, coupled with high suspended solids content. Metal sources in the HWF include (1) suspended inorganic paint pigment solids, (2) organic metallic catalysts or viscosity modifiers, (3) inorganic metal containing cleansing solutions, and (4) organic-based residual tank bottoms. Obviously, organic and inorganic sources of metals are common in the HWF and may be contained in aqueous or solid phases. The company has selected solution-based metals to provide a conservative estimate of emissions because a greater percentage will disperse to the flue gas of the unit.

"Metered quantities of metals are introduced most effectively for the purpose of documenting precise feed rates by directly pumping organic or inorganic metal solutions with the HWF. This technique assures greater accuracy than blending of metals with the HWF before pumping. Pumping metal compounds—either organic-based or water-soluble—at uniform rates while the compounds are dispersed in the HWF supply line is considerably more reliable than mixing these compounds in agitated storage tanks. Placing the compounds in storage tanks may cause precipitation or sludging of one or more metals, thereby causing an unreliable feed situation. Pumping them directly to the HWF supply line may cause turbulence in the fuel line and burner assembly assures proper dispersion in the flame zone. The selection process can be simplified by four criteria that are considered to be important in evaluating a metal compound:

- Whether it is readily available commercially at a reasonable cost and in the quantities required for the test.
- Whether the selected material is "manageable." It must not be extremely corrosive, reactive, or flammable. The compound should not pose significantly more potential health hazards than the metal alone.
- Whether it is readily soluble in simple solvents, such as mineral spirits, fuel oil, or water.
- If consistent with the criteria above, whether the compound has the following specified properties:

- Organic-based,
- If inorganic-based, the material can go into the solution at a concentration that allows easy handling, or
- Does not contain anions, in sufficient quantity, that might interfere with or complicate the performance test protocol.

"The following organic- or inorganic-based compounds meet all of the criteria and were selected for use:

> "**Cadmium -** Cadmium acetate solution in methanol provides a workable source of organically bound cadmium. Cadmium is usually present in hazardous waste in pigments and petrochemical wastes.
>
> "**Lead -** A mixture of lead 2-ethylhexoate and neodecanoate in a petroleum distillate provides an excellent source of organically bound lead.
>
> "**Arsenic -** A sodium arsenate solution in water is frequently present in hazardous wastes, because it is a commonly used fungicide and wood preservative.
>
> "**Beryllium -** Beryllium sulfate, 4-hydrate is very toxic. There is very little beryllium in hazardous waste. Spiking rates are low. This compound was chosen because it is relatively easy to manage and is readily soluble in water.
>
> "**Chromium VI -** Sodium chromate solution is an excellent source of hexavalent chromium. This solution is also very easy to work with and minimizes the potential hazard of hexavalent chrome."

Example Action: Clark notes that this discussion is sufficient to adequately address the requirements of this section.

Notes:

3.1.5 Reviewing Section D-5b(1)(e)—Pollution Control Equipment Operation

Regulations:
40 CFR Part 266.102(e)
40 CFR Part 270.62(b)(2)(vi)
40 CFR Part 270.66(c)(3)(vii)

Guidance: U.S. EPA. 1997. "Generic Trial Burn Plan." Center for Combustion Science and Engineering. Page D-5.41.

Explanation: Regulations require a description of, and planned operating conditions for, any emission control equipment that will be used. Typically, APCSs are designed to remove PM and neutralize acid gases so the emissions of each remain within standards.

Check For: The TBP reviewer should check for the following information:

☐ APCS description

☐ APCS design specification

☐ Construction materials

☐ Residue removal systems

☐ Caustic control system

☐ pH and temperature monitors

☐ APCS operating conditions

Example Situation: Lois and Clark were reviewing the following description of an APCS:

"Section 1.0 Tempering Chamber - The tempering chamber is a refractory-lined, vertical vessel equipped with water spray nozzles. Downflow combustion gases are collected by water from spray nozzles to a set point temperature under 800°F. Gases then travel laterally and then upwardly through insulated ductwork to a pair of vertical spray dryer absorbers.

"The abrupt change in direction of combustion gases causes additional solid particulates to drop out of the gas stream into the bottom of the tempering chamber. These solids are collected by a conveyor system at the base of a tempering chamber.

"Section 2.0 Spray Dryer Absorbers - The spray dryer absorbers (SDA) are insulated, vertical vessels equipped with overhead spray nozzles for the addition of lime slurry to the gas stream. Lime slurry droplets react with acid gases to form dry calcium salts, which are removed by a conveyor system at the base of the SDA.

"Section 3.0 Lime Slurry System - the lime slurry system consists of a dry lime bin, a lim slurry mixing tank, and pumps. The lime-water blending is semibatch and is process-controlled by level and density instrumentation. The lime slurry is diluted and delivered as needed to spray nozzles in the SDAs.

"Section 4.0 Fabric Filters - the fabric filters are pulse jet-type baghouse with insolatable compartments for on-stream maintenance. The particulate, which is carried over from SDAs, will coat the exterior of the individual filter bag. Periodically, an internal header directs a blast of air downwardly inside of these bags. This blast causes the bag to flex, dislodging the built-up filter cake. Filtered material drops to the bottom collecting chambers, and collecting conveyors receive this material and transport it to a vacuum truck for disposal.

"Section 5.0 Collecting Drag Conveyors - Collecting drag conveyors transport collected particulates, calcium salts, and unreacted lime from the SDAs and the fabric filters to a mechanical conveyor system that discharges the materials into a vacuum tanker. The material and air from this system discharges to a collecting baghouse that discharges to the vacuum tanker. The air then passes through the bulk solids storage baghouse prior to discharging to the atmosphere.

"The kiln ash, baghouse and spray-dryer-absorber residual, and SCC ash are all considered to be hazardous and, after necessary analyses, are all disposed of at a secure hazardous waste landfill.

"Section 6.0 Induced-Draft Fan - The induced-draft fan provides the motive power for the entire incinerator train and APCS train. In so doing, the fan produces a system wide negative pressure that prevents fugitive emissions.

"Section 7.0 Induced-Draft Fan Outlet Duct - The duct is insulated and includes sampling nozzles and extractive continuous emissions monitoring.

"Section 8.0 Stack - The insulated stack is equipped with ports for U.S. EPA isokinetic sampling and combustion gas flow monitoring instrumentation."

Example Action: Lois and Clark noted several deficiencies in this section; some examples are provided below:

This section, in its entirety, provides little information regarding construction materials for components of the APCS. This information needs to be provided to determine the potential for fugitive emissions and waste interaction with various APCS components.

Section 1.0 This section provides information regarding the tempering chamber; however, it does not identify the manufacturer. This information is needed to determine the potential for fugitive emissions or maintenance problems caused by a lack of readily available replacement parts.

Section 2.0 This section describes SDAs but not typical flow rates and basic process flow information. Basic schematics should be a part of the stand-alone TBP, not referenced to a document that the reviewer may not have.

Section 3.0 This section describes the lime slurry system but fails to discuss how lime slurry is physically made and mixed. It is also unclear what is meant by "process-controlled." A description of the entire system should be included.

Section 4.0 This section describes fabric filters. No information is presented regarding (1) fabric material, (2) temperature limitations, or (3) pore size. This section should be modified to include this information so that the permit writer can determine if the bags are appropriate for the proposed system. This section should also discuss bag durability and a potential maintenance and replacement schedule (including a description of how bag leaks will be detected).

Section 6.0 This section describes the induced-draft fan; however, the maximum capacity of the induced-draft fan or the fan curve are not included. This information is needed so that the permit writer can review the adequacy of the fan to maintain combustion pressure and prevent fugitive emissions.

Section 8.0 This section describes the combustion unit stack; however, it fails to provide basic information such as diameter, height, and the location of sampling ports and potential upstream and downstream disturbance. It mentions the presence of "insulation;" however, it does not identify the type of insulation and the potential for this insulation to be entrained in the stack gas and to affect sampling results.

Lois and Clark ask the facility to revise this discussion based on their section-specific comments.

Notes: ____

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3.1.6 Reviewing Section D-5b(1)(f)—Shut-Down Procedures

Regulations:
40 CFR Part 270.62(b)(2)(vii)
40 CFR Part 270.66(c)(8)

Guidance: U.S. EPA. 1997. “Generic Trial Burn Plan.” Center for Combustion Science and Engineering. Page D-5.41.

Explanation: The TBP must present procedures for rapidly stopping waste feed, shutting down the combustion unit, and controlling emissions in the event of equipment malfunction or failure. During normal operation, the combustion unit has specific limits that must not be exceeded. If they are, the permit requires an AWFCO be activated, and all waste feeds are instantaneously stopped. However, combustion air, auxiliary fuel flow, and other combustion unit operations continue (for example, kiln rotation), as does the operation of the APCS.

All facilities should have shut-down procedures and a contingency plan for equipment malfunctions that require shutdown of the entire operating system. SOPs for these actions should be included with the TBP.

Check For: The TBP reviewer should check for the following information:

☐ Shutdown procedures discussion

☐ AWFCOs presentation as permit limits during waste feed activities

☐ Emergency power supply

☐ Anticipated shutdown frequency, and historical records of shutdown frequency (if existing unit)

Example Situation: Lois reads the *Shutdown Procedures* section of the TBP as follows:

“After certification of compliance, if operating conditions exceed the limits that will be established during the trial burn, waste feeds to the kiln will be automatically cut off. Following a cutoff, while hazardous waste remains in the kiln, operating condition requirements will include maintaining minimum combustion chamber temperature, operating the APCS in accordance with permit requirements, and continuous monitoring of all parameters for which permit limits will be established. Waste will not be fed to the kiln until the unit is operating within the conditions specified in the permit. In addition, hazardous waste feed to the kiln will be discontinued in the event of a failure of the induction fan, any failure of the instrumentation listed in Exhibit 3.1.6-1, see page 1-111, or any failure of the data collection and logging systems that would invalidate the data necessary to evaluate compliance with cutoff parameters. During the trial burn, cutoff limits listed above will be modified or established.”

Example Action: This description does not address rapid procedures for complete shutdown of the unit resulting from a malfunction that might trigger an AWFCO. Generally, if a boiler or cement kiln burner nozzle is plugged, the facility will stop flow only to that nozzle, replace the waste fuel with a secondary fossil fuel, and conduct the necessary maintenance while the unit continues to operate. A rapid shutdown might occur during a severe storm in which there is a power outage. The backup power must come on within a set period of time, usually 1 minute or less, and keep the kiln rotating and the induced-draft fan on. In this way, any solids or unburned material in the kiln are exposed to the surrounding temperature. The induced-draft fan keeps a negative pressure on the system and controls fugitive emissions. Lois asks the facility to revise this section to include a contingency plan for a malfunction that results in complete shutdown of the unit.

Notes: ______________________________

EXHIBIT 3.1.6-1

MONITOR AND CONTROL DEVICE SPECIFICATIONS

Operating Parameter	Units Measured	Monitor/ Controller Type	Manufacturer	Model #[1]	Calibration Frequency
Combined Waste Feed Rate	gph	Flow Meter	Micromotion	RFT9712	Monthly[2]
Aqueous Feed Rate	gph	Pump	Burks Pumps	737CTIME-55	Monthly[2]
Solvent Feed Rate	gph	Pump	Viking	LQ4125	Monthly[2]
Auxiliary Fuel Flow Rate	SCFM	Control Valve	Barber Colman	—	N/A
Fume Flow Rate	SCFM	Flow Meter	Annubar	ANR-75	Quarterly
Atomization Steam Pressure	psig	Gauge	Ashcroft	N/A	Inspected Daily, Replaced quarterly[3]
Liquid Waste Feed Pressure	psig	Gauge	Ashcroft	N/A	Inspected Daily, Replaced Quarterly[3]
Auxiliary Fuel Pressure	psig	Gauge	Ashcroft	N/A	Inspected Daily, Replaced Quarterly[3]
Boiler Steam Pressure	psig	Gauge	Ashcroft	N/A	Inspected Daily, Replaced Quarterly[3]
Combustion Chamber Pressure	psig	Gauge	Ashcroft	N/A	Inspected Daily, Replaced Quarterly[3]
Burner Flame	uv	Sensor	Honeywell	C7035A	N/A
Combustion Temperature	°F	Thermocouple	Honeywell	UDC 300	Monthly[2]
Stack Gas Flow Rate	SCFM	Meter	Annubar	ANR-75	Quarterly
Stack Gas CO	ppm	Probe	Anarad	AR-50-SM	Daily Yearly Spec
Stack Gas O_2	%	Probe	Teledyne	9600	Monthly Yearly Spec

Notes:

N/A = Not Available
[1] = Or equivalent
[2] = It is recommended, based on operating and manufacturer specifications, that this calibration frequency be updated to quarterly
[3] = It is recommended that gauges be replaced on a semi-annual basis
% = percent
CO = Carbon monoxide
°F = Degrees Fahrenheit
gph = Gallons per hour
SCFM = Standard cubic feet per minute
O_2 = Oxygen
psig = Pounds per square inch gauge
ppm = Parts per million
uv = Ultraviolet

3.1.7 Reviewing Section D-5b(1)(g)—Combustion Unit Performance

Regulations: 40 CFR Part 266.102 and 103
40 CFR Part 270.62(a)
40 CRF Part 270.66(b)

Guidance: U.S. EPA. 1997. "Generic Trial Burn Plan." Center for Combustion Science and Engineering. Pages D-5.42.

Explanation: This section should state performance objectives of startup, shakedown, pretest, and trial burn testing, as well as post-trial burn test activities. This section should also include a detailed discussion of combustion activities, schedule, and changes of combustion unit performance over the duration of the cleaning schedule.

Check For: The TBP reviewer should check for the following information:

- ☐ Startup performance objectives
  - ☐ Demonstration of mechanical operation
  - ☐ Readiness of the combustion system to achieve optimum operational capacity for a sustained period
- ☐ Shakedown performance objectives
  - ☐ Adjusting and fine-tuning of combustion conditions, including burner controls systems
  - ☐ Adjusting feed and APCS
  - ☐ Verification of CEMS operations
- ☐ Pretest performance objectives. Pretest is a dry run that is conducted for the trial burn at new combustion units but is not required by regulations.

  - ☐ Confirmation of selected sampling and analytical methods
  - ☐ Operation of the system under full trial burn conditions
  - ☐ Demonstration of capabilities of the complete system and individual components
  - ☐ Finalization of target operating conditions for the trial burn

- ☐ Combustion unit performance characteristics over time

  - ☐ Cleaning schedule
  - ☐ Cleaning activities
  - ☐ Changes in performance

Example Situation: Lois and Clark read the *Combustion Unit Performance* section of the TBP as follows:

"During the incinerator startup, all systems and subsystems will be tested under "cold" conditions to determine integrity and operation. Electrical circuits will be checked for continuity and response to signals from controllers, and control room controller commands will be checked in the field for operational readiness. Nonhazardous fuels will be used for hot startup to determine design capacity for firing rates, air movement, and scrubber performance.

"During the incinerator shakedown phase, hazardous waste will be introduced into the incinerator to (1) determine the combustion control system of the operation, (2) develop fan curves, (3) conduct quench and scrubber water flow rate requirements, (4) calibrate all CEMS, and (5) assess noise from the incinerator. To determine readiness, personnel will operate the incinerator at or near conditions planned for the trial burn.

"During the pretest, the incinerator will run one test under each planned trial burn test condition to confirm that sampling and analytical methods are correct and to make any necessary adjustments. During the pretest phase, the incinerator is operated under conditions planned in the TBP and needed for the permit."

Example Action: Lois notes that this section does not provide startup operations in a sequential order; it is unclear whether operational readiness during the startup phase will be determined from the waste feed end or the flue emissions stack. In addition, Clark realizes that the section does not provide adequate discussion on procedures to be used in determining incinerator design capacity. Lois and Clark ask that the facility revise this section to include the criteria by which operational readiness would be determined and that they provide a more detailed discussion of incinerator design capacity.

Notes: ______________________________

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3.2 REVIEWING SECTION D-5b(2) - NEW COMBUSTION UNIT CONDITIONS

Regulations: 40 CFR Part 270.62(a)
40 CFR Part 270.66(b)

Guidance: U.S. EPA. 1997. "Generic Trial Burn Plan." Center for Combustion Science - Engineering. Pages D-5.43.

Explanation: The TBP for new combustion units covers four phases of operation:

- Phase one - startup testing
- Phase two - shakedown testing
- Phase three - trial burn testing
- Phase four - post-trial burn operation

Subsections 3.2.1 through 3.2.3 explain the goals of phases one, two, and four and the type of information the permit writer should review. The determinations drawn from the phases should be well supported.

Check For: The TBP reviewer should check for the following information:

☐ A startup plan is a recommended attachment to the TBP

☐ The shakedown test should be comprehensive and detailed

☐ The proposed post-trial burn operating conditions should be justified

Example Situation: See Subsections 3.2.1 through 3.2.3 for specific example situations.

Example Action: See Subsections 3.2.1 through 3.2.3 for specific example actions.

Notes: ____

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3.2.1 Reviewing Section D-5b(2)(a) and (b)—New Combustion Unit Startup/Shakedown Performance

Regulations:

40 CFR Part 264.343
40 CFR Part 266.102(b)(4)(I)
40 CFR Part 270.62(b)(2)(vii)
40 CFR Part 270.66(b)(1)

Guidance:

U.S. EPA. 1989. "Handbook—Guidance on Setting Permit Conditions and Reporting Trial Burn Results." ORD. EPA/625/6-89/019. January. Chapter 2.

U.S. EPA. 1992. "Technical Implementation Document for EPA's Boiler and Industrial Furnace Regulations (BIF)." OSWER. EPA-530-R-92-011. March. Pages 10-8 and 10-9.

U.S. EPA. 1997. "Generic Trial Burn Plan." Center for Combustion Science and Engineering. Pages D.5-44 and D.5-45.

U.S. EPA. 1998. "Protocol for Human Health Risk Assessment at Hazardous Waste Combustion Facilities." EPA-R6-098-002. Section 2.5.

Explanation:

This section is usually required as part of the RCRA Part B permit application, however, inclusion of this section in the TBP is recommended. The pretrial burn or start-up and shakedown period establishes conditions for the purpose of determining operational readiness following completion of construction. Permits generally do not allow firing of hazardous wastes during the startup phase; natural gas or other fossil fuels are burned to achieve full operating conditions, such as desired temperature. However, permits may allow limited burning of hazardous wastes during the shakedown phase to help stabilize the new combustion unit and to prepare the unit for the trial burn. This pretrial burn phase may last up to 720 operating hours and may be extended for an additional 720 operating hours when burning regulated hazardous waste. See Component 7—How to Prepare Permit Conditions for additional discussion on these issues.

Check For:

The TBP reviewer should check for the following information:

❑ Fuel fired during startup phase (should be nonhazardous fuel)

❑ Wastes to be burned during shakedown phase (can be hazardous or nonhazardous)

❑ Notification of the introduction of hazardous wastes in the combustion unit (the facility should specify how much in advance the notification would be provided to U.S. EPA or state agency)

❑ Time required to achieve operational readiness after introduction of hazardous wastes or initiation of shakedown phase

- ☐ Operating conditions and their limits during start-up/shakedown phase
  - ☐ Group A parameters
  - ☐ Group B parameters
  - ☐ Group C parameters
- ☐ Basis for establishing operating conditions
- ☐ Information regarding proposed or anticipated emission rates during startup, including a demonstration that these emission rates will be protective of human health and the environment
- ☐ Whether the AWFCO system will be operational during the shakedown phase or the combustion of hazardous wastes

Example Situation: Clark reads the *New Combustion Unit Startup/Shakedown Performance* section of the TBP as follows:

"The facility plans to test all incinerator operating components following a "cold" test regiment that incorporates manufacturers' recommendations for (1) all conveyors, rams, and blowers; (2) kiln rotation motors; (3) ash removal mechanisms; (4) scrubber water and pH controls; (5) CEMS; and (6) the induced-draft fan.

"Following successful operation of the system during cold testing, the facility will combust either natural gas or fuel oil (virgin fuel or a synthetic blend may be used) in the incinerator to cure the refractory, in accordance with manufacturers' recommendations for time and temperature.

"After the refractory has been properly cured, the facility will introduce a 50/50 blend of ethylene glycol and isopropyl alcohol to each of the liquid injection nozzles to test "hot"operations of the liquid injection system. Each nozzle will be tested at design specifications.

"Following a successful demonstration of the liquid injection system, the facility will introduce sand and excavated clean dirt to the solids feed chute and the containerized solids feed conveyor. This test will be conducted while the incinerator is firing either virgin fuel or the synthetic blend. A solids residence time will be measured at various kiln rotation speeds and will be incorporated into the operations log for future reference. This test is designed to ensure that all safety mechanisms are functioning and that the system can properly feed solids to the kiln without generating fugitive emissions.

"Following shakedown tests, a liquid synthetic blend of calcium chloride will be added to produce ash content for scrubber removal efficiency testing. Scrubber performance will be measured by stack sampling for PM using proposed maximum achievable control technology (MACT) standards for the target emission limit.

“During testing activities of incinerator operations using hazardous waste feed, the CEMS will be operating with CO being monitored on a 1-hour rolling average basis. If the CO level exceeds the 100 ppm by volume rolling average, hazardous waste feed will be shut off, and an engineering analysis will be conducted to determine why combustion was producing high CO levels.

“Regulated hazardous waste feed will be introduced only when all system components are performing up to design specifications and emissions are within permitted limits. The clock will then start on the permitted 720 hours of pretrial burn activity, which will be conducted by using wastes instead of synthetic material. After these operations are concluded, the facility will inform the U.S. EPA and state regulatory officials that it intends to perform the RCRA trial burn, giving at least 14 days notice.”

Example Action: After reviewing this section of the TBP, Clark determines that this discussion is unclear, incomplete, or inadequate in several ways. This section does not clearly state whether startup and shakedown operations will establish conditions necessary to determine operational readiness of the incinerator, nor does it clearly indicate where startup ends and shakedown begins. Clark asks that the facility clarify these issues.

No discussion exists concerning the operability of the AWFCO system during startup and shakedown operations. The AWFCO system should be in operation at all times during the combustion of hazardous wastes. Clark asks that the facility revise this section to include a discussion on the AWFCO system and conditions that would trigger the system.

This section also does not indicate whether regulatory agencies will be notified of the introduction of hazardous waste into the incinerator during the pretrial burn or shakedown phases. The facility should give at least a 2-week notice to regulatory agencies concerning introduction of hazardous wastes. Clark asks that the facility revise this section to discuss such notification.

Notes: ____

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3.2.2 Reviewing Section D-5b(2)(c)—New Combustion Unit Post-Trial Burn Operation

Regulations:
40 CFR Part 266.102(d)(iii)
40 CFR Part 270.62(c)
40 CFR Part 270.66(b)(3)

Guidance: U.S. EPA. 1997. "Generic Trial Burn Plan." Center for Combustion Science and Engineering. Page D-5.46.

Explanation: This section should discuss whether and how the combustion unit will operate during the interim periods—between completion of the trial burn and receipt of final approval from U.S. EPA and the state agency. The combustion system should operate within requested final permit limits and in compliance with all federal requirements. See Component 7—How to Prepare Permit Conditions for additional discussion on this issue.

Check For: The TBP reviewer should check for the following information:

- ☐ Operating procedures during the interim period (facility should clearly state federal requirements with which it will comply—such as 40 CFR Parts 264, 266, and 270—and summarize the requirements)
- ☐ How interim operating conditions will be documented
- ☐ How AWFCO system integrity will be tested during interim operations
  - ☐ Checking signal path between the monitoring point and the control system
  - ☐ Checking during calibration of combustion system monitors
  - ☐ Adjusting the trip point for each event that triggers AWFCO system

Example Situation: In reviewing the *New Incinerator Post-Trial Burn Operation* section of the TBP, Lois reads as follows:

"During the post-trial burn period, the facility will continue incinerating hazardous wastes at operating conditions similar to those followed during the trial burn. Because a Class I POHC was used during the trial burn, the facility believes that it can accept and successfully destroy any organic compound on the new U.S. EPA incinerability index. The facility will not accept or burn any dioxin or PCB wastes. All waste feed shutoffs and interlocks that were in effect during the trial burn will be in effect during the post-trial burn period for safety and environmental protection."

Example Action: Lois is dissatisfied with this section because it does not provide adequate information pertaining to post-trial burn operations. It fails to discuss state and federal requirements with which it would comply, procedures for documenting operating conditions, and measures to check the integrity of the AWFCO system during post-trial burn operations. Lois asks that the facility revise this section to include this information.

Notes: ____

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3.2.3 Reviewing Section D-5b(2)(d)—Combustion Unit Performances

Regulations: 40 CFR Part 270.62(a)
40 CFR Part 270.66(a)

Guidance: U.S. EPA. 1997. "Generic Trial Burn Plan." Center for Combustion Science and Engineering. Page D-5.47.

Explanation: This section should summarize the rationale for the operating conditions proposed for the startup, shakedown, and post-trial burn periods. Please see Section 3.1.7 of this component and Component —How to Prepare Permit Conditions for further guidance.

Check For: See Section 3.1.7 of this component for specific "check for" items.

Example Situation: See Section 3.1.7 of this component for specific example situations.

Example Action: See Section 3.1.7 of this component for specific example actions.

Notes: ____
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4.0 REVIEWING SECTION D-5c—TRIAL BURN SUBSTITUTE SUBMISSIONS

Regulations: 40 CFR Part 270.19(c)
40 CFR Part 270.66(a)(6)

Guidance: U.S. EPA. 1983. “Guidance Manual for Hazardous Waste Incinerator Permits.” OSWER. July. Section 3.1, Pages 3-1 through 3-4.

U.S. EPA. 1997. “Generic Trial Burn Plan.” Center for Combustion Science and Engineering. Page D-5.48.

Explanation: Facilities can submit performance data from a separate but similar combustion unit in lieu of conducting a trial burn on each similar unit. U.S. EPA 1983 Guidance Manual for Hazardous Waste Incineration Permits provides criteria for determining similarity of combustion unit and waste. Substitute data should contain all data that was required as part of the TBP. Substitute data should also include a comparison of the wastes, design, and operating conditions for the unit to be used with that for which comparative burn data are available. Trial burn substitute submissions are usually encountered for multiple similar units located at the same facility (for example, multiple boilers).

Check For: The TBP reviewer should check for the following information:

☐ Analysis of each waste or waste mixture (see Section 3.1 through 3.1.7 for list of items to be checked in reviewing this information)

☐ Detailed engineering description (see Section 3.1 through 3.1.7 for list of items to be checked in reviewing this information)

☐ Description and analysis of wastes to be burned compared with the waste for which data from operational or trial burns are provided to support the position that a trial burn is not needed

☐ Design and operating conditions of the combustion unit to be used, compared with that for which comparative burn data are available

☐ Description of the results submitted from previously conducted trial burns, including sampling and analysis techniques and methods, and results of operating parameters monitoring

☐ Expected combustion unit operation information to demonstrate compliance with 40 CFR Parts 264.243 and 264.345

Example Sections: Clark reviews the following section:

“The proposed combustion unit I2 will be identical in design, construction, and operation to the permitted combustion unit I1. Both the combustion units receive waste from a common holding tank. The proposed combustion unit will be used to burn wastes when there is an excess capacity of wastes.

"The facility has completed a trial burn for the existing combustion unit and subsequently obtained a hazardous waste permit. The facility intends to operate the proposed combustion unit at the permitted conditions for existing combustion unit."

Example Comments: Clark determines the preliminary information provided in the section is adequate; however, he requests that the facility provide detailed information regarding the existing combustion unit's design and specifications. He also requests that the facility provide a professional engineer's certificate that the units will be identical.

Notes: ____

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5.0 REVIEWING SECTION D-5d—DETERMINATIONS

Regulations: 40 CFR Part 270.62(b)(6) through 270.62(b)(10)
40 CFR Parts 270.66(f)

Guidance: U.S. EPA. 1997. "Generic Trial Burn Plan." Center for Combustion Science and Engineering. Pages D-5.48 through D-5.57.

Explanation: Reporting requirements include a blend of facility operation, sampling and analysis, and performance results. U.S. EPA policy also requires specific results. Permit conditions for a hazardous waste incinerator should assure that the unit always meets performance standards. This information should be presented in the TBP to ensure that all of the data needed to support these conclusions will be collected during the proposed test.

Details regarding the information contained in this section are explained in Subsections 5.1, trial burn results, and 5.2, final operating limits.

The facility owner and operator are ultimately responsible for assuring that the TBR provides data which support permit conditions that are acceptable to the facility.

Check For: The TBP reviewer should check for the following information:

☐ A description of how trial burn results will be presented

☐ A description of proposed final operating limits to be determined

☐ A description of how final operating limits will be determined based on results of the trial burn test

☐ A discussion of how the trial burn plan and trial burn test compare

☐ A presentation of anticipated permit conditions based on trial burn test results

☐ Differences encountered during testing that varied from the plan

☐ Failures encountered during testing

☐ Presentation of test results with example calculations

☐ Supporting documentation for certification and laboratory QA/QC

☐ Obvious differences in numerical presentations

Example Situation: Clark reviews the following results outline for the TBR:

- Test method summary
- Waste feed results
- Particulate results
- HCl results
- DRE results
- Dioxins, furans, and semivolatile results

The operational conditions for the three boilers tested are divided into Group A, B, and C parameters per U.S. EPA guidance. Group A parameters are continuously monitored and interlocked with the AWFCO system. Group B parameters are established during the trial burn, but do not require continuous monitoring and are not interlocked with the AWFCO system. Operating records will be maintained by the company. Group C parameters are established based on manufacturer specifications and are independent of the data collected during the trial burn.

Group A Parameters

- Minimum combustion temperature
- Maximum induced draft fan flame
- Maximum liquid feed rate
- Maximum CO hourly rolling average

Group B Parameters

- Maximum ash feed rate
- Maximum chloride feed rate

Group C Parameters

- Minimum steam atomization pressure waste feed nozzle

Example Action: Lois and Clark attempted to verify if everything proposed in the TBP and the information needed to develop permit conditions will be included in the final report. However, this brief outline does not provide a detailed description of what type of data will be presented for each of the items identified. This section should include examples of the tables to be used to present the data, as well as a detailed description (or even a preliminary draft) of the text that will be used to support proposed operating limits. This section should also identify appendices that will be included with the TBR to support the information presented in this section. Clark asks the facility to revise this section based on the deficiencies noted.

Although listed as a Group A parameter, minimum combustion temperature was not shown on the permit conditions for two of the three boilers. This is contrary to controlling the operating envelope by establishing a minimum operating temperature demonstrated during the trial burn where the required 99.99 percent DRE was met.

In the TBP, the Group B feed rate parameters have a reported stack gas flow rate of 2.054 in a summary table, but in the feed rate calculation, the rate is expressed as 2,054 dry standard cubic feet per minute (dscfm). The TBP should be revised accordingly.

Notes: ____

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5.1 REVIEWING SECTION D-5d(1)—TRIAL BURN RESULTS

Regulations: 40 CFR Part 270.62(b)(6)
40 CFR Parts 270.66(d)(3), (4), and (5)

Guidance: U.S. EPA. 1997. “Generic Trial Burn Plan.” Center for Combustion Science and Engineering. Pages D-5.48 through D-5.50.

Explanation: After the trial burn has been completed, trial burn results will be submitted in a format that is acceptable to U.S. EPA based on the format in the approved TBP. Unless other arrangements are made, the report is due within 90 days after completion of the trial burn. The TBR will be certified in accordance with the requirements of 40 CFR Parts 270.62(b)(7) through 270.62(b)(9). See Component 6—How to Review a Trial Burn Report for further guidance on reviewing Trial Burn Reports.

Check For: Each TBP should propose a TBR section on the trial burn results that presents the following information:

- ☐ Quantitative analysis of combustion gas concentrations of POHCs, metals, HCl, particulate, PCDD/PCDFs, PICs, O_2, CO, and CO_2 including the following:
  - ☐ Actual trial burn COPC emission rate values (including complete detection limit values for nondetected compounds) in grams per second
  - ☐ Adjusted COPC emission rate values (for the risk assessment, if any) in grams per second
  - ☐ Justification and description of any proposed emission rate adjustments for risk assessment purposes
- ☐ Quantitative analysis of any scrubber water, ash residues, or other residues (for use in estimating the POHC rate)
- ☐ Computation of HCl removal efficiency (if HCl emission rate exceeds 4 lb/hr)
- ☐ Computation of particulate, HCl and Cl_2, metals, PIC, and PCDD/PCDF emissions
- ☐ Identification of fugitive emissions and their means of control
- ☐ Maximum, minimum, average, and standard deviation of combustion chamber temperatures

☐ Maximum, minimum, average, and standard deviation of APCS operating conditions

☐ Maximum, minimum, average, and standard deviation of combustion gas velocity

☐ Continuous monitoring results of CO concentration in combustion gas

☐ Other information specified in the TBP

Example Situation: Lois and Clark reviewed the following outline for the proposed TBR.

- Test Method Summary
- Waste Feed Results
- Particulate Results
- HCl Results
- DRE Results
- Dioxins, Furan, and Semivolatile Results"

All boilers achieved compliance with the standards specified in 40 CFR Part 266.102 and the appropriate state regulations. A summary of the DRE, particulate, and HCl emissions are shown below for each boiler:

Standard	Boiler 1	Boiler 2	Boiler 3	Regulatory Limit
Particulate	0.0057 gr/dscf	0.006 gr/dscf	0.0010 gr/dscf	0.08 gr/dscf
HCl	0.00024 lb/hr	0.002 lb/hr	0.006 lb/hr	4 lb/hr
DRE	> 99.99 percent	> 99.99 percent	>99.99 percent	99.99 percent

Due to the very low chloride content, there was no sampling and analysis for PCDD/PCDFs. No boiler had a scrubber so all scrubber testing was waived. Due to the low ash content, no particle size distribution (PSD) testing was required. Parameters that were measured during the trial burn include:

- Combustion chamber temperature, for only 1 boiler

- Minimum residence time

- Burner and atomized settings

Example Comments: Lois determined that this outline is inadequate. The report should contain a detailed description regarding all of the applicable information listed above. The facility must also discuss how each of these items will be presented and how data in the tables will be supported using appendices and example calculations. Lois asks the facility to revise this section based on her comments.

Notes: ____

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5.2 REVIEWING SECTION D-5d(2)—FINAL OPERATING LIMITS

Regulations: 40 CFR Part 270.62(b)(10)
40 CFR Part 270.66(f)

Guidance: U.S. EPA. 1997. "Generic Trial Burn Plan." Center for Combustion Science and Engineering. Pages D-5.50 through D-5.58.

Explanation: If the DRE, metals, PM, HCl, PICs, and stack gas CO performance objectives, (as described in the TBP) are achieved during the trial burn, the combustion unit operating permit should allow the facility to use the combustion system to incinerate RCRA hazardous solid and liquid wastes at rates and conditions demonstrated in the trial burn. See Component 7—How to Prepare Permit Conditions for further guidance on setting permit limits.

Check For: The TBP reviewer should check for the following information:

- ☐ Group A parameters are continuously monitored and interlocked with the AWFCO. Interruption of waste feed is automatic when specified limits are exceeded. These parameters are applicable to all facilities.

  - ☐ Minimum temperatures measured at each combustion chamber exit
  - ☐ Maximum CO emissions measured at the stack or other appropriate location
  - ☐ Maximum flue gas flow rate or velocity measured at the stack or other appropriate location
  - ☐ Maximum pressure in PCC and SCC
  - ☐ Maximum feed rate of each waste type to each combustion chamber

  These parameters are specific to each facility based on the type of APCS present.

  - ☐ Minimum differential pressure across particulate venturi scrubber
  - ☐ Minimum liquid-to-gas ratio and pH to wet scrubber
  - ☐ Minimum caustic feed to dry scrubber
  - ☐ Minimum kVA settings to ESP (wet/dry) and kVA for IWS
  - ☐ Minimum pressure differential across baghouse
  - ☐ Minimum liquid flow rate for IWS
  - ☐ APCS inlet gas temperature

- ☐ Group B parameters do not require continuous monitoring and are thus not interlocked with the waste feed cutoff systems. Operating records are required to ensure that trial burn worst-case conditions are not exceeded.

  - ☐ POHC incinerability limits

  - ❑ Maximum total halides and ash feed rate to the combustion unit
  - ❑ Maximum size of batches on containerized waste
  - ❑ Minimum particulate scrubber blowdown or total solids content of the scrubber liquid

- ❑ Group C parameters are set independently of trial burn test conditions. Limits are based on equipment manufacturer’s design and operating specifications and are considered good operating practices. Parameters do not require continuous monitoring and are not interlocked with the AWFCO.

  - ❑ Minimum/maximum nozzle pressure to scrubber
  - ❑ Maximum total heat input capacity for each chamber
  - ❑ Liquid injection chamber burner settings:

    - ❑ Maximum viscosity of pumped wastes
    - ❑ Maximum burner turndown
    - ❑ Minimum atomization fluid pressure
    - ❑ Minimum waste heating value only if waste provides 100 percent heat input to chamber

- ❑ Title 40 CFR Part 266.102 parameters are in addition to Group A, B, and C parameters and apply to BIFs that use hazardous waste as a fuel

  - ❑ Minimum and maximum device production rate
  - ❑ Alternate CO standard and maximum THC limit
  - ❑ Sampling and analysis of metals in the hazardous waste and other fuels with feed rate limits

- ❑ Title 40 CFR Part 266.103(c) requires the owner operator to document compliance with emissions standards that control production rate, minimum waste Btu content, metals feed rate, chlorine feed rate, PM emissions and, if applicable, facility risk assessments for pollutant dispersion from the stack.

Example Situation: Lois and Clark reviewed the following summary of permit conditions:

“The trial burn is structured to obtain the data necessary to establish permit conditions. We propose that the following conditions be established in the permit, based on the successful demonstration of unit performance during the trial burn. These limits apply to Unit 1 while hazardous waste is burned. Unit 2 will continue to operate under its interim status conditions until its APCS is replaced with a baghouse. The conditions are:

- Maximum total hazardous waste feed rate (measured during Condition 1 of the trial burn, expected to be 5.9E06 grams per hour [g/hr]).

- Maximum pumpable hazardous waste feed rate (measured during Condition 1 of the trial burn, expected to be 5.9E06 g/hr).

- Maximum BIF metals feed rates equal to the levels measured during Condition 1 of the trial burn for the Tier III metals (arsenic, beryllium, cadmium, chromium, and lead) and equal to the adjusted Tier I limits for antimony, barium, mercury, silver, and thallium.

- Maximum total chlorine feed rate (measured during Condition 1 of the trial burn)

- Maximum combustion zone temperature (measured during Condition 1 of the trial burn by an optical pyrometer)

- Minimum combustion zone temperature (measured during Condition 2 of the trial burn by an optical pyrometer)

- Maximum secondary air temperature (measured during Condition 1 of the trial burn as a measure of maximum combustion zone temperature in the event of a pyrometer failure)

- Maximum baghouse inlet temperature (measured during Condition 1 of the trial burn)

- Minimum baghouse pressure drop (measured during Condition 1 of the trial burn)

- Maximum flue gas flow rate (measured during Condition 1 of the trial burn)

“The results of the boiler tests show the following anticipated operating limits:

- Minimum combustion chamber temperature—2,000°F in the oxidizer and 1,600°F in the reoxidizer

- Maximum induced draft fan flow—3,608 standard cubic feet per minute to produce the minimum residence time

- Maximum liquid waste feed rate—1,206 pounds per hour (lb/hr)

- Carbon monoxide)—<100 ppmv hourly rolling average

- Ash feed rate—0.71 lb/hr

- Chloride feed rate—3.89 lb/hr

- Minimum steam atomization pressure for the waste feed nozzle—85 psig"

Example Action: In accordance with U.S. EPA guidance, Lois and Clark suggest that the facility summarize proposed operating conditions in a table (final operating conditions are typically summarized in table format) and that the facility break down specific process parameters as follows:

- Group A—Continuously monitored parameters that are connected to an AWFCO system
- Group B—Parameters cannot be continuously monitored with compliance based on operating records
- Group C—Parameters with limits that are set independently of the trial burn

They also request that the facility provide detailed supporting calculations indicating how each of the proposed values was determined. Because there is no scrubber on the boiler, there are no scrubber related permit conditions. The metals were analyzed in the waste and the results indicated the facility could meet the Tier I metals limits.

Notes: ____

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ATTACHMENT A

U.S. EPA REGION 6 GENERIC TRIAL BURN PLAN

The U.S. EPA Region 6 Generic Trial Burn Quality Assurance Project Plan is located in Attachment A of Component 2 of the Hazardous Waste Combustion Unit Permitting Manual.

CONTENTS

CONTENTS (Continued)

FIGURES (ATTACHMENT A)

FIGURES (ATTACHMENT A) (Continued)

TABLES (ATTACHMENT B)

APPENDICES

Appendix

ACRONYMS AND ABBREVIATIONS

$\mu g/m^3$	Micrograms per cubic meter
$\eta g/m^3$	Nanograms per cubic meter
acfm	Actual cubic feet per minute
APCS	Air pollution control system
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
AWFCO	Automatic waste feed cut-off
BIF	Boiler or industrial furnace
Btu	British thermal unit
CEM	Continuous emission monitor
CFC	Certified-for-construction
cfm	Cubic feet per minute
CLP	Contract laboratory program
DARS	Data acquisition and recording system
DAS	Data acquisition system
DCS	Distributed control system
DNPH	Dinitrophenylhydrazine
DQO	Data quality objectives
DRE	Destruction and removal efficiency
EPA	U.S. Environmental Protection Agency
FDA	Food and Drug Administration
FID	Flame ionization detector
FRP	Fiberglass-reinforced plastic
GC	Gas chromatograph
GCMS	Gas chromatograph and mass spectrometry
gpm	Gallons per minute
gr/dscf	Grains per dry standard cubic foot
HHRA	Human health risk assessment
hp	Horsepower

ACRONYMS AND ABBREVIATIONS (Continued)

HWIGS	Hazardous Waste Incineration Guidance Series
inwc	Inches water column
kVA	Kilovolt ampere
mL	Milliliter
MMT	Multi-metals train
N	Normality
NDIR	Nondispersive infrared
NFPA	National Fire Protection Agency
NPDES	National Pollutant Discharge Elimination System
P&ID	Piping and instrumentation diagram
PCB	Polychlorinated biphenyl
PCDD	Polychlorinated dibenzodioxin
PCDF	Polychlorinated dibenzofuran
PFD	Process flow diagrams
PIC	Product of incomplete combustion
PM	Particulate matter
POHC	Principal organic hazardous constituent
ppm_{dv}	Parts per million dry volume
psig	Pounds per square inch per gallon
QAPP	Quality assurance project plan
RCRA	Resource Conservation and Recovery Act
SCC	Secondary combustion chamber
T/R	Transformer and rectifier
TCL	Target compound list
TCLP	Toxicity characteristic leaching procedure
TCO	Total chromatographable organics
TDS	Total dissolved solids
TEQ	Toxicity-equivalent quality
TRV	Thermal relief vent

ACRONYMS AND ABBREVIATIONS (Continued)

TSCA	Toxic Substances Control Act
TSDF	Treatment, storage, and disposal facility
TSS	Total suspended solids
UPS	Uninterruptible power supply
VOA	Volatile organics analysis
VOST	Volatile organic sampling train
WESP	Wet electrostatic precipitator
WWTS	Wastewater treatment system

EXECUTIVE SUMMARY

This example trial burn plan is a guide for preparing the trial burn portion of a Resource Conservation and Recovery Act (RCRA) permit application. This example trial burn plan is for a new incinerator train that consists of a rotary kiln incinerator, a secondary combustion chamber (SCC), a boiler for energy recovery, and a wet air pollution control system (APCS). The rotary kiln will be fired with solid wastes and liquid wastes. Liquid wastes will be also fired in the SCC.

This example plan is intended to be generic from the standpoint that it can be modified to meet the requirements of a particular system that differs in configuration or regulatory status from the example rotary kiln incineration (such as an interim status boiler undergoing initial permitting or an existing incinerator undergoing permit renewal). Specifically, portions of the plan that are not applicable may be excluded, or the existing text may be modified to meet the unique requirements of a particular unit. For example, a boiler using a liquid organic hazardous waste stream as fuel followed by a dry APCS (with a spray dryer, partial quench, and baghouse), the sections relative to the rotary kiln can be excluded, the sections on the SCC can be modified to reflect the combustion chamber portion of the boiler, the sections on solid and sludge waste and aqueous waste can be excluded, and the APCS description can be modified accordingly. The sampling and analytical protocols can be similarly modified to exclude or include parameters specific to the performance objectives, the unit being tested, or the waste streams being treated.

This example plan consolidates, into a single testing program, the traditional RCRA trial burn elements (for example, two test conditions follow: (1) maximum metals feed rates at high temperature, and (2) maximum organic waste feed rate at low temperature to demonstrate destruction and removal efficiency [DRE]) with those for more contemporary risk burns performed under either worst-case or normal operating conditions. This plan outlines a test program in which the risk burn is performed under normal operating conditions. As such, it includes three test conditions: (1) high-temperature metals burn, (2) low-temperature DRE burn, and (3) normal operating condition risk burn.

[*NOTE TO USER: The risk burn may be performed under normal operating conditions only if the facility burns wastes that have little temporal variation in chemical and physical properties, at nearly constant rates, under operating conditions that do not fluctuate widely. Facilities that do not meet these criteria, including most commercial hazardous waste combustion facilities and captive facilities that burn highly variable wastes, must perform the risk burn under worst-case conditions.*]

This example plan contains generic language and, through the use of bracketed text, identifies necessary user-specific text. Guidance is provided throughout this example trial burn plan to aid in making the unit-specific modifications. This guidance appears in brackets and italics as [*NOTE TO USER:* ....].

This example plan has been organized generally in accordance with the format recommended by the U.S. Environmental Protection Agency (EPA) for a trial burn plan submitted with the RCRA Part B permit application (EPA 1983). Some modifications to the format have been made to accommodate newer permitting guidance. To facilitate the review of this example trial burn plan, independent of the balance of the permit application, the format also includes a detailed introduction, which provides an overview of the boiler or incinerator facility and the proposed trial burn program.

INTRODUCTION

[*NOTE TO USER: To orient the reviewer and thereby facilitate the overall review of the trial burn plan, the inclusion of an introduction is recommended; it should be located at the beginning of the trial burn plan. The introduction should provide for the reviewer a brief and condensed overview of the entire plan and should include the following information:*

- *Facility identification*
- *Reasons for the trial burn plan submission (such as new application, permit modification, or permit renewal)*
- *Organization of the trial burn plan*
- *General process description of the unit*
- *Description of the wastes to be treated in the unit*
- *Overview of the test program, including descriptions of metals, destruction and removal efficiency (DRE), and risk burn test conditions*
- *Performance objectives to be demonstrated*
- *Sampling and analytical program to support demonstration of the performance objectives*
- *Approach to establishing the final permit limits*]

[*Enter Company Name (Enter Company Acronym)*] requests a Resource Conservation and Recovery Act (RCRA) permit for the rotary kiln incineration system to be located at [*Enter Facility Location*]. This trial burn plan is submitted as Section D-5 of the RCRA Part B permit application for a new rotary kiln hazardous waste incineration system, hazardous waste storage tanks, and hazardous waste container storage areas. This trial burn plan has been written following a format suggested in U.S. Environmental Protection Agency (EPA) completeness checklists. EPA regulatory citations are given, as appropriate, throughout the trial burn plan.

TRIAL BURN PLAN ORGANIZATION

This trial burn plan is a stand-alone document. The quality assurance project plan (QAPP) is provided in Appendix D-5.1.

The balance of this introduction provides an overview of the trial burn plan, including, among other information, the following:

- Process descriptions

- Waste feed descriptions
- Trial burn objectives
- Trial burn approach
- Trial burn program
- Trial burn protocol
- Expected final permit conditions resulting from the trial burn

All figures and tables referenced in the text of this plan are presented in Attachments A and B, respectively. Appendices follow the attachments. The first figure is Figure D-5.1; the first table is Table D-5.1, and the first appendix is Appendix D-5.1.

Following the introduction, the trial burn plan adheres to the EPA-recommended format for trial burn plans submitted as part of the RCRA Part B permit application.

[*NOTE TO USER: The trial burn plan is suggested as a stand alone document because this portion of the permit application typically undergoes at least one revision before it is finalized.*]

WASTE TREATMENT SYSTEM PROCESS AND FEED DESCRIPTIONS

[*REQUIREMENT: Provide a summary engineering description that encompasses the entire treatment, storage, and disposal facility (TSDF), as follows: (1) waste blending and storage operations, (2) combustion process, (3) heat recovery system, (4) APCS equipment, and (5) combustion and air pollution control residues (such as ash or blowdown) treatment. In describing these elements of the TSDF, indicate their design bases (such as codes, capacities, temperatures, or pressures) and the normal ranges of operating conditions*.]

[*NOTE TO USER: The following process description is provided as an example only.*]

The rotary kiln incinerator facility consists of five primary process areas: (1) waste blending and storage, (2) incineration system, (3) heat recovery boiler, (4) APCS, and (5) ash handling system. The facility site plan showing the locations of these areas is shown on Figure D-5.1.

This trial burn plan covers only the incineration, energy recovery, and APCSs. The descriptions of the waste blending and storage and ash handling systems contained herein are provided only to facilitate an understanding of their configuration relative to the balance of the waste treatment system. More details on the waste storage and ash handling areas are provided in the permit application Sections D-1, Containers, and D-2, Tank Systems.

The incineration process includes a rotary kiln with a secondary combustion chamber (SCC). The heat recovery boiler is a radiant/convective unit. The APCS is a high-energy, venturi-type, scrubber system with a wet electrostatic precipitator (WESP).

The basic flow of materials through the TSDF is illustrated on Figure D-5.2. Descriptions of the discrete TSDF components follow.

Waste Blending and Storage

All of the liquid hazardous wastes burned in the incinerator will be generated in on-site processes. These liquids will be hard-piped from the generating processes to the hazardous waste tank farm. Storage of the wastes will take place in four 50,000-gallon vertical stainless steel tanks that will be constructed to the standards of American Society of Mechanical Engineers (ASME) Section VIII and American Petroleum Institute (API) codes.

When each tank is filled, its inlet lines will be sealed by a valve, tagged, and locked. Samples of the liquid will be collected and analyzed for conformance to the incinerator waste acceptance criteria (see Table D-5.1). Once certified as acceptable for burning in the incinerator, the tank will be released to incinerator operations for feeding to the kiln. Periodically, the contents of several tanks may be blended. Refer to Section D-2 of the permit application for more details on the storage and blending of wastes in the tanks.

Combustion Process

The kiln will be a Model No. [*Enter Model Number*] unit built by [*Enter Manufacturer Name*] in [*Enter Year*]. The rotary kiln will be [*Enter Dimension*] feet long and [*Enter Dimension*] feet wide with a slope of [*Enter Slope*] feet per feet and will be refractory lined. It will be rated for a maximum heat release of [*Enter Rating*] million British thermal units (Btu) per hour and a solids processing rate of [*Enter Solids Capacity*] tons per hour. A simplified block flow diagram of the rotary kiln combustion process is provided on Figure D-5.3.

As shown on Figure D-5.4, the combustion fuels (waste liquids and natural gas) will be fed with combustion air into the hot end of the kiln through the burner system. The fuel mixture will be burned, producing flame temperatures between [*Enter Low Temperature*] and [*Enter High Temperature*] °F.

The induced draft fan will provide motive force to transport the combustion gas toward the cold end of the kiln where it will exit at temperatures between [*Enter Low Temperature*] and [*Enter High Temperature*] °F. The combustion gas flow rate typically will range from [*Enter Low Flow Rate*] to [*Enter High Flow Rate*] actual cubic feet per minute (acfm).

Combustion gas exiting the rotary kiln will be treated thermally in the SCC. The SCC will provide high temperature, residence time, and turbulent mixing for thermal destruction of any organic constituents that may be present in the combustion gas from the rotary kiln. The SCC will be a vertical, cylindrical, refractory-lined afterburner that will be fired with waste liquids and natural gas. It will be rated for a maximum heat release of [*Enter Heat Release Rating*] million Btus per hour. Its design combustion gas flow rate, operating temperature, and combustion gas residence time will be [*Enter Flow Rate*], [*Enter Temperature*], and [*Enter Residence Time*], respectively. Under normal operations, combustion gas flow rates will range from [*Enter Low Flow*] to [*Enter High Flow*] acfm; the SCC temperature will range from [*Enter Low Temperature*] to *[Enter High Temperature*] °F; the combustion gas residence time in the SCC will range from [*Enter Low Residence Time*] to [*Enter High Residence Time*].

The solids will travel through the rotary kiln in the opposite direction (counter-current) from the combustion gas flow. The solids will be conveyed into the rotary kiln through an enclosed auger-shredder feed chute from the feed hopper. Under normal operations, the solids feed rate into the kiln ranges from [*Enter Low Feed Rate*] to [*Enter High Feed Rate*]. The ash will gravity discharge to an enclosed rolloff container. Ash production rates corresponding to the range of solids feed rates discussed above will vary from [*Enter Low Ash Rate*] to [*Enter High Ash Rate*].

Heat Recovery System

Combustion gas exiting the SCC will pass through a waste heat recovery boiler. The waste heat recovery boiler will be a Model No. [*Enter Model Number*] unit built by [*Enter Manufacturer Name*] in [*Enter Year*]. The waste heat recovery boiler has approximate dimensions of [*Enter Dimensions*]. It will be rated for [*Enter Production Rate*] pounds of steam per hour at a pressure of [*Enter Pressure*] pounds per square inch, gauge (psig).

Under normal operating conditions, the waste heat recovery boiler will produce [*Enter Production Rate*] pounds per hour of [*Enter Pressure*] psig steam. Combustion gases normally enter the unit at [*Enter Entrance Temperature*] °F and exit at [*Enter Exit Temperature*] °F.

Air Pollution Control System

The APCS will be designed to remove acid gases, particulate matter, and metals from the combustion gas prior to discharge to the atmosphere. The APCS has three major components: quench, high-energy venturi scrubber, and WESP.

In the quench, the heat recovery boiler or SCC combustion gas will be cooled adiabatically by saturating water sprays. The quench column will be an upflow design with a diameter of [*Enter Diameter*] and a height of [*Enter Height*]. The column will be packed with [*Enter Packing Material*]. Under normal operating conditions, a liquid to gas ratio of [*Enter Number*] gallons per minute (gpm) to [*Enter Number*] cubic feet per minute (cfm) will be maintained. The quench will be designed for a maximum inlet temperature of [*Enter Design Inlet Temperature*] and a maximum outlet temperature [*Enter Design Outlet Temperature*] °F. Typical gas inlet and exit temperatures will be [*Enter Entrance Temperature*] and [*Enter Exit Temperature*] °F, respectively.

From the quench, saturated combustion gas will pass through the high-energy venturi scrubber where high-pressure water sprays will create small droplets for efficient capture of small particulate. Under normal operating conditions, a pressure drop of [*Enter Pressure Drop*] inches of water column will be maintained across the venturi scrubber. The final portion of the high-energy venturi scrubber will be the vane separator. The vane separator will contain multiple flat surface areas, or vanes, that will be rinsed continuously with fresh water. The vanes provide a surface for water-droplet-entrained particulate to collect.

Combustion gas exiting the vane separator will be ducted to the WESP, which will be used to remove sub-micron particulate matter. Clean combustion gas from the WESP passes through the induced draft fan. The combustion gas will then be vented to the atmosphere through the stack.

An induced draft fan will be the combustion gas prime mover. The incineration system, boiler, and APCS units will be interconnected and sealed (infiltration air-controlled) chambers. The induced draft fan will maintain the combustion chambers and each unit of the APCS at less than atmospheric pressure to facilitate the control of fugitive emissions. The high-pressure point in the system, the rotary kiln, will be maintained typically at [*Enter Vacuum Level*] inches of water column vacuum.

[*NOTE TO USER: In the case of boilers and thermal oxidizers (liquid waste incinerators), the combustion zone and possibly the APCS may be operated with combustion chambers and APCSs greater than atmospheric (positive) pressure.*]

Ash Handling System

The incinerator normally produces [*Enter Production*] pounds of ash per [*Enter Time*]. The typical ash composition will be as follows: [*Metal Oxide A at 12 Weight Percent*], [*Metal Oxide B at 10 Weight Percent*], and [*Metal Oxide C at 8 Weight Percent*]. The ash will be both a characteristic and a listed hazardous waste that will be assigned EPA waste codes [*Enter Waste Code*], [*Enter Waste Code*], and [*Enter Waste Code*].

The ash will be stabilized with Portland cement in the ash handling area prior to final disposal at an off-site hazardous waste landfill. Refer to Sections D-1 and D-2 of the permit application for more details on the ash handling system.

Blowdown Treatment

The wet scrubber system typically will produce [*Enter Production Rate*] gpm of blowdown, which will be treated in the on-site wastewater treatment system (WWTS) prior to discharge through the facility’s National Pollution Discharge Elimination System (NPDES) outfall. The blowdown normally will have a pH of [*Enter pH*]. Total dissolved solids (TDS) and total suspended solids (TSS) will be [*Enter TDS*] and [*Enter TSS*], respectively.

Section D-5b(1)(a) provides a more detailed engineering description of [*Enter Company Acronym*]'s rotary kiln incineration system. Appendix D-5.2 contains the process flow diagrams (PFD) and piping and instrumentation diagrams (P&ID). A general arrangement drawing for the rotary kiln incinerator system process unit can also be found in Appendix D-5.2. Manufacturers’ specifications for the rotary kiln incinerator system components are included in Appendix D-5.3.

WASTES TO BE TREATED

[*REQUIREMENT: Provide a general description of the waste to be treated by the combustion system. Describe the processes that generate the waste and the quantities of the various wastes that are burned each year. Specify the waste codes, main constituents, and constituent concentrations of each waste. Detailed and complete waste characterization data must be presented (list of chemical constituents and their concentrations, heat value, chlorine content, density, viscosity, vapor pressure, percent solids, ash content, and other parameters). To justify the principal organic hazardous constituents (POHC) selection, identify the Appendix VIII constituents of and their nominal concentrations in the waste. The following waste description is provided as an* *example only. A general background on the wastes to be treated and their origin allows the permit writer to understand the selection of the trial burn objectives that coincide with facility operational requirements*.]

[*Enter Company Acronym*] produces a variety of specialty chemicals used by numerous industries, including pharmaceuticals and other health products. The wastes produced by [*Enter Company Acronym*] include high-Btu organic solvents, like methanol, ethanol, and toluene; low-Btu aqueous solutions containing low-level concentrations of solvents or products and filter media wetted with these solvents and water; and contaminated packaging materials. These wastes, sludges from the facility WWTS, and sludges removed during storage tank and process vessel cleaning operations will be burned in the rotary kiln.

Most of [*Enter Company Acronym*]'s wastes will be RCRA-listed or characteristic wastes containing constituents listed in 40 Code of Federal Regulation (CFR) 261 Appendix VIII. [*Enter Company Acronym*] does not produce or handle any products containing polychlorinated biphenyls (PCB) that would be regulated under Toxic Substance Control Act (TSCA). [*Enter Company Acronym*] does not generate any waste materials that are designated as F020, F021, F022, F023, F026, or F027 wastes (dioxin waste codes).

The acceptance criteria for wastes to be burned in the incineration system are summarized in Table D-5.1. [*Enter Number of Waste Streams*] different waste streams will be burned in the incinerator. The wastes that will be burned in the incinerator will be generated in batches. The composition of batches do not vary significantly. However, these wastes will be blended prior to burning to produce three distinct waste feed streams: high-Btu liquids, low-Btu liquids, and solids. Descriptions, including waste codes and annual quantities burned, of these waste streams are provided in Table D-5.2. Refer to Section C, Waste Characteristics, of the permit application for additional information on the "as-generated" wastes.

[*Enter Company Acronym*] has explored and continues to look for additional ways to recover and reuse as much of its wastes as is practicable, especially the solvent wastes. The wastes intended to be burned in the incinerator cannot be reused by [*Enter Company Acronym*], will not be marketable, or will not be economically recoverable. [*Enter Company Acronym*] currently disposes of hazardous wastes at an off-site commercial TSDF, at considerable cost. The proposed unit will provide [*Enter Company Acronym*] with a more economically competitive method of disposal with the additional benefit of providing supplemental steam for facility use.

[*Enter Company Acronym*] intends to process the feed streams described above as follows:

- The solid wastes will be burned in the rotary kiln.
- The high-Btu solvents will be atomized by steam through the dual fuel burners (natural gas and waste liquids) and burned as fuels in the kiln and the SCC.
- The low-Btu liquid wastes will be atomized through waste nozzles by high-pressure air into the rotary kiln and SCC.

All combustion residues (such as ash and scrubber blowdown) will be handled as if they are derived from RCRA wastes.

TRIAL BURN OBJECTIVES

[*REQUIREMENT: Specify the trial burn objectives, including objectives dictated by 40 CFR 264, 266, and 761, as necessary, and those dictated by EPA (1998a and 1998b) for completing human health and ecological risk assessments*.]

[*NOTE TO USER: The following list of trial burn objectives is provided as an example only and reflects a very wide spectrum of requirements. The objectives for your trial burn may require modification to address the state and EPA region-specific requirements, especially those related to dispersion and deposition modeling and to human health and ecological risk assessments.*]

The objectives for the [*Enter Company Acronym*] trial burn are as follows:

- Demonstrate 99.99 percent DRE of the designated POHC chlorobenzene and carbon tetrachloride.
- Demonstrate adequate control of fugitive emissions.
- Demonstrate control of carbon monoxide emissions to less than 100 parts per million dry volume (ppm_{dv}), corrected to 7 percent oxygen, on a 60-minute rolling average basis.
- Demonstrate control of particulate emissions to less than 0.08 grains per dry standard cubic foot (gr/dscf) corrected to 7 percent oxygen.
- Measure the particle size of emitted particulate matter to facilitate site-specific air dispersion modeling.
- Demonstrate maximum chlorine feed rate, and show that subsequent hydrogen chloride and chlorine emissions total no greater than the larger of 4 pounds per hour or 1 percent of their potential mass emissions prior to entering the APCS and that the resulting emissions comply with 40 CFR 266 Tier III standards.
- Demonstrate that the emissions of the following metals are controlled to meet the 40 CFR 266 Tier III standards at their trial burn feed rates: arsenic, beryllium, cadmium, and hexavalent chromium.
- Demonstrate that the feed rates of the following metals meet the 40 CFR 266 Adjusted Tier I feed rate standards: antimony, barium, lead, mercury, selenium, silver, and thallium.
- Provide data regarding the emissions of metals, polychlorinated dibenzodioxins and polychlorinated dibenzodifurans (PCDD and PCDF), and other products of incomplete combustion (PIC) for use in performing site-specific human health and ecological risk assessments.

- Establish limitations on waste feed characteristics and process operating conditions in order to ensure compliance with performance standards and risk-based emission limits.

[*NOTE TO USER: The trial burn objectives for all units will include an assessment of DRE, carbon monoxide, particulate, hydrogen chloride and chlorine, and metals to comply with the requirements of 40 CFR 264 Subpart O and 40 CFR 266 Subpart H. Measurement of PIC emissions, including PCDDs and PCDFs, will be required to conduct site-specific air dispersion modeling and human health risk assessment (HHRA). Determination of particle-size distribution will be required to conduct site-specific air dispersion modeling and to develop emission rates of contaminants of potential concern. A preliminary site-specific dispersion model and an HHRA based on assumed (or previously measured) stack parameters and emissions will be used to identify the potential sampling and analytical requirements for hydrogen chloride and chlorine, metals, and PICs. Consult with your state regulatory agency and EPA regional office, and obtain approval of your protocols before beginning any dispersion modeling or risk assessment work.*]

TRIAL BURN APPROACH

[*REQUIREMENT: Specify which of the basic permitting approaches (such as Tier I, II, or III for metals and chlorine in the metals and DRE burns, worst-case or normal-case for the risk burn, and single- or multiple-point approach) are being pursued. If an alternative approach is being used, provide a detailed description. Cite any published guidance or literature upon which the permitting approach has been grounded.*]

[*NOTE TO USER: Three basic approaches are available to establish the operating limits outlined in Chapter 3 of Guidance on Setting Permit Conditions and Reporting Trial Burn Results (EPA 1989):*

- *Single waste/single operating condition—single-point approach*
- *Multiple wastes/multiple operating conditions—multiple-point approach*
- *Multiple wastes/single operating condition—universal approach*

The user is advised to review this EPA guidance on the various approaches and consider the approach that best suits the particular unit and waste stream(s). The third approach is the most commonly used approach because it provides the most flexibility to the operator; the operator can treat a variety of wastes under a single set of operating conditions established on the basis of trial burn results. The first approach is most applicable to a unit treating only a single waste stream of consistent character. The second approach may be advisable if the various wastes being treated exhibit extreme variations in the character or quantity.]

The proposed trial burn testing program is based upon the universal approach outlined in *Guidance on Setting Permit Conditions and Reporting Trial Burn Results* (EPA 1989). The universal approach establishes one set of permit conditions or limits applicable to all modes of operation. This approach, as proposed in the following section, will allow [*Enter Company Acronym*] to treat the variety of wastes produced by the [*Enter Company Acronym*] facility by confining the incinerator's operation to a well-defined set of operating limits or an operating envelope.

Maximum waste feed rates for each stream will be specified in the permit. The incinerator operator will thus have the flexibility to deal with a variety of wastes and waste combinations, while controlling the overall combustion process within specific limits (including temperature, combustion gas velocity, and thermal duty) that preclude maximizing the feed rates of all waste streams simultaneously.

PROPOSED TRIAL BURN PROGRAM

[*REQUIREMENT: Describe the trial burn program and the information to be collected during each test run under each test condition. If waste spiking is planned, describe the composition and quantities of spiking compounds that will be used. Also describe the methods that will be used either to inject the spiking compounds directly into the incinerator or to blend the spiking compounds with the waste feeds. Correlate the information collected under each test condition to the trial burn objectives (specifically, provide the linkage between test design and test objectives).*]

The proposed trial burn testing program consists of three separate tests; each includes three replicate runs. The rotary kiln and SCC operate during all three tests, incinerating a combination of liquid and solid wastes. Tests 1 and 2 involve stack emission sampling at extremes of incineration operating temperatures and waste feed rates in order to demonstrate compliance with the RCRA performance standards for DRE, metals, particulate matter, carbon monoxide, hydrogen chloride, and chlorine emissions. Test 3 involves stack sampling at normal incineration process operating conditions to characterize stack emissions to develop data for use in multi-pathway direct and indirect human health and ecological risk assessments.

[*Enter Company Acronym*] intends to establish final permit limits based on adjusted Tier I values for eight boiler and industrial furnace (BIF) metals (antimony, barium, lead, mercury, nickel, selenium, silver, and thallium) and on Tier III values for four carcinogenic BIF metals (arsenic, beryllium, cadmium, and chromium) and for hydrogen chloride and chlorine.

The target operating conditions for Tests 1, 2, and 3 are summarized in Table D-5.3 and outlined below. The compositions and feed rates of the waste materials to be burned during the three tests are described in Appendix D-5.4.

Test 1—High-Temperature Metals Burn

Test 1 will be a high-temperature test designed to establish permit conditions for maximum hourly rolling average temperatures for the kiln and SCC and maximum hourly rolling average feed rate limits for metals. Test 1 will be designed to demonstrate worst-case metals partitioning from the solid waste feed to the combustion gas stream.

During Test 1, the following operating conditions will be maintained:

- Maximum combustion chamber temperatures (kiln and SCC)

- Maximum metals feed rates

- Maximum chlorine feed rates

- Worst-case APCS operations (specifically, minimum venturi differential pressure, minimum venturi and WESP recycle flow rates, minimum scrubber liquid pH, and minimum WESP kilovolt amperes [kVa]).

Metals partitioning to the off-gas is a function of combustion chamber temperature and chlorine concentration in the waste feed. In combination with the maximum metals feed rates, these operating conditions present a maximum metals loading challenge to the APCS. The minimum differential pressure, recycle flow rates, and pH operating conditions test the APCS's capabilities under conditions least favorable for removing metals from the combustion gas.

Under Test 1, the solid and liquid wastes will be spiked with an organic chlorine compound (perchloroethylene liquid) and organometallic liquid compounds of the four carcinogenic metals. These compounds will be procured in sealed 55-gallon drums and will be metered into the solid and liquid wastes directly from the drums using chemical feed pumps and injection manifolds. Injection points for the solid waste will be located within the solid feed chute just upstream from its transition into the rotary kiln. The injection points for the liquid waste will be in the feed lines just upstream from the waste injection nozzles.

Test 2—Low-Temperature DRE Burn

Test 2 will be a test of low combustion chamber temperatures and high mass feed rates to demonstrate DREs of designated POHCs. Test 2 will demonstrate the permit limits for maximum hourly rolling average waste feed rates and minimum combustion operating temperatures. POHCs and organic chlorine will be metered to the solid waste feed and the liquid waste feed line(s) during Test 2, in the same manner as described above for metals and organic chlorine.

The Test 2 operating conditions are designed to demonstrate worst-case operation of the rotary kiln incineration system by testing its performance under the following conditions simultaneously:

- Minimum combustion chamber temperatures

- Maximum combustion gas velocity

- Maximum waste feed rates

- Maximum chlorine feed rates

- Minimum differential pressure, recycle flow rates, pH, and kVA in the APCS

Destruction of organics is a function of time, temperature, and turbulence, so the minimum combustion chamber temperatures and maximum combustion gas velocity conditions of Test 2 challenge the capability of the rotary kiln incineration system to destroy organics under conditions least favorable for organics destruction (minimum time at minimum temperature). The maximum feed rate presents the maximum challenge for the waste feed systems to deliver waste feeds and the ash handling system to collect ash residues. The maximum waste feed rates, in conjunction with maximum combustion gas velocity, also present a maximum particulate loading challenge to the APCS. The maximum chlorine feed rates present the maximum challenge for the rotary kiln incineration system's APCS to remove hydrogen chloride from the combustion gas. The minimum differential pressure, recycle flow rates, and pH operating conditions test the APCS's capabilities under conditions least favorable for removing particulate and acid gases from the combustion gas.

Test 3—Risk Burn

Test 3 will be a test of normal operating conditions in order to develop data for the multi-pathway risk assessment. During Test 3, measurements of stack emissions of particulate, particle-size distribution, hydrogen chloride, chlorine, and PICs, including PCDDs and PCDFs, will be made while the incineration system is operated at normal conditions.

[*NOTE TO USER: The volatilization of metals from the solid wastes is a function of the temperature and the presence of halogenated compounds that produce acid gases when combusted and aid in the volatilization of the metals. A high-temperature test for assessing potential metals emissions from solid wastes is counter to the establishment of minimum temperature limits for the destruction and removal of of organics. Hence, the reason for the first two tests in this example trial burn plan: one to demonstrate maximum potential metals emissions and one to demonstrate DRE. The third test involving either normal or worst-case operating conditions is needed to develop data for risk assessment. This example uses normal operating conditions because the facility is a captive waste burner with waste feed streams that are not highly variable in chemical composition. Waste burners that have highly variable waste feed streams, especially commercial hazardous waste combustion facilities, are not eligible for testing under normal operating conditions and must test under worst-case conditions. In general, risk burn testing under worst-case conditions will yield the most conservative risk assessment results and corollary risk-based permit conditions. Many facilities that perform risk burn tests under worst-case conditions will combine the DRE and risk burns into a single test.*]

TRIAL BURN SAMPLING AND ANALYTICAL PROTOCOLS

The proposed trial burn sampling and analysis program is summarized in Table D-5.4. Sample locations are shown on Figure D-5.4. Detailed sampling procedures are provided in the QAPP (see Appendix D-5.1). The structure of this trial burn testing program is based on the previously stated trial burn objectives.

During Test 1, the waste feeds will be spiked with controlled amounts of metals and organic chlorine source chemicals. During Test 1, the stack will be sampled using the following methods:

- Metals using the multi-metals train (MMT) (MMT 40 CFR 266 Appendix IX, and SW-846 Method 0060) (see Figure D-5.5)

- Hexavalent chromium emissions using the hexavalent chromium sampling train (Method Cr^{+6}, 40 CFR 266 Appendix IX, and SW-846 Method 0061) (see Figure D-5.6)

- Hydrogen chloride, chlorine, and particulate emissions using the Method 0050 sampling train (Method 0050, 40 CFR 266 Appendix IX and SW-846) (see Figure D-5.7)

DRE and maximum mass feed rates will be demonstrated during Test 2. The waste feeds will be spiked with controlled amounts of the designated POHCs and organic chlorine source chemicals. The stack will be sampled as follows:

- Hydrogen chloride, chlorine, and particulate emissions will be sampled using the Method 0050 sampling train (see Figure D-5.7).

- Volatile organics, including the POHCs chlorobenzene and carbon tetrachloride, will be sampled using the volatile organic sampling train (VOST) (SW-846, Method 0031). An illustration of the VOST is provided on Figure D-5.8.

- The semivolatile POHC naphthalene will be sampled using the Modified Method 5 train (SW-846 Method 0010, see Figure D-5.10).

During Test 3, emissions of hydrogen chloride and chlorine, particulate, metals, PCDDs and PCDFs, and other PICs will be measured. Particle-size distribution also will be measured. The stack will be sampled as follows:

- Hydrogen chloride, chlorine, and particulate emissions will be sampled using the Method 0050 sampling train (see Figure D-5.7).

- Particle-size distribution will be measured using a [*Enter Type*] cascade impactor.

- Volatile organics will be sampled using two trains: (1) the volatile organic sampling train (VOST) (SW-846, Method 0031), and (2) the Tedlar™ bag sampling train (SW-846 Method 0040). The VOST will be used to speciate volatile PICs in stack emissions. The SW-0040 bag samples will be collected for on-site gas chromatograph (GC) analysis of the low-molecular-weight PICs, with an emphasis on quantification of methane, ethane, propane, butane, pentane, hexane, and heptane. Illustrations of the VOST and Method 0040 sampling train are provided on Figures D-5.8 and D-5.9, respectively.

- Semivolatile organics will be sampled using three variations (A, B, and C) of the Modified Method 5 (MM5) train (MM5, SW-846 Method 0010) (see Figure D-5.10). The MM5A train will be used to sample the stack emissions for speciated semivolatile PICs identifiable using SW-846 Method 8270 and for PCDDs and PCDFs identifiable by high-resolution gas chromatography and mass spectroscopy (GC/MS) SW-846 Method 8290. The MM5B train will be used to sample the stack emissions for unspeciated semivolatile and nonvolatile mass. The MM5C train will be used to sample the stack emissions for polynuclear aromatic hydrocarbons (PAH).

- Aldehyde and ketone PICs will be sampled using the Method 0011 sampling train (Method 0011, 40 CFR 266 Appendix IX and SW-846) (see Figure D-5.11).

FINAL PERMIT LIMITS

[*REQUIREMENT: Propose a methodology for establishing final permit conditions for the incinerator system based on the results of the trial burn test.*]

The anticipated permit operating conditions resulting from the trial burn testing are summarized in Table D-5.5, which includes the proposed basis for each permit condition. The process parameters are broken down by Group A, B, and C parameters, as established in the applicable EPA guidance documents. Permit conditions for Group A and B parameters will be established on the basis of trial burn results. Permit conditions for Group C parameters will be established on the basis of EPA guidance, process design and safety considerations, or equipment manufacturers' recommendations.

Group A parameters will be continuously monitored process parameters, which will be tied to automatic waste feed cutoffs (AWFCO). Group B parameters do not require continuous monitoring and will be not interlocked with the AWFCO system; however, detailed operating records will be maintained to demonstrate compliance with permitted operating conditions. Some Group C parameters will be continuously monitored and interlocked with the AWFCO system.

Group C parameters will be established independently of trial burn results. For the most part, their respective limits will be based on engineering considerations and good operating practices. For safety and system performance purposes, the quench tower exit temperature and the differential pressure between atomizing gas and waste feed will be monitored and recorded continuously and interlocked with the AWFCO system.

During the shakedown period, the AWFCO settings for Group A and interlocked Group C parameters will be those listed in Table D-5.6. During the trial burn, the interlocks for these Group A and C parameters will remain operational at the limits listed in Table D-5.6.

Group B parameters will be monitored and recorded continuously during the trial burn but will not be interlocked with the AWFCO system.

As indicated in Table D-5.5, [*Enter Company Acronym*] expects to establish final permitted operating limits for Group A and B parameters based on the results of Tests 1, 2, and 3. The following list highlights some of the limits that will be based on the results of Tests 1 and 2:

- The permit limit for maximum hourly rolling average rotary kiln combustion gas temperature will be the mean of the highest hourly rolling average combustion temperatures demonstrated during each of the three runs in Test 1, which will be the worst-case for metals emissions.

- The permit limit for maximum hourly rolling average SCC temperature will be the mean of the highest hourly rolling average SCC temperatures demonstrated during each of the three runs in Test 1.

- The permit limit for maximum hourly rolling average total metal feed rates will be the mean of the highest hourly rolling average metal feed rate recorded during each run of Test 1.

- The permit limit for maximum hourly rolling average metal feed rates for liquid wastes (pumpable wastes) will be the mean of the highest hourly rolling average liquid waste feed rate recorded during each run of Test 1.

- The permit limit for maximum hourly rolling average solid waste feed rate will be the mean of the highest hourly rolling average solid waste feed rate recorded during each run of Test 2.

- The permit limits for maximum hourly rolling average high-Btu and low-Btu liquid waste feed rates to the kiln and SCC will be the means of the respective highest hourly rolling average liquid waste feed rates recorded during each run of Test 2.

- The permit limit for minimum rotary kiln temperature will be the mean of the lowest hourly rolling average temperatures demonstrated during the three Test 2 runs.

- The permit limit for the minimum hourly rolling average SCC temperature will be the mean of the lowest hourly rolling average temperatures demonstrated during each run in Test 2.

- The permit limit for maximum hourly rolling average combustion gas velocity will be the mean of the highest hourly rolling average combustion gas velocities demonstrated during Test 2.

- The permit limit for maximum organic chlorine feed rate limit will be the average chlorine feed rate recorded in all runs under Tests 1 and 2.

- The permit limit for maximum liquid waste ash content limit (maximum ash mass feed rate for any combination of liquid wastes) will be the average ash feed rate recorded in the three runs under Test 1.

The following list identifies some of the risk-based permit limits expected to be established based on the results of Test 3:

- The permit limit for maximum annual average rotary kiln combustion gas temperature will be the mean of the highest hourly rolling average temperatures demonstrated during each of the three runs in Test 3.

- The permit limit for minimum annual average rotary kiln combustion gas temperature will be the mean of the lowest hourly rolling average temperatures demonstrated during each of the three runs in Test 3.

- The permit limit for maximum annual average SCC temperature will be the mean of the highest hourly rolling average SCC temperatures demonstrated during each of the three runs in Test 3.

- The permit limit for the minimum annual average SCC temperatures will be the mean of the lowest hourly rolling average SCC temperatures demonstrated during each of the three runs in Test 3.

- The permit limit for maximum annual average solid waste feed rate will be the mean of the highest hourly rolling average solid waste feed rate recorded during each run of Test 3.

- The permit limits for maximum hourly rolling average high-Btu and low-Btu liquid waste feed rates will be the means of the respective highest hourly rolling average liquid waste feed rates recorded during each run of Test 3.

- The permit limit for maximum annual average combustion gas velocity will be the mean of the highest hourly rolling average gas velocities demonstrated during each run of Test 3.

- The permit limit for maximum heat recovery boiler inlet temperature will be the mean of the highest hourly rolling average inlet temperatures recorded during each run of Test 3.

A detailed discussion of the protocol for establishing these and other final permit limits based on the results of the trial burn is provided in Section D-5d(2).

D-5 INCINERATORS [40 CFR 264.340 through 264.351, 270.19, and 270.62]

This section of the trial burn plan is Section D-5 of the RCRA Part B permit application. The information contained herein is intended to supersede all previous submittals of Section D-5. The format follows that recommended by EPA for permit applications.

D-5a JUSTIFICATION FOR EXEMPTION [40 CFR 270.19(a)]

[*NOTE TO USER: This section could be used by operators applying for an exemption based upon data submitted in lieu of a trial burn [40 CFR 270.19(c)], characteristic waste exemption [40 CFR 264.340(b)], low-risk waste exemption (40 CFR 266.109), or DRE exemption (40 CFR 266.110).*]

This section is not applicable. [*Enter Company Acronym*] is not seeking an exemption from any of the incinerator or trial burn requirements.

D-5b TRIAL BURN [40 CFR 270.19(b)]

The following sections provide an engineering description of the incineration system and describe the testing program to meet the performance requirements of the RCRA incinerator regulations and EPA guidance.

D-5b(1) TRIAL BURN PLAN [40 CFR 270.19(b)]

The following trial burn plan discusses the current engineering configuration of the [*Enter Company Acronym*] incineration system and outlines the proposed trial burn operating conditions, sampling and monitoring procedures, and analytical methods that will be used to establish operating parameters for inclusion in the final permit. As engineering changes encountered during construction, startup, and shakedown necessitate revisions to this trial burn plan, any such changes will be coordinated with EPA Region [*Enter EPA Region*] and the [*Enter State Agency Acronym*].

D-5b(1)(a) Detailed Engineering Description of the Incinerator [40 CFR 270.62(b)(2)(ii)]

The following sections provide a detailed engineering description of the incineration system. A complete set of PFDs, P&IDs, equipment arrangements, and process control logic diagrams is provided in Appendix D-5.2. Specifications for major system components are provided in Appendix D-5.3. The design bases for major components of the incinerator system are summarized in Table D-5.7. A simplified process flow diagram is provided on Figure D-5.3.

The incineration system's engineering drawings and specifications were prepared by [*Enter Architect-Engineer*]. Site preparations were performed by [*Enter Site Development Contractor*]. The general contractor for construction and equipment installation will be [*Enter Contractor's Name*]. Construction will begin [*Enter Date*] and is expected to be completed by [*Enter Date*]. Project turnover to [*Enter Company Name*] is expected to occur on [*Enter Date*].

The [*Enter Company Acronym*] incinerator system was custom fabricated according to [*Enter Fabrication Company Name*] Specification No. [*Enter Number*]. The certified-for-construction (CFC) engineering designs and specifications were prepared by [*Enter Process Design Contractor*]. The rotary kiln and SCC were fabricated by [*Enter Fabrication Company Name*], under Shop Order No. [*Enter Number*]. The heat recovery boiler was fabricated by [*Enter Fabrication Company Name*] under Shop Order No. [*Enter Number*]. The APCS was fabricated by [*Enter Fabrication Company Name*] under Shop Order No. [*Enter Number*].

D-5b(1)(a)(1) Description of Rotary Kiln and SCC [40 CFR 270.62(b)(2)(ii)(B) and (C)]

The primary combustion chamber will be rotary kiln model [*Enter Model Number*] designed by [*Enter Design Company Name*] (Drawing [*Enter Drawing Number*] in Appendix D-5.2). The rotary kiln dimensions will be [*Enter Dimension*] feet outside diameter by [*Enter Length*] long. The inside diameter will be [*Enter Dimension*]. The rotary kiln will be lined with [*Enter Thickness*] of refractory. Appendix D-5.3 provides data sheets for the castable refractories.

The rotary kiln will be a controlled air, direct-fired, countercurrent (fuel and air added at the high-temperature ash discharge end) unit. The kiln will be rated for a maximum heat release of [*Enter Maximum heat release*] million Btus per hour. Design maximum liquid and solid waste feed rates will be [*Enter Liquid Capacity*] and [*Enter Solids Capacity*], respectively.

High-Btu liquid wastes and natural gas will be fired through the rotary kiln burner to maintain the rotary kiln operating temperature and provide high-temperature oxidation. Solid and sludge wastes will be fed continuously from the auger-shredder through a feed chute into the rotary kiln. The ash from the rotary kiln will be discharged to an enclosed rolloff container through a discharge chute below the burner housing. Low-Btu (aqueous) wastes will be atomized into the rotary kiln combustion gas via a nozzle at the burner end of the rotary kiln.

Solids residence time will vary from [*Enter Residence Time Range*] minutes. Typical solids retention time will be [*Enter Retention Time*] minutes. Solids retention time in the rotary kiln is inversely proportional to the rotary kiln rotational speed. Solids retention time can be calculated from the following equation:

$$t = 2.28\ L/DSN$$

where

t = mean retention time, minutes
L = rotary kiln length, feet
D = rotary kiln internal diameter, feet
S = rotary kiln slope, inch per feet
N = rotational speed, revolutions per minute

The installed slope of the rotary kiln will be [*Enter Slope*] inches per foot. If the rotary kiln is rotated at [*Enter Rotation Rate*] revolutions per minute (rpm), the solids retention time will be [*Enter Residence Time*] minutes. The expected range of rotation speeds will be [*Enter Range*] rpm.

The effective gas volume of the rotary kiln combustion chamber will be [*Enter Volume*]. The expected range of combustion gas flow rates will be [*Enter Range*] acfm. The expected combustion gas residence time in the rotary kiln, calculated according to the following equation, will be [*Enter Residence Time*] seconds:

([*Enter Kiln Volume*] ft^3/[*Enter Expected Flow Rate*] acfm)*60 sec/min = [*Enter Residence Time*] sec

where
ft^3 = cubic feet
acfm = actual cubic feet per minute
sec/min = seconds per minute
sec = seconds

Combustion gases will be discharged from the rotary kiln through a ventilation-duct into the SCC at a temperature between [*Enter Low Temperature*] and [*Enter High Temperature*] °F.

The SCC (Drawing [*Enter Drawing Number*] in Appendix D-5.2) will consist of a steel cylindrical shell lined with refractory material. The SCC will be rated for a maximum heat release of [*Enter Maximum Heat Release*]. Its design capacity for liquid waste injection will be [*Enter Liquids Capacity*]. The burner section of the SCC will be a specially designed combustion chamber that completes the combustion of the gas from the rotary kiln by firing natural gas and high-Btu liquid wastes. Low-Btu (aqueous) wastes will be atomized into the SCC combustion gas via a nozzle in the burner section of the SCC. Combustion gases will be heated in the SCC to temperatures between [*Enter Low Temperature*] and [*Enter High Temperature*] °F.

The SCC has an inside diameter of [*Enter Inside Diameter*] feet and an inside height of [*Enter Height*] feet. The SCC will be lined with about [*Enter Thickness*] inches of high-temperature, acid-resistant, insulating refractory material (refer to data sheets in Appendix D-5.3). The burner section will compose the lower [*Enter Length*] feet of the SCC, followed by a [*Enter Length*]-foot-long combustion section and a [*Enter Length*]-foot-long cross-over duct from the top. The thermal relief vent (TRV) will be situated at the top of the SCC.

The total volume of the SCC combustion section will be about [*Enter Volume*] cubic feet. When the refractory-lined cross-over duct is included, the overall volume will be about [*Enter Volume*] cubic feet (Refer to Drawing [*Enter Drawing Number*] in Appendix D-5.2). The SCC volume will provide a [*Enter Residence Time*] retention time at a gas flow rate of [*Enter Volumetric Flow Rate*] acfm, as demonstrated by the following equation:

([*Enter SCC Volume*] ft^3/[*Enter Volumetric Flow*] ft^3/min)*60 sec/min = [*Enter Residence Time*] sec

where
ft^3 = cubic feet
ft^3/min = cubic feet per minute
sec/min = seconds per minute
sec = seconds

If the volume of the cross-over duct is included, the gas residence time increases to [*Enter Residence Time*] seconds, as demonstrated by the following equation:

([*Enter Volume*] ft^3/[*Enter Volumetric Flow*] ft^3/min)*60 sec/min = [*Enter Residence Time*] sec

where

ft^3 = cubic feet
ft^3/min = cubic feet per minute
sec/min = seconds per minute
sec = seconds

The typical SCC combustion gas flow rate is expected to be [*Enter Volumetric Flow*] acfm, and the maximum flow is expected to be [*Enter Volumetric Flow*] acfm (trial burn heat and material balance). The SCC combustion gas retention times for these flow rates will be [*Enter Residence Time*] and [*Enter Residence Time*] seconds, respectively.

To provide for safe handling of wastes that will be present in the rotary kiln during a malfunction or emergency condition, the SCC will be equipped with a TRV. The TRV will be a safety system designed to provide a safe and controlled means of emergency venting combustion gas to bring about a controlled shutdown of the incineration system. If an event, such as a power failure, were to occur, all waste feeds to the rotary kiln and SCC will be discontinued. However, the combustion gas rising from the residual solid and sludge wastes in the rotary kiln must be vented. The rotary kiln combustion gas will be diverted through the SCC and TRV to the atmosphere. The TRV will remain open as long as solid and sludge wastes are present in the rotary kiln. The TRV will be closed after the cause that initiated TRV has been corrected or when all solid and sludge residuals have been processed through the rotary kiln and the rotary kiln is shutdown. TRV operation is discussed in more detail in Appendix D-5.6.

D-5b(1)(a)(2) Nozzle and Burner Design [40 CFR 270.62(b)(2)(ii)(H)]

Nozzle and burner systems will be located in both the rotary kiln and the SCC. The rotary kiln will be equipped with a single dual-fuel burner. The SCC will be equipped with two dual-fuel burners (startup and main). Manufacturer's specifications for the rotary kiln burner and the two SCC burners have been included in Appendix D-5.3. Drawings showing the locations of the waste burners in the kiln faceplate and the SCC are included in Appendix D-5.2 as Drawings [*Enter Drawing Numbers*].

The rotary kiln burner will be a [*Enter Manufacturer Name and Model Number*] dual-fuel air burner (or equivalent) rated at [*Enter Btu Rating*] million Btu per hour. It will be designed to burn either natural gas or liquids with a minimum heat value of [*Enter Minimum Heat Value*] and viscosities less than [*Enter Maximum Viscosity*]. The burner will have a continuous gas pilot with a capacity of [*Enter Btu Rating*] million Btu per hour. The maximum turn-down ratio of the burner will be [*Enter Maximum Turn-Down Ratio*]. It will be designed to produce a [*Enter Flame Shape*]-shaped flame and low nitrogen oxide emissions. Internal parts will be fabricated of [*Enter Material of Construction*]. The burner’s refractory ring will be constructed of [*Enter Refractory Material*]. The burner will be positioned within the rotary kiln firing hood at the treated material discharge end of the rotary kiln.

The two SCC burners will be [*Enter Manufacturer and Model Number*] dual-fuel air burners (or equivalent) rated at [*Enter Btu Rating*] and [*Enter Btu Rating*] million Btu per hour, respectively. The smaller SCC burner (the startup burner) will have a continuous gas pilot with a capacity of [*Enter Btu Rating*] million Btu per hour. The larger, main SCC burner will have a continuous gas pilot with a capacity of [*Enter Btu Rating*] million Btu per hour. Both burners will be designed to burn either natural gas or liquids with a minimum heat value of [*Enter Minimum Heat Value*] and viscosities less than [*Enter Maximum Viscosity*]. The smaller burner will have a maximum turn-down ratio of [*Enter Maximum Turn-Down Ratio*]. The larger burner will have a maximum turn-down ratio of [*Enter Maximum Turn-Down Ratio*]. Both burner bodies will be fabricated of [*Enter Material of Construction*]. Internal parts include [*Enter Material of Construction*] components and [*Enter Material of Construction*] refractory rings.

Both SCC burners will be positioned at the bottom of the SCC near the discharge duct from the rotary kiln. The main SCC air blower can provide up to about [*Enter Volumetric Capacity*] standard cubic feet per minute (scfm) of air for the burners and cooling air for the burner section of the SCC. The purge air blower provides up to about [*Enter Volumetric Capacity*] scfm for localized cooling of sight ports and other miscellaneous SCC equipment. The tertiary air blower provides up to about [*Enter Volumetric Capacity*] scfm of combustion air for the combustion section of the SCC combustion.

All three waste burners in the kiln and the SCC will be equipped with [*Enter Brand Name and Model Number*] flame scanners as part of the flame safety management system. These scanners continuously monitor flame conditions and will be interlocked with the AWFCO to stop all waste feeds automatically in the event of a flameout.

High-Btu and low-Btu liquid wastes incinerated in the rotary kiln system will be pumped from feed tanks to the burner and nozzle systems. In-line strainers will be provided to prevent oversized solids from entering and clogging the burners and nozzles. All liquid waste flow rates will be monitored continuously, recorded, and controlled using flow meters. Steam and high-pressure air will be used for atomizing high-Btu liquid wastes and low-Btu liquid wastes, respectively.

High-Btu liquid wastes can be fired in the dual fuel rotary kiln burner alone or in combination with natural gas. Similarly, high-Btu liquid wastes can be fired in the dual fuel main SCC burner alone or in combination with natural gas. The high-Btu liquid waste burner guns will be equipped for steam atomization. A minimum differential pressure of [*Enter minimum ΔP*] between the atomizing steam and the liquid waste will be maintained at all times to ensure proper atomization.

Low-Btu liquid wastes will be injected into the combustion zone through nozzles in the rotary kiln and SCC. These nozzles will be constructed of [*Enter Material of Construction*]. The low-Btu liquid nozzles will be equipped for high-pressure air atomization. A minimum differential pressure of [*Enter Minimum ΔP*] between the atomizing air and the liquid waste will be maintained at all times to ensure proper atomization. Low-Btu liquid wastes will be, in general, aqueous wastes with zero or negligible heating value. The rotary kiln low-Btu liquid waste nozzle will be located in the burner face of the rotary kiln. The nozzle can be used to inject low-Btu liquid wastes into the rotary kiln or to add process water to the system for temperature control. The nozzle will have a [*Enter Turndown Ratio*] to 1 turndown ratio. Similarly, the SCC low-Btu liquid wastes nozzle will have a [*Enter Turndown Ratio*] to 1 turndown ratio.

The SCC will be equipped with separate quench water nozzles to add process water for temperature control. These water nozzles will have a [*Enter Turndown Ratio*] to 1 turndown ratio.

D-5b(1)(a)(3) Description of the Waste Heat Recovery Boiler

The waste heat recovery boiler will be a Model [*Enter Model Number*] water tube-type economizer manufactured by [*Enter Manufacturer Name*]. It will be rated to produce [*Enter Production Rate*] pounds per hour of [*Enter Pressure*] psig steam at [*Enter Temperature*] °F. The boiler will be code stamped under the ASME Boiler and Pressure Vessel Code. The boiler's overall dimensions will be [*Enter Dimension*] high, [*Enter Dimension*] long, and [*Enter Dimension*] wide. The boiler's internal components will be constructed of [*Enter Construction Material*]. Design drawings (Drawings [*Enter Drawing Numbers*]) for the boiler are provided in Appendix D-5.2.

The waste heat recovery boiler uses the SCC combustion gas to generate steam for facility use. Combustion gases will enter and exit the boiler at [*Enter Entrance Temperature*] and [*Enter Exit Temperature*] °F, respectively. The heat recovery boiler will be equipped with a bypass duct to allow continued operation of the rotary kiln incineration system when the boiler must be taken off-line for maintenance.

The operating volume of the boiler radiant section will be [*Enter Volume*] cubic feet. In the radiant section, water will be circulated through tubes in the boiler walls. Heat will be recovered in the radiant section by radiant transfer through the boiler walls. The operating volume of the boiler convective section will be [*Enter Volume*] cubic feet. In the convective section, water will be circulated through tube banks suspended in the combustion gas stream. Heat will be recovered by convective transfer as the combustion gas passes through the tube banks. The total boiler combustion gas residence time will be [*Enter Time Range*]. The product steam will be typically [*Enter Temperature*] °F and [*Enter Pressure*] psig. Boiler exit temperature will be typically in the range of [*Enter Temperature Range*] °F. Steam production will be typically [*Enter Production Rate*] per hour.

D-5b(1)(a)(4) Description of the Auxiliary Fuel Systems [40 CFR 270.62(b)(2)(ii)(D)]

Natural gas will be fired to heat both the rotary kiln and the SCC to the proper operating temperatures prior to feeding any hazardous wastes. The natural gas and high-Btu liquid wastes can be used to maintain the desired combustion conditions in the combustion zones while treating wastes.

Natural gas will be supplied to the rotary kiln through a supply line to the burner system. The burner system will be equipped with independent monitors, controls, interlocks, and fail safe devices required by the National Fire Protection Agency (NFPA). Natural gas will be supplied to the SCC through a large supply line that splits to supply the SCC burner system. Each branch contains independent monitors, controls, interlocks, and other safety devices.

D-5b(1)(a)(5) Capacity of Prime Mover [40 CFR 270.62(b)(2)(ii)(E)]

The combustion gas prime mover will be a [*Enter Manufacturer and Model Number*] centrifugal fan or equivalent that operates as an induced draft fan. Under normal conditions, the induced draft fan will operate at [*Enter Volumetric Flow Rate*] acfm, [*Enter Temperature*]°F, [*Enter Pressure*] inches of water inlet vacuum, and [*Enter Pressure*] inches of water outlet pressure. The induced draft fan will be rated at [*Enter Volumetric Flow Rate*] acfm at [*Enter Temperature*]°F and static inlet pressure of [*Enter Pressure*] inches of water. The induced draft fan will have a [*Enter Horsepower*] horsepower (hp) totally enclosed fan-cooled motor.

D-5b(1)(a)(6) Description of Waste Feed Systems [40 CFR 270.62(b)(2)(ii)(D)]

Typically, three types of waste materials will be fed to the [*Enter Company Acronym*] incineration system:

- High-heat-value liquid wastes (high-Btu liquid wastes)
- Low-heat-value liquid wastes (low-Btu liquid wastes)
- Solid wastes

High- and low-Btu liquid wastes can be fed to either the rotary kiln or to the SCC. High-Btu liquid (organic solvent) wastes will be fired through dual fuel (natural gas, liquid fuel, or both) burners in the rotary kiln and SCC. The dual high-Btu liquid waste and natural gas burners will be equipped with steam for atomizing the liquid wastes. Low-Btu liquid (primarily aqueous) wastes will be fed through nozzles in both combustion chambers. The low-Btu liquid waste injection nozzles will be equipped for air atomization. The liquid wastes will be fed from agitated liquid waste feed tanks. The liquid waste feed lines will be equipped with filters to prevent oversized particles from clogging the burners and nozzles. Nozzle and burner designs are described in Section D-5b(1)(a)(2). The feed rate capacities and other design bases of the various liquid waste feed systems are presented in Table D-5.8.

Solid wastes (including solids and sludges) will be fed directly to the rotary kiln by an auger-shredder. The auger-shredder hopper capacity will be [*Enter Volume*] cubic yards. The design basis of the auger-shredder will be presented in Table D-5.8.

D-5b(1)(a)(7) Description of Ash Handling System [40 CFR 270.62(b)(2)(ii)(D)]

Hot ash will be discharged from the rotary kiln directly through a discharge chute into an enclosed rolloff container. The rolloff container cover and ash discharge feed chute have custom-designed connections to provide a mated mechanical seal to the rotary kiln system. This mechanical seal allows the rolloff container to use the rotary kiln draft to maintain a vacuum to control fugitive emissions. The ash discharge chute will be equipped with a manually operated valve to isolate and provide a mechanical seal so that a full rolloff container can be replaced without interrupting the operation of the rotary kiln. The capacity of each rolloff container will be [*Enter Volume*] cubic yards.

D-5b(1)(a)(8) Description of Automatic Waste Feed Cutoff System [40 CFR 270.62(b)(2)(ii)(F)]

The primary function of the AWFCO system interlocks will be to prevent the feeding of hazardous waste if incineration conditions are outside the RCRA permit limits. During startup and shutdown of the incinerator or during process upsets, the interlock system will automatically stop hazardous waste feed systems and prevent their restart until the incinerator is at proper operating conditions, and the interlock will be manually reset. As shown on the process control logic loop diagram (see Drawing [*Enter Drawing Number*] in Appendix D-5.2), the process controller immediately will initiate auxiliary fuel feed to the kiln and the SCC upon any AWFCO event in order to maintain the kiln and SCC temperatures until all wastes and waste residues exit the combustion chambers.

Descriptions of the process monitoring instruments that will be interlocked with the AWFCO system and their cutoff points are shown in Table D-5.9. P&IDs are included in Appendix D-5.2 as Drawings [*Enter Drawing Numbers*]. The AWFCO system will be tested weekly before, during, and after the trial burn.

The final AWFCO parameter values for permitted operation under 40 CFR Subpart O are expected to be negotiated between EPA Region [*Enter EPA Region*], the [*Enter State Agency Acronym*], and [*Enter Company Acronym*] based on the results of the RCRA trial burn. A discussion of the AWFCO parameters follows:

- High- and Low-Rotary-Kiln Combustion Gas Temperature—The rotary kiln gas temperature will be monitored continuously at the exit of the rotary kiln by thermocouples TE-[*### and ###*]. If the hourly rolling average rotary kiln exit gas temperature falls below the permitted minimum temperature or rises above the permitted maximum, the solid and liquid waste feeds to the rotary kiln will be stopped.

- High- and Low-SCC Exit Gas Temperature—The temperature of the SCC combustion gas will be monitored continuously by multiple thermocouples TE-[*###, ###, ### and ###*]. If the hourly rolling average SCC exit gas temperature falls below the permitted minimum temperature or rises above the permitted maximum, the solid feed and liquid waste feeds to the rotary kiln and the liquid waste feeds to the SCC will be stopped.

- High-Rotary-Kiln Solid and Sludge Waste Feed Rate—The auger-shredder continuously feeds solids to the rotary kiln. The auger-shredder feed rate will be based on the auger shaft speed (rpm). A speed sensor (SS-[*###*]) continuously monitors auger shaft speed. The auger-shredder shaft speed will be used by the control system logic to calculate the mass feed rate, which will be reported by weight indicating controller (WIC-[*###*]) and for the totalizer (WQI-[*###*]). Rotary kiln waste feed will stop automatically if the auger-shredder rpm for the solids feed rate exceeds the permitted maximum value established during the trial burn.

- High-Rotary-Kiln and SCC High-Btu Liquid Waste Feed Rate—High-Btu liquid wastes will be fed from the feed tanks to the rotary kiln and SCC by pumps. The flow rates of the high-Btu liquid waste to the rotary kiln and SCC burners will be monitored continuously by flow meters (FE-[*###*] and FE-[*###*]). If the high-Btu liquid waste hourly rolling average feed rate to either the rotary kiln or SCC exceeds its permitted rate, the individual high-Btu liquid waste feed stream exceeding its permitted limit will be stopped automatically.

- High-Rotary-Kiln and SCC Low-Btu (Aqueous) Liquid Waste Feed Rate—Low-Btu liquid waste will be fed from the feed tanks to the rotary kiln and SCC by pumps. The flow rates of the low-Btu liquid waste to the rotary kiln and SCC lances will be monitored continuously by flow meters (FE-[###] and FE-[###]). If the low-Btu liquid waste's hourly rolling average feed rate to either the rotary kiln or SCC exceeds its permitted rate, the individual low-Btu liquid waste feed stream exceeding its permitted limit will be stopped automatically.

- Low-Stack-Gas Oxygen Concentration—The oxygen concentration will be measured in the stack by oxygen analyzer AIT-[###]. The oxygen AWFCO system will stop all waste feeds to the incineration system whenever the hourly rolling average of the stack gas oxygen concentration falls below the permitted value.

- High-Stack-Gas Carbon Monoxide Concentration—Carbon monoxide concentrations will be measured in the stack by carbon monoxide monitor AIT-[###] and AIT-[###]. The carbon monoxide AWFCO system will stop all waste feeds to the incineration system automatically if the hourly rolling average stack gas carbon monoxide concentration exceeds the permitted value corrected to 7 percent oxygen, dry basis. The oxygen correction factor will be calculated using the following equation:

$$CO_c = CO_m \times \frac{14}{(21 - O_{2m})}$$

where

Co_c = the stack carbon monoxide concentration corrected to 7 percent oxygen dry basis
Co_m = the measured stack carbon monoxide concentration, dry basis
O_{2m} = the measured stack oxygen concentration, dry basis

- High-Stack-Gas Flow Rate—The flow sensor located in the stack (FE-[###]) will be operating continuously and will be connected to the AWFCO interlock whenever wastes are being fed to the incineration systems. All waste feeds will be stopped automatically if the hourly rolling average stack gas flow rate exceeds the permitted maximum value.

- High-Rotary-Kiln Pressure—A negative pressure will be maintained in the rotary kiln to control fugitive emissions. The pressure at the upstream end of the rotary kiln will be monitored continuously by PIT-[###] and PIT-[###]. All waste feeds to the rotary kiln will be stopped automatically if the hourly rolling average rotary kiln pressure exceeds the permitted value.

- High-Heat Recovery Boiler Inlet Temperature—The combustion gas inlet temperature to the boiler will be monitored continuously by TT-[###]. Any time that the hourly rolling average temperature exceeds the set point, an AWFCO will be initiated.

- High-Quench-Outlet Temperature—High-quench-outlet temperatures could result in failure of process equipment and a safety hazard to personnel. The waste feed will stop automatically if the hourly rolling average quench outlet temperature, as measured at

TE-[###] and TE-[###], exceeds the manufacturer's high-temperature limit for downstream APCS equipment. High-quench-outlet temperature is indicative of the loss of quench recycle flow or a plugged spray nozzle, which results in less than adequate cooling of the combustion gas.

- Low-Venturi-Scrubber Liquid/Gas Ratio—The recirculating venturi scrubber liquid and the stack gas flow rate will be monitored continuously. Whenever the hourly rolling average liquid/gas ratio drops below the permitted value, the waste feeds will be stopped automatically.

- Low-Venturi-Scrubber Differential Pressure—The venturi scrubber differential pressure will be measured by PDIT-[###] and will be controlled at or above a minimum value to ensure efficient particle collection. All waste feeds will be stopped automatically if the hourly rolling average differential pressure falls below the minimum permitted value.

- Low-Venturi-Scrubber Sump pH—The pH of the venturi scrubber solution will be monitored continuously by AE-[###]. If the hourly rolling average scrubber falls below the permitted minimum, all waste feeds will be stopped automatically.

- Low-WESP kVA—The WESP transformer and rectifier (T/R) voltage and amperage will be continuously monitored. If the hourly rolling average WESP T/R kVA falls below the permitted minimum kVA, all waste feeds to the incineration systems will be stopped automatically.

- Low-Scrubber Blowdown Flow—The scrubber system blowdown flow rate will be monitored continuously by FIT-[###]. Whenever the hourly rolling average scrubber blowdown flow rate drops below the permitted value, all waste feeds will be stopped automatically.

- Low-WESP Liquid Flow—The liquid flow rate in the WESP will be monitored continuously by FIT-[###]. If the hourly rolling average liquid flow rate drops below the permitted value, all waste feeds will be stopped automatically.

- Flameout—Flame conditions in the rotary kiln and the SCC will be monitored continuously. Whenever, a flameout is detected in either the kiln or the SCC, all waste feeds will be stopped automatically.

- Thermal Relief Vent Opening—Any time that the thermal relief vent opens, the waste feeds will be stopped automatically.

The control system will be designed to eliminate, insofar as possible, unnecessary AWFCO events, while still maintaining a conservative position. As indicated in Table D-5.9, several instruments will be redundant. For some parameters, the AWFCO will be activated when both redundant sensors detect conditions beyond the set points. For other parameters, the AWFCO will be activated when only one sensor detects conditions beyond the set points. In general, when one instrument fails, it usually will go out of range and create an alarm in the distributed control system (DCS) to alert the operator to the problem.

The redundant rotary kiln exit gas temperature thermocouples, TE-[*### and ###*], will be designed to initiate an AWFCO when both register low-low rotary kiln combustion gas temperature; thermocouples TE-[*### and ###*] perform a similar function for low-low SCC combustion gas temperature. The redundancy of these instruments will be designed to prevent unnecessary AWFCO events caused by the following types of thermocouple failure:

- Complete Failure of the Junction—The system will be designed to cause the indicated temperature to go to full scale if this occurs; TSH-[*### or ###*] or TSH-[*###, ###, ###, or ###*] will alarm as an indication to maintenance that the thermocouple has failed and must be replaced.

- Gradual Aging of the Thermocouple Material—In general, the millivoltage generated by an aged thermocouple will be less than a new thermocouple. The indicated temperature will therefore be lower over time. To avert unnecessary AWFCO events, the thermocouples will be replaced during scheduled preventive maintenance. Consistent with the manufacturer's recommendations, the elapsed time between replacements will not exceed [*Enter Manufacturer's Recommendation*] days.

The carbon monoxide analyzers, AIT-[*###*] and AIT-[*###*], will be completely redundant, non-dispersive infrared (NDIR) analyzers. As such, they will be calibrated automatically on a daily (two-point) and weekly (three-point) basis. These devices will be expected to meet the 40 CFR 266 Appendix IX calibration drift requirements. The carbon monoxide analyzers initiate an AWFCO whenever either analyzer detects conditions beyond the set point.

The rotary kiln pressure indicators, PIT-[*###*] and PIT-[*###*], will be completely redundant pressure transmitters. As such, they measure vacuum in the rotary kiln. Each transmitter will fail low; specifically, a failure will result in a signal less than 4 milliamperes, and will result in a panel alarm for that transmitter, indicating to operations that the transmitter requires replacement. The higher of the two transmitter outputs will be selected for use in controlling the induced draft fan's speed and as the input to the high-high rotary kiln pressure switch (PSHH-[*###*]), which initiates the AWFCO.

The quench combustion gas thermocouple and temperature transmitters, TE-[*###*] and TE-[*###*], will be designed to protect the scrubber system from high-high temperature. Each transmitter will be configured to go full scale upon thermocouple failure. The output from both transmitters must be high-high to initiate an AWFCO. The signal transmitted by each transmitter will be recorded in the data historian. When the transmitters are calibrated, historian's records will be examined, and the thermocouple that produced a record at least 10 °F lower than the other will be replaced.

The remainder of the measurement devices that initiate an AWFCO will be sufficiently robust that their accuracy and repeatability will not vary significantly between calibrations, except for AE/AIT-[*###*] pH measurement. An AWFCO will occur if any of these measuring devices were to fail. The frequency at which the pH device will require standardization and transmitter adjustment will be a function of the severity of the service and will have to be determined by operational experience.

D-5b(1)(a)(9) Stack Gas Monitoring [40 CFR 270.62(b)(2)(ii)(G)]

Continuous emissions monitors (CEM) will be used to monitor stack gases continuously for carbon monoxide and oxygen concentrations. The CEMs will meet all of the performance specifications detailed in "EPA Methods Manual for Compliance with the BIF Regulations" (40 CFR 266 Appendix IX). Sample ports for the CEM probes will be located above the stack gas recycle duct in the stack. Additional sample ports exist for trial burn testing.

The carbon monoxide analyzer will be a [*Enter Manufacturer Name and Model Number*] NDIR analyzer. The analyzer's specifications will be as follows:

- Range—[*Enter Range of Instrument*] ppm
- Accuracy—[*Enter Accuracy as Percent of Full Scale*]
- Drift—[*Enter Drift as Percent of Full Scale*] per week
- Reproducibility—[*Enter Reproducibility as Percent of Full Range*]
- Response time—[*Enter Percent of Full Scale*] in 10 seconds

The oxygen analyzer will be a [*Enter Manufacturer Name and Model Number*] paramagnetic analyzer. The analyzer's specifications will be as follows:

- Range—[*Enter Range of Instrument*] ppm
- Accuracy—[*Enter Accuracy as Percent of Full Scale*]
- Drift—[*Enter Drift as Percent of Full Scale*] per week
- Reproducibility—[*Enter Reproducibility as Percent of Full Range*]
- Response time—[*Enter Percent of Full Scale*] in 10 seconds

The CEM system manufacturer's specifications are included in Appendix D-5.3. The primary functions of the CEM system will be as follows:

- Continuously measure, display, and record the gas concentrations in the stack.
- Activate alarms, and interrupt waste feed when preset values are exceeded.

Other important functions of the CEM system will be as follows:

- Remotely display stack gas composition and CEM system operational status.
- Automatically and manually calibrate sampling and analysis trains.

- Automatically record and print the stack gas composition.

- Activate alarms when a malfunction occurs in the CEM system.

All CEM system instrumentation will be located in a climate-controlled CEM building. The location of the CEM building is shown on Drawing [*Enter Drawing Number*] (see Appendix D-5.2). The operation and control logic of the CEM system are depicted on Drawings [*Enter Drawing Numbers*] (see Appendix D-5.2).

The stack gas sample will enter the CEM train through a probe assembly located in the stack gas duct, where the gas will be filtered to remove particulate. The sample then will be drawn through a heated line to the sample conditioning system where it will be cooled and filtered to remove moisture and remaining particulate matter. Next, the sample will be transferred by a sample gas pump through a final filter to the distribution system where the sample flow will be regulated and delivered to the oxygen and carbon monoxide analyzers.

A programmable logic controller (PLC) will be the primary control unit for the CEM system. The PLC will be located in the CEM building. The PLC processor will be capable of performing independent data logging, calculating, and reporting functions. The PLC will allow the performance of all extractive CEM control functions, including the following:

- Automatically calibrate the gas analyzers at selected time intervals.

- Automatically back purge sample probes.

- Provide operating status of the sample conditioning and analyzer systems to the data acquisition system (DAS).

- Provide input/output signal interfaces to the strip-chart recorders, the CEM DAS, and the plant DCS.

The PLC will transmit data to the DCS, which will provide remote monitoring and recording of CEM operations at the plant control room. All analog and digital input/output signals will be conditioned properly to reduce noise and to isolate signals from voltage transients. The DCS will display and record the uncorrected and rolling averages for the gas concentrations. The indication of all gas composition will be updated at least every 15 seconds. The DCS also will activate alarms and initiate an AWFCO when high carbon monoxide concentrations are in the stack gas or when the DCS experiences a loss of analyzer signal.

The CEM system will be calibrated using a three-point calibration method. Span gases of [*Enter Range of Percentages*], [*Enter Range of Percentages*], and [*Enter Range of Percentages*] of instrument span will be used to calibrate the oxygen analyzer. Span gases of [*Enter Range of Percentages*], [*Enter Range of Percentages*], and [*Enter Range of Percentages*] of instrument span will be used to calibrate the carbon monoxide analyzer. Concentrations of these span gases will be injected sequentially into the sampling system at the stack. Gases will be injected by opening the solenoid valve on each certified gas standard cylinder to allow the reference gas to flow under pressure to the sample probe. The reference gas will be drawn through the sample transport, sample conditioning, and sample delivery system and will be analyzed in the same manner as a stack gas sample. Calibration results will be stored and printed through the DAS.

The concentrations of the reference gases will span the expected concentrations of the actual gas samples. The CEM system will be calibrated daily with zero and span gases and weekly with zero, medium, and span gases. The zero and span gas calibrations will be considered a verification of the quality of data received from the monitors. If the data from the analysis show a span drift response greater than 2 percent, a full calibration will be performed using all three reference gas concentrations.

The analyzer output signal will be received by the CEM DAS. The CEM DAS also receives and stores calibration data, calculates the response factor, compares it with former reference data, and determines if the current value is within preset limits. If the response factor is outside established limits, the controller will activate a calibration alarm at the monitoring system status panel. If the response factor is within established limits, the DAS adjusts the analyzer signals by the calibration response factor and stores the corrected gas component concentration values on magnetic media.

D-5b(1)(a)(10) Air Pollution Control Equipment [40 CFR 270.62(b)(2)(ii)(G)]

The APCS includes the following equipment:

- Quench
- Venturi scrubber
- WESP
- Induced draft fan
- Stack

Equipment design and shop drawings, process flow diagrams, and P&IDs for the APCS are provided in Appendix D-5.2.

The quench system serves four primary purposes, as follows: (1) cool the boiler or SCC combustion gas for protection of downstream APCS devices, (2) provide a contact chamber for particulate and acid gas removal, (3) saturate the combustion gas to optimize the performance of the venturi scrubber, and (4) rapidly remove free energy from the combustion gas to reduce PIC formation potential in the APCS.

The quench will be designed to cool the combustion gas from either the boiler or the SCC. The combustion gas, regardless of whether it is from the boiler or directly from the SCC, will be ducted to the quench system where it will be cooled to adiabatic saturation temperature (typically between 170 °F and 190 °F) via a high volume of scrubber water sprays.

Condensation and excess water will be collected in a sump just below the quench. The sump solution contains particulate and salts. The quench liquid will be recycled through a system of strainers and hydroclones where large particulate will be removed. The liquid then will be recycled back through the quench.

The saturated combustion gas stream will exit the quench and enter the high-energy venturi scrubber, which is designed for high-efficiency particulate and acid gas removal. The entrained scrubber solution droplets will coalesce or combine in the venturi scrubber throat to help to remove sub-micron particulate and acid gases.

After exiting the venturi scrubber, the combustion gas stream will flow through a second mixing tube and then enter the vane separator. The vane separator will be a Chevron-type demister designed to remove entrained water and particulate droplets from the cleaned gas stream before the gas enters the WESP. An internal spray header with spray nozzles will provide an intermittent fresh-water spray to the separator plates for cleaning.

The combustion gas exiting the vane separator will enter the bottom of the WESP tower and flow upward through vanes or perforated plates whose function will be to distribute the flow across the entire cross-section of the tower. This will provide uniform residence time in the collector section, which will maximize performance. Scrubber solution from the WESP sump will be recycled continuously to the conditioning nozzles to precondition the combustion gas before entering the WESP collection area.

The cooled gas will flow upward through electrically grounded tubes called collector electrodes. An ionizer electrode maintained at high negative direct current (DC) potential will be mounted concentrically in each collector electrode. The high-voltage differential between ionizer and collector electrodes will produce an intense electromagnetic field called a corona. Particles passing through the corona will be charged negatively and will be attracted to the collector electrode. Particles reaching the collector wall will be captured in a water film and drain into the WESP sump.

The induced draft fan will be downstream from the WESP. The fan will be the primary mover of combustion gases through the system. It will maintain a rough vacuum (negative pressure) in the rotary kiln, SCC, boiler, and APCS.

Combustion gas from the induced draft fan will be ducted to the stack. Recycled stack gas will be used to maintain a relatively constant gas flow rate through the venturi scrubber in order to maintain the desired pressure differential. The cleaned gas will be discharged from a [*Enter Stack Height*]-foot stack to the atmosphere. The gas composition will be monitored and recorded continuously by the CEM system. Operating information for each of the APCS components follows:

- Quench—The quench will contain spray nozzles to cool and humidify combustion products to adiabatic saturation. The gas outlet temperature will be between about 170 and 190 °F. The total recycle flow rate to all nozzles will be about [*Enter Flow Rate*] gpm.

- Quench Sump—The quench sump will be [*Enter Dimension*] feet in diameter and [*Enter Dimension*] feet high with a conical bottom.

- Quench Recycle—Recycled quench solution will be pumped through a system of strainers and hydroclones to remove suspended solids. The cleansed effluent from the hydroclones will be recycled back to the quench sump. A portion of this recycle stream will be purged to the facility WWTS. The solids removed by the strainers and hydroclones will be treated in the rotary kiln.

- Venturi Scrubber—The venturi scrubber will be a *[Enter Manufacturer Name and Model Name or Number*] with a vane-type gas and water separator. The housing will be constructed of fiberglass-reinforced plastic (FRP). The vane separator will contain [*Enter Number*] corrosion-resistant demister modules. The recycle flow rate to the venturi quench will be about [*Enter Volumetric Flow Rate*] gpm. The differential pressure across the venturi scrubber will be about [*Enter Differential Pressure*] inches of water column. The scrubber solution to the venturi scrubber will be pH-controlled with caustic. The pH set point will be maintained at [*Enter pH*].

- The WESP will be an up-flow unit with a square surface dimension of [*Enter Dimension*] feet by [*Enter Dimension*] feet. The WESP vessel shell will be made of [*Enter Construction Material*] with a total collection area of [*Enter Collection Area*]-square feet 1,000 acfm. The electrostatic section will be washed by a set of co-current sprays at the collection inlet and a set of counter-current washing sprays at the collector exit. Scrubber solution recycle flow to the washing header will be about [*Enter Volumetric Flow Rate*] gpm. Furthermore, the intermittent washdown sprays will be operated at about [*Enter Volumetric Flow Rate*] gpm to remove any material that may adhere to collector surfaces.

- Induced Draft Fan—The rotary kiln incineration system prime mover will be a [*Enter Manufacturer and Model Number*] centrifugal fan or equivalent. The fan wheel will be constructed of [*Enter Construction Material*] or equivalent, and the housing will be constructed of FRP. The fan will be designed to maintain a negative pressure in the rotary kiln incineration system and will handle an inlet gas flow of about [*Enter Volumetric Flow*] acfm at [*Enter Temperature*] ° F with an induced draft of [*Enter Vacuum Rating*] inches of water column. The fan will be driven by a [*Enter Horsepower*] hp variable speed motor.

- Stack Gas Recycle Duct—Clean stack gas can be recycled from the stack to the transition duct upstream of the conditioner venturi scrubber. The stack gas will be recycled to allow the rotary kiln incineration system to be operated at lower combustion rates, hence lower stack flow rates, while maintaining the differential pressure across the scrubber above the AWFCO set point.

- Recycle Water Systems—The scrubber solution from each device in the APCS will be recycled by a system of sumps and pumps. Fresh makeup water can be added to the quench, vane separator, WESP, and venturi scrubber unit. The scrubbing solution will cascade upstream through the scrubbers to the quench.

D-5b(1)(a)(11) Construction Materials [40 CFR 270.62(b)(2)(ii)(I)]

The construction materials for the incinerator system components are specified in Table D-5.10.

D-5b(1)(a)(12) Location and Description of Temperature, Pressure, and Flow Indicating and Control Devices [40 CFR 270.62(b)(2)(ii)(J)]

[*NOTE TO USER: This section should include instrument numbers consistent with the P&IDs so that the reviewer fully understands the operation of the unit.*]

The locations of the process control instruments are shown on the following piping diagrams and P&IDs provided in Appendix D-5.2: [*List Drawing Numbers and Titles*].

This section provides a general description of temperature, pressure, flow, and other instrumentation requirements necessary to ensure compliance with all permit conditions. A discussion of the major controls of the rotary kiln incineration system that will be linked to the DCS is also provided. Table D-5.11 shows the instruments that will be used to monitor plant operations and record data for the facility operating record and the trial burn. Table D-5.11 also includes a listing of the alarm settings for key process monitoring equipment.

The proper operation of this monitoring equipment will be necessary to ensure consistent compliance with all permit conditions and safe and efficient operation of the rotary kiln incineration system. Although all process monitoring instrumentation receive periodic maintenance, equipment critical to compliance with permit operating conditions receives additional attention. Key issues associated with these instruments include the following:

- Continuing and preventive maintenance
- Verification of instrument calibration
- Verification of AWFCO integrity

The preventive maintenance program will be augmented by information received from daily and periodic inspections of the process and equipment. Instrument calibration and preventive maintenance will be performed following the procedures and frequencies described in Table D-5.12.

The DCS will control the incineration system operation. The control loop logic diagrams are provided in Appendix D-5.2. A description of the primary control loops follows.

Rotary Kiln Solid and Sludge Waste Feed Control

The solid and sludge waste feed introduced into the rotary kiln will be monitored constantly by means of a speed sensor (SS-[###]) on the auger-shredder shaft (Z-[###]). The auger feed rate will be factory-calibrated based on the auger speed (rpm) and a fixed feed density. A weigh recorder (WR-[###]) and a weigh-indicating totalizer (WQI-[###]) will be installed in the DCS to maintain a continuous record of the feed rate based on auger speed and calibrated control logic. The speed sensor

(SS-[###]) sends a signal to the weigh-indicating controller (WIC-[###]), which controls the speed of the auger shaft (Z-[###]), thereby controlling the waste feed rate discharged into the rotary kiln. A high-high waste feed rate switch (WSHH-[###]) will be installed and will trigger an alarm (WAHH-[###]) and an AWFCO if the hourly rolling average feed rate exceeds the maximum set point.

Rotary Kiln High-Btu Liquid Waste Feed Control

The flow of high-Btu liquid waste to the rotary kiln burner will be monitored constantly by means of a flow meter (FE-[###]) on the high-Btu liquid waste feed line. A flow recorder (FR-[###]) and a flow-indicating totalizer (FQI-[###]) will be installed in the DCS to maintain a continuous record of the high-Btu liquid waste feed rate. The flow element (FE-[###]) will send a signal to the flow-indicating controller (FIC-[###]) that will control the flow valve (FV-[###]) to the rotary kiln burner. A high-high flow rate switch (FSHH-[###]) will be installed and will trigger an alarm (FAHH-[###]) and an AWFCO if the hourly rolling average feed rate exceeds the maximum set point.

Rotary Kiln Low-Btu Liquid (Aqueous) Waste Feed Control

The flow of low-Btu liquid (aqueous) waste to the rotary kiln aqueous lance will be monitored constantly by means of a flow meter (FE-[###]) on the low-Btu liquid waste feed line. A flow recorder (FR-[###]) and a flow-indicating totalizer (FQI-[###]) will be installed in the DCS to maintain a continuous record of the low-Btu liquid waste feed rate. The flow element (FE-[###]) will send a signal to the flow-indicating controller (FIC-[###]) that will control the flow valve (FV-[###]) to the rotary kiln. A high-high flow rate switch (FSHH-[###]) will be installed and will trigger an alarm (FAHH-[###]) and an AWFCO if the hourly rolling average feed rate exceeds the maximum set point.

Rotary Kiln Pressure Control

Rotary kiln pressure will be monitored constantly by means of redundant pressure transmitters (PIT-[*### and ###*]) mounted on the rotary kiln ash discharge hood. A pressure recorder (PR-[###]) will be installed in the DCS to maintain a continuous record of the rotary kiln pressure. A pressure controller (PIC-[###]) will send a signal to the induced draft fan speed controller (SIC-[###]), which will adjust the speed of the variable speed fan to control the rotary kiln pressure. A high-high rotary kiln pressure switch (PSHH-[###]) will be installed and will trigger an alarm (PAHH-[###]) and an AWFCO if the hourly rolling average rotary kiln pressure exceeds the maximum pressure set point.

Rotary Kiln Combustion Gas Temperature and Burner Controls

During normal operation, the rotary kiln combustion gas temperature will be controlled by modulating the natural gas flow rate to the rotary kiln burner (G-[###]). A temperature controller (TIC-[###]) will control the rotary kiln burner gas rate. The natural gas flow rate to the burner will be adjusted up or down to maintain the rotary kiln combustion gas temperature. The burner will have a [*Enter Number*] to [*Enter Number*] turndown ratio.

Temperature recorders (TR-[*### and ###*]) and temperature indicators (TI-[*### and ###*]) will be installed in the DCS for continuous process monitoring. A low-low rotary kiln combustion gas temperature switch (TSLL-[###]) will trigger an alarm (TALL-[###]) and an AWFCO if the hourly rolling average temperature falls below the minimum temperature set point. A high-high rotary kiln off-gas temperature switch (TSHH-[###]) will trigger an alarm (TAHH-[###]) and an AWFCO if the hourly rolling average temperature rises above the maximum temperature set point.

Secondary Combustion Chamber Gas Temperature and Burner Control

The SCC temperature will be maintained by measuring the SCC off-gas temperature in the cross-over duct by means of redundant duplex thermocouples (TE-[*###, ###, ###, and ###*]). Temperature indicators and recorders, including TIC-[###] and TR-[###], will be installed in the DCS for continuous process monitoring. A low-low temperature switch (TSLL-[###]) will be installed to trigger an alarm (TALL-[###]) and an AWFCO if the hourly rolling average SCC combustion gas temperature falls below the minimum temperature set point.

The flow rates of high- or low-Btu liquid wastes to the SCC will be set normally to a fixed flow value. Then the SCC temperature will be controlled automatically by the temperature controller (TIC-[###]), which will send a signal and control the SCC main burner (G-[###]) natural gas flow rate. The natural gas flow rate will be increased or decreased to maintain the SCC off-gas temperature. The SCC main burner combustion air flow rate will be set via controller (FFIC-[###]) at a ratio to gas flow rate to maintain a stable flame. The SCC main burner will have a turndown ratio of [*Enter Number*] to [*Enter Number*].

The desired oxygen content in the stack gas will be 3 to 5 percent. This oxygen level will be adjusted in the SCC. The operator constantly monitors the stack gas oxygen concentration as described later in this section. If the stack gas oxygen level continues to decrease after secondary and tertiary air blowers have reached maximum output, the operator will have the option of making adjustments to the waste feed rates and combustion air flows to the rotary kiln, as described previously, or by reducing or shutting off the high- and low-Btu liquid waste feed rates to the SCC, or by increasing the combustion air to gas ratio to the burners to allow more combustion air into the SCC.

If the SCC burner firing rate has been reduced to its minimum and the SCC combustion gas temperature continues to increase, the operator can respond by making adjustments in the rotary kiln operation, or by reducing or shutting off the high-Btu liquid waste feed rate to the SCC, or by increasing the low-Btu (aqueous) waste or injecting process water to absorb the excess heat release.

SCC High-Btu Liquid Waste Feed Control

The flow of high-Btu liquid waste to the SCC main burner will be monitored constantly by means of a flow meter (FE-[###]) on the high-Btu liquid waste feed line. A flow recorder (FR-[###]) and a flow-indicating totalizer (FQI-[###]) will be installed in the DCS to maintain a continuous record of the high Btu liquid waste feed rate. The flow element (FE-[###]) will send a signal to the flow-indicating controller (FIC-[###]) that will control the flow valve (FV-[###]) to the SCC main burner. A high-high flow rate switch (FSHH-[###]) will be installed and will trigger an alarm (FAHH-[###]) and an AWFCO if the hourly rolling average feed rate exceeds the maximum set point.

SCC Low-Btu Liquid Waste Feed Control

The flow of low-Btu liquid (aqueous) waste to the SCC aqueous lance will be monitored constantly by means of a flow meter (FE-[###]) on the low-Btu liquid waste feed line. A flow recorder (FR-[###]) and a flow-indicating totalizer (FQI-[###]) will be installed in the DCS to maintain a continuous record of the low-Btu liquid waste feed rate. The flow element (FE-[###]) will send a signal to the flow-indicating controller (FIC-[###]) that will control the flow valve (FV-[###]) to the SCC. A high-high flow rate switch (FSHH-[###]) will be installed and will trigger an alarm (FAHH-[###]) and an AWFCO if the hourly rolling average feed rate exceeds the maximum set point.

Quench Outlet Gas Temperature

The quench outlet gas temperature will be measured by means of two sets of duplex thermocouples (TE-[*### and ###*]). Temperature recorders (TR-[*### and ###*]) and temperature indicators (TI-[*### and ###*]) will be installed in the DCS for continuous process monitoring. If a high-high temperature in the quench outlet gas is detected, the alarm (TAHH-[###]) will be activated. If the maximum hourly rolling average quench exit temperature is exceeded, the control system will trigger an AWFCO.

Quench Recycle Flow

The quench liquid recycle flow will be measured by means of a flow meter (FE-[###]). A flow indicator (FI-[###]) and a flow recorder (FR-[###]) will be installed in the DCS for continuous process monitoring. A low-low flow switch (FSLL-[###]) will be installed and will trigger an alarm (FALL-[###]) and an AWFCO if the hourly rolling average flow rate drops below the minimum set point.

Venturi Scrubber Recycle Rate

Scrubbing liquid will be recycled into the venturi scrubber, and the flow rate will be measured by means of the flow meter (FE-[###)]. The liquid flow rate will be monitored continuously in the DCS via the flow indicator (FI-###) and recorded via the flow recorder (FR-[###]). A low-low flow switch (FSLL-[###]) will be installed and will trigger an alarm (FALL-[###]) and an AWFCO if the hourly rolling average flow rate drops below a minimum set point.

Venturi Scrubber Sump pH

The pH of the venturi sump scrubbing liquid will be monitored by means of a pH analyzer (AE-[###]). A recorder (AR-[###]) and an indicator (AIC-[###]) will be installed in the DCS for continuous process monitoring. A transmitter (AIT-[###]) will send the pH signal to the controller (AIC-[###]) and adjust the addition of caustic accordingly to maintain the desired pH. A low-low analyzer switch (ASLL-[###]) will be installed and will trigger an alarm (AALL-[###]) and an AWFCO if the hourly rolling average pH falls below the minimum set point.

Venturi Scrubber Differential Pressure

The differential pressure across the venturi scrubber will be measured by means of a differential pressure transmitter (PDIT-[###]). A recorder (PDR-[###]) and an indicator (PDIC-[###]) will be installed in the DCS for continuous process monitoring. The indicating controller (PDIC-[###]) will send a signal to the recycle gas flow controller (PDY-[###]) to adjust the amount of recycle gas to maintain the required differential pressure. A low-low differential pressure switch (PDSLL-[###]) will be installed to trigger an alarm (PDALL-[###]) and an AWFCO if the hourly rolling average differential pressure falls below a minimum set point.

Scrubber Liquid Blowdown Rate

The scrubber liquid blowdown flow will be measured by means of the flow meter (FE-[###]). A flow indicator (FI-[###]) and a flow recorder (FR-[###]) will be installed in the DCS for continuous process monitoring. If a low flow is detected, the low-flow alarm (FAL-[###]) will be activated. If the hourly rolling average blowdown flow drops below the minimum set point, an AWFCO will be triggered.

WESP Transformer/Rectifier kVA

The T/R control panel will have on and off switches (HS-[###] and HS-[###], respectively) with indicators (HL-[###] and HL-[###], respectively). The control panel will display primary and secondary voltage (EI-[###] and EI-[###], respectively) and primary and secondary amperage (II-[###] and II-[###], respectively). The control panel will have high- and low-voltage alarms (EAH-[###] and EAL-[###]) and a high-amperage alarm (IAH-[###]). The control panel will send voltage and amperage information to the DCS, where the low-low kVA interlock will be initiated (YALL-[###]).

The transformer will have a high-high pressure switch and alarm (PSHH-[###] and PAHH-[###]), high-high temperature switch and alarm (TSHH-[###] and TAHH-[###]), and a low-low transformer liquid-level switch and alarm (LSLL-[###] and LALL-[###]). The transformer pressure, temperature, and liquid-level switches will activate automatically to shut off the WESP and will initiate an AWFCO if the pressure exceeds the maximum set point.

WESP Liquid Flow Rate

The WESP liquid flow will be measured by means of the flow meter (FE-[###]). A flow indicator (FI-[###]) and a flow recorder (FR-[###]) will be installed in the DCS for continuous process monitoring. If a low flow is detected, the low-flow alarm (FAL-[###]) will be activated. If the hourly rolling average blowdown flow drops below the minimum set point, an AWFCO will be triggered.

Stack Gas Oxygen Level

Stack gas oxygen level will be measured continuously by an oxygen analyzer (AIT-[###]). The oxygen will be indicated and recorded continuously in the DCS by an indicating controller and recorder (AIC-[###] and AR-[###], respectively). If the oxygen level is below the preset low-low level set-point, oxygen level switch ASLL-[###] will be triggered. If the hourly rolling average stack gas oxygen concentration drops below the set point, an AWFCO will be triggered.

Stack Gas Carbon Monoxide Level

The stack gas carbon monoxide level will be measured by means of two redundant sets of carbon monoxide analyzers (AIT-[###] and AIT-[###]). Redundant indicators (AI-[###] and AI-[###]) and recorders (AR-[###] and AR-[###]) will be installed in the DCS for continuous process monitoring. If the carbon monoxide level is above the preset high-high level set point, and either one of the redundant high-high carbon monoxide level switches (ASHH-[###] and ASHH-[###]) is triggered, the corresponding alarm will sound. An AWFCO will be triggered if the hourly rolling average carbon monoxide level rises above 100 ppm_{dv}.

Stack Gas Flow Rate

The stack gas flow rate will be measured by means of the Annubar™ flow meter (FE-[###]). A flow recorder (FR-[###]) and a flow indicator (FI-[###]) will be installed in the DCS for continuous process monitoring. A high-high flow switch (FSHH-[###]) will be installed and will trigger an alarm (FAHH-[###]) and an AWFCO if the preset maximum hourly rolling average flow rate is exceeded.

D-5b(1)(a)(13) Incineration System Startup Procedures [40 CFR 270.62(b)(2)(vii)]

The rotary kiln incineration system will be brought up to full operating condition while firing fossil fuel (natural gas) before introducing any hazardous wastes to the rotary kiln or SCC. The phrase, full operating condition, means that combustion temperatures are above the minimum for feeding waste, that the rotary kiln is under vacuum, and that the unit is in compliance with all other regulatory limits. The startup sequence will be, essentially, in reverse order of the direction that waste feed and combustion products pass through the system, in that the APCS will be started first, and the waste feed system will be started last. Before any of the rotary kiln incineration system processing equipment can be started, all utilities and the control system must be operational.

The specific procedures for starting the rotary kiln incineration system and introducing waste feed to the system follow. The typical period of time required for startup will be [*Enter Hours*] hours.

Rotary Kiln Incineration System Startup Procedures

A summary of the rotary kiln incineration system startup procedures follows.

Startup Utilities

1. Provide electrical power to the main switch gear, the motor control centers, and the control room.
2. Place the uninterruptible power supply (UPS) in operating mode.
3. Perform a pre-operational check of all systems to be used.
4. Place the emergency power generator in stand-by mode.
5. Start the DCS.

6. Start the plant and instrument air systems.

7. Start the process water system.

8. Start the caustic system.

Startup APCS Train

9. Perform and check, as applicable, the following:

   a. Fill and pressurize the quench emergency water tank.

   b. Fill the scrubber and quench sumps.

   c. Fill the clarifiers and thickener tanks and the clarifier overflow tanks.

10. Start the APCS train, as follows:

    a. Start the scrubber and quench recycle pumps. Adjust recycle flow rates, as necessary.

    b. Start the induced draft fan.

    c. Start the wash water sprays to the vane separator. Adjust flow rate, as necessary.

11. Start the APCS wastewater treatment system:

    a. Start the hydroclone recycle pump.

    b. Adjust the hydroclone recycle pump.

    c. Start the clarifier overflow pump.

    d. Start the clarifier sludge pump.

    e. Turn the grounding switch on the WESP T/R to the HV or ON position.

    f. Switch on the WESP hot-purge heater and blower, and allow them to operate for 15 minutes.

    g. Start the WESP makeup water and WESP recycle pump.

Startup Boiler System

12. Start the boiler.

    a. Start the boiler feed water system.

b. Bring the water level in the boiler to the correct operating level.

c. Check that the steam vent valve is open.

Startup Secondary Combustion Chamber Train

13. Start the SCC.

    a. Set combustion air flows and start the combustion air blower.

    b. Start the SCC burner ignition purge air cycle.

    c. After completing the purge cycle, start the pilot burner.

    d. Start the cold start burner.

    e. Gradually increase the cold start burner gas flow to raise the SCC temperature according to the refractory heat-up schedule.

    f. Start the main burner to provide additional heat. Adjust gas flow to bring the SCC up to operating temperature.

    g. Maintain or turn off the cold start burner, depending on the process requirements.

    h. Start the tertiary air blower.

Adjust Boiler Operation

14. Perform boiler heatup tasks.

    a. Monitor boiler heatup.

    b. Close the stream drum vent when a good steam plume is evident.

    c. Check that the safety valve is operable.

    d. Check the water column for proper operation by blowing down the water column until a low-water alarm sounds.

    e. Blow down the water glass.

    f. Open the service valve when the desired steam pressure is achieved.

    g. Maintain the water level in the boiler.

Startup Rotary Kiln

15. Start rotary kiln system.

    a. Start the rotary kiln lubrication system.

    b. Start rotary kiln combustion air fans. Flow controllers must have set points to permit purge.

    c. Start the rotary kiln purge cycle (rotary kiln will purge through TRV).

    d. After completing the purge, start the burner pilot.

    e. After the pilot flame has been established, start the burner on minimum fire. The burner must be lit within 5 minutes of lighting its pilot. Otherwise, the pilot must be shut off, and the rotary kiln must be re-purged.

16. Start heating the rotary kiln. After the rotary kiln has been purged and the burner has been ignited, switch the rotary kiln combustion gas to the boiler and APCS by closing the TRV.

17. When the rotary kiln and SCC reach permitted minimum operating temperatures (refer to Table D-5.6) and all waste feed parameters are satisfied, the rotary kiln is ready to receive hazardous waste. Start the waste feed systems individually (high-Btu liquids first, low-Btu liquids second, and solids third), and adjust feed rates to the desired set point, while maintaining rotary kiln and SCC temperatures and other system-operating parameters.

D-5b(1)(b) Sampling and Monitoring Procedures [40 CFR 270.62(b)(2)(iii)]

The objectives of the trial burn are as follows:

- Calculate particulate mass emission rates during all tests.
- Determine particle-size distributions during Test 3.
- Calculate hydrogen chloride removal efficiency during Tests 1 and 2.
- Calculate metal feed rates, emission rates, and removal efficiencies during Test 1.
- Calculate POHC DREs during Test 2.
- Confirm the fate of POHCs fed to the system during Test 2.
- Document metals, PCDDs and PCDFs, volatile and semivolatile PICs, PAH, aldehyde, and ketone emissions in the stack gas that occur during destruction of hazardous waste constituents during Test 3.

- Document carbon monoxide and oxygen concentrations in the stack gas that occur during destruction of hazardous waste constituents during all tests.

- Document the process operating conditions that will be used in establishing operating permit conditions during all tests.

The sampling and analysis procedures included in this section were selected to accomplish the objectives discussed above. The following sampling and analysis procedures are based on spiking carcinogenic metals (specifically, arsenic, beryllium, cadmium, and chromium), ash, and organic chlorine in the waste feeds in Test 1 and spiking chlorobenzene, carbon tetrachloride, and naphthalene as the POHCs, organic chlorine, and ash in Test 2. No spiking is planned in Test 3.

The rationale for the selection of the POHCs is presented in Section D-5b(1)(d)(2). The waste spiking program is described in Section D-5b(1)(d)(4).

PIC emissions data, including PCDDs and PCDFs, is being collected for use in performing the site-specific HHRA.

The QAPP for the trial burn is included in Appendix D-5.1.

D-5b(1)(b)(1) Sampling Locations and Procedures

The locations at which solid, liquid, and gaseous samples will be collected from the incineration and APCSs are shown on Figure D-5.4. The materials supplied to the incineration and APCS processes, including solid and sludge waste feed, high-Btu liquid feed, low-Btu liquid feed, caustic, and process water, will be sampled at locations 1, 2, 3, 16, and 17, respectively. Samples of processed solids residuals (ash) will be collected at location 14. Scrubber blowdown water will be sampled at location 15. Gaseous samples for determining POHCs, PICs, PCDDs and PCDFs, metals, hydrogen chloride and particulate emissions, and combustion gas composition will be collected at locations 4 through 13. The carbon monoxide and oxygen concentration of the combustion gas will be monitored continuously at location 18. Natural gas and combustion air will not be sampled.

Sampling standard operating procedures (SOP) are provided in Appendix D-5.7. The sampling procedures for collecting samples at each location are summarized in Table D-5.4. Sampling frequency and reference methods also are included in Table D-5.4. The numbers following each heading refer to the sampling location shown on Figure D-5.4 and in Table D-5.4.

Process grab samples for volatile organic analysis (VOA) will be collected and packaged separately in the field and will be composited by the laboratory immediately before analysis. All other process grab samples will be composited in the field and shipped to the laboratory as composite samples for analysis. This method eliminates the potential loss of volatile organics from the process samples during compositing in the field.

Additional details regarding sample locations, frequencies, and methods follow.

D-5b(1)(b)(1)(a) Solid and Sludge Waste Feed (Location 1)

Wastewater treatment sludge or similar low-Btu, high-ash-content solid waste materials from the [*Enter Company Acronym*] facility will be used as the solid feed during all three trial burn tests. Because the generation rate of wastewater treatment sludge will be relatively low, it will be necessary for [*Enter Company Acronym*] to stockpile wastewater treatment sludge to have sufficient quantities for trial burn purposes. The sludge waste feed will be sampled at 15-minute intervals during each trial burn run under all three test conditions.

During Test 1, precisely prepared solutions of metal salts will be metered continuously to the solid and sludge feed via a tap on the auger-shredder feed chute, as described in Section D-5b(1)(d). Similarly, organic POHCs will be metered continuously to the solid and sludge waste feed during Test 2. Solid and sludge waste feed will be sampled before the addition of POHCs or metals.

Two of the selected POHCs, chlorobenzene and carbon tetrachloride, will be liquids. The third POHC, naphthalene, will be a solid. The naphthalene will be dissolved in known proportions of mineral oil for metering to the solid and sludge waste feed during Test 2. POHC and metal spiking compounds will be of reagent-grade purity. Certified analyses of all POHC and spiking compounds will be obtained from the suppliers before the trial burn. The POHCs and metal spiking solutions will not be sampled on site.

D-5b(1)(b)(1)(b) High-Btu Liquid Waste Feeds (Location 2)

Actual high-Btu liquid wastes will be used as the high-Btu liquid waste feed to the kiln and SCC during all three trial burn tests. During Tests 1 and 2, the actual wastes will be blended with perchloroethylene to create a high-Btu liquid waste blend with the required heat of combustion and organic chlorine content.

During all three trial burn tests, high-Btu liquid wastes will be fed to both the rotary kiln and the SCC from the same blend/feed tank. Grab samples will be collected from a tap in the high-Btu feed recycle line upstream of the point at which POHCs or metals solutions are introduced at 15-minute intervals during each replicate test run and will be composited for the run.

Solutions of metal salts will be fed to the high-Btu waste feed line or the low-Btu waste feed line immediately upstream of the combustion chamber injection point during Test 1. Grab samples of the high-Btu liquid waste blend will be collected from a tap in the organic feed recycle line upstream of the POHC or metals addition point at 15-minute intervals during each test sampling run.

During Test 2, the preparation of POHCs will be similar to the solutions described previously for solid and sludge waste. The POHC solutions will be metered to the high-Btu liquid waste feed line or the low-Btu liquid waste feed line, immediately upstream of the combustion chamber injection point, during Test 2.

D-5b(1)(b)(1)(c) Low-Btu Liquid Waste Feeds (Location 3)

Actual low-Btu liquid wastes will be fed to the kiln and SCC during all three trial burn tests. During Tests 1 and 2, these actual wastes will be spiked with ash-particulate-producing material (copper sulfate) and will be used as the low-Btu liquid waste feed during all tests. Metals solutions will be fed into the low-Btu liquid waste feed line immediately upstream of the combustion chamber injection point, during Test 1. POHCs also will be fed to the low-Btu feed line immediately upstream of the combustion chamber injection point during Test 2. Grab samples will be collected from a tap in the low-Btu feed line, upstream of the point where POHCs or metals solutions will be introduced, at 15-minute intervals, during each replicate test run and will be composited for the run.

D-5b(1)(b)(1)(d) Stack Gas (Locations 4 through 13)

Samples of the particulate, acid gases, metals, POHCs, and PICs from the combustion gas will be collected from the stack gas at locations 4 through 11 (shown on Figure D-5.4). The stack's sampling ports will be designed for isokinetic sampling. Detailed procedures for the stack gas sampling methods are located in Appendix D-5.7. DRE and metal sampling times are presented in Appendix D-5.8.

Hydrogen Chloride, Chlorine, and Particulate Train

The Method 0050 hydrogen chloride, chlorine, and particulate isokinetic sampling train (Method 0050, Figure D-5.7) will be used at location 6 to collect hydrogen chloride and chlorine samples during the three trial burn tests. The total sampling time will be about 3 hours during each replicate sampling run. The Method 0050 train will be operated concurrently with the other sampling train(s) to sample about 2 cubic meters of stack gas. The Method 0050 procedure will include measurement of the stack gas flow rate and temperature according to EPA Methods 1 and 2. About every 30 minutes, integrated samples of the stack gas will be collected in gas bags for carbon dioxide and oxygen determinations by an Orsat analyzer according to EPA Method 3. Stack gas moisture content will be determined by EPA Method 4.

[*NOTE TO USER: The non-isokinetic hydrogen chloride and chlorine sampling train, Method 0051, may be used if the stack is a dry stack, i.e., contains no water droplets. This, however, will require sampling particulate using a separate Method 5 sampling train or performing particulate analysis using the particulate filter from the MMT. However, the particulate filter from the MMT may only be used for particulate analysis if sampling is not being done for mercury in the stack gas.*]

Particle-Size Distribution

Samples of stack gases will be collected at location 7 during Test 3 using a [*Enter Type*] cascade-type impactor. Typically, these samples will be conducted over a [*Enter Minutes*]-minute period.

Multi-Metals Train

An MMT (MMT, Figure D-5.5) (40 CFR 266, Appendix IX, or SW-846, Method 0060) will be used at location 4 for collection of metals from the stack gas during Tests 1 and 3. The sampling train impingers will be charged with a solution of 5 percent nitric acid and 10 percent hydrogen peroxide to capture metals (i.e., antimony, arsenic, barium, beryllium, cadmium, total chromium, lead, mercury, nickel, selenium, silver, and thallium) and acidified potassium permanganate (composed of 4 percent potassium permanganate and 10 percent sulfuric acid) to capture any mercury that will be not captured by the nitric acid and hydrogen peroxide solution. The total sampling time will be about 3 hours during each replicate sampling run. The MMT will be operated concurrently with the other sampling train(s) to sample about 2 cubic meters of stack gas. The MMT procedure will include measurement of the stack gas flow rate and temperature according to EPA Methods 1 and 2, carbon monoxide and oxygen determinations by an Orsat analyzer according to EPA Method 3, and gas moisture content according to EPA Method 4. The Method 0050 stack measurements of these parameters will be used for the MMT calculations.

[*NOTE TO USER: If an Adjusted Tier I limit is satisfactory for mercury, the acidified potassium permanganate impingers and mercury analysis may be deleted from the sampling and analytical program.*]

Hexavalent Chromium Sampling Train

A hexavalent chromium sampling train (Figure D-5.6) (Method Cr^{+6}, 40 CFR 266, Appendix IX, or SW-846, Method 0061) sampling train will be used at location 5 for collection of hexavalent chromium from the stack gas during Tests 1 and 3. The hexavalent chromium sampling train will be a recirculating Teflon™ impinger train with a Teflon™ aspirator assembly and other components. The sampling train impingers will be charged with potassium hydroxide to capture and preserve hexavalent chromium. The total sampling time will be about 3 hours during each replicate sampling run. The hexavalent chromium sampling train will be operated concurrently with the MMT to sample about 2 cubic meters of stack gas. The hexavalent chromium procedure will include measurement of the stack gas flow rate and temperature according to EPA Methods 1 and 2, carbon monoxide and oxygen determinations by an Orsat analyzer according to EPA Method 3, and gas moisture content according to EPA Method 4. The Method 0050 stack measurements of these parameters will be used for the MMT calculations.

[*NOTE TO USER: The hexavalent chromium procedure specifies the use of 0.1 normality (N) potassium hydroxide solution. To preserve the hexavalent chromium, it is critical that the pH of the impinger solutions not drop below about 10. At a pH of 9 or less, hexavalent chromium is readily reduced to trivalent chromium. Experience has shown that the use of potassium hydroxide solutions that are as strong as 5 N may be necessary to ensure that the impinger pH is maintained sufficiently high.*

The hexavalent chromium sampling train uses a Teflon™ probe and has Teflon™ components. Use of the hexavalent chromium sampling train in a hot stack, such as a boiler or a combustion unit with a dry APCS, will require use of a water-jacketed sampling probe.]

Volatile Organic Sampling Train

A VOST (see Figure D-5.8) will be used at location 8 during Tests 2 and 3 to collect the POHC chlorobenzene and volatile PICs from the stack gas on sorbent resin. The VOST will be configured in accordance with SW-846 Method 0031 with two Tenax™ resin tubes and one Anasorb™ tube in series. Because the VOST will be a non-isokinetic sampling train, it may share a sampling port with any of the isokinetic sampling trains with no impact to the operation of either sampling train. The VOST will be operated concurrently with the other sampling trains to collect a total of four sets of VOST cartridges for each test run. Three sets will be targeted for analysis, and the fourth set will serve as a back-up in the event of tube breakage or damage during shipment and laboratory handling. About 20 liters of stack gas will be sampled per set of VOST cartridges at 0.5 liters per minute for 40 minutes (slow-VOST conditions). The VOST cartridges will be capped immediately upon removal from the train, wrapped in aluminum foil, placed in glass tubes, and sealed. The Method 0050 stack parameter measurements will be used for the VOST calculations.

Method 0040 Samples

In addition to the volatile organics sampling associated with the VOST during Test 3, other low-molecular-weight PICs (such as methane, ethane, propane, butane, pentane, hexane, and heptane) will be measured using SW-846 Method 0040 (see Figure D-5.9). Bag samples of the stack gas collected in accordance with SW-846 Method 0040 at location 9 will be analyzed using an on-site GC (40 CFR 60, Appendix A, Method 18). Approximately 30 liters of stack gas will be collected over a 120 minute period. The Method 0050 stack parameter measurements will be used for the Method 0040 calculations.

Modified Method 5

Three MM5 sampling trains (see Figure D-5.10) will be used at locations 10, 11, and 12 for collecting semivolatile PICs, PCDDs and PCDFs, PAHs, and unspeciated semivolatile organics from the stack gas on sorbent resin during Tests 2 and 3. In all cases, the sorbent trap will contain XAD-2 resin to capture organics, and the impingers will be filled with water. The total sampling time for all MM5 sampling trains will be about 4 hours during each replicate sampling run. The MM5 sampling trains will be operated concurrently with the other sampling trains to sample a minimum of 3 cubic meters of stack gas per sampling train.

The MM5 procedure will include a measurement of the stack gas flow rate and temperature according to EPA Methods 1 and 2, carbon dioxide and oxygen determinations by an Orsat analyzer according to EPA Method 3, and gas moisture content according to EPA Method 4. The Method 0050 stack measurements of these parameters will be used for the MM5 calculations.

The first type of MM5 sampling train, MM5A, will targeted for the POHC naphthalene sample in Test 2 and semivolatile PICs, including PCDDs and PCDFs, in Test 3. The samples will be analyzed for identifiable semivolatile POHC and PICs by SW-846 Method 8270 and PCDDs and PCDFs by SW-846 Method 8290. The MM5A sampling train will be operated and recovered according to the procedures described in SW-846 Methods 0010 and 3542 in Test 2 and Methods 0010, 3542, and 0023A in Test 3. The QAPP (see Appendix D-5.1) provides descriptions of the data quality objectives (DQO) and sampling surrogates for this train.

The second MM5 sampling train, MM5B, will be used to collect samples to determine the unspeciated mass of semivolatile and nonvolatile organics during Test 3. The front and back halves of this sampling train will be analyzed for total chromatographable organics (TCO) by GC and for non-chromatographable nonvolatile organics gravimetrically. The QAPP (see Appendix D-5.1) provides a description of the DQOs and surrogates to be used in this MM5 sampling train.

The third MM5 sampling train, MM5C, will be used to collect stack gas samples for analysis for PAHs, according to the procedures described in California Air Resources Board (CARB) Method 429. Analysis of the extracts for PAHs will be performed using modified SW-846 Method 8290 and CARB-429 as guidance.

Method 0011

The stack gas will be sampled at location 13 and analyzed for aldehyde and ketone PICs using a Method 0011 sampling train (see Figure D-5.11) during Test 3. Aldehydes and ketones are not quantified adequately by other means because the analytical process can result in its degradation to other PICs. The train will be operated isokinetically because the stack gas contains water droplets in which aldehydes and ketones are soluble.

The Method 0011 sampling train will consist of a series of four impingers. The first and second impingers will contain 100 to 200 milliliters (mL) each of a cleaned 2,4-dinitrophenylhydrazine (DNPH) solution, while the third impinger will serve as a moisture knockout. The fourth impinger will contain a pre-weighed amount of indicating silica gel.

The Method 0011 sampling train will be used at location 8 after the completion of hydrogen chloride, chlorine, and particulate sample collection using the Method 0050 sampling train. The Method 0011 sampling train will be operated for about 2 hours during Test 3, concurrently with the other sampling trains, in order to sample about 90 cubic feet of stack gas. In the Method 0011 procedure, the stack gas flow rate and temperature are measured according to EPA Methods 1 and 2; carbon dioxide and oxygen are determined by an Orsat analyzer according to EPA Method 3, and gas moisture content will be determined according to EPA Method 4. The Method 0050 stack measurements of these parameters will be used for the Method 0011 calculations.

D-5b(1)(b)(1)(e) Incinerator Ash (Location 14)

For tests during which solid wastes will be burned, grab samples will be collected from the ash discharge every 30 minutes. Large and obviously inert pieces of ash will be discarded from each sample.

D-5b(1)(b)(1)(f) Scrubber Blowdown (Location 15)

Grab samples will be taken from a tap in the quench liquid discharge line. Before the test, two grab samples will be collected 30 minutes apart and composited to provide a baseline sample. Grab samples will be taken every 30 minutes during each replicate sampling run.

D-5b(1)(b)(1)(g) Process Water (Location 16)

Grab samples will be collected from a supply line tap every 60 minutes during each replicate sampling run.

D-5b(1)(b)(1)(h) Caustic Solution (Location 17)

One sample will be taken from the feed tank after the batch is prepared and mixed. Caustic solution samples will be retained (archived) for analysis, if needed.

D-5b(1)(b)(1)(i) Combustion Gas (Location 18)

A CEM system will be installed in the duct to the stack in order to monitor the carbon monoxide and oxygen concentration of the incineration combustion gas. The carbon monoxide monitor will be an NDIR device. The oxygen monitor will be a paramagnetic system. Details of the equipment installed are included in Appendix D-5.3.

D-5b(1)(b)(2) Analytical Procedures

The analyses planned for the trial burn samples are listed in Table D-5.4. The standard methods cited for density, TDS, TSS, viscosity, pH, heat content, metals content, ash content, elemental analysis, organic chlorine, stack gas oxygen, carbon dioxide, and particulate are EPA-approved methods that require no further explanation in this plan. Details on recovering metals, POHCs, PCDDs and PCDFs, and volatile and semivolatile PICs from the samples for analysis follow.

D-5b(1)(b)(2)(a) Solid and Sludge Waste Feed and Incinerator Ash

The solid waste feed and ash samples will be screened to remove obvious pieces of inert material. For POHC recovery and analysis, aliquots of the solid waste feed and ash samples will be dispersed in methanol and analyzed by GC/MS procedures. Aliquots of well-mixed solid waste feed samples will be prepared according to EPA procedures and analyzed for antimony, arsenic, barium, beryllium, cadmium, total chromium, lead, nickel, selenium, silver, and thallium by SW-846 Method 6010, inductively coupled argon plasma spectroscopy (ICP), or Method 6020, ICP/mass spectrometry (ICP/MS) and cold vapor atomic absorption (CVAA) for mercury. Aliquots of well-mixed ash samples also will be prepared according to EPA procedures and analyzed for metals by ICP or ICP/MS and CVAA.

D-5b(1)(b)(2)(b) High-Btu Liquid Waste Feed

Aliquots of well-mixed samples will be diluted in an appropriate solvent for analysis using GC/MS procedures for POHCs. Aliquots of well-mixed samples will be prepared according to EPA procedures and analyzed for antimony, arsenic, barium, beryllium, cadmium, total chromium, lead, nickel, selenium, silver, and thallium by ICP or ICP/MS and CVAA for mercury.

D-5b(1)(b)(2)(c) Process Water, Caustic Solution, Low-Btu Liquid Waste Feed, and APCS Scrubber Blowdown

For POHC analysis, all samples will be prepared and analyzed by GC/MS analyses. Aliquots of well-mixed low-Btu liquid waste samples will be prepared according to EPA procedures and analyzed for antimony, arsenic, barium, beryllium, cadmium, total chromium, lead, nickel, selenium, silver, and thallium by ICP or ICP/MS, and CVAA for mercury. Aliquots of well-mixed APCS purge- and process-water samples will be prepared according to EPA procedures and analyzed for metals by ICP or ICP/MS and CVAA. Caustic solution will not be analyzed for metals.

D-5b(1)(b)(2)(d) Method 0050 Hydrogen Chloride, Chlorine, and Particulate Sampling Train Impingers

The particulate filter and front-half rinses from the Method 0050 sampling train will be dried and weighed by EPA Method 5 to determine particulate emissions. The sulfuric acid and sodium hydroxide impinger solutions will be analyzed separately for chloride ion by SW-846 Method 9057 (ion chromatography). The corresponding concentrations of hydrogen chloride and chlorine will be calculated and reported for the sampling train.

D-5b(1)(b)(2)(e) Particle-Size Distribution

The particle-size distribution will be determined gravimetrically by recovering and weighing the contents of each of the [*Enter Number*] stages of the [*Enter Type*] cascade impactor.

D-5b(1)(b)(2)(f) Method 0060 Multi-Metals Train Samples

The filter will be digested by SW-846 Method 0060. Front half rinses will be digested by SW-846 Method 3050. For the metals antimony, arsenic, barium, beryllium, cadmium, total chromium, lead, nickel, selenium, silver and thallium, the front half rinses and the particulate filter digestion solution will be combined and analyzed by ICP or ICP/MS, while the 5 percent nitric acid and 10 percent hydrogen peroxide impingers will be prepared by SW-846 Method 3010 and analyzed by ICP or ICP/MS for mercury. CVAA will be used to analyze for mercury in the combined front-half rinse and filter digestion conditions and in the impingers. The 4 percent potassium permanganate and 10 percent sulfuric acid impingers and the 8N hydrochloric acid impinger rinses will be analyzed separately by CVAA for mercury. The front-half and the nitric acid and 10 percent hydrogen peroxide impinger analyses results will be added together to determine the total metals emission rate for the ICP or ICP/MS metals. The front-half, the nitric acid and 10 percent hydrogen peroxide impinger, the 4 percent potassium permanganate and 10 percent sulfuric acid impinger, and the hydrochloric acid glassware rinse analysis results will be added together to determine the total mercury emission rate.

D-5b(1)(b)(2)(g) Method 0061 Hexavalent Chromium Train Samples

The rinses and impinger solutions that were collected and filtered in accordance with the hexavalent chromium procedures, are refiltered through a 0.45-micron filter before analysis by ion chromatography with a post-column reactor (IC/PCR). The results will be used to determine the hexavalent chromium emission rate. The total chromium emission rate will be determined using the Method 0060 samples.

D-5b(1)(b)(2)(h) VOST Sorbent Tubes

The Tenax™ and Anasorb™ sorbent tubes will be recovered from the sampling train, desorbed thermally to an analytical trap and analyzed by GC/MS according to the protocol detailed in Method 5041. VOST sorbent tubes will be analyzed for the POHC chlorobenzene and the EPA contract laboratory program (CLP) volatile target compound list (TCL) and the 20 largest unidentified GC/MS peaks (volatile PICs).

The mass of the low-molecular PIC concentrations will be reported as total nanograms of organics per cubic meter (ηg/m^3). Next, this sum will be subtracted from the sum of the masses of all volatile organics determined using the VOST, also reported in terms of (ηg/m^3). The difference will be reported as unspeciated mass. This unspeciated mass will be added proportionally to the concentrations of specific volatile organics determined from the VOST samples.

D-5b(1)(b)(2)(i) MM5A Samples

The particulate filter and front-half rinses (acetone and methylene chloride only) recovered from the MM5A sampling train will be Soxhlet-extracted using methylene chloride for 18 hours (SW-846 Method 3540). Semivolatile surrogates (Tests 2 and 3) and dioxin and furan isotope dilution internal standards (Test 3 only) will be added to the samples at this stage of the sample preparation, as described in the QAPP (see Appendix D-5.1).

The Test 2 extract samples will be analyzed for the semivolatile POHC naphthalene by SW-846 Method 8270.

In Test 3 only, a subsequent Soxhlet extraction will be conducted using toluene. After which a 50 percent portion of the methylene chloride extract will be analyzed by SW-846 Method 8270 for semivolatile POHCs and PICs. The remaining 50 percent of the methylene chloride extract will be combined with 50 percent of the toluene extract and analyzed by Method 8290 for PCDDs and PCDFs.

The XAD-2 resin tube and the solvent rinse of the back-half filter holder and coil condenser samples will be handled in the same manner as the front-half samples, except that they will be prepared and analyzed as a separate sample and will not be spiked with dioxin and furan surrogates because these surrogates will have been applied to the XAD-2 resin before the trial burn.

A 1-liter portion of the back-half composite (impinger contents and glassware rinses) will be liquid-liquid extracted using methylene chloride only, according SW-846 Method 3510. Sequential base-neutral, acid-extractable extractions will be conducted. These extracts will be combined, reduced to a final volume of 5 mL and analyzed by Method 8270 for semivolatile POHCs and PICs.

D-5b(1)(b)(2)(j) MM5B Samples

The front half composite (XAD-2 resin, solvent probe rinse, particulate filter, and connecting glassware rinses) from the MM5B sampling train will be Soxhlet-extracted using methylene chloride. Extraction will proceed for 18 hours. Semivolatile unspeciated mass surrogates will be applied to the train components, as described in the QAPP (see Appendix D-5.1). The composite sample will be liquid-liquid extracted and volume-reduced in the same manner described for MM5A samples.

The MM5B samples will be analyzed in two parts: (1) for moderate boiling compounds (100 ^{o}F to 300 ^{o}F) by capillary column GC and flame ionization detector (FID) , and (2) high boiling compounds (greater than 300 ^{o}F) by the gravimetric (GRAV) method.

D-5b(1)(b)(2)(k) MM5C Samples

The MM5C samples will be collected and recovered in the same manner as described above for the Test 2 MM5A samples, except as follows:

- The front-half rinse, resin and back-half rinse, and condensate samples will be prepared and analyzed as three separate samples.
- PAH-specific sampling surrogates, isotope dilution internal standards, and recovery standards will be applied.
- Analysis of the extracts will be performed by high-resolution GC/high-resolution MS using a modification of SW-846 Method 8290 and CARB 429 as guidance.

D-5b(1)(b)(2)(l) Method 0011 Samples

The Method 0011 sampling train components will be analyzed by SW-846 Method 8315 for aldehydes and ketones. The sampling train components are analyzed in two parts: (1) the first impinger and (2) the second and third impingers. The impingers are analyzed in two parts in order to evaluate analyte breakthrough. The separate analyses will be added together and reported as a total catch for the sampling train.

D-5b(1)(b)(2)(m) Method 0040 Samples

The Method 0040 bag sample will be analyzed for organics with boiling points less than 100 °C using a field GC/FID. The condensate sample collected from the sampling train will be placed in a 40-mL septum vial and analyzed for volatile organics using purge and trap GC/FID SW-846 Methods 5340 and 0040.

D-5b(1)(c) Trial Burn Schedule [40 CFR 270.62(b)(2)(iv)]

The trial burn schedule is summarized in the following sections.

D-5b(1)(c)(1) Schedule

The trial burn will begin after [*Enter Company Acronym*] has received approval for the Part B trial burn plan and has successfully completed startup, shakedown, and pretesting of the incinerator. The typical test run schedule for the trial burn is shown in Table D-5.13. The test will span about 11 days: 1 day for setup, 9 days of testing, and 1 day for cleanup.

D-5b(1)(c)(2) Duration of Each Trial Burn Test

Three trial burn tests are planned, each consisting of three replicate sampling runs. One run is expected to be completed each day. Actual sampling time during each sampling run will last at least 8 hours. The incinerator will be fed test wastes at least 1 hour before each sampling run to establish steady operation at process test conditions. Therefore, total test time each day will be at least 9 hours. Assuming minimal interruption of incinerator operation, the incinerator can be expected to operate on test waste feeds for up to [*Enter Hours*] hours per day for about 9 days.

D-5b(1)(c)(3) Quantity of Waste To Be Burned

Test waste liquids and solids will be fed to the incinerator for an estimated [*Enter Product of Hours per Day from Previous Paragraph Multiplied by 9 Days*] hours. At the feed rates specified for the tests in Table D-5.3, the quantities of high-Btu liquids, low-Btu liquids, and solids required for the trial burn will be [*Enter Quantity*], [*Enter Quantity*], and [*Enter Quantity*], respectively. Allowing a 25 percent safety factor, the consumption of test feed materials will be expected to be about [*Enter Volume*] gallons of high-Btu liquid wastes, [*Enter Volume*] gallons of low-Btu liquid wastes, [*Enter Weight*] tons of solid wastes.

In Tests 1 and 2, the test waste liquids and solids will be actual wastes spiked with POHCs, organic chlorine, metals, and ash, as appropriate for the test condition. In Test 3, only actual wastes will be burned. Spiking will not occur during Test 3. Descriptions of the spiking compounds required for this trial burn are provided in Table D-5.14. The estimated quantities of POHC, organic chlorine, metals, and ash-spiking materials required for the trial burn, including a 25 percent safety factor, will be as follows:

POHC
chlorobenzene, [*Enter Quantity*]
carbon tetrachloride, [*Enter Quantity*]
naphthalene, [*Enter Quantity*]

Organic Chlorine
Perchloroethylene, [*Enter Quantity*]

Metals
[*Enter list of metal compounds*], [*Enter Quantities*]

Ash
copper sulfate, [*Enter Quantity*]

The unit will be expected to reach equilibrium at test conditions with normal waste or auxiliary fuel and will be switched to the test waste 1 hour before the start of each sampling run. POHC, ash, metals and organic chlorine source chemical spiking will be started concurrently with the test waste feed. A surplus of test waste will be prepared in case operational problems require a longer testing period. After the trial burn program is completed, all remaining wastes or spiking materials will be fed to the incineration system until combusted, used in the [*Enter Company Acronym*] facility, or returned to the vendor.

D-5b(1)(d) Test Protocols [40 CFR 270.62(b)(2)(v)]

The test protocols are summarized in the following sections.

D-5b(1)(d)(1) Waste Characterization

The hazardous wastes to be incinerated in the rotary kiln are discussed in Section C and in the introduction to Section D-5 of the permit application. Table D-5.2 summarizes the chemical and thermodynamic property parameters for the blended wastes to be incinerated during normal operation and the trial burn. The information in Table D-5.2 is based on the requirements of 40 CFR 270.62(b)(2)(I) and the *Guidance Manual for Hazardous Waste Incinerator Permits* (EPA 1983).

D-5b(1)(d)(2) **POHC Selection Rationale**

According to the EPA guidance, the selection of POHCs should be based primarily on three factors: (1) heat of combustion, (2) thermal stability ranking, and (3) presence in, or representativeness of, the actual wastes to be burned. Consistent with this guidance, [*Enter Company Acronym*] used the following three criteria to select the POHCs for this trial burn:

- At least one POHC must be present as an Appendix VIII constituent in the actual wastes.
- At least one POHC must have a high ranking as a Class 1 compound on the University of Dayton thermal stability ranking list.
- At least one POHC must be combustible at a low heat.

In assessing representativeness and appropriateness of compounds for POHC selection, current waste profile data were reviewed for those Appendix VIII compounds that will be the most prevalent in the waste available for incineration. Based on this review, carbon tetrachloride was determined to be present in the actual waste. Given that carbon tetrachloride also is combustible at a low heat, the compound was selected as a POHC.

Chlorobenzene and naphthalene were selected as the second and third POHC, primarily because of their high rankings as Class 1 compounds on the University of Dayton thermal stability index.

Because [*Enter Company Acronym*] feels it is important to obtain as flexible a permit as possible, [*Enter Company Acronym*] proposes to use actual wastes spiked with high-ranking Appendix VIII constituents, naphthalene, chlorobenzene, and carbon tetrachloride as the trial burn POHCs.

Because the POHCs include Class 1 compounds from the University of Dayton list and another compound that is combustible at low heat, the trial burn should provide a significant challenge to the incineration system's ability to destroy all of the constituents in the wastes it will burn. It is anticipated that the final permit will allow for incineration of all wastes that meet the profiles considered for POHC selection. Accordingly, successful incineration of these compounds at DREs of 99.99 percent or greater during the trial burn tests should result in a permit that allows incineration of all Class 1 or lower compounds.

D-5b(1)(d)(3) **Trial Burn Protocol and Operating Conditions**

The trial burn will consist of three tests. All three trial burn tests will include triplicate sampling runs. A total of 9 sampling runs will be conducted.

Test 1 will be conducted to demonstrate worst-case metals emissions performance under the following conditions:

- Maximum rotary kiln temperature
- Maximum SCC temperature
- Maximum ash content in low-Btu liquid waste content
- Maximum total organic chlorine feed rate in the solid feed and in the liquid waste feed
- Maximum metals feed rates to the kiln and SCC (Tier III metals spiked to the rotary kiln solid and sludge wastes and the SCC high- or low-Btu liquid waste feed line)
- Minimum venturi scrubber pressure drop, minimum venturi scrubber pH, minimum WESP liquid flow rate, minimum WESP power input, and minimum scrubber liquid blowdown rate

Test 2 will be conducted to demonstrate the DRE of the rotary kiln incineration system under the following conditions:

- Maximum solid waste feed rate
- Maximum rotary kiln high-Btu liquid waste feed rate
- Maximum SCC high-Btu liquid waste feed rate
- Maximum rotary kiln low-Btu liquid waste feed rate
- Maximum SCC low-Btu liquid waste feed
- Maximum ash content in low-Btu liquid waste content
- Minimum rotary kiln temperature
- Minimum SCC temperature
- Maximum combustion gas velocity
- Maximum organic chlorine content in the solid and liquid waste feed streams
- POHCs fed to the rotary kiln in solids and low-Btu liquid waste feeds
- POHCs fed to the SCC in low-Btu liquid waste feeds
- Minimum venturi scrubber pressure drop, minimum venturi scrubber pH, minimum WESP liquid flow rate, minimum WESP power input, and minimum scrubber liquid blowdown rate

Test 3 will be conducted to develop emissions data needed to support the performance of direct and indirect risk assessments. Test will be conducted under the following operating conditions:

- Normal solid waste feed rate
- Normal rotary kiln high-Btu liquid waste feed rate
- Normal SCC high-Btu liquid waste feed rate
- Normal rotary kiln low-Btu liquid waste feed rate
- Normal SCC low-Btu liquid waste feed
- Normal rotary kiln temperature
- Normal SCC temperature

The three trial burn tests will be performed to demonstrate and obtain permit limits that have the flexibility to accommodate different types of wastes feed and process conditions. The objectives of the trial burn will be as follows:

- Demonstrate that metal emission rates at metal feed rates proposed for the solid and sludge and liquid waste feeds (at maximum rotary kiln temperature during Test 1) are in compliance with Tier III limits.
- Demonstrate 99.99 percent or greater POHC DRE during maximum combined solid and liquid waste feed rates and minimum rotary kiln and SCC temperatures during Test 2.
- Demonstrate hydrogen chloride emissions and removal efficiency during Test 2 with the highest chlorine feed rate successfully demonstrated (less than 4 pounds per hour or 99 percent removal) as the permitted maximum.
- Determine that particulate emissions during all tests are less than 0.08 gr/dscf corrected to 7 percent oxygen.
- Demonstrate maximum combustion gas velocity during Test 2.
- Determine the metals, PCDDs and PCDFs, volatile and semivolatile PIC, hydrogen chloride, chlorine, and particulate matter emissions in the stack gas during Test 3.

As recommended in the *BIF Technical Implementation Document* (EPA 1992), one run during each test will capture all or part of a boiler soot blowing event. Particulate emissions from trial burn runs (including a soot blow) will be corrected for soot blowing, as follows:

$$E = \left[\left(E_{SBR} - E_{NOSB} \right) \times \left[\frac{AS + BS}{AR} \right] \times \frac{C_n}{C_t} \right] + E_{NOSB}$$

where

E = emission rate
E_{SBR} = average E of samples collected during test run with soot blowing corrected to 7 percent oxygen
E_{NOSB} = average E of samples collected during test runs without soot blowing corrected to 7 percent oxygen concentration
A = hours of soot blowing during the test run with soot blowing
B = hours without soot blowing during the test run with soot blowing
S = normal number of hours of soot blowing per 24 hours
R = normal number of hours of operation per 24 hours
C_n = normal number of operating hours between cleaning cycles
C_t = number of operating hours between cleaning cycles during test

D-5b(1)(d)(4) <u>Waste Constituents</u>

The anticipated compositions of the actual wastes to be burned during the trial burn are summarized in Table D-5.2. Under all three tests, actual wastes will be burned. During Test 1, the actual wastes will be spiked with ash, organic chlorine, and metals. During Test 2, the actual wastes will be spiked with POHCs, ash, and organic chlorine. No spiking will occur in Test 3. The actual wastes will be spiked with chlorobenzene, naphthalene, and carbon tetrachloride as POHCs; perchloroethylene as a source of organic chlorine; copper sulfate as a source of ash; and compounds of arsenic, beryllium, cadmium, and chromium. The composition of the spiking compounds and their targeted spiking rates are provided in Table D-5.14. Calculations of the quantities of spiking compounds required are provided in Appendix D-5.4. Details on the spiking program follow.

D-5b(1)(d)(4)(a) <u>Solid and Sludge Wastes</u>

All three trial burn tests will include the incineration of solid and sludge wastes. Perchloroethylene and solutions of the metal salts described in Table D-5.14 will be metered continuously to the solid waste feed auger just upstream from the kiln feed chute during Test 1. Perchloroethylene and POHCs will be continuously metered to the solid waste feed in the same location during Test 2. Spiking solution flow meters will be equipped with data loggers that will record and integrate flow rates continuously. Drawing [*Enter Drawing Number*] shows the spiking location and hardware (see Appendix D-5.2).

D-5b(1)(d)(4)(b) High-Btu Liquid Wastes

During all three tests, high-Btu liquid wastes will be fired in the rotary kiln and SCC burners. To maintain a steady flame in the burners, the liquid wastes fired must be well-blended and have a consistent heat content. Metal spiking solutions, as described in Table D-5.14, will be metered into the high-Btu liquid waste feed manifold just upstream from the waste burners during Test 1. During Test 2, perchloroethylene and POHCs will be metered to the incineration system by injecting them into the high-Btu waste feed manifold at the same location as the metal spiking solutions. Spiking solution flow meters will be equipped with data loggers that will record and integrate flow rates continuously. Drawing [*Enter Drawing Number*] shows the spiking location and hardware (see Appendix D-5.2).

D-5b(1)(d)(4)(c) Low-Btu Liquid Wastes

Low-Btu liquid waste will be injected into the kiln and the SCC during all three tests. This waste stream will be spiked with ash-particulate-producing material, such as copper sulfate or a similar material, during Tests 1 and 2. The copper sulfate will be added to the low-Btu liquid wastes as an ash surrogate to demonstrate the particulate removal capability of the APCS. The dissolved copper sulfate will not be removed by the waste feed line filters and will produce fine particulate when atomized into the combustion gas. The copper sulfate particulate will present a significant particulate removal challenge to the APCS. The quantity of ash spiking material fed to the combustion chambers will be tracked by adding measured quantities of copper sulfate to measured volumes of low-Btu liquids in a mixing tank and monitoring the feed rate of low-Btu liquids to the kiln and SCC, as described in Section D-5b(1)(a)(12). The mixing tank will be agitated at all times to dissolve the ash material.

Perchloroethylene and metals solutions, as described in Table D-5.14, will be metered into the low-Btu liquid waste feed line during Test 1. Perchloroethylene will be metered into the low-Btu liquid waste feed during Test 2. Spiking solution flow meters will be equipped with data loggers that will record and integrate flow rates continuously. Drawing [*Enter Drawing Number*] shows the spiking location and hardware (see Appendix D-5.2).

Chlorobenzene, naphthalene, and carbon tetrachloride will be received in sealed 55-gallon drums. The chlorobenzene and carbon tetrachloride will be pumped into the solid waste and liquid waste using variable-speed chemical-metering pumps. Micromotion mass flow meters located in the pump discharge lines will monitor the chlorobenzene flow rates continuously. The outputs from the flow meters will be linked to a PC-based DAS that will support continuous recording of the chlorobenzene flow rates.

Naphthalene will be mixed batch-wise with mineral oil at a ratio of [*Enter Number*] to [*Enter Number*] in a [*Enter Gallons*]-gallon portable tank equipped with an agitator. Quantities of naphthalene and mineral oil added to each batch will be weighed to the nearest 0.1 pound using calibrated scales. Batch sizes of [*Enter Gallons*] gallons will be prepared for each run. Typically, the batches will be prepared the day before each run. The naphthalene and mineral oil solutions will be metered into the solid and liquid wastes in the same manner as the chlorobenzene.

Perchloroethylene and metals spiking solutions will be received in sealed 55-gallon drums. The perchloroethylene and metals spiking solutions will be metered into the liquid wastes in the manner described previously for chlorobenzene.

Copper sulfate will be received in 70 pound bags. Weighed amounts of copper sulfate will be added to measured volumes of low-Btu liquids in an agitated 500-gallon blend tank to produce a spiked waste with a known concentration of ash. The flow rate of the blended low-Btu liquid to the combustion chambers will be monitored continuously with Micromotion mass flow meters.

D-5b(1)(d)(5) Combustion Temperature Ranges

The anticipated combustion chamber temperatures for the tests will be as indicated in Table D-5.3. Based on experience with similar incineration systems, occasional excursions of ±50 °F will be possible in the rotary kiln. If such temperature fluctuations occur in the kiln, the SCC will be likely to experience a corresponding temperature variation.

D-5b(1)(d)(6) Waste Feed Rates

The planned waste feed rates for the trial burn tests are summarized in Table D-5.3.

D-5b(1)(d)(7) Combustion Gas Velocity Indicator

The measured indicator of combustion gas velocity during the trial burn will be the combustion gas flow rate as measured by the stack-installed combustion gas velocity indicator.

D-5b(1)(d)(8) Waste Feed Ash Content

The liquid wastes that will be burned in the incineration system contain very little ash. To establish a permit condition that allows liquid feed streams with high ash contents, an inert particulate material copper sulfate will be added to the low-Btu liquid wastes before they are fed to the rotary kiln and SCC, as described in Sections D-5b(1)(c)(3) and D-5b(1)(d)(4).

The solid wastes used will have an ash content greater than 85 percent. No ash spiking of the solid waste will be necessary.

D-5b(1)(d)(9) Auxiliary Fuel

Natural gas will be used as required to maintain temperatures at maximum thermal duty in both the primary and secondary combustion chambers. Natural gas also will be used as pilot burner fuel for both the rotary kiln and the SCC.

D-5b(1)(d)(10) Organic Chlorine Content

The anticipated organic chlorine content of the trial burn feed material is shown in Table D-5.2. Waste feeds will be spiked with organic chlorine, as described in Table D-5.14. Assuming that 100 percent of the organic chlorine fed to the combustion chambers converts to hydrogen chloride, the maximum hydrogen chloride entering the APCS of the rotary kiln during the trial burn will be about [*Enter Mass*] pounds per hour.

D-5b(1)(d)(11) Metals

The proposed Tier III metals (arsenic, beryllium, cadmium, and chromium) feed rates are shown in Table D-5.3. Adjusted Tier I feed rate limits are proposed for antimony, barium, lead, mercury, nickel, selenium, silver, and thallium.

D-5b(1)(e) Pollution Control Equipment Operation [40 CFR 270.62(b)(2)(vi)]

Pollution control equipment is described in Section D-5b(1)(a)(10). The anticipated operating conditions for the trial burn are summarized in Table D-5.3. Fluctuations in APCS temperatures, flow rates, and pressures are expected to occur during the trial burn.

D-5b(1)(f) Shutdown Procedures [40 CFR 270.62(b)(2)(vii)]

The AWFCO system and parameters for shutting down the waste feeds are described in Section D-5b(1)(a)(8). AWFCOs for Group A and continuously monitored and interlocked Group C parameters will be in operation during the trial burn. During the trial burn, the system's operation will be monitored closely by the system operators. If the operation of the system during the trial burn should deviate significantly from the desired range of operation or become unsafe, the operators will manually shut off waste feeds to the system.

In the event of a major equipment or system failure, it may be necessary to shut down the combustion and APCSs completely. A shutdown of this type will be performed in strict accordance with the facility’s standard operating procedures. Shutdown will be the reverse of the startup process described in Section D-5b(1)(a)(13) and will involve shutting down subsystems in the following order:

- Rotary kiln
- SCC
- Heat recovery boiler
- APCS
- Utilities

D-5b(1)(g) Incinerator Performance [40 CFR 270.62(a)]

[*Note to User: In this section, a rationalization of the operating conditions selected for the trial and risk burns should be provided. In particular, this section should demonstrate that the performance standards of 40 CFR 264.343 will be met while operating under the proposed test conditions.*]

[*Enter Company Acronym*] believes that the conditions specified in Section D-5b(1)(d) for the trial burn will be adequate to meet the performance standards of 40 CFR 264.343 while firing any combination of feed materials for the following reasons:

- Our experience with identical kilns and SCC burning similar liquid and solid wastes under similar operating conditions at [*Identify Locations of Similar Plants*] shows that the expected DRE will exceed 99.99 percent. In trial burn tests conducted at [*List Facilities with Similar Combustion and APCSs*], DREs of [*List Demonstrated DREs*] were achieved.

- Our experience with identical kilns and SCC burning similar liquid and solid wastes under similar operating conditions at [*Identify Locations of Similar Plants*] suggests that the hydrogen chloride and particulate emissions will be less than 4 pounds per hour and 0.08 grains per dry standard cubic foot, respectively. In trial burn tests conducted at [*List Facilities with Similar Combustion and APCSs*], hydrogen chloride emissions of [*List Hydrogen Chloride Emissions*] were measured. During these same tests, particulate emissions of [*List Particulate Emissions*] were measured. In all of the cases, emissions of hydrogen chloride and particulate were well below the respective performance standards.

- Thermodynamic and finite element modeling performed by [*List Engineering Companies and Vendors*] demonstrates that DRE will exceed 99.99 percent and hydrogen chloride and particulate emissions will be below the performance standards of 4 pounds per hour and 0.08 grains per dry cubic foot.

- Maximum uncontrolled emissions of hydrogen chloride and particulate during testing have been predicted to be [*Present Estimates of Uncontrolled Emissions*]. Certifications and other information prepared by the vendors of the APCS equipment indicate that the aggregate removal efficiencies of the APCS equipment for hydrogen chloride and particulate will be [*Provide Removal Efficiencies*], suggesting maximum controlled emissions of [*Provide Estimates of Maximum Controlled Emissions*]. These controlled emissions are well below the performance standards.

- The range of operating conditions planned for the trial burn period are within the design envelope of the combustion and APCSs (refer to the design basis in Table D-5.7).

- The combustion and APCSs will be tightly controlled by the DCS, and AWFCO systems will be operational at all times during the trial burn period.

D-5b(2) NEW INCINERATOR CONDITIONS [40 CFR 270.62(a)]

[*NOTE TO USER: Section D-5b(2) applies only to new units. Startup and shakedown should proceed in a disciplined manner, according to a written plan. During startup, the system will be tested while firing auxiliary fuel only in order to verify operational readiness for hazardous wastes. Once successful startup testing has been completed, shakedown testing using hazardous waste feeds will be performed to optimize system operations prior to the trial burn. The initial shakedown period will be limited to 720 hours of operation while firing hazardous waste.*

Pretesting during the shakedown period is discretionary but recommended. A pretest may not be warranted for an existing or interim status unit that has been previously tested and in which the owner/operator has confidence in the unit's ability to meet the trial burn objectives. The pretest, however, being a dry run for the trial burn, will aid the identification of any testing logistical problems or sampling and analytical problems before the formal trial burn. Correction of these problems will minimize the chances that a trial burn will have to be repeated, a costly and potentially publicly embarrassing situation. The areas of chief concern are potential problems in analyzing the waste feed matrices or stack sampling and analysis for POHCs, PICs, and metals. Another and possibly more important reason for performing a pretest is that the pretest data can be used as a basis for establishing the interim operating limits for the unit. Otherwise, the regulatory authorities may limit the interim operation of the unit to limits substantially less than the trial burn demonstrated limits.]

After construction, [*Enter Facility Owner*] will perform instrument debugging, instrument calibration, process control simulations, and related preliminary systems testing before startup on auxiliary fuel. Once this preliminary systems testing is complete, startup and shakedown will commence sequentially, as described in Sections D-5b(2)(a) and (b). During the startup/shakedown period, the entire system will be thoroughly tested to verify that the entire system conforms to design requirements and performs in a safe, consistent, and predictable manner.

Preliminary systems, startup, and shakedown testing will proceed in accordance with the [*Enter Company Acronym*] startup plan (see Appendix D-5.5). The startup plan defines all activities, methodologies, standards, startup criteria, and compliance actions associated with the testing of the system. The startup plan addresses 15 functional areas of system design, construction, and operational readiness, as defined below:

1. Design
2. Construction
3. Organization and staffing
4. Standard operating procedures
5. Personnel and process safety
6. Environmental protection and permitting
7. Waste characterization and certification
8. Configuration management
9. Maintenance and monitoring
10. Fire protection

11. Emergency preparedness

12. Training

13. Test requirements and acceptance

14. Information management

15. Nonconformance and issue management

As stated in the startup plan, operating conditions will be maintained within the envelope of anticipated final operating limits defined in Table D-5.5 throughout the startup/shakedown period. These limits on operating conditions will be based on good engineering practice and experience with similar hazardous waste incineration systems and, as such, should comply with the requirements of 40 CFR 270.62(a)(1).

All of the limits on operating conditions specified in Table D-5.5 are based upon the anticipated performance of the new incineration system. Because the suggested conditions are engineering estimates, the numerical values should be considered to be approximate values to be confirmed or modified as design, startup/shakedown, and pretesting progresses.

During the startup/shakedown period, hazardous wastes will not be fed to the system unless the conditions described above are satisfied. The flow of hazardous waste to the incinerator will be stopped if operating conditions deviate from the established limits. An AWFCO system, described in Section D-5b(1)(a)(8), will be in operation at all times during the incineration of hazardous wastes. AWFCO settings during the startup/shakedown period will be those specified in Table D-5.6. Individual AWFCOs for those parameters that may cause total incinerator shutdown (such as auxiliary fuel, burners, or induced draft fan) may be bypassed momentarily during routine calibrations.

D-5b(2)(a) Startup

The objectives of the startup period are as follows:

- [*List Objectives of Startup Documented in the Startup Plan*]

The startup phase will be used to test the rotary kiln incineration system subsystems, as appropriate, without the introduction of actual hazardous wastes into the incineration systems. The startup test will be performed by firing nonhazardous solid wastes and fossil fuels only. Fresh process water will be used in the scrubber system.

During the first startup tests, the natural gas burners in the rotary kiln will be fired to cure the refractories and check out the prime air mover and system instrumentation under actual temperatures and pressure.

Next, [*Enter Facility Operator*] plans to feed nonhazardous surrogate solid wastes into the rotary kiln to check out the solid waste feed system, the ash handling system, the APCS, and the process control system. The SCC will be operated on natural gas during this test. During this test, the feed rate, heat value, and moisture content of the solid waste will be adjusted to simulate the full range of expected solid waste operation.

When the startup objectives have been satisfied, the startup period will be completed, and the shakedown phase will commence.

D-5b(2)(b) Shakedown

The objectives of the shakedown are as follows:

- [*List Objectives of Shakedown Documented in the Startup Plan*]

During the shakedown phase, actual hazardous wastes will be introduced into incineration system in accordance with 40 CFR 264.344(c)(1) to bring the unit to a point of operational readiness for the trial burn. [*Enter Company Acronym*] will provide EPA Region [*Enter Region*] and [*Enter State Agency*] with a 2-week notice before introducing hazardous wastes into the system.

This phase will take up to 720 hours of hazardous waste operation. If [*Enter Company Acronym*] determines that additional time will be necessary to ensure operational readiness before the trial burn, an extension of up to 720 additional hours of operating time will be requested.

During the 720-hour startup/shakedown period, [*Enter Company Acronym*] will conduct pre-trial burn testing (pretesting) at the proposed trial burn conditions to verify incinerator performance before the formal trial burn tests. [*Enter Company Acronym*] may request final modifications to the trial burn plan based on the pretest results. Should changes to the trial burn plan be deemed necessary by [*Enter Company Acronym*], such changes will be coordinated with EPA Region [*Enter EPA Region*] and the [*Enter State Agency Name (Enter State Agency Acronym)*].

The shakedown testing program will involve a series of progressively rigorous tests, as described in the shakedown plan (see Appendix D-5.5). The shakedown testing program will include pretesting using the POHC, metal, and ash spiking materials and stack sampling methods proposed for the trial burn, as a dry run for the trial burn. The pretest will consist of one run at each of the three test conditions. The pretest objectives are as follows:

- Confirm that the selected sampling and analytical methods for the trial burn are appropriate, and identify and correct any problems.

- Operate the system at full trial burn conditions.

- Demonstrate performance capabilities of the complete system and its individual components.

- Finalize target operating conditions for the trial burn.

While the sampling and analytical procedures used will be the same as the procedures used during the trial burn, the level of quality assurance will be less. For example, split samples and audits will not be used during the pretest. Verbal and preliminary data from the laboratories will be used to assess the pretest results. About [*Enter Days*] days will be required to compile and evaluate the pretest results and compile a brief summary report. Upon evaluation of the pretest results, the conditions for the actual trial burn will be finalized.

D-5b(2)(c) New Incinerator Post-Trial Burn Operation [40 CFR 270.62(c)]

The interim period between completion of the trial burn and receipt of final approval from EPA Region [*Enter Region*] and [*Enter State Agency Name*] for full operating authority could be several months. During this time, [*Enter Company Acronym*] intends to continue operating the incineration system on a full-time basis, operating under all federal requirements as per 40 CFR 264, 266, and 270. During this period, [*Enter Company Acronym*] expects the incineration system to operate within the operating envelope defined and demonstrated by the three trial burn tests, with the exceptions of high-Btu liquids, low-Btu liquids, solids waste feed rates, and metals and chlorine feed rates, which shall be limited to 75 percent of the maximum levels demonstrated during the trial burn.

[*NOTE TO USER: The operating limits for high-Btu liquids, low-Btu liquids, solids waste feed rates, and metals and chlorine feed rates may range from 50 to 90 percent of the maximum levels demonstrated during the trial burn.*]

The incinerator will be inspected visually on a daily basis during operation for fugitive emissions, leaks, and associated equipment spills and for signs of tampering, as per 40 CFR 264.347(b). All appropriate operating records will be maintained for documentation of operating conditions.

The AWFCO system and associated alarms, as described in Section D-5b(1)(a)(8), will be functioning any time hazardous waste is being introduced into the incinerator.

The proposed method for testing the AWFCO system includes a complete check of hardware, set point, and software, not simply electronic verification of software. The integrity of the final elements (such as valve and auger-shredder) will be proven by closing the waste feed block valves. The proposed method of testing the AWFCO system is as follows:

- The control system will poll the individual monitors to the system continuously. If the integrity of the signal path between the control system and the monitor is compromised or fails, the fail-safe features of the control system will initiate a control system alarm and AWFCO automatically for the affected parameter. This includes the failure of an input module. The control system will ensure constant integrity of the AWFCO signal path between the monitoring point and the control system. If the integrity of the signal path between the control system and the final element fails, the fail safe features of the control system will initiate an AWFCO automatically for the affected waste stream. This will include the failure of an output module because the control system does not use traces, which can fail in the energized state.

- The incineration system monitors will be calibrated quarterly. Hazardous waste processing will be stopped prior to this testing sequence. During the calibration sequence, the field technician, in coordination with the control room operator, will test the integrity of most AWFCOs. The field operator will send an artificial signal that will, normally, initiate an AWFCO. The control room operator will verify that the signal alarm is received, and the output closes the automatic liquid waste feed block valve(s) and stops the solid and sludge waste feed.

- AWFCO testing will be performed weekly using simulations of off-normal operations. An AWFCO test screen will be configured in the DCS for this purpose. Each week, one of the events that results in an AWFCO will be simulated by adjusting the trip point for that event in an appropriate direction to initiate shutdown of each of the waste feeds by de-energizing the relay to the waste feed cut-off valve (valve fails closed). The remainder of the AWFCO initiating events will be activated in a manner similar to the first, and the de-energization of the relay that provides shutdown of the waste feed will be demonstrated. During the testing period, the waste feed cutoffs will be operated using a manual override. The control room operator will be responsible for manually initiating an AWFCO, should actual operating conditions violate any of the AWFCO limits during testing.

D-5b(2)(d) Incinerator Performance [40 CFR 270.62(a)]

[*Note to User: In this section, a rationalization of the operating conditions selected for the startup, shakedown, and post-trial burn operation should be provided. In particular, this section should demonstrate that the performance standards of 40 CFR 264.343 will be met while operating the unit during startup, shakedown, and post-trial burn operation.*]

[*Enter Company Acronym*] believes that the conditions specified in Section D-5b(2) for the startup, shakedown, and post-trial burn operation will be adequate to meet the performance standards of 40 CFR 264.343 while firing any combination of feed materials for the following reasons:

- Our experience with identical kilns and SCC burning similar liquid and solid wastes under similar operating conditions at [*Identify Locations of Similar Plants*] shows that the expected DRE will exceed 99.99 percent. In trial burn tests conducted at [*List Facilities with Similar Combustion and APCSs*], DREs of [*List Demonstrated DREs*] were achieved.

- Our experience with identical kilns and SCC burning similar liquid and solid wastes under similar operating conditions at [*Identify Locations of Similar Plants*] suggests that the hydrogen chloride and particulate emissions will be less than 4 pounds per hour and 0.08 grains per dry standard cubic foot, respectively. In trial burn tests conducted at [*List Facilities with Similar Combustion and APCSs*], hydrogen chloride emissions of [*List*

Hydrogen Chloride Emissions] were measured. During these same tests, particulate emissions of [*List Particulate Emissions*] were measured. In all of the cases, emissions of hydrogen chloride and particulate were well below the respective performance standards.

- Thermodynamic and finite element modeling performed by [*List Engineering Companies and Vendors*] demonstrates that DRE will exceed 99.99 percent and hydrogen chloride and particulate emissions will be below the performance standards of 4 pounds per hour and 0.08 grains per dry cubic foot.

- Maximum uncontrolled emissions of hydrogen chloride and particulate during shakedown and testing have been predicted to be [*Provide Estimates of Uncontrolled Emissions*]. Certifications and other information prepared by the vendors of the APCS equipment indicate that the aggregate removal efficiencies of the APCS equipment for hydrogen chloride and particulate will be [*Provide Removal Efficiencies*], suggesting maximum controlled emissions of [*Provide Estimates of Maximum Controlled Emissions*]. These controlled emissions are well below the performance standards.

- The range of operating conditions planned for the startup, shakedown, and post-trial burn periods are within the design envelope of the combustion and APCSs (refer to the design basis in Table D-5.7).

- The combustion and APCSs will be tightly controlled by the DCS, and AWFCO systems will be operational at all times during the startup, shakedown, and post-trial burn periods.

- Startup and shakedown will be conducted in a disciplined manner, according to the written startup plan (see Appendix D-5.5).

D-5c TRIAL BURN SUBSTITUTE SUBMISSIONS [40 CFR 270.19(c)]

This section is not applicable. A trial burn will be conducted.

[*NOTE TO USER: Previous interim status testing may be proposed as data in lieu of trial burn data, subject to EPA and state regulatory agency approval.*]

D-5d DETERMINATIONS [40 CFR 270.62(b)(6)]

The required information for the trial burn determinations is summarized in the following sections.

D-5d(1) TRIAL BURN RESULTS [40 CFR 270.62(b)(7)]

The results of the trial burn test must be submitted in the report format specified in Table D-5.15. The key elements that must be included in each section of the trial burn report are as follows:

- A summary of trial burn results describing any unusual process conditions (deviations from the approved trial burn plan) or difficulties experienced with sampling, testing, or analysis (Executive Summary)

- A discussion of any inconsistencies in the data and assessment of, and/or justification for, usability of the data (Executive Summary)

- A summary of conclusions in meeting the trial burn plan objectives (Executive Summary)

- A list of key project personnel (Section 1.0)

- A detailed description of chemical and physical analysis of waste feed and process samples (Section 2.0)

- A concise description of the test program including reasons for testing, number and types of tests, technical approach, test locations, sampling trains, and special equipment (Section 3.0)

- A comparison of test conditions to planned conditions for all waste and fuel feed rate information, waste generation rate information, and stack gas parameter rate information, including at a minimum, the following (Section 4.0)

    - Maximum, minimum, average, and standard deviation of the solid, high-Btu liquid, and low-Btu liquid waste feed rates

    - Maximum, minimum, average, and standard deviation of combustion chamber temperatures

    - Maximum, minimum, average, and standard deviation of APCS operating conditions

    - Maximum, minimum, average, and standard deviation of combustion gas velocity

- A summary of test results and a comparison with permit or regulatory compliance limits, including the following (Section 5.0)

    - Analytical results

    - Quantitative analysis of POHCs in waste feed

    - Stack gas concentrations (such as gr/dscf, pounds per dscf, ppm_{dv}, milligrams per liter) and stack gas emission rates (pounds per hour and gallons per second) of POHCs, metals, hydrogen chloride, chlorine, particulate, PCDDs and PCDFs, PICs, oxygen, carbon monoxide, and carbon dioxide

    - Computation of DRE

  - Particle-size distribution

- A description of sampling methods, sample preparation, and analytical procedures (Section 6.0)

- The method for determining the detection limit in the matrix for each analysis, and the data and results of the detection limit determination (Section 7.0)

- A copy of the trial burn plan (Appendix A)

- A copy of the trial burn QAPP (Appendix B)

- A stack sampling report (Appendix C)

- A process sampling report (Appendix D)

- A quality assurance and quality control (QA/QC) report, including completed chain-of-custody forms, analysis request forms, and a key relating laboratory sample identification numbers to trial burn sample identification numbers (Appendix E)

- Instrument calibration records (Appendix F)

- Performance calculations, including the example calculations used in each determination and all the raw data needed for traceability of the results calculated (Appendix G)

- Field logs (Appendix H)

- Analytical data packages (Appendix I)

  - Test data summary tables with raw and calculated data, including the associated QA/QC results for all the data

  - A summary of the data validation procedures and criteria indicating how the data met the data validation criteria and the QA/QC objectives stated in the approved QAPP and approved methodology

  - Completed data validation checklists

  It should be noted that all data must be submitted for all analysis conducted, including the data from failed runs.

[*Enter Company Acronym*] will submit the trial burn report within 90 days after completion of the trial burn. The trial burn report will be certified in accordance with the requirements of 40 CFR 270.62(b)(7-9).

D-5d(2) FINAL OPERATING LIMITS [40 CFR 270.62(b)(10)]

[*NOTE TO USER: This section is probably the most important section in the trial burn plan. Here the performance objectives and the sampling and analysis programs come together to establish operating limits for the unit. This is the permittee's opportunity to communicate to the permit writer exactly how the test sampling and analysis data and the demonstrated operating conditions are expected to be interpreted into final permit operating limits. This information should be repeated in the trial burn report.*]

If the DRE, metals, particulate, hydrogen chloride, and PICs performance objectives set forth in Section D-5b(1)(d)(3) are achieved during the trial burn, the RCRA incineration operating permit should allow the incineration system to be used to incinerate RCRA hazardous solid and liquid wastes at the rates and under the conditions discussed in this section.

The destruction of organics is a function of time, temperature, and turbulence. The minimum thermal treatment temperature and maximum combustion gas velocity test the capability of the rotary kiln incineration system to destroy organics under conditions least favorable for organics destruction (minimum time at minimum temperature) and subsequent PIC formation. The maximum waste feed rates present the maximum challenge for the particulate loading to the APCS. The Tier III metals feed rates present a significant challenge for the rotary kiln incineration system's APCS to remove the metals from the combustion gas. The high-chlorine feed rate and minimum recycle flow rates and pH operating conditions test the APCS's capabilities under the least favorable conditions for removing hydrogen chloride from the combustion gas.

The anticipated final operating conditions resulting from the trial burn are summarized in Table D-5.5. Table D-5.5 was prepared following the hierarchy of process-control-related performance parameters, as established by the *Guidance on Setting Permit Conditions and Reporting Trial Burn Results* (EPA 1989). Each anticipated rotary kiln incineration system final operating limitation is listed by process parameter, target value during the trial burn, and anticipated manner by which the limit will be established. In accordance with EPA guidance, the process parameters presented in Table D-5.5 are broken down by Group A, B, and C parameters, as follows:

- Group A—These parameters will be monitored continuously and will be connected to an AWFCO system. When a Group A parameter is exceeded, contaminated waste feed must be discontinued immediately. Group A parameters will be established based on demonstrated operating conditions during the trial burn.

- Group B—These parameters will not be monitored continuously. Compliance with these parameters will be based on operating records to ensure that routine operation is within the operational limits established by the trial burn.

- Group C—Limits on these parameters will be set independently of trial-burn-demonstrated parameters. Instead, these limits will be based on EPA guidance, equipment manufacturer's design and operating specifications, operational safety considerations, and good engineering practices. Group C parameters include parameters monitored both continuously and periodically. Depending upon the particular Group C parameter, a Group C parameter may or may not be an AWFCO parameter.

D-5d(2)(a) Group A Parameters

Establishment of permit limits for the Group A parameters is discussed in the following paragraphs.

- Maximum Hazardous Waste Feed Rates—Maximum waste feed rate will be a Group A parameter. The maximum waste feed rates for high- and low-Btu liquids and solids will be demonstrated during Test 2. The final, approved permit limit for each waste feed stream will be based on the arithmetic mean of the highest hourly rolling average waste feed rate demonstrated during the three Test 2 runs.

- Minimum Rotary Kiln Temperature—Minimum rotary kiln temperature limit will be proposed as a Group A parameter related to meeting the DRE. Provided that satisfactory DRE for the designate POHCs is obtained during Test 2, the final, approved permit limit for minimum rotary kiln temperature should be based on the arithmetic mean of the lowest hourly rolling average temperatures demonstrated during the three Test 2 runs.

- Maximum Rotary Kiln Temperature—Maximum rotary kiln temperature limit will be proposed as a Group A parameter related to meeting the metals emission limits. Provided that satisfactory metals emissions for the Tier III metals are obtained during Test 1, the final, approved permit limit for maximum rotary kiln temperature should be based on the arithmetic mean of the highest hourly rolling average temperatures demonstrated during the three Test 1 runs.

- Maximum SCC Temperature—Maximum SCC temperature limit will be proposed as a Group A parameter related to meeting the metals emission limits. Provided that satisfactory metals emissions for the Tier III metals are obtained during Test 1, the final, approved permit limit for maximum SCC temperature should be based on the arithmetic mean of the highest hourly rolling average temperatures demonstrated during the three Test 1 runs.

- Minimum SCC Temperature—Minimum SCC temperature limit will be a Group A parameter related to DRE and will be demonstrated during Test 2. Test 2 will be designed to demonstrate 99.99 percent or greater DRE on two POHCs. Provided that satisfactory DRE results are obtained for the designated POHCs during the trial burn, the final, approved permit limit for SCC temperature should be based on the arithmetic mean of the lowest hourly rolling average temperatures demonstrated during the the three Test 2 runs.

- Maximum Combustion Gas Velocity—Combustion gas velocity will be a Group A parameter related to DRE and combustion gas treatment based on the trial burn demonstrated stack gas flow. Combustion gas velocity in the stack will be an indicator of combustion gas residence time in the SCC, the portion of the rotary kiln incineration system responsible for DRE. The final, approved operating condition should be based on the arithmetic mean of the highest hourly rolling average stack gas flow rate, as demonstrated during each of the three Test 2 runs.

- Maximum Boiler Inlet Temperature—The maximum combustion gas inlet temperature to the boiler will be a Group A parameter based on the results of the risk burn. The final operating limit for this parameter is expected to be the mean of the highest hourly rolling average inlet temperatures recorded during each of the three runs under Test 3.

- Minimum Vane Separator Process Water Flow Rate—The minimum vane separator process water flow rate will be based on the mean of the minimum hourly rolling average flow rates recorded during each of the trial burn runs under Tests 1 and 2.

- Minimum Venturi Scrubber Differential Pressure—The minimum differential pressure across the venturi scrubber will be based on the mean of the minimum hourly rolling average differential pressures recorded during each of the trial burn runs under Tests 1 and 2.

- Minimum Venturi Scrubber Liquid To Gas Ratio—The minimum venturi scrubber liquid to gas ratio will be based on the mean of the minimum hourly rolling average liquid to gas ratios recorded during each of the trial burn runs under Tests 1 and 2.

- Minimum Venturi Scrubber Recycle pH—The venturi scrubber solution pH will be controlled to a minimum value during the trial burn, while the liquid to gas ratio will be minimized. Provided that adequate hydrogen chloride control has been demonstrated at high chloride feed rate, minimum liquid to gas ratio, and minimum pH during the trial burn, the minimum venturi scrubber pH should be based on the arithmetic mean pH value demonstrated during all runs of the trial burn under Tests 1 and 2.

- Minimum Scrubber Blowdown Flow Rate—The permit condition for the minimum scrubber blowdown flow rate is expected to be established as the mean of the lowest recorded flow rates during each of the runs under Tests 1 and 2.

- Minimum WESP Power Input—The WESP kVA will be controlled to a minimum value during the trial burn while the combustion gas flow will be maximized. Provided that adequate particulate and metals control has been demonstrated at high liquid waste ash feed and maximum metals feed rates during the trial burn, the minimum WESP kVA should be based on the arithmetic mean kVA value demonstrated during all runs of the trial burn under Tests 1 and 2.

- Minimum WESP Liquid Flow Rate—The WESP liquid flow will be controlled to a minimum during the trial burn. Provided that adequate particulate and metals control are demonstrated during the trial burn, the permit condition for minimum WESP liquid flow rate should be based on the arithmetic mean of the lowest hourly rolling average flow rates recorded during each of the six runs under Tests 1 and 2.

- Maximum Carbon Monoxide Concentration in the Stack**—**Maximum carbon monoxide concentration in the stack will be a Group A parameter related to PIC control and normally will be established at the performance standard of 100 ppm$_{dv}$ corrected to 7 percent oxygen 60-minute. During all nine runs of the trial burn, compliance with this performance standard will be demonstrated by controlling the carbon monoxide concentration in the stack gas below this limit. When the 60-minute, rolling average carbon monoxide concentration exceeds 100 ppm$_{dv}$ corrected to 7 percent oxygen, all waste feeds will be stopped automatically. Waste feeds will not be resumed until the rolling average concentration falls below the 100 ppm$_{dv}$ rolling average limit.

- Minimum Oxygen Concentration in the Stack**—**Minimum oxygen in the stack gas will be a Group A parameter. The rotary kiln and SCC will be operated under oxidative operating conditions to treat the waste feeds. The oxygen levels in the combustion system will be controlled to result in a stack gas concentration of 3 to 5 percent oxygen. The final operating limit for oxygen in the stack gas will be the mean of the lowest hourly rolling averages recorded during each of the three tests runs.

D-5d(2)(b) Group B Parameters

Establishment of Group B parameter limits based on the results of Tests 1 and 2 is discussed in the following paragraphs.

- Maximum Metals Feed Rate Limits**—**The feed rate of the metals to the combustion process will be controlled Group B parameters. The Tier I metals feed rate limits for this facility will be established on the basis of effective stack height, stack gas temperature and stack gas flow rate. The Tier I metals feed rate limits, as calculated using the procedures of 40 CFR 266 Appendix I, are as follows:

  - [*List Tier I Metals and Feed Rate Screening Limits*]

  It is anticipated that the final permit will require that the feed rates of Tier I metals (antimony, barium lead, mercury, nickel, selenium, silver, and thallium) be measured in the waste feeds to demonstrate compliance with the Tier I limits. Tier I metals limit compliance will be based on the operating records, which show that the feed rates of these metals do not exceed the respective rates allowed in the final permit.

  The Tier III emission limits and the underlying dispersion modeling based on the emissions measurements made during the trial burn will be presented to EPA in a document, "U.S. EPA Tier III Limits for Metals and Hydrogen Chloride for the Proposed Incinerator, [*Enter Company Name*], [*Enter Facility Location*], [*Enter Consultant Company Name*], [*Enter Consultant Company Location*], [*Enter Day, Year*]."

  Provided that the emission rates of the Tier III metals are in compliance with the Tier III allowable emissions limits, the final permit condition for maximum hourly rolling average feed rates of arsenic, beryllium, cadmium, and chromium are expected to be based on the feed rates of these metals demonstrated during Test 1. Separate feed rate limits will be proposed for solid and sludge wastes and liquid wastes. Metals limits compliance will be based on the operating records, which show that the feed rates of these metals do not exceed the respective rates demonstrated during Test 1.

- Maximum Chlorine Feed Rate—The feed rate of chlorine, which will be converted primarily to hydrogen chloride and possibly to small amounts of chlorine in the combustion process, will be controlled as a Group B parameter. The RCRA hydrogen chloride performance standard [40 CFR 264.343(b)] requires either 99 percent hydrogen chloride removal or less than 4 pounds of hydrogen chloride per hour stack emission during the incineration of chlorinated hazardous wastes. BIF (40 CFR 266.107) regulates hydrogen chloride and chlorine using a tiered approach similar to metals. Based on the waste profile, [*Enter Company Acronym*] has determined that a 99 percent removal and Tier III approach will be necessary. [*Enter Company Acronym*] requests that the permit condition be based on the maximum pounds of organic chlorine per hour that will be fed to the rotary kiln incineration systems and will be successfully removed as hydrogen chloride to either the 99 percent removal or Tier III limits.

  Because the source of hydrogen chloride, either as chlorinated liquid or solid and sludge waste, is not relevant to the hydrogen chloride removal performance of the APCS equipment, it is requested that the permit will allow any combination of chlorinated liquid and solid and sludge wastes to be incinerated as long as the total organic chlorine rate does not exceed the organic chlorine permit condition. The final permit condition for maximum hourly rolling average feed rate of chlorine is expected to be based on the maximum amount of chlorine fed during the Test 2 and for which effective acid gas control will be demonstrated. The total feed rate of chlorine will include the chlorine contributions from the combination of solid and sludge wastes, liquid wastes, spiked organic chlorine source chemical, and spiked POHCs. Compliance will be demonstrated based on the operating records, which show that the feed rates of chlorine in the waste feeds do not exceed the limit.

- POHC DRE—Effective demonstration of 99.99 percent or greater DRE of the three designated POHCs, chlorobenzene, naphthalene, and carbon tetrachloride, spiked to the waste feeds will be done during Test 2. Chlorobenzene and carbon tetrachloride, which are Class 1 compounds on the University of Dayton Thermal Stability Ranking, will provide a rigorous test of the rotary kiln incineration system's capability to treat the [*Enter Company Acronym*] wastes. The final approved POHC DRE limits for the rotary kiln incineration system should allow a treatment of any of the [*Enter Company Acronym*] wastes at the maximum feed rates demonstrated during Test 2. [*Enter Company Acronym*]'s final permit should allow incineration of all 40 CFR 261 Appendix VIII organic compounds, except hazardous wastes designated as F020, F021, F022, F023, F026, and F027 or wastes containing greater than 50 ppm PCBs that are regulated by TSCA, which will be prohibited.

- Maximum Particulate Matter Emissions—The expected permit condition for this parameter is 0.08 gr/dscf, the RCRA performance standard for incinerators and BIF units. [*NOTE TO USER: The air permit for the facility may contain a more* *restrictive particulate matter emission limit than the RCRA standard cited above. If so, cite the more restrictive limit here.*]

- Maximum Ash Content of Waste—The solid and sludge waste used during the trial burn will have an ash content greater than 85 percent. It is expected that there will not be a permit condition related to the ash content of the solid and sludge wastes.

  During all trial burn tests, ash-producing material will be added to the low-Btu liquid wastes to provide significant challenge to the particulate removal capabilities of the APCS. Particulate emissions will be measured during all trial burn tests. If the particulate emissions are at or below those stated in the trial burn objectives (0.08 gr/dscf), these tests should be considered as acceptable particulate tests for all solid wastes, sludges, and slurries, regardless of the solids ash content. The maximum permitted liquid waste ash content for liquid hazardous waste will then be based on the mean of the ash contents in the liquid waste during the six runs under Tests 1 and 2.

- Maximum Emissions of Chlorine and Hydrogen Chloride—The expected permit condition for this parameter is 4 pounds per hour, as required under 40 CFR 264.343(b).

Expected risk-based Group B permit limits are described below.

[*Note to User: Risk-based permit conditions will be an outgrowth of the multi-pathway risk assessment completed after the trial burn. Each facility will have unique risk factors, so it is anticipated that the nature and extent of risk-based permit conditions will be highly variable. The following permit conditions are presented as examples only*.]

- Maximum Dioxin and Furan Emissions—The expected permit condition for this parameter will be established on the basis of the site-specific risk assessment.

- Maximum Annual Average Hazardous Waste Feed Rates—Assuming that the multi-pathway risk assessment results are favorable, the final approved permit limits for maximum annual average hazardous waste feed rates is expected to be based on the arithmetic means of the highest hourly rolling average waste feed rates demonstrated during the three Test 3 runs.

- Minimum Annual Average Rotary Kiln Temperature—Provided the multi-pathway risk assessment results are favorable, the final approved permit limit for the minimum annual average rotary kiln temperature is expected to be based on the arithmetic mean of the lowest hourly rolling average temperatures demonstrated during each of the three Test 3 runs.

- Maximum Annual Average Rotary Kiln Temperature—Provided the multi-pathway risk assessment results are favorable, the final approved permit limit for the maximum annual average rotary kiln temperature is expected to be based on the arithmetic mean of the highest hourly rolling average temperatures demonstrated during each of the three Test 3 runs.

- Maximum Annual Average SCC Temperature—Provided that satisfactory multi-pathway risk assessment results are obtained, the final permit limit for the maximum annual average SCC temperature is expected to be based on the arithmetic mean of the three highest hourly rolling average temperatures demonstrated during each of the three Test 3 runs.

- Minimum Annual Average SCC Temperature—Provided that satisfactory multi-pathway risk assessment results are obtained, the final permit limit for the minimum annual average SCC temperature is expected to be based on the arithmetic mean of the lowest hourly rolling average temperatures demonstrated during each of the three Test 3 runs.

- Maximum Annual Average Combustion Gas Flow Rate—The final permit condition for the maximum annual average combustion gas flow rate is expected to be based on the arithmetic mean of the highest hourly rolling average stack gas flow rates demonstrated during each of the three Test 3 runs.

D-5d(2)(c) Group C Parameters

Establishment of Group C parameters is discussed in the following paragraphs.

- CEM System Operation—CEM system operation will be a Group C parameter to comply with EPA guidance that CEMs must be operational when the rotary kiln incineration system is processing wastes. A loss of instrument signal from either the carbon monoxide or oxygen CEM will result in an AWFCO.

- Maximum Rotary Kiln Pressure—Rotary kiln pressure is normally a Group C parameter established based on EPA guidance for fugitive emissions control. Fugitive emissions control will be a qualitative demonstration. Fugitive emissions from the rotary kiln will be controlled by maintaining the pressure in the rotary kiln slightly below atmospheric pressure. A limit of ≤0.08 inch of water column will be proposed for this AWFCO limit, which will be in effect during the trial burn. When the rotary kiln pressure exceeds the maximum pressure limit, all waste feeds to the rotary kiln will be stopped automatically.

- Maximum Quench Exit Temperature—Quench exit temperature will be proposed as a Group C parameter based on the manufacturer's recommendations. The maximum temperature limit proposed for quench duct exit temperature will be 210 °F to protect temperature-sensitive FRP construction materials of the acid gas scrubbing system. When the quench duct exit temperature exceeds the maximum limit, all waste feeds will be stopped.

- Minimum Heating Value—[*Enter Company Acronym*] expects that the final permit will specify minimum heating value permit conditions for the high-Btu liquid waste equal to those recommended by the burner manufacturers, as follows:

    - Rotary kiln burner, [*Enter Manufacturer's Recommendation*]

- Small SCC burner, [*Enter Manufacturer's Recommendation*]

- Large SCC burner, [*Enter Manufacturer's Recommendation*]

[*Enter Company Acronym*] anticipates that the final permit will not specify a maximum or minimum heating value for solid wastes or low-Btu liquid wastes. The minimum heating value concept, while relevant to high-Btu liquid wastes, is not relevant to low heating value solids such as sludges or slurries. As stated on page 4-22 of the *Guidance Manual for Hazardous Waste Incinerator Permits* (EPA 1983),

> "However, in the case of solids fed to rotary kilns, hearths and other solids handling incineration equipment, a different approach to specifying a heating value for waste is needed. Many solid wastes, by their very nature, are subject to wide variations in heating value, and rotary kiln, hearth, and similar incinerator designs attempt to deal with this problem. Such designs provide for the volatiles in the solids to be vaporized and subsequently destroyed in an afterburner or secondary combustion chamber. Thus in specifying heating values for solid waste feeds, a lower heating value limit may not be required if the incinerator is equipped and operated to maintain sufficient temperature by addition of liquid waste or auxiliary fuel."

Because the incineration system will have dual-fuel capability in both the rotary kiln and SCC chambers, the rotary kiln should not have a heating value permit condition for the incineration of solid wastes. The quoted information also will be applicable to the low-Btu liquid wastes, which will not be used as burner fuel in either the rotary kiln or the SCC.

- Maximum Liquid Waste Viscosity—An upper limit on the viscosity of liquid wastes will be established at [*Enter Viscosity*] centipoise, commensurate with the recommendations of the manufacturers of the liquid waste injection nozzles and burners.

- Maximum Thermal Input to Kiln—An upper limit on the thermal input to the kiln will be established at [*Enter Btu per Hour*], based on the recommendations of the kiln manufacturer.

- Maximum Thermal Input to SCC—An upper limit on the thermal input to the SCC will be established at [*Enter Btu per Hour*], based on the recommendations of the SCC manufacturer.

- Maximum Solids Content of Liquid Wastes—An upper limit on the solids content of the liquid wastes will be established at [*Enter Percent Solids*], based on the recommendations of the burner and nozzle manufacturers.

- Maximum Burner Turndown—An upper limit on the turndown ratio will be established for each burner at [*Enter Turndown Ratio*], based on the recommendations of the burner manufacturers.

- Minimum Venturi Scrubber Nozzle Pressure—A lower limit on the pressure of the scrubber liquid at the venturi nozzle will be established at [*Enter Pressure*] psig, based on the recommendations of the venturi manufacturer.

- Minimum WESP Nozzle Pressure—A lower limit on the pressure of the scrubber liquid at the WESP nozzles will be established at [*Enter Pressure*] psig, based on the recommendations of the WESP manufacturer.

- Minimum Differential Pressure Between Atomizing Steam and High-Btu Liquid Waste—A lower limit on the pressure diffential will be established at [*Enter Pressure*] psig, based on the recommendations of the liquid waste burner manufacturer.

- Minimum Differential Pressure Between Atomizing Air and Low-Btu Liquid Waste—A lower limit on the pressure diffential will be established at [*Enter Pressure*] psig, based on the recommendations of the liquid waste nozzle manufacturer.

REFERENCES

U.S. Environmental Protection Agency (EPA). 1983. “Guidance Manual for Hazardous Waste Incinerator Permits.” Office of Solid Waste. Washington, D.C. March.

U.S. EPA. 1989. “Guidance on Setting Permit Conditions and Reporting Trial Burn Results.” Hazardous Waste Incineration Guidance Series, Volume II. Office of Solid Waste. Washington D.C. EPA/625/6-89/019. January.

U.S. EPA. 1992. “BIF Technical Implementation Document.” Washington, D.C. EPA-530-R-92-011. March.

U.S. EPA. 1996. “Test Methods for Evaluating Solid Waste, Physical/Chemical Methods.” Washington, D.C. SW-846. Update III. December.

U.S. EPA. 1998a. “Protocol for Human Health Risk Assessment at Hazardous Waste Combustion Facilities.” EPA-R6-098-002. Center for Combustion Science and Engineering, Multimedia Planning and Permitting Division, U.S. EPA Region 6. Dallas, Texas. January.

U.S. EPA. 1998b. “Protocol for Screening Level Ecological Risk Assessment at Hazardous Waste Combustion Facilities.” EPA-R6-098-003. Center for Combustion Science and Engineering, Multimedia Planning and Permitting Division, U.S. EPA Region 6. Dallas, Texas. January.

APPENDIX D-5.1

QUALITY ASSURANCE PROJECT PLAN

APPENDIX D-5.2

PROCESS FLOW DIAGRAMS, PIPING AND INSTRUMENTATION DIAGRAMS, AND FACILITY LAYOUT

APPENDIX D-5.2

PROCESS FLOW DIAGRAMS, PIPING AND INSTRUMENTATION DIAGRAMS, AND FACILITY LAYOUT

This appendix must include the following diagrams, as describe in this section:

- General arrangement
- Construction
- Piping and instrumentation
- Process control logic

General Arrangement Diagrams

General arrangement diagrams must be provided showing top and side views of entire incineration system, including elevations.

Construction Diagrams

Construction diagrams for the following equipment must be provided with sufficient detail to show inside and outside dimensions; varying refractory thicknesses; location and orientation of burners, nozzles, and augers into chambers; and instrument locations (actual) and sample taps:

- Kiln
- Secondary combustion chamber and thermal relief vent (including induced draft and elevation)
- Kiln faceplate
- Auger feed system
- Ash-handling system
- Boiler

- Quench
- Venturi
- Wet electrostatic precipitator
- Induced draft fan and stack (including port and monitor locations, inner diameter, and elevations)

Piping and Instrumentation Diagrams

Piping and instrumentation diagrams must be provided with sufficient detail to show the following elements:

- Tag numbers
- Locations
- Elements
- Indicating controllers
- Valves
- Switches
- Alarms
- Interlocks/cutoffs

Process Control Logic Diagrams

Process control logic diagrams must show the control logic for combustion, air pollution control, and continuous emissions monitoring systems.

APPENDIX D-5.3

MANUFACTURERS’ SPECIFICATIONS

APPENDIX D-5.3

MANUFACTURERS' SPECIFICATIONS

This appendix must include the following information:

- Burner nozzle specifications—for the kiln burner, kiln atomizer, secondary combustion chamber (SCC) startup burner, SCC main burner, SCC atomizer, and SCC quench nozzles—must be provided with sufficient detail to include the following information:
    - Type (internal or external mix)
    - Diagram
    - Capacity
    - Turndown ratio
    - Atomizing media and pressure
    - Fuel pressure
    - Viscosity range
    - Percent solids and size limits
    - Explanation of how atomizing media are controlled relative to feed rate changes
- Fan curve
- Instruments (such as thermocouples, flow meters, and annubars)
- Rotary kiln specifications and fabrication drawings
- SSC specifications and fabrication drawings
- Data sheets for castable refractories
- Specifications and fabrication drawings for air pollution control equipment
- Specifications for continuous emission monitors
- Specifications and fabrication drawings for waste feed systems

APPENDIX D-5.4

WASTE FEED AND CHLORINE, METALS, AND POHC SPIKING INFORMATION

APPENDIX D-5.4

WASTE FEED AND CHLORINE, METALS, AND POHC SPIKING INFORMATION

Actual solid and liquid wastes will be burned in the incineration system during three tests. The liquid wastes will be spiked with copper sulfate and perchloroethylene in Tests 1 and 2 to increase the ash and chlorine feed rates to the desired levels. The liquid wastes also will be spiked with metals in Test 1 and principal organic hazardous constitutents (POHC) in Test 2. The solid wastes will be spiked with perchloroethylene and metals in Test 1 and perchloroethylene and POHCs in Test 2. No spiking will occur in Test 3.

The expected composition of the high-British thermal unit (Btu) liquid waste that will be used in order to formulate the waste feed for all three tests will be as shown in Table D-5.4-1. As shown therein, the waste before spiking is expected to be 80 percent by weight ethanol and 20 percent by weight water.

The expected composition of the low-Btu liquid waste that will be used in order to formulate the waste feed for all three tests will be as shown in Table D-5.4-2. As shown therein, the waste before spiking is expected to be 100 percent by weight water.

The expected composition of the solid waste that will be used in order to formulate the waste feed to the rotary kiln in all three tests will be as shown in Table D-5.4-3.

ORGANIC CHLORINE AND ASH SPIKING

The target feed rates for organic chlorine and ash in both Tests 1 and 2 are as listed in Table D-5.4-4.

Table D-5.4.5 shows the composition of the high-Btu liquid following spiking with perchloroethylene and copper sulfate in order to raise the chlorine and ash feed rate to the target levels in Tests 1 and 2.

Table D-5.4.6 shows the composition of the low-Btu liquid waste following spiking with perchloroethylene and copper sulfate in order to raise the chlorine and ash feed rates to the target levels in Tests 1 and 2.

Table D-5.4.7 shows the composition of the solid waste following spiking with perchloroethylene in order to raise the chlorine feed rate in that stream to the target levels in Tests 1 and 2.

The purity and composition of the perchloroethylene and copper sulfate spiking compounds used for the trial burn will be certified by an independent party. These certifications will be included in the trial burn report.

METAL SPIKING

The trial burn's metal sampling and analysis program includes spiking metals to the solid and liquid waste feeds in the rotary kiln and secondary combustion chamber (SCC) during Test 1. For the trial burn, [*Enter Company Name*] will use a contractor that specializes in providing metal spiking services for incineration testing programs. The contractor's procedures and methods will be coordinated with U.S. Environmental Protection Agency (EPA) Region [*Enter Region Number*] and the [*Enter State Agency*]. The metallic compounds proposed by the contractor for spiking the liquid and solid wastes are indicated in Tables D-5.4-8 and D-5.4-9, respectively. The selection of these compounds has been based upon their physical properties and availabilities. These compounds will not be substituted without approval from EPA Region [*Enter Region Number*] and the [*Enter State Agency*].

Target Metal Feed Rates

The target metal feed rates for the trial burn were established as follows:

- The minimum feed rate of each metal must result in a detectable amount in the stack gas. The determination of the minimum feed rate of each metal was based on its analytical method detection limit, the stack gas sample size, the anticipated dry stack gas flow rate, and the anticipated air pollution control system (APCS) removal efficiency and incineration system partitioning factor.

- Once the minimum feed rate of each metal was determined, this value was then compared to the metal's maximum expected feed rate in [*Enter Company Name*]'s waste materials. Whenever the metal feed rate corresponding to the minimum detectable amount in the stack gas was found to exceed the expected maximum feed rate of the same metal in [*Enter Company Name*]'s waste materials, the proposed feed rate was adjusted upward. In each case, the maximum feed rate of any metal was limited to no more than 80 percent of its Tier III limit based on its anticipated APCS removal efficiency and incineration system partitioning factor.

The results of this analysis are presented in Table D-5.4-10.

The metals arsenic, beryllium, cadmium, and chromium will be spiked to the waste feeds during Test 1 to demonstrate compliance with the Tier III emissions limits for these metals at higher than Tier III feed rates. The preliminary air dispersion modeling performed to support the development of the proposed Tier III limits is provided in Appendix D-5.10. [*Enter Company Name*] will comply with Adjusted Tier I limits (Tier III emission limits as permit waste feed rate limits with no credit taken for APCS removal) for antimony, barium, lead, mercury, selenium, silver, and thallium.

The purity and compositions of the metals spiking compounds used for the trial burn will be certified by an independent party. These certifications will be included in the trial burn report.

Metal Spiking to the Solid Wastes

Metals will be spiked to the solid waste feed by injecting solutions of metal salts. This metal spiking method for the solid wastes gives a high degree of control to the actual quantity of metals being spiked. The metal salts proposed for solids during Test 1 of the trial burn are indicated in Table D-5.4.8.

Metals Spiking to the Liquid Wastes

Solutions of metals will be added to the high- or low-Btu waste feed line during Test 1. The actual amount of metal spiking solutions required for the liquid wastes will be determined by the metal's target feed rate and the limitations of the spiking equipment available. The metal salts proposed for the liquid wastes during Test 1 of the trial burn are indicated in Table D-5.4.9.

Anticipated Detection Limits

The values for the metal spiking rates are based on the stack detection limits in Table D-5.4-11.

Sample Calculation for Metals of Concern

As an example, the calculation for beryllium follows:

Beryllium

Tier III Limit/(1 - APCS Removal Efficiency) = Theoretical Maximum Liquid Metals Feed Rate = (0.00037 pound per hour [lb/hr])/(1 - 0.95) = 0.0074 lb/hr

Theoretical Maximum Liquid Metals Feed Rate x 0.80 = Maximum Proposed Trial Burn Liquids Metal Feed Rate = 0.0074 lb/hr x 0.80 = 0.006 lb/hr

Spiking Rate in Liquids = Maximum Proposed Trial Burn Liquid Metals Feed Rate - Expected Liquid Metals Feed Rate = 0.14 lb/hr - 0.005 lb/hr = 0.135 lb/hr

POHC SPIKING

Appendix D-5.8 provides calculations of POHC spiking rates.

QUANTITY OF TRIAL BURN FEED MATERIALS

Assumed duration of waste burning during trial burn is as shown:

Test 1 = 27 hrs
Test 2 = 24 hrs
Test 3 = 39 hrs

High-Btu Liquid Wastes

The quantity of high-Btu liquid waste is calculated as follows:

Test 1 – 2,183 lbs/hr x 27 hrs = 58,941 lbs
Test 2 – 2,183 lbs/hr x 24 hrs = 52,392 lbs
Test 3 – 1,800 lbs/hr x 39 hrs = 70,200 lbs
Subtotal = 181,533 lbs

Add 25 percent safety factor = 45,383 lbs

Total = 226,916 lbs

Low-Btu Liquid Wastes

The quantity of low-Btu liquid waste is calculated as follows:

Test 1 – 700 lbs/hr x 27 hrs = 18,900 lbs
Test 2 – 700 lbs/hr x 24 hrs = 16,800 lbs
Test 3 – 600 lbs/hr x 39 hrs = 23,400 lbs
Subtotal = 48,000 lbs
Add 25 percent safety factor = 12,000 lbs
Total = 60,000 lbs

Solid Wastes

The quantity of solid waste is calculated as follows:

Test 1 – 4,883 lbs/hr x 27 hrs = 501,841 lbs
Test 2 – 4,883 lbs/hr x 24 hrs = 117,192 lbs
Test 3 – 4,000 lbs/hr x 39 hrs = 156,000 lbs
Subtotal = 48,000 lbs
Add 25 percent safety factor = 775,033 lbs
Total = 501,841 lbs

Perchloroethylene

The quantity of perchloroethylene is calculated as follows:

Test 1 – 351 lbs/hr x 27 hrs = 9,477 lbs
Test 2 – 351 lbs/hr x 24 hrs = 8,424 lbs

Test 3 – 0 lbs/hr x 39 hrs = 0 lbs

Subtotal = 17,901 lbs

Add 25 percent safety factor = 74,475 lbs

Total = 22,376 lbs

Chlorobenzene, Carbon Tetrachloride, Napthalene, and Acetone POHCs

The quantity of chlorobenzene POHCs is calculated as follows:

Test 1 – 0 lbs/hr x 27 hrs = 0 lbs

Test 2 – 20 lbs/hr x 24 hrs = 480 lbs

Test 3 – 0 lbs/hr x 39 hrs = 0 lbs

Subtotal = 480 lbs

Add 25 percent safety factor = 120 lbs

Total = 600 lbs

The quantity of carbon tetrachloride POHCs is calculated as follows:

Test 1 – 0 lbs/hr x 27 hrs = 0 lbs

Test 2 – 20 lbs/hr x 24 hrs = 480 lbs

Test 3 – 0 lbs/hr x 39 hrs = 0 lbs

Subtotal = 480 lbs

Add 25 percent safety factor = 120 lbs

Total = 600 lbs

The quantity of napthalene POHCs is calculated as follows:

Test 1 – 0 lbs/hr x 27 hrs = 0 lbs

Test 2 – 60 lbs/hr x 24 hrs = 1,440 lbs

Test 3 – 0 lbs/hr x 39 hrs = 0 lbs

Subtotal = 1,440 lbs

Add 25 percent safety factor = 360 lbs

Total = 1,800 lbs

The quantity of acetone POHCs (for dissolving naphthalene) is calculated as follows:

Test 1 – 0 lbs/hr x 27 hrs = 0 lbs

Test 2 – 100 lbs/hr x 24 hrs = 2,400 lbs

Test 3 – 0 lbs/hr x 39 hrs = 0 lbs

Subtotal = 2,400 lbs

Add 25 percent safety factor = 600 lbs

Total = 3,000 lbs

Metal Salts

Certified dispersions of the metal salts described in Tables D-5.4-8 and D-5.4-9 will be procured. The dispersions will be formulated to permit the metal spiking rates identified in the referenced tables to be achieved by injecting the dispersions into the liquid and solid wastes at low flow rates (less than 0.1 gallon per minute [gpm]). Required quantities of metal dispersions will be as follows:

Test 1 – 0.1 gpm x 60 min/hr x 27 hr = 162 gallons

Test 2 – 0 gpm x 60 min/hr x 24 hr = 0 gallons

Test 3 – 0 gpm x 60 min/hr x 24 hr = 0 gallons

Subtotal = 162 gallons

Add 25 percent safety factor = 40 gallons

Total = 202 gallons

TABLE D-5.4-1

EXPECTED COMPOSITION OF HIGH-BTU LIQUID WASTE COMPOSITION (BEFORE SPIKING)

Constituent	Wt.%	Btu/lb	Specific Gravity	Density (lb/gal)	%Ash	%Carbon	%Hydrogen	%Oxygen	%Water	%Chlorine
Ethanol	80	11,943	0.79	6.59	0.50	37.49	12.58	49.93	0.00	0.00
Water	20	0	1.00	8.34	0.00	0	11.11	88.89	100.00	0.00
High-Btu liquid	100	9,554.4	0.83	6.92	0.40	29.99	12.28	57.72	20.00	0.00

Notes:

Btu = British thermal unit
Btu/lb = British thermal units per pound
lb/gal = Pounds per gallon
Wt.% = Weight percent

TABLE D-5.4-2

EXPECTED COMPOSITION OF LOW-BTU LIQUID WASTE (BEFORE SPIKING)

Constituent	Wt.%	Btu/lb	Specific Gravity	Density (lb/gal)	%Ash	%Carbon	%Hydrogen	%Oxygen	%Water	%Chlorine
Water	100	0	1.00	8.34	0.00	0	11.11	88.89	100.00	0.00
Low-Btu liquid	100	0	1.00	8.34	0.00	0	11.11	88.89	100.00	0.00

Notes:

Btu = British thermal unit
Btu/lb = British thermal units per pound
lb/gal = Pounds per gallon
Wt.% = Weight percent

TABLE D-5.4-3

SOLID WASTE COMPOSITION (BEFORE SPIKING)

Constituent	Btu/lb	%Carbon	%Hydrogen	%Oxygen	%Nitrogen	%Water	%Sulfur	%Chlorine	%Ash
Solids	224	0.66	0.26	2.59	0.10	8.99	0.03	0.00	30.70
Solids Feed	224	0.66	0.26	2.59	0.10	8.99	0.03	0.00	30.70

Note:

Btu/lb = British thermal units per pound

TABLE D-5.4-4

TARGET FEED RATES FOR ORGANIC CHLORINE AND ASH (TESTS 1 AND 2)

Spiking Substance	**Feed Stream**	**Target Feed Rate (lbs/hr)**
Organic Chlorine	High-Btu liquid	100
	Low-Btu liquid	100
	Solid waste	100
	Total	300
Ash	High-Btu liquid	50
	Low-Btu liquid	50
	Solid waste	1,500
	Total	1,600

Notes:

Btu = British thermal unit
lbs/hr = Pounds per hour

TABLE D-5.4-5

COMPOSITION OF HIGH-BTU LIQUID WASTE FOR TESTS 1 AND 2 (SPIKED WITH CHLORINE AND ASH)

Constituent	lbs/hr	Wt.%	Btu/lbs	Specific Gravity	Density (lbs/gal)	%Chlorine	Chlorine (lbs/hr)	%Ash	Ash (lbs/hr)
High-Btu liquid	2,183	94.02	9,554.4	0.83	6.92	0.00	0.00	0.40	10
Perchloroethylene	117	5.00	--	--	--	85.71	100.00	0.00	0
Ash (as copper sulfide)	40	1.71	0	3.15	26.27	0.00	0.00	100.00	40
Low-Btu liquid mix	2,340	100.00	--	--	--	4.27	100.00	2.14	50

Notes:

Btu = British thermal unit
Btu/lbs = British thermal units per pounds
lbs/gal = Pounds per gallon
lbs/hr = Pounds per hour
Wt.% = Weight percent
-- = Not applicable

The test amount of liquid ash is as follows: 2,340 lbs/hr (rotary kiln + secondary combustion chamber total) x 0.0214 = 50 lbs/hr
The test amount of chlorine is as follows: 2,340 lbs/hr (rotary kiln + secondary combustion chamber total) x 0.0429 = 100 lbs/hr

TABLE D-5.4-6

COMPOSITION OF LOW-BTU LIQUID WASTE FOR TESTS 1 AND 2 (SPIKED WITH CHLORINE AND ASH)

Constituent	lbs/hr	Wt.%	Btu/lbs	Specific Gravity	Density (lbs/gal)	%Chloride	Chlorine (lbs/hr)	%Ash	Ash (lbs/hr)
Low-Btu liquid	700	94.02	9,554.4	0.83	6.92	0.00	0.00	0.40	3
Perchloroethylene	117	5.00	--	--	--	85.71	100.00	0.00	0
Ash (as copper sulfide)	47	1.71	0	3.15	26.27	0.00	0.00	100.00	47
Low-Btu liquid mix	864	100.00	--	--	--	11.57	100.00	5.79	50

Notes:

Btu = British thermal unit
Btu/lbs = British thermal units per pound
lbs/gal = Pounds per gallon
lbs/hr = Pounds per hour
Wt.% = Weight percent
-- = Not applicable

The test amount of liquid ash is as follows: 864 lbs/hr (rotary kiln + secondary combustion chamber total) x 0.0579 = 50 lbs/hr
The test amount of chlorine is as follows: 864 lbs/hr (rotary kiln + secondary combustion chamber total) x 0.1157 = 100 lbs/hr

TABLE D-5.4-7

COMPOSITION OF SOLID WASTE FOR TESTS 1 AND 2 (SPIKED WITH PERCHLOROETHYLENE)

Constituent	lbs/hr	Wt%	Btu/lbs	%Chlorine	Chlorine (lbs/hr)	%Ash	Ash (lbs/hr)
Perchloroethylene	117	2.34	--	85.71	100	0.00	0
Solids	4,883	97.66	224	0.00	0	30.70	1,500
Solids Feed	5,000	100.00	--	2.00	100	29.98	1,500

Notes:

Btu = British thermal unit
Btu/lbs = British thermal units per pound
lbs/hr = Pounds per hour
Wt.% = Weight percent
-- = Not applicable

The test amount of chlorine is as follows: 5,000 lbs/hr solids feed x 0.02 = 100 lbs/hr
The test amount of liquid ash is as follows: 5,000 lbs/hr solids feed x 0.2998 = 1,500 lbs/hr

TABLE D-5.4-8

METALS SPIKING MATERIALS FOR SOLIDS

Metal	Form	Metal Target Feed Rate (lbs/hr)	Metal Salt Target Feed Rate (lbs/hr)
Arsenic	Sodium arsenate (Na_3AsO_4), heptahydrate (22.5 wt.% Arsenic)	0.28	1.25
Beryllium	Beryllium sulfate ($BeSO_{4,}$), tetrahydrate (5.1 wt.% Beryllium)	0.12	2.36
Cadmium	Cadium acetate ($Cd(C_2H_3O_2)_2$), dihydrate (42.2 wt.% Cadmium)	0.043	0.1
Hexavalent chromium	Sodium dichromate ($Na_2Cr_2O_{7,}$), dihydrate (34.9 wt.% Chromium)	0.048	0.14

Notes:

lbs/hr = Pounds per hour
wt.% = Weight percent

All values have been rounded to approximate values; actual values may vary.

TABLE D-5.4-9

METALS SPIKING MATERIALS FOR LIQUIDS

Metal	Form	Metal Target Feed Rate (lbs/hr)	Metal Salt Target Feed Rate (lbs/hr)
Arsenic	Arsenic trioxide (As_2O_3), (76.9 wt.% Arsenic)	0.14	0.2
Beryllium	Beryllium sulfate ($BeSO_4$), tetrahydrate (5.1 wt.% Beryllium)	0.006	0.12
Cadmium	Cadium oxide (CdO), (87.5 wt.% Cadmium)	0.043	0.05
Trivalent chromium	Chromic oxide (Cr_2O_3), (68.4 wt.% Chromium)	0.0024	0.004

Notes:

lbs/hr = Pounds per hour
wt.% = Weight percent

All values have been rounded to approximate values; actual values may vary.

TABLE D-5.4-10

METALS OF CONCERN

Metal	Tier III Emission Limit[a] (lbs/hr)	Theoretical Percent Volatilization in the Kiln (%)	Theoretical Percent APCS Removal Efficiency (%)	Theoretical Maximum Liquid Metals Feed Rate (lbs/hr)	Maximum Proposed Trial Burn Liquids Metals Feed Rate (lbs/hr)[d]	Expected Metals Feed Rate in Actual Liquid Waste (lbs/hr)	Theoretical Maximum Solids Metals Feed Rate (lbs/hr)	Maximum Proposed Trial Burn Solids Metals Feed Rate (lbs/hr)[d]	Expected Metals Feed Rate in Actual Solid Waste (lbs/hr)[d]
Arsenic	0.0026	50[e]	98.5[c]	0.173	0.14	0.0052	0.35	0.28	0.09
Beryllium	0.00037	5[b]	95[b]	0.0074	0.006	0.00006	0.148	0.12	0.0006
Cadmium	0.0027	100[b]	95[b]	0.054	0.043	0.00006	0.054	0.043	0.014
Chromium	0.000074	5[b]	97.5[c]	0.0030	0.0024	0.0005	0.060	0.048	0.029

Notes:

APCS = Air pollution control system
lbs/hr = Pounds per hour

[a] "U.S. Environmental Protection Agency Tier III Limits for Metals and Hydrogen Chloride for the Proposed Incinerator, [*Enter Company Name*], [*Enter City, State*]," [*Enter Consultant/Preparer*], [*Enter Month Day, Year*].

[b] "Guidance on Metals and Hydrogen Chloride Controls for Hazardous Waste Incinerators," U.S. Environmental Protection Agency (EPA), August 1989.

[c] "Measurement of Particulates, Metals, and Organics at a Hazardous Waste Incinerator," Garg, S., EPA/530-SW-89-067, EPA, Office of Solid Waste, Washington, D.C., November 1988.

[d] Approximately 80 percent of the Tier III limit is based on the assumed partitioning factors and removal efficiencies.

[e] "The Behavior of Arsenic in a Rotary Kiln," Robert C. Thurnau, EPA, Cincinnati, Ohio, and Donald Fournier, Jr., Acurex Corporation, Jefferson, Arkansas, *Journal of the Air and Waste Management Association*, Vol. 42, No. 2, February 1992.

TABLE D-5.4-11

ANTICIPATED DETECTION LIMITS

Metal	Stack Detection Limit (g/m^3)[a]	Back-Half Detection Limit (μg/L or ppb)[b]	Front-Half Detection Limit (μg/L or ppb)[c]
Arsenic	2×10^{-6}	3	30
Beryllium	7×10^{-8}	0.1	1
Cadmium	3×10^{-7}	0.5	5
Total Chromium	7×10^{-7}	1	10

Notes:

g/m^3 = Grams per cubic meter
μg/L = Micrograms per liter
ppb = Parts per billion

[a] Based on a 3-cubic-meter dry gas sample
[b] Based on a 2,000-milliliter sample size
[c] Based on a 25-milliliter sample size

APPENDIX D-5.5

STARTUP PLAN

APPENDIX D-5.5

STARTUP PLAN

This appendix contains the startup plan for the incineration system. The startup plan will address the 15 functional areas described in Section D-5b(1) of the trial burn plan.

APPENDIX D-5.6

THERMAL RELIEF VENT OPERATION

APPENDIX D-5.6

THERMAL RELIEF VENT OPERATION

This appendix must include the following information:

- Identification of all conditions that might cause a thermal relief vent opening
- Documentation that a fault-tree analysis was performed to determine the effect of reliabilities of individual system components on the frequency of failure
- Based on the fault-tree reliability analysis, identification of the components that should be redundant to reduce frequency of failure
- Continuous data recorder to document openings and duration of openings
- Procedures to cut off waste and minimize emissions
- Calculations to prove bypass height will cause sufficient natural draft to keep negative pressure at the front of the kiln
- Reporting requirements, including cessation of waste burning if the thermal relief vent opens for reasons not specified in the permit
- Emission estimates and dispersion modeling to factor into risk assessment, unless openings are very infrequent

APPENDIX D-5.7

SAMPLING STANDARD OPERATING PROCEDURES

APPENDIX D-5.7

SAMPLING STANDARD OPERATING PROCEDURES

CONTENTS

CONTENTS (Continued)

APPENDIX D-5.7

SAMPLING STANDARD OPERATING PROCEDURES

Procedure Number:	***01***
Procedure Title:	***Low-Btu Liquid Waste Feed Sampling Procedure***
Sample Name:	Low-Btu liquid waste feed
Sampler:	Field sampling specialist
Process Sample Locations:	The sample tap will be located on the liquid waste feed line upstream of the spiking input points of the metal, principal organic hazardous constituents, and ash.
Sampling and Health and Safety Equipment:	Glass sample collection bottles (1-gallon Wheaton jug and 1-liter Boston-round glass bottles) with Teflon™-lined lids, pre-cleaned glass graduated cylinders, 40-milliliter) volatile organic analysis (VOA) vials with Teflon™-lined septa, full face respirator (if required), safety glasses (if respirator is not required), and latex gloves
Sample Collection Frequency:	A grab aliquot will be taken at the beginning of testing and at 15-minute intervals for the duration of each test run.
Sampling Procedures:	The nonvolatile parameter samples will be collected by building a master composite sample of the liquid waste feed in the 1-gallon Wheaton jug. At the completion of the run, subsamples of the master composite will be collected for the ultimate, proximate, british thermal unit (Btu) output, ash content, viscosity, and density analyses. The 1-gallon sample will be shaken vigorously before pouring off subsamples. Sampling for Nonvolatile Parameters—Purge the sampling tap by allowing at least three tap volumes of liquid to flow into a waste container. Next, collect a measured grab volume of sample (approximately 200 mL) at each 15-minute interval. Add each grab volume to a numbered, prelabeled 1-gallon Wheaton jug to build the final composite. Grab portions will be stored on ice during the implementation of the sampling run. On the sample collection sheet, record the date and time that each grab sample was taken and the approximate volume of the final composite sample. At the conclusion of the test run, shake the 1-gallon composite sample vigorously to provide good mixing, and fill a numbered and prelabeled 1-liter Boston-round bottle from the composite. On the sample collection

sheet, document that the aliquot was removed from the original composite. The 1-liter sample will be used for proximate analyses. The balance of original composite sample is retained for other nonvolatile analyses. Check the label and number of both composite samples for sample tracking quality assurance.

VOA Sampling—Concurrent with nonvolatile sampling at each 15-minute interval, collect a pair of 40-mL VOA vials so as to exclude headspace bubbles. Label and number each pair of VOA vials with sample numbers for individual VOA pair tracking. Record the date and time that each VOA pair was taken on the sample collection sheet. Volatile sample compositing will be conducted in the controlled environment of the laboratory.

Note that liquid samples that contain mostly solvents or an organic compound form a convex meniscus at the top of the VOA vial. Under these conditions, a headspace free sample cannot be obtained. This information will be recorded on the sample collection sheets.

Sample Preservation:

The nonvolatile liquid waste feed sample portions require storage on ice throughout testing and sample transport to the laboratory. If residual chlorine is expected in these samples, volatile samples in VOA vials will be prepreserved by adding four drops of 0.008 percent sodium thiosulfate to each VOA vial before sampling commences and also will be stored on ice during and after the test run. When the samples are shipped to the laboratory, they will be shipped with a sufficient amount of ice so as to arrive at the laboratory cold (4 °C ± 2 °C).

Caution: The liquid waste feed samples will be stored on ice in an area away from the sample trailer where train samples are being handled, away from other trace-analyte-containing samples and away from the sample container supply area.

Documentation and Record-keeping:

Before sampling is commenced, each bottle will be labeled with a specific sample number, the project name, the run number, the sample description, the date, and the time of sampling. The sampler will fill out a sample collection sheet for every sample collected of the low-Btu waste feed. The time that each aliquot of the waste stream is collected will be logged as it is collected. The sample collection sheet will provide a place to record the sample number, project name, the run number, the sampler's name, the sample type, sample description, sample source, the bottle type, and the date and time of each grab collection. The sampling coordinator also will record all samples collected into a field logbook. This logbook will serve as the master document listing of all of the trial burn samples collected.

Quality Assurance and

Quality Control:	The required number of analyses for these samples is defined in Table 10-1 of the quality assurance project plan. The laboratory is required to analyze separately all of the field samples, field quality control samples, and laboratory quality control samples specified in Table 10-1.
Method References:	Method S004, EPA-600/8-84-002 [S004 is a tap sampling method appropriate for sampling liquid wastes in pipes or process lines]. Taken from Harris, J.C.; Rechsteiner, C.E.; Larson D.J.; Thrun, K.E.; *Combustion of Hazardous Wastes, Sampling and Analysis Methods*; Noyes: New Jersey, 1985. "Practice for Manual Sampling of Petroleum and Petroleum Products." ASTM D-4057-88. Taken from *Annual Book of ASTM Standards.* D-1989-93. American Society for Testing and Materials; ASTM: Philadelphia, PA, 1996.

Procedure Number: ***02***

Procedure Title: ***High-Btu Liquid Waste Feed Sampling Procedure***

Sample Name: High-Btu liquid waste feed

Sampler: Field sampling specialist

Process Sample Locations: The sample tap will be located on the liquid waste feed line upstream of the spiking input points of the metal, principal organic hazardous constituents, and ash.

Sampling and Health and Safety Equipment: Glass sample collection bottles (1-gallon Wheaton jug and 1-liter Boston-round glass bottles) with Teflon™-lined lids, pre-cleaned glass graduated cylinders, 40-milliliter (mL) volatile organic analysis (VOA) vials with Teflon™-lined septa, full-face respirator (if required), safety glasses (if respirator is not required), and latex gloves

Sample Collection Frequency: A grab aliquot will be taken at the beginning of testing and at 15-minute intervals for the duration of each test run.

Sampling Procedures: The nonvolatile parameter samples will be collected by building a master composite sample of the liquid waste feed in the 1-gallon Wheaton jug. At the completion of the run, subsamples of the master composite will be collected for the ultimate, proximate, british thermal unit (Btu) output, ash content, viscosity, and density analyses. The 1-gallon sample will be shaken vigorously before pouring off subsamples.

<u>Sampling for Nonvolatile Parameters</u>—Purge the sampling tap by allowing at least three tap volumes of liquid to flow into a waste container. Next, collect a measured grab volume of sample (approximately 200 mL) at each 15-minute interval. Add each grab volume to a numbered, prelabeled 1-gallon Wheaton jug to build the final composite. Grab portions will be stored on ice during the implementation of the sampling run. On the sample collection sheet, record the date and time that each grab sample was taken, and the approximate volume of the final composite sample.

At the conclusion of the test run, shake the 1-gallon composite sample vigorously to provide good mixing, and fill a numbered and prelabeled 1-liter Boston-round bottle from the composite. On the sample collection sheet, document that the aliquot was removed from the original composite. The 1-liter sample will be used for proximate analyses. The balance of original composite sample is retained for other nonvolatile analyses. Check the label and number of both composite samples for sample tracking quality assurance.

VOA Sampling—Concurrent with nonvolatile sampling at each 15-minute interval, collect a pair of 40-mL VOA vials so as to exclude headspace bubbles. Label and number each pair of VOA vials with sample numbers for individual VOA pair tracking. Record the date and time that each VOA pair was taken on the sample collection sheet. Volatile sample compositing will be conducted in the controlled environment of the laboratory.

Note that liquid samples that contain mostly solvents or an organic compound form a convex meniscus at the top of the VOA vial. Under these conditions, a headspace free sample cannot be obtained. This information will be recorded on the sample collection sheets.

Sample Preservation:

The nonvolatile liquid waste feed sample portions require storage on ice throughout testing and sample transport to the laboratory. If residual chlorine is expected in these samples, volatile samples in VOA vials will be prepreserved by adding four drops of 0.008 percent sodium thiosulfate to each VOA vial before sampling commences and also will be stored on ice during and after the test run. When the samples are shipped to the laboratory, they will be shipped with a sufficient amount of ice so as to arrive at the laboratory cold (4 °C ± 2 °C).

Caution: The liquid waste feed samples will be stored on ice in an area away from the sample trailer where train samples are being handled, away from other trace-analyte-containing samples and away from the sample container supply area.

Documentation and Record-Keeping:

Before sampling is commenced, each bottle will be labeled with a specific sample number, the project name, the run number, the sample description, the date, and the time of sampling. The sampler will fill out a sample collection sheet for every sample collected of the low-Btu waste feed. The time that each aliquot of the waste stream is collected will be logged as it is collected. The sample collection sheet will provide a place to record the sample number, project name, the run number, the sampler's name, the sample type, sample description, sample source, the bottle type, and the date and time of each grab collection. The sampling coordinator will also record all samples collected into a field logbook. This logbook will serve as the master document listing of all of the trial burn samples collected.

Quality Assurance and Quality Control:

The required number of analyses for these samples is defined in Table 10-1 of the quality assurance project plan. The laboratory is required to analyze separately all of the field samples, field quality control samples, and laboratory quality control samples specified in Table 10-1.

Method References:

Method S004, EPA-600/8-84-002 [S004 is a tap sampling method appropriate for sampling liquid wastes in pipes or process lines]. Taken from Harris, J.C.; Rechsteiner, C.E.; Larson D.J.; Thrun, K.E.; *Combustion of Hazardous Wastes, Sampling and Analysis Methods*; Noyes: New Jersey, 1985.

“Practice for Manual Sampling of Petroleum and Petroleum Product.” ASTM D-4057-88. Taken from *Annual Book of ASTM Standards.* D-1989-93. American Society for Testing and Materials; ASTM: Philadelphia, PA, 1996.

Procedure Number: ***03***

Procedure Title: ***Solid Waste Feed Sampling Procedure***

Sample Name: Solid waste feed

Sampler: Field sampling specialist

Process Sample Locations: The sample will be located in the ram feeder operations or conveyor belt delivery area (solid feed). A sample of the solid waste feed will be taken upstream of the addition of any chlorine source chemical ash spiking or metals spiking materials.

Sampling and Health and Safety Equipment: Sampling scoop, glass sample collection jars (1-liter [L] wide-mouth powder glass jar, 120-milliliter [mL] glass, 250-mL wide-mouth glass) with Teflon™-lined lids, latex gloves, and eye protection

Sample Collection Frequency: One grab aliquot will be collected at the beginning of testing and at 15-minute intervals for the duration of each test run.

Sampling Procedures: Three grab samples of the solid waste feed material will be collected at the beginning of the test run: a 250-mL wide-mouth sample collection jar for the proximate-type analysis, a full-120 mL wide-mouth sample collection jar for volatile analysis, and a 1-L glass sample collection jar for other nonvolatile analyses. All jars will be sealed with Teflon™-lined lids. The 120-mL volatile sample jar will contain as little headspace as possible. Record the date and time that the grab samples were taken on the sample collection sheet. At the conclusion of sampling, check the label and number of each sample for sampling tracking quality assurance.

Sample Preservation: All samples of the incinerator solid waste feed will be stored on ice throughout testing and sample transport to the laboratory. When the samples are shipped to the analytical laboratory, they will be shipped with a sufficient amount of ice so as to arrive at the laboratory cold (4 °C ± 2 °C).

Caution: The solid waste feed samples will be stored on ice in an area outside of the sample trailer where train samples are being handled, away from other trace analyte containing samples and away from the sample container supply area.

Documentation and Record-Keeping: Before sampling is commenced, each bottle will be labeled with a specific sample number, the project name, the run number, the sample description, the date, and the time of sampling. The sampler will fill out a sample collection sheet for every sample collected of the solid waste feed. The time that each aliquot of the waste stream is collected will be logged as it is collected. The sample collection sheet will provide a place to record the sample number, the project name, the run number, the sampler's name, the sample type, the sample description, the sample source, the bottle type, and the date and time of each grab collection. The sampling coordinator also will also record all samples collected into a field logbook. This logbook will serve as the master document listing of all of the trial burn samples collected.

Quality Assurance and Quality Control:

The required number of analyses for these samples is defined in Table 10-1 of the quality assurance project plan. The laboratory is required to analyze separately all of the field samples, field quality control samples, and laboratory quality control samples specified in Table 10-1.

Method References:

Method S007, EPA-600/8-84-002 [S007 is a trowel or scoop sampling method appropriate for sampling solid waste materials such as soil or ash]. Taken from Harris, J.C.; Rechsteiner, C.E.; Larson D.J.; Thrun, K.E.; *Combustion of Hazardous Wastes, Sampling and Analysis Methods*; Noyes: New Jersey, 1985.

"Practice for Manual Sampling of Petroleum and Petroleum Products." ASTM D-4057-88. Taken from *Annual Book of ASTM Standards.* D-1989-93. American Society for Testing and Materials; ASTM: Philadelphia, PA, 1996.

Procedure Number: ***04***

Procedure Title: ***Incinerator Ash Sampling Procedure***

Sample Name: Incinerator ash

Sampler: Field sampling specialist

Process Sample Locations: The sample will be located in the rotary kiln ash discharge or conveyor belt delivery area.

Sampling and Health and Safety Equipment: Sampling scoop, glass sample collection jars (1-liter [L] wide-mouth glass powder jar, 120-milliliter [mL] wide-mouth glass powder jar, 250-mL wide-mouth glass powder jar) with Teflon™-lined lids, aluminum foil, latex gloves, and eye protection

Sample Collection Frequency: Grab aliquots will be collected at the beginning of testing and at 30-minute intervals for the duration of each test run.

Sampling Procedures: The nonvolatile parameter and proximate-type samples will be collected by building a master composite sample of the incinerator ash. At the completion of the run, subsamples will be collected for the proximate-type analyses.

Samples for Nonvolatile Parameters—Collect grab samples (approximately 100 mL each) of the incinerator ash at 30-minute intervals. Composite each grab sample into a 1-L wide-mouth powder jar over the course of each run. On the sample collection sheet, record the date and time that each grab sample was taken and approximate volume of final composite sample. At the end of the test run, use the sampling scoop as a mixing tool and the aluminum foil as a working surface to blend the ash grab samples thoroughly. Alternately, if the sample can be mixed sufficiently by agitation, then shaking can be done. Collect an aliquot of the blended ash material in a 250-mL wide-mouth powder jar for proximate-type analysis. Retain the balance of the ash composite in the 1-L wide-mouth powder jar for other nonvolatile analyses. Seal all jars with a Teflon™-lined lids. On the sample collection sheet, document that the aliquot was removed from the original composite. Check the label and number of both composite samples for sample tracking quality assurance.

VOA Sampling—Concurrent with the non-VOA sampling, collect a full 120-mL sample in a wide-mouth powder jar at the beginning and at each 30-minute interval for volatile analysis. Label and number each 120-mL sample with sample numbers for individual sample tracking. On the sample collection sheet, record the date and time that each VOA sample

	was taken. Volatile sample compositing will be conducted in the controlled environment of the laboratory.
Sample Preservation:	All incinerator ash samples will be stored on ice throughout testing and sample transport to the laboratory and will be stored away from the sample container supply area. Samples will be shipped with a sufficient amount of ice so as to arrive at the analytical laboratory cold (4 °C ± 2 °C).
Documentation and Record-Keeping:	Before sampling is commenced, each bottle will be labeled with a specific sample number, the project name, the run number, the sample description, the date and the time of sampling. The sampler will fill out a sample collection sheet for every sample collected of the incinerator ash. The time that each aliquot of the waste stream is collected will be logged as it is collected. The sample collection sheet will provide a place to record the sample number, the project name, the run number, the sampler’s name, the sample type, the sample description, the sample source, the bottle type, and the date and time of each grab collection. The sampling coordinator also will record all samples collected into a field logbook. This logbook will serve as the master document listing of all of the trial burn samples collected.
Quality Assurance and Quality Control:	The required number of analyses for these samples is defined in Table 10-1 of the quality assurance project plan. The laboratory is required to analyze separately all of the field samples, field quality control samples, and laboratory quality control samples specified in Table 10-1.
Method References:	Method S007, EPA-600/8-84-002 [S007 is a trowel or scoop sampling method appropriate for sampling solid waste materials such as soil or ash]. Taken from Harris, J.C.; Rechsteiner, C.E.; Larson D.J.; Thrun, K.E.; *Combustion of Hazardous Wastes, Sampling and Analysis Methods;* Noyes: New Jersey, 1985. “Practice for Manual Sampling of Petroleum and Petroleum Products.” ASTM D-4057-88. Taken from *Annual Book of ASTM Standards.* D-1989-93. American Society for Testing and Materials; ASTM: Philadelphia, PA, 1996.

Procedure Number: ***05***

Procedure Title: ***Caustic Solution Sampling Procedure***

Sample Name: Caustic solution

Sampler: Field sampling specialist

Process Sample Location: The sample will be located at the tap on the caustic feed supply line.

Sampling and Health and Safety Equipment: Amber glass sample collection jar (1-gallon Wheaton jug with Teflon™-lined lid), 40-milliliter (mL) volatile organic analysis (VOA) vials with Teflon™-lined septa, latex gloves, and eye protection

Caution: The pH of this sample will be greater than 12. Care will be taken to avoid spilling or splashing this sample when it is collected. Skin or eye contact with this sample matrix will cause severe burns.

Sample Collection Frequency: One grab sample will be taken per sampling run.

Sampling Procedures: A sample of the caustic solution will be collected and analyzed for each sampling run. Caustic solution samples will be collected from the sample tap location on the caustic solution supply line.

<u>Samples for Nonvolatile Parameters</u>—Collect approximately 1 gallon of caustic solution in the 1-gallon amber glass Wheaton jug, and seal with a Teflon™-lined lid. Check the label and number of the sample for sample tracking quality assurance. Record the date, time, and sample number on the sample collection sheet.

<u>VOA Samples</u>—Collect samples in one pair of 40-mL VOA vials so as to eliminate headspace bubbles. Check the label and number of the pair of VOA vials for sample tracking quality assurance. Record the date, time, and sample number on the sample collection sheet.

Sample Preservation: The caustic solution samples will <u>not</u> be chilled with ice during or after collection if precipitation of solids is observed during the chilling of the sample. Chilling may cause precipitation of solid sodium hydroxide from the caustic solution. Also, volatile samples in VOA vials will not be preserved if precipitation occurs. Caustic solution samples will be shipped to the analytical laboratory without ice if precipitation occurs.

Documentation and Record-Keeping: Before sampling is commenced, each bottle will be labeled with a specific sample number, the project name, the run number, the sample description, the date and the time of sampling. The sampler will fill out a sample collection sheet for every sample collected of the caustic solution. The time that each sample of the waste stream is collected will be logged as it is collected. The sample collection sheet will provide a place to record the sample number, the project name, the run number, the sampler's name, the sample type, the sample description, the sample source, the bottle type, and the date and time of each grab collection. The sampling coordinator also will record all samples collected into a field logbook. This logbook will serve as the master document listing of all of the trial burn samples collected.

Quality Assurance and Quality Control:

The required number of analyses for these samples is defined in Table 10-1 of the quality assurance project plan. The laboratory is required to analyze separately all of the field samples, field quality control samples, and laboratory quality control samples specified in Table 10-1.

Method References:

Method S004, EPA-600/8-84-002 [S004 is a tap sampling method appropriate for sampling liquid wastes in pipes or process lines]. Taken from Harris, J.C.; Rechsteiner, C.E.; Larson D.J.; Thrun, K.E.; *Combustion of Hazardous Wastes, Sampling and Analysis Methods;* Noyes: New Jersey, 1985.

"Practice for Manual Sampling of Petroleum and Petroleum Products." ASTM D-4057-88. Taken from *Annual Book of ASTM Standards.* D-1989-93. American Society for Testing and Materials; ASTM: Philadelphia, PA, 1996.

Procedure Number: ***06***

Procedure Title: ***Air Pollution Control System Purge Water Sampling Procedure***

Sample Name: Scrubber purge water

Sampler: Field sampling specialist

Process Sample Locations: The sample will be located at the sample tap on the scrubber purge water recirculation line.

Sampling and Health and Safety Equipment: Glass sample collection jars (1-gallon Wheaton jug, and 1-liter [L] Boston-round glass jars) with Teflon™-lined lids, pre-cleaned glass graduated cylinders, 40-mL volatile organic analysis (VOA) vials with Teflon™-lined septa, full face respirator (if required), safety glasses (if respirator not required), and latex gloves

Sample Collection Frequency: A grab aliquot will be taken at the beginning of testing and at 30-minute intervals for the duration of each test run.

Sampling Procedures: <u>Samples for Nonvolatile Parameters</u>—The nonvolatile parameters will be collected by building a master composite sample of the purge stream. At the completion of the run, subsamples of the master composite sample will be collected for the proximate analyses. Purge the tap by allowing at least three tap volumes of liquid to flow into a waste container. Collect a measured grab volume of sample (approximately 400 mL) at each time interval to build a final composite sample of approximately 1-gallon. Add each grab to a numbered, prelabeled 1-gallon Wheaton jug to build the final composite. Grab portions are to be stored on ice during the implementation of the sampling run. On the sample collection sheet, record the date and time that each grab sample was taken and approximate volume of the final composite sample.

At the conclusion of the test run, shake the 1-gallon composite sample to provide good mixing, and fill a numbered and prelabeled 1-L Boston-round jar from the composite. On the sample collection sheet, document that the aliquot was removed from the original composite. The 1-L sample will be used for total solids, total suspended solids, and total dissolved solids analyses. The balance of original composite sample is retained for other nonvolatile analyses. Check the label and number of both composite samples for sample tracking quality assurance.

Caution: The scrubber purge water master composite sample may contain a relatively high amount of solids. Subsampling will require thorough shaking of the composite samples followed by immediate pouring of the subsample.

VOA Sampling—Concurrent with non-VOA sampling at each time interval, collect a pair of samples in 40-mL VOA vials so as to minimize headspace bubbles. Label and number each pair of VOA vials with sample numbers for individual sample tracking. On the sample collection sheet, record the date and time that each VOA sample was taken. Volatile sample compositing will be conducted in the laboratory.

Note: The scrubber purge water may be sampled from a location in the recirculation line that delivers hot sample material. Hot sample that is placed into VOA vials will cavitate when cooled. The scrubbeer purge water in these sample vials either will have to be "topped off" after they have cooled, or will have to be chilled before delivery to the VOA vials.

Sample Preservation:

The nonvolatile purge stream sample portions require storage on ice throughout testing and sample transportation to the laboratory. If residual chlorine is suspected in these samples, then volatile samples in VOA vials will be prepreserved by adding four drops of 0.008 percent sodium thiosulfate to each VOA vial before sampling commences. Samples in VOA vials also will be stored on ice during and after the test run. Samples will be stored away from the sample container supply area. When the samples are shipped to the analytical laboratory, they will be shipped on ice and will arrive at the laboratory cold (4° C ± 2 °C)

Documentation and Record-Keeping:

Before sampling is commenced, each bottle will be labeled with a specific sample number, the project name, the run number, the sample description, the date and the time of sampling. The sampler will fill out a sample collection sheet for every sample collected of the purge stream. The time that each aliquot of the waste stream is collected will be logged as it is collected. The sample collection sheet will provide a place to record the sample number, the project name, the run number, the sampler's name, the sample type, the sample description, the sample source, the bottle type, and the date and time of each grab collection. The sampling coordinator also will record all samples collected into a field logbook. This logbook will serve as the master document listing of all of the trial burn samples collected.

Quality Assurance and Quality Control:

The required number of analyses for these samples is defined in Table 10-1 of the quality assurance project plan. The laboratory is required to analyze separately all of the field samples, field quality control samples, and laboratory quality control samples specified in Table 10-1.

Method References:

Method S004, EPA-600/8-84-002 [S004 is a tap sampling method appropriate for sampling liquid wastes in pipes or process lines]. Taken from Harris, J.C.; Rechsteiner, C.E.; Larson D.J.; Thrun, K.E.; *Combustion of Hazardous Wastes, Sampling and Analysis Methods;* Noyes: New Jersey, 1985.

“Practice for Manual Sampling of Petroleum and Petroleum Products.” ASTM D-4057-88. Taken from *Annual Book of ASTM Standards.* D-1989-93. American Society for Testing and Materials; ASTM: Philadelphia, PA, 1996.

Procedure Number: ***07***

Procedure Title: ***Air Pollution Control System Makeup Water Sampling Procedure***

Sample Name: Makeup water

Sampler: Field sampling specialist

Process Sample Locations: The sample will be located at the sample tap on the makeup water line.

Sampling and Health and Safety Equipment: Glass sample collection jars (1-gallon Wheaton jug and 1-liter [L] Boston-round glass jars) with Teflon™-lined lids, precleaned glass graduated cylinders, 40-mL volatile organic analysis (VOA) vials with Teflon™-lined septa, full-face respirator (if required), safety glasses (if respirator not required), and latex gloves

Sample Collection Frequency: A grab aliquot will be taken at the beginning of testing and at 30-minute intervals for the duration of each test run.

Sampling Procedures: The nonvolatile parameter samples will be collected by building a master composite sample of the makeup water. At the completion of the run, subsamples of the master composite sample will be collected for analysis of any non-principal organic hazardous constituent (POHC) that may be required on this sample (such as metals).

<u>Samples for Nonvolatile Parameters</u>—Purge tap by allowing at least three tap volumes of liquid to flow into a waste container. Collect a measured grab volume of sample (approximately 400 mL) at each time interval to build a final composite sample of approximately 1 gallon. Add each grab to a numbered, prelabeled 1-gallon Wheaton jug to build the final composite. Grab portions are to be stored on ice during the implementation of the sampling run. On the sample collection sheet, record the date and time that each grab sample was taken and the approximate volume of the final composite sample.

At the conclusion of the test run and if special additional parameters have been required, shake the 1-gallon composite sample to provide good mixing, and fill a numbered and prelabeled 1-L jar from the composite. Disregard this step if the makeup water is being analyzed only for POHCs. Document that the aliquot was removed from the original composite on the sample collection sheet. The balance of original composite sample is retained for other analyses. Check the label and number of both composite samples for sample tracking quality assurance.

VOA Sampling—Concurrent with nonvolatile sampling at each time interval, collect a pair of 40-mL VOA vials so as to minimize headspace bubbles. Label and number each pair of VOA vials with sample numbers for individual sample tracking. On the sample collection sheet, record the date and time that each VOA sample was taken. Volatile sample compositing will be conducted in the laboratory.

Sample Preservation: The nonvolatile makeup water sample portions require storage on ice throughout testing and sample transport to the laboratory. If residual chlorine is expected in these samples, then volatiles samples in VOA vials will be prepreserved by adding four drops of 0.008 percent sodium thiosulfate to each VOA vial before sampling commences and also will be stored on ice during and after the test run. When the samples are shipped to the analytical laboratory, they will be shipped with a sufficient amount of ice and will arrive at the laboratory cold (4 °C ± 2 °C).

Documentation and Record-Keeping: Before sampling is commenced, each bottle will be labeled with a specific sample number, the project name, the run number, the sample description, and the date and time of sampling. The sampler will fill out a sample collection sheet for every sample collected of the makeup water. The time that each aliquot of the waste stream is collected will be logged as it is collected. The sample collection sheet will provide a place to record the sample number, the project name, the run number, the sampler's name, the sample type, the sample description, the sample source, the bottle type, and the date and time of each grab collection. The sampling coordinator also will record all samples collected into a field logbook. This logbook will serve as the master document listing of all of the trial burn samples collected.

Quality Assurance and Quality Control: The required number of analyses for these samples is defined in Table 10-1 of the quality assurance project plan. The laboratory is required to analyze separately all of the field samples, field quality control samples, and laboratory quality control samples specified in Table 10-1.

Method References: Method S004, EPA-600/8-84-002 [S004 is a tap sampling method appropriate for sampling liquid wastes in pipes or process lines]. Taken from Harris, J.C.; Rechsteiner, C.E.; Larson D.J.; Thrun, K.E.; *Combustion of Hazardous Wastes, Sampling and Analysis Methods;* Noyes: New Jersey, 1985.

"Practice for Manual Sampling of Petroleum and Petroleum Products." ASTM D-4057-88. Taken from *Annual Book of ASTM Standards.* D-1989-93. American Society for Testing and Materials; ASTM: Philadelphia, PA, 1996.

Procedure Number: ***08***

Procedure Title: ***Sampling Procedure for Metals in the Stack Gases***

Sample Name: Stack gas multi-metals train (MMT)

Sampler: Stack sampling engineer

Process Sample Location: The sample will be located at the stack sampling platform.

Note: Blank corrections will <u>not</u> be allowed on data from this train. Sample containers can be a significant source of a metal's background, so only U.S. Environmental Protection Agency (EPA) Level III bottles will be used to collect samples. The narrow neck style (Boston round) is recommended because it is designed to seal in liquids, whereas a wide-mouth design (Packer bottles) is prone to leak and can cause contamination of the sample at the lid by allowing solutions to get behind the Teflon™ insert; therefore, Packer bottles are not allowed. The narrow neck style has built-in seals in the lids. Bottles and petri dishes will be made of glass and cleaned by the glassware cleaning procedure. The cleaning procedure requires that all glassware be soaked in a 10 percent nitric acid solution for 4 hours.

Sampling and Health and Safety Equipment: EPA Method 5 MMT, glass petri dish with particulate filter and impinger chemical reagents, glass sample containers with Teflon™-lined lids, and latex gloves

Sample Collection Frequency: Samples will be collected continuously for the duration of each sampling run. Typically, the stack gas sample volume will be 2 cubic meters sampled at a sampling rate not to exceed 0.75 cubic meter per hour.

Sampling Procedures: The sampling train is assembled with a particulate filter; an empty first impinger to knockout moisture; 100 milliliters (mL) of a 5 percent nitric acid and 10 percent hydrogen peroxide solution in the second and third impingers; an empty fourth impinger; 100 mL of a 4 percent potassium permanganate and 10 percent sulfuric acid solution in the fifth and sixth impingers, and indicating silica gel in the seventh impinger. The fourth impinger is intentionally left empty to prevent carryover of any reagents. The impinger containing the indicating silica gel will be weighed initially to the nearest 0.5 gram.

An initial traverse will be made with a pitot tube at each sample port following EPA Methods 1 and 2 to establish the stack velocity profile, temperature, and flow rate, and to check for cyclonic air flow. Sample point location will be in accordance with EPA Method 1. The total sampling time during a run will be approximately 3 hours with a nominal

2 dry standard cubic meters of sample collected. EPA Method 5 procedures are followed for pre-test and post-test leak checks, isokinetic sampling rate, filter change-outs (if needed), port changes, and data recording.

Sample Recovery—The probe section of the sampling train will be removed after the final leak check has passed the required criteria. The probe filter assembly and impinger box of the sampling train are transferred intact to the cleanup area for sample recovery as follows:

- The particulate filter is removed from its holder and carefully placed into its original glass petri dish, which is sealed with Teflon™ tape and sealed in a Ziplock™ bag for shipment.

  Note: The acetone probe rinsing procedure will be eliminated if the determination of particulate emissions is not part of the MMT.

- The internal surfaces of the nozzle, probe, and front half of the filter holder are cleaned by repeated rinsing with acetone and brushing with a nonmetallic brush. The acetone rinsates are collected together into a prelabeled, numbered sample collection container. The same train components are then rinsed with a 0.1 normality (N) nitric acid solution, brushed, and given a final nitric acid rinse. These nitric acid rinsates are collected together in a separate, prelabeled, numbered sample container.

- The volumetric contents of the first three impingers (1, 2, and 3) are measured to the nearest 0.5 mL individually and delivered into a single, numbered, prelabeled sample container. The impingers are then rinsed with a 0.1N nitric acid solution, which is then added to the sample collection bottle.

- **Note:** The final volume (or weight gain) of these three impingers is required for moisture gain calculations. The final volume including rinse volumes must also be recorded also in order to calculate the target metals' train total content. This note applies to all impinger catches from this train.

- The volumetric contents of impinger 4 (which began empty) is measured to the nearest 0.5 mL using a graduated cylinder and delivered to a single, numbered, pre-labeled sample container. The fourth impinger is then rinsed with a 0.1N nitric acid solution and added to the sample container. <u>This sample will be analyzed separately for mercury.</u>

- The volumetric contents of the fifth and sixth impinger catches are measured individually to the nearest 0.5 mL and delivered into a single, numbered, prelabeled sample container. The impingers are then rinsed with the 4 percent potassium permanganate and 10 percent sulfuric acid solution and followed by a rinse with 100 mL of deionized water, which is then added to the same sample collection bottle. Each 100-mL portion is sufficient to afford three rinses of each impinger. <u>This sample composite will be analyzed separately for mercury.</u>

- If no visible deposits remain after the water rinse, then no further rinse is needed. However, if the impinger surfaces have remaining deposits or coloration, rinse all surfaces of the fifth and sixth impingers with 25 mL of 8N hydrogen chloride, taking care to contact all sides of the glassware. Finally, deliver the 25 mL of acid to a separate, numbered, prelabeled sample container. <u>This sample composite will be analyzed separately for mercury.</u>

- The indicating silica gel contents of the seventh silica gel impinger are weighed to the nearest 0.5 gram to determine the amount of moisture collected. Note the color of the indicating silica gel, and make a notation of its condition.

Sample Preservation:

When the samples are shipped to the analytical laboratory, they will be shipped with a sufficient amount of ice and will arrive at the laboratory cold (4 ^{o}C ± 2 ^{o}C).

Documentation and Record-Keeping:

Before sampling is commenced, each bottle will be labeled with a specific sample number, the project name, the run number, the sample description, and the date and time of sampling. The sampler will fill out a sample collection sheet for every sample collected of the makeup water. The time that each aliquot of the waste stream is collected will be logged as it is collected. The sample collection sheet will provide a place to record the sample number, the project name, the run number, the sampler’s name, the sample type, the sample description, the sample source, the bottle type, and the date and time of each grab collection. The sampling coordinator also will record all samples collected into a field logbook. This logbook will serve as the master document listing of all of the trial burn samples collected.

Quality Assurance and Quality Control:

The required number of analyses for these samples is defined in Table 10-1 of the quality assurance project plan. The laboratory is required to analyze separately all of the field samples, field quality control samples, and laboratory quality control samples specified in Table 10-1.

A complete multi-metals blank train will be prepared once during the test burn series and will be located near the base of the stack in a manner similar to the actual MMT. All associated leak checks will be conducted on the blank train. The blank train will remain sealed with its filter box and probe heated to the required temperature at that location during one test run. The blank train samples will be recovered using the same procedures as those described for the actual sampling trains.

Note: Blank corrections will not be allowed for any of these blank samples. Blanks demonstrate that sampling equipment, technique, and handling do not contaminate these samples.

The glassware for performing the MMT metals emissions tests is prone to display memory effects for several metals unless it is carefully prepared before testing. MMT glassware for the actual testing and for the blank train (including spare parts, bottles, and petri dishes) will be prepared by the following metals removal procedure:

- Wash and rinse all glassware with hot soapy water and regular tap water. Soak all glassware in a 10 percent nitric acid solution (approximate) for 4 hours. Rinse thoroughly with deionized water, followed by acetone, and finally leave to air dry. Brushes and probe rams will be nonmetallic and receive the same cleaning as glassware.

Reagent blanks for each of the following solutions or sampling media will be collected as individual samples and submitted to the laboratory for analysis:

0.1N nitric acid
Particulate filter
5 percent nitric acid and 10 percent hydrogen peroxide
4 percent potassium permanganate and 10 percent sulfuric acid
8N hydrogen chloride

All bottles containing liquid samples will be marked on the outside of the container to show the height of fluid level so that leakage during shipment can be demonstrated not to have occurred.

Method References: “Test Methods.” 40 CFR 60 Appendix A, EPA Methods 1, 2, 3, and 5.

"Method 0060 - Determination of Metals in Stack Emissions." Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method 0060, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, D.C. 20460.

Procedure Number: ***09***

Procedure Title: ***Sampling Procedure for Hexavalent Chromium in the Stack Gases***

Sample Name: Stack gas hexavalent chromium recirculatory train

Sampler: Stack sampling engineer

Process Sample Location: The sample will be located at the stack sampling platform.

Sampling and Health and Safety Equipment: U.S. Environmental Protection Agency (EPA) hexavalent chromium recirculatory sampling train, equipped with a peristaltic pump, Teflon™ fittings and connecting tubes for recirculation, Teflon™ impingers with Teflon™ connectors, and 0.1 normality (N) to 1.0N potassium hydroxide impinger solution, deionized water, and indicating silica gel; glass sample bottles with Teflon™-lined lids; nitrogen purge system and nitrogen pressure filtration system; and latex gloves

Sample Collection Frequency: Samples will be collected continuously for the duration of each sampling run; typically, the stack gas sample volume will be 2 cubic meters sampled at a rate not to exceed 0.75 cubic meters per hour. Three runs will constitute a test.

Sampling Procedures: **Note:** Typically, the 0.1N potassium hydroxide specified in the method is not concentrated enough to maintain the pH greater than or equal to 8.5 throughout the test. If the first impinger falls below pH 8.5, the hexavalent chromium will convert to trivalent chromium, and the test run will be invalid. Therefore, a more concentrated potassium hydroxide impinger solution is recommended. Increases in strength to 1.0N potassium hydroxide is advised.

<u>Train Preparation</u>—Prior to the on-site sample collections, all components of the sampling train and filtration apparatus will be cleaned according to the method specifications. The stack gas sampling collection equipment will be calibrated in accordance with SW-846 Method 0061 and Method 5 standard protocols.

The sampling train is assembled as specified in the SW-846 Method 0061. The first impinger will be charged with 150 milliliters (mL) of the 0.1N potassium hydroxide impinger solution, and approximately 75 mL of potassium hydroxide impinger solution will be placed in the second and third impingers. The fourth impinger will be a stack gas condensate knockout trap and will remain empty. The fifth impinger will contain indicating silica gel weighed to the nearest 0.5 gram.

<u>Sample Train Operation</u>—An initial traverse is made with a pitot tube at each sample port following EPA Methods 1 and 2 to establish the stack velocity profile, temperature, and flow rate and to check for cyclonic air flow. Sample point location will be in accordance with EPA Method 1. The total sampling time during a run will be approximately 4 hours with a nominal 3 dry standard cubic meters of sample collected. EPA Method 5 procedures are followed for pretest and post-test leak checks, isokinetic sampling rate, port changes, and data recording.

Immediately before sample collection, a thorough check of the recirculation system of the first impinger to the probe will be performed, and then the system will be started. The potassium hydroxide recirculating system will be cooled in an ice bath during sample collection.

<u>Hexavalent Chromium Train Sample Recovery</u>—The entire hexavalent chromium train will be moved intact to the cleanup area for sample recovery as follows:

- With the sample train intact and the impinger 4 outlet opened, a nitrogen cylinder purge system will be connected to the input of the impinger of the hexavalent chromium train. The recirculation line will be capped. Next, the potassium hydroxide impingers of the train will be purged with ultra-clean nitrogen gas at a delivery rate of approximately 10 liters per minute for 30 minutes.

- Impingers 1 through 4—The pH of impinger 1 is checked using pH strip paper and recorded on the sample collection sheet. The pH of this solution will be greater than 8.5. If the pH is less than 8.5, the sampling train is invalid. The impinger catches for each impinger (1 through 4) will be measured volumetrically and combined into a single collection bottle. The glass nozzle, aspirator (or pump), all connecting tubing, and impingers will be rinsed four times using deionized water, and the rinses will be added to the sample bottle.

- The final pre-rinse volume of impingers 1 through 4 before rinsing is required to calculate moisture gain in the train. The final volume of impingers 1 through 4 inclusive of the system rinses is also required in order to calculate the total hexavalent chromium in the train for an individual sampling run.

- The entire impinger train sample will be filtered through a 0.45 micrometer acetate or Teflon™ filter in a filtration device equipped with nitrogen pressure connectors. Then, the filtration device will be washed with deionized water, and the rinses will be added to the sample.

- The silica gel impinger will be weighed to the nearest 0.5 gram to determine the amount of moisture gained during sampling.

Sample Preservation:

When the samples are shipped to the analytical laboratory, they will be shipped with a sufficient amount of ice and will arrive at the laboratory cold (4 °C ± 2 °C).

Documentation and Record-Keeping:

Before sampling is commenced, each bottle will be labeled with a specific sample number, the project name, the run number, the sample description, and the date and time of sampling. The sampler will fill out a sample collection sheet for every sample collected of the makeup water. The time that each aliquot of the waste stream is collected will be logged as it is collected. The sample collection sheet will provide a place to record the sample number, the project name, the run number, the sampler's name, the sample type, the sample description, the sample source, the bottle type, and the date and time of each grab collection. The sampling coordinator also will record all samples collected into a field logbook. This logbook will serve as the master document listing of all of the trial burn samples collected.

Quality Assurance and Quality Control:

The required number of analyses for these samples is defined in Table 10-1 of the quality assurance project plan. The laboratory is required to analyze separately all of the field samples, field quality control samples, and laboratory quality control samples specified in Table 10-1.

A blank potassium hydroxide recirculatory train will be set up during one run of the trial burn. The blank train will be placed at the base of the stack, leak checked, and left in the sampling environment for the same length of time as the actual stack gas sampling train. At the conclusion of the stack sampling, a final leak check will be performed on the blank train, and sample recovery will be performed using the same procedures as for the actual stack gas sampling trains. Reagent blanks will be taken of the stack potassium hydroxide impinger solution and the deionized water used for rinses.

The holding times for hexavalent chromium samples will be 24 hours unless the on-site matrix spikes are performed at the time of sample recovery (Method 7199). All samples will be preserved on ice to (4 °C ± 2 °C). The first impinger of the train will be checked for pH greater than 8.5. At any time during the test or during sample recovery that the pH is determined to be below 8.5, the test will be considered invalid. The impinger may be checked halfway through the test at port change in order to anticipate the adequacy of the potassium hydroxide strength in finishing the test.

In lieu of administering the analytical program on a 24-hour holding time, the hexavalent chromium impinger composite sample will be divided into 3 (100-mL) aliquots. Two of the three samples will receive spikes (at the time of sample recovery) of hexavalent chromium in the following concentrations:

- 2 times the expected native hexavalent chromium concentration
- 5 times the expected native hexavalent chromium concentration

One of the aliquots is maintained as the original sample. Each aliquot will be placed in individually numbered sample bottles and submitted for separate hexavalent chromium analysis.

A 200-mL reagent blank will be collected of the 0.1N potassium hydroxide reagent source during one run of the test burn. Additionally, a deionized water rinse solution will be sampled as a reagent blank.

Method References:

"Determination of Hexavalent Chromium Emissions from Stationary Sources." Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method 0061, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). U.S. Environmental Protection Agency (EPA), Office of Solid Waste and Emergency Response (OSWER), Washington, D.C. 20460.

"Determination of Hexavalent Chromium in Drinking Water, Groundwater and Industrial Wastewater Effluents by Ion Chromatography." Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method 7199, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). EPA, OSWER, Washington, D.C. 20460.

"Test Methods." 40 CFR 60 Appendix A, EPA Methods 1, 2, 3, and 5.

Procedure Number: ***10***

Procedure Title: ***Sampling Procedure for Volatile Organics in the Stack Gases***

Sample Name: Stack volatiles organic sampling train (VOST)

Sampler: Stack sampling engineer

Sampling Locations: The samples will be located at the incinerator or boiler stack sampling platform.

Sampling and Health and Safety Equipment: VOST, Tenax™ and Anasorb™ 747 resin cartridges, glass culture tubes with screw-top caps, aluminum foil, glass 40-milliliter (mL) volatile organic analysis (VOA) vials with screw-top caps and Teflon™-lined septa, dry ice, and latex gloves

Note: SW-846 Method 0031 is a three-tube configuration of the VOST system. Two Tenax™ resin tubes are required in addition to an Anasorb™ 747 resin tube as the third tube. Tenax™/charcoal resin tubes are no longer allowed. Except for field blanks and trip blanks, VOST samples will be analyzed by running the two Tenax™ resin tubes together and running the Anasorb™ 747 as a separate sample. Field blanks and trip blanks can be run as a one sample set.

Sample Collection Frequency: Samples will be collected continuously during the sampling run with replacement of resin cartridges pairs after each 40 minutes of sampling. Each pair of tubes will be used to sample a nominal 20 liters of stack gas. The VOST condensate is to be measured volumetrically and collected once at the end of each sampling run in 40-mL VOA vials.

Four sets of resin cartridges will be collected during the run. Three of the sets will be analyzed, and one set will serve as a back-up set to be analyzed in the event of breakage or sample loss from the other sets.

Sampling Procedures: The preparation of VOST glassware, probes, condensers, and connecting glassware will include a thorough rinsing of these components with an ultrapure grade of methanol. Subsequently, glass components will be baked in an oven at 100 °C. Teflon™ tubing will be cleaned after each test in a similar fashion or replaced.

Resin Tube Preparation and Handling—The laboratory will prepare or purchase the resin tubes and deliver them to the field sampling crew before the sampling event. The procedures for preparing, handling, storing, and analyzing the tubes will be those described in the SW-846 Method 0031. For the trial burn, a batch of resin tubes will be prepared. Recycled VOST tubes that have been used on other trial burn projects are not allowed. Two complete sets of tubes from this batch of VOST tubes will be spiked with the surrogate compounds and the target compounds and will be analyzed by the analytical laboratory as spiked resin blanks. The Tenax™ tubes will be analyzed separately from the Anasorb™ 747 tubes. Analysis of the spiked resin blanks before the trial burn demonstrates that the resin batch is clean and will reversibly recover the volatile spikes placed on them before analysis.

Persons handling VOST tubes and train components will wear latex gloves. Fresh gloves will be worn during every resin tube change out.

VOST samples must be stored and handled in a separate trailer or laboratory space. Persons handling the Modified Method 5 (MM5) train samples will not participate in the sampling or handling of VOST samples at any time because MM5 train sample recoveries require the open use of acetone, methylene chloride, and toluene. These solvents will cross-contaminate the VOST samples unless deliberate care is taken to prevent exposure.

The resin tubes will be protected from contamination by placing them in glass culture tubes during shipping and storage. These tubes will contain clean charcoal as a fugitive contaminant scavenger. For shipment to the site, the tubes will be packed separately and kept at less than or equal to 4 °C on ice in insulated storage containers that are dedicated to VOST tube storage. Dry ice is recommended in order to purge the storage coolers constantly with the carbon dioxide subliming from the solid. Regular ice also is acceptable. VOST tubes must be stored and handled in an area isolated from the probe rinse solvents used for the MM5 trains.

At the test site VOST handling area, the tubes will be stored on ice until needed. Before each replicate sampling run, the sample coordinator will supply prelabeled resin tubes, including a prelabeled field blank set, to the stack sampling engineer conducting the VOST sampling. Samples or blank tubes that remain on the stack sampling platform will be stored in a dedicated cooler that contains ice.

At the end of each run, the sample coordinator will recover the tubes and a VOST sample collection sheet from the stack samplers. VOST samples will then be repacked on ice and prepared for shipment, via overnight delivery to the analytical laboratory. The VOST shipment will be accompanied by the sample documentation.

VOST Operation—The sample collection procedures will be as described in the standard EPA protocol (EPA-600/8-84-007). The dry gas meter will be calibrated before arriving at the test site, and the sample train will be cleaned and assembled before installing the resin tubes. The end caps of the tubes will be stored in each tube's corresponding clean glass culture tube while the Tenax™ tubes are in the train. The train will be leak-tested near 10 inches mercury in such a manner as to prevent exposure of the train components to the ambient air. Leak tests will be conducted before and after the sampling interval for each resin set.

Before sampling is commenced, ice water will be circulated through the condensers. The temperature exiting the first condenser will be less than 10 °C in order to provide conditions at the Tenax™ resin that will effectively capture low boiling organic components (products of incomplete combustion) in the stack gas. The ice water will be monitored regularly during the test to replenish the ice for maximum cooling capacity. The probe will be inserted into the sampling port and purged with stack gas. The probe will be heated from 138 °C to 150 °C (280 °F to 302 °F). The stack will be sampled at a rate of 0.5 liter (L) per minute for 40 minutes to collect a nominal sample volume of 20 L for each set of tubes.

The sample collection data shown in the reference method will be recorded for each tube set. Also, a sample collection entry for VOST will be logged in the field logbook.

After collecting the samples, the tube pair will be removed from the VOST, the end caps will be replaced, and they will be returned to their culture tubes and stored in coolers on ice.

At the conclusion of the sampling run, the volume of the condensate water will be measured and recorded on the sample collection sheet. The condensate will be collected in a VOA vial with no headspace. Organic-free deionized water will be added, if needed, to top off the VOA vial if less than 40 mL of condensate is collected. If more than 40 mL of condensate is collected, only one VOA vial will be filled, and the excess condensate will be discarded.

Sample Preservation:

When the samples are shipped to the analytical laboratory, they will be shipped with a sufficient amount of ice (option of dry ice is available) and will arrive at the laboratory cold (4 °C ± 2 °C).

Documentation and Record-Keeping:

Before sampling is commenced, each bottle will be labeled with a specific sample number, the project name, the run number, the sample description, and the date and time of sampling. The sampler will fill out a sample collection sheet for every sample collected of the makeup water. The time that each aliquot of the waste stream is collected will be logged as it is collected. The sample collection sheet will provide a place to record the sample number, the project name, the run number, the sampler's name, the sample type, the sample description, the sample source, the bottle type, and the date and time of each grab collection. The sampling coordinator also will record all samples collected into a field logbook. This logbook will serve as the master document listing of all of the trial burn samples collected.

Quality Assurance and Quality Control:

The required number of analyses for these samples is defined in Table 10-1 of the quality assurance project plan. The laboratory is required to analyze separately all of the field samples, field quality control samples, and laboratory quality control samples specified in Table 10-1.

During the sampling run, the end caps will be removed from the field blank tube set to simulate the handling of the test sample tubes. The tubes will remain open for approximately 10 minutes. The tubes will be placed in the train, and a leak check will be conducted. After the leak check, the resin tubes will be removed from the train and returned to their culture tubes. This procedure approximates the handling and the amount of time that the sample tubes are exposed to ambient conditions during a tube exchange. Longer periods are acceptable.

For each sample shipment to the laboratory, a VOST tube set will be removed from storage, assigned a sample number, and logged in as the VOST trip blank set. This set will remain sealed during the test and during shipment of associated samples.

Samples will be placed on dry ice in clean coolers, which will be stored in an area away from other samples and potential contamination sources. The VOST condensate sample will be stored and shipped in a separate cooler and preserved by chilling to less than or equal to 4 °C with ice. VOST samples may be shipped daily by overnight service to the laboratory.

Field blank sets of VOST samples will be collected during each sampling run. Trip blank sets will be collected with each shipment of samples to the preforming laboratory. The corresponding Tenax™ and Anasorb™ 747 tubes from a field blank set can be analyzed together. Two spiked resin blanks will be prepared and analyzed before the trial burn. A VOST audit will be conducted during the trial burn project, if required by the officiating agency.

Method References:

"Protocol for the Collection and Analysis of Volatile POHCs Using VOST." EPA-600/8-84-007. U.S. Environmental Protection Agency (EPA), Washington, D.C. 20460.

"Sampling Method for Volatile Organic Compounds (SMVOC)." Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods.* SW-846 Method 0031, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). EPA, Office of Solid Waste and Emergency Response, Washington, D.C. 20460.

Procedure Number: ***11***

Procedure Title: ***Sampling Procedure for Semivolatile Organics and Dioxins and Furans in the Stack Gases***

Sample Name: Modified Method 5 (MM5) semivolatile sampling train

Sampler: Stack sampling engineer

Process Sample Location: Samples will be collected at the stack sampling platform.

Sampling and Health and Safety Equipment: MM5 sampling train, using an XAD-2 resin tube (containing approximately 30 grams XAD-2 resin), particulate filter, organic-free deionized water, aluminum foil, glass sample bottles with Teflon™-lined lids, and latex gloves

Sample Collection Frequency: Samples will be collected continuously for approximately 3 hours until at least 3 cubic meters (m^3) of stack sample is collected for each run; the sampling rate will be less than or equal to 0.75 m^3 per hour. Three runs will constitute a test.

Sampling Procedures: This MM5 train will be used to sample semivolatile, dioxin, and furan emissions in the stack gas. As such, the train requirements are a combination of specifications from SW-846 Method 0023A and Method 0010. Also included are the requirements for separate train components from SW-846 Method 3542 and Method 0023A. Probe rinse solvents will be acetone, methylene chloride, and toluene. The use of a 50:50 mixture of methanol and methylene chloride will be abandoned.

XAD-2 Tube Preparation—The laboratory will prepare the XAD-2 resin tubes and deliver them to the sampling team for use during the project. During the resin preparation, a 100-microgram (μg) spike C carbon-13-labeled naphthalene (or alternate labeled semivolatile compound) will be applied to each XAD-2 resin tube. The five Method 0023A sampling surrogates also will be spiked onto the XAD-2 resin tube. This labeled naphthalene spike will serve as a semivolatile sampling surrogate to indicate analyte loss due to the sampling process. The procedures for preparing, handling, storing, and analyzing the tubes are those described in EPA SW-846 Method 0010. As described in the method, the XAD-2 resin material will be cleaned by Soxhlet extraction and dried. Precleaned XAD-2 resin also is commercially available (Supelco). Two XAD-2 resin tubes using the prepared or purchased resin will be spiked with a matrix spike mixture and analyzed as laboratory resin blanks to confirm that the resin is free from significant background contamination and to assess recovery of the analytes from the resin.

For storage and transport to the field, the resin tubes will have their ends sealed with Teflon™ tape, wrapped in aluminum foil, sealed in Ziplock™ bags, and packed in a clean sample cooler. In the field, the cooler will be stored in the sample recovery trailer and resin tubes are removed only when ready for labeling and installation in the sampling train.

Before each sampling run, the sampling coordinator will supply a XAD-2 resin tube and a field blank tube to the stack sampling engineer who will operate the MM5 train. At the end of each run, the sample coordinator will recover the XAD-2 resin tubes and other train components and prepare the sample documentation. The MM5 stack samples will be stored on ice at approximately 4 ^{o}C in insulated coolers in a storage area away from sources of fugitive contamination.

MM5 Train Operation—The MM5 train components will be provided by the stack sampling team. With the exception of the necessary modification for installing and recovering the resin tubes, the sampling procedures will be as specified in U.S. Environmental Protection Agency (EPA) Methods 1 and 2 for stack flow measurements and Method 4 and 5 for moisture content and particulate. An initial traverse is made with a pitot tube at each sample point following Methods 1 and 2 to establish the stack velocity profile, temperature, and flow rate and to check for cyclonic air flow. Sample point location will be in accordance with Method 1. The sampling team will record the data as recommended in EPA Method 5.

Note: The sampling rate for this train will not exceed 0.75 m^3 per hour. Faster rates can lead to a low bias in the semivolatile compounds (particulates of incomplete combustion) with relatively low boiling points and relatively high vapor pressures. Lowered removal efficiency and desorbing of organics by stripping are potential problems at the higher sampling rates.

The sampling equipment will be calibrated before and after the test. The pretest calibrations will be available for agency review before testing commences.

The first impinger will be an empty condensate knockout impinger. The MM5 train will be charged with 100 milliliters of organic-free deionized water in the second and third impingers. The fourth impinger will contain indicating silica gel that is tare weighed to the nearest 0.5 gram.

The sampling train will be leak tested according to EPA Method 5 protocols. An activated charcoal filter will be placed on the end of the probe to ensure that no ambient contaminants are allowed to enter the train during leak checks.

<u>MM5 Train Sample Recovery</u>—The samples will be recovered from the MM5 train, as follows:

- Particulate Filter - The filter will be removed from its holder and placed carefully in its original, labeled petri dish; sealed with Teflon™ tape, and sealed in a Ziplock™ plastic bag for shipment to the laboratory.

- Solvent Probe Rinse - The nozzle, probe, and the front half of the filter holder will be brushed and rinsed three times with acetone followed by brushing and rinsing three times each with methylene chloride. The rinses will be combined and placed in a labeled sample collection bottle with a Teflon™-lined lid.

- Toluene Probe Rinse - The nozzle, probe, and front half of the filter holder will be brushed and rinsed three times with toluene. The rinses will be combined and placed in a separate, labeled sample collection bottle with a Teflon™-lined lid.

- Back-Half Filter Holder and Coil Condenser Solvent Rinse - The back half of the filter holder, coil, condenser, and connecting glassware will be rinsed three times with acetone and three times with methylene chloride. These rinses will be placed in a separate, labeled sample container with a Teflon™-lined lid.

- Back Half Filter Holder and Coil Condenser Toluene Rinse - The back half of the filter holder, coil, condenser, and connecting glassware will be rinsed three times with toluene. The condenser rinse will be placed in a separate, labeled sample container with a Teflon™-lined lid.

- XAD-2 Resin Tube - The XAD-2 resin tube will be removed from the sampling train, and its ends will be sealed with Teflon™ tape. It will be wrapped in aluminum foil, sealed in a Ziplock™ bag, and stored for shipment to the laboratory.

- Condensate Impinger Composite and Solvent Rinses - The contents of each impinger (1 through 3) will be volumetrically measured to the nearest milliliter, and combined into a glass sample bottle with a Teflon™-lined lid. The total volume before rinsing is required to calculate the moisture gain for this train.

Each impinger and connecting glassware will be rinsed three times each with methylene chloride. A toluene rinse will not be performed because an analysis for dioxins and furans in the impinger contents is not necessary. Solvent rinses will be placed into the same container as the aqueous condensate. Before the solvent rinses are added to the sample, but after the deionized water rinses are completed and added to the sample, the total aqueous sample volume will be measured volumetrically to the nearest milliliter and recorded on the sample collection sheet. All three impingers are included in this sample because carryover of moisture and organic compounds is entrained into impingers 2 and 3.

- Indicating Silica Gel - The silica gel impinger will be reweighed to the nearest 0.5 gram, and the weight gain is calculated as moisture gain in the train.

Sample Preservation:

When the samples are shipped to the analytical laboratory, they will be shipped with a sufficient amount of ice and will arrive at the laboratory cold (4 °C ± 2 °C).

Documentation and Record-Keeping:

Before sampling is commenced, each bottle will be labeled with a specific sample number, the project name, the run number, the sample description, and the date and time of sampling. The sampler will fill out a sample collection sheet for every sample collected of the makeup water. The time that each aliquot of the waste stream is collected will be logged as it is collected. The sample collection sheet will provide a place to record the sample number, the project name, the run number, the sampler's name, the sample type, the sample description, the sample source, the bottle type, and the date and time of each grab collection. The sampling coordinator also will record all samples collected into a field logbook. This logbook will serve as the master document listing of all of the trial burn samples collected.

Quality Assurance and Quality Control:

The required number of analyses for these samples is defined in Table 10-1 of the quality assurance project plan. The laboratory is required to analyze separately all of the field samples, field quality control samples, and laboratory quality control samples specified in Table 10-1.

A complete MM5 blank train will be prepared once during the test burn series, set up near the base of the stack similar to the actual MM5 sampling train, and will apply an equivalent number of associated leak checks. The train will remain sealed with the filter holder and probe heated to the required temperature at that location for a period equivalent to one test run. The blank train samples will be recovered using the same procedures described above for the actual train samples.

All of the MM5 sample components will be assigned unique sample tracking numbers and labeled with the date and test run number. The samples will be recovered by the sample coordinator and the stack sampling engineer, and the sample collection documentation will be recorded. The sample coordinator will record the appropriate data in the field logbook and pack the samples on ice in a storage cooler.

- An XAD-2 field blank will be collected once during each run. The field blank XAD-2 tube will be opened in the field for the same length of time as is required to assemble the MM5 train. Field blanks will be analyzed for the same analytical parameters as the actual test samples.

- An XAD-2 trip blank will be collected at least once for each shipment of samples. The trip blank will be transported from the laboratory to the sampling site, stored at the sampling site with the other XAD-2 samples, and transported back to the laboratory with the samples. Trip blanks will be analyzed for the same analytical parameters as the actual test samples.

- Reagent blanks of the probe rinse solvents, particulate filter, and deionized water will be collected once during the trial burn.

Method References:

"Modified Method 5 Sampling Train" [appropriate for sampling stack gas for semivolatiles]. Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods.* SW-846 Method 0010, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). U.S. Environmental Protection Agency (EPA), Office of Solid Waste and Emergency Response (OSWER), Washington, D.C. 20460.

"Extraction of Semivolatile Analytes Collected Using Method 0010 Modified Method 5 Sampling Train." Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method 3542, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). EPA, OSWER, Washington, D.C. 20460.

"Sampling Method for Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofuran Emissions from Stationary Sources," [appropriate for sampling stack gas]. Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods.* SW-846 Method 0023A, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September

1994), Final Update IIB (January 1995), and Final Update III (December 1996). EPA, OSWER, Washington, D.C. 20460.

“Method 5 - Determination of Particulate Emissions from Stationary Sources” [appropriate for sampling stack gas isokinetically]. 40 CFR 60 Appendix A, July 1990.

Procedure Number: ***12***

Procedure Title: ***Sampling Procedure for Polynuclear Aromatic Hydrocarbons in the Stack Gases***

Sample Name: Modified Method 5 (MM5) semivolatile sampling train

Sampler: Stack sampling engineer

Process Sample Location: Samples will be collected at the stack sampling platform.

Sampling and Health and Safety Equipment: MM5 sampling train, using an XAD-2 resin tube (approximately 30 grams XAD-2 resin), particulate filter, organic-free deionized water, aluminum foil, glass sample bottles with Teflon™-lined lids, and latex gloves

Sample Collection Frequency: Samples will be collected continuously for approximately 3 hours until at least 3 cubic meters (m^3) of stack sample is collected for each run; the sampling rate will be less than or equal to 0.75 m^3 per hour. Three runs will constitute a test.

Sampling Procedures: This MM5 train will be used to sample polynuclear aromatic hydrocarbon (PAH) emissions in the stack gas. As such, the train requirements are a combination of specifications from U.S. Environmental Protection Agency (EPA) SW-846 Method 0010 and California Air Resources Board (CARB) Method 429. Also included are the requirements for separate train components from SW-846 Method 3542. Probe rinse solvents will be acetone and methylene chloride. The use of a 50:50 mixture of methanol and methylene chloride will be abandoned.

<u>XAD-2 Tube Preparation</u>—The laboratory will prepare the XAD-2 resin tubes and deliver them to the sampling team for use during the project. During the resin preparation, a spike of carbon-13-labeled PAH sampling surrogates will be applied to each XAD-2 resin tube. The three sampling surrogates will be spiked onto the XAD-2 resin tube. These sampling surrogate spikes will indicate analyte loss due to the sampling process. The procedures for preparing, handling, storing, and analyzing the tubes are those described in EPA SW-846 Method 0010. As described in the method, the XAD-2 resin material will be cleaned by Soxhlet extraction and dried. Precleaned XAD-2 resin also is commercially available (Supelco). Using the prepared or purchased resin, two XAD-2 resin tubes will be spiked with a matrix spike mixture and analyzed as laboratory resin blanks to confirm that the resin is free from significant background contamination and to assess recovery of the analytes from the resin.

For storage and transport to the field, the resin tubes will have their ends sealed with Teflon™ tape. They will be wrapped in aluminum foil, sealed in Ziplock™ bags, and packed in a clean sample cooler. In the field, the cooler will be stored in the sample recovery trailer, and resin tubes will be removed only when ready for labeling and installation in the sampling train.

Before each sampling run, the sampling coordinator will supply a XAD-2 resin tube and a field blank tube to the stack sampling engineer who will operate the MM5 train. At the end of each run, the sample coordinator will recover the XAD-2 resin tubes and other train components and prepare the sample documentation. The MM5 stack samples will be stored on ice at approximately 4 °C in insulated coolers in a storage area away from sources of fugitive contamination.

<u>MM5 Train Operation</u>—The MM5 train components will be provided by the stack sampling team. With the exception of the necessary modification for installing and recovering the resin tubes, the sampling procedures will be as specified in U.S. Environmental Protection Agency (EPA) Methods 1 and 2 for stack flow measurements and EPA Method 4 and 5 for moisture content and particulate. An initial traverse is made with a pitot tube at each sample point following Methods 1 and 2 to establish the stack velocity profile, temperature, and flow rate and to check for cyclonic air flow. The sample point location will be in accordance with Method 1. The sampling team will record the data as recommended in Method 5.

Note: The sampling rate for this train will not exceed 0.75 m^3 per hour. Faster rates can lead to a low bias in the semivolatile compounds (PAHs) with relatively low boiling points and relatively high vapor pressures. Lowered removal efficiency and desorbing of organics by stripping are potential problems at the higher sampling rates.

The sampling equipment will be calibrated before and after the test. The pretest calibrations will be available for agency review before testing commences.

The first impinger will be an empty condensate knockout impinger. The MM5 train will be charged with 100 milliliters (mL) of organic-free deionized water in the second and third impingers. The fourth impinger will contain indicating silica gel that is tare weighed to the nearest 0.5 gram.

The sampling train will be leak tested according to EPA Method 5 protocols. An activated charcoal filter will be placed on the end of the probe to ensure that no ambient contaminants are allowed to enter the train during leak checks.

MM5 Train Sample Recovery—The samples will be recovered from the MM5 train, as follows:

- Particulate Filter - The filter will be removed from its holder and carefully placed in its original, labeled petri dish. It will be sealed with Teflon™ tape; and sealed in a Ziplock™ plastic bag for shipment to the laboratory.

- Solvent Probe Rinse - The nozzle, probe, and front half of the filter holder will be brushed and rinsed three times with acetone followed by brushing and rinsing three times each with methylene chloride. The rinses will be combined and placed in a labeled sample collection bottle with a Teflon™-lined lid.

- Back-Half Filter Holder and Coil Condenser Solvent Rinse - The back half of the filter holder, the coil, condenser, and connecting glassware will be rinsed three times with acetone and three times with methylene chloride. These rinses will be placed in a separate, labeled sample container with a Teflon™-lined lid.

- XAD-2 Resin Tube - The XAD-2 resin tube will be removed from the sampling train, and its ends will be sealed with Teflon™ tape. It will be wrapped in aluminum foil, sealed in a Ziplock™ bag, and stored for shipment to the laboratory.

- Condensate Impinger Composite and Solvent Rinses - The contents of each impinger (1 through 3) will be measured volumetrically to the nearest milliliter and combined into a glass sample bottle with a Teflon™-lined lid. The total volume before rinsing is required in order to calculate the moisture gain for this train. Each impinger and connecting glassware is rinsed three times each with methylene chloride. Solvent rinses will be placed into the same container as the aqueous condensate. Before the solvent rinses are added to the sample, but after the deionized water rinses are completed and added to the sample, the total aqueous sample volume will be measured volumetrically to the nearest milliliter and recorded on the sample collection sheet. All three impingers are included in this sample because carryover of moisture and organic compounds are entrained into impingers 2 and 3.

- Indicating Silica Gel - The silica gel impinger will be reweighed to the nearest 0.5 gram and the weight gain will be calculated as moisture gain in the train.

Sample Preservation:

When the samples are shipped to the analytical laboratory, they will be shipped with a sufficient amount of ice and will arrive at the laboratory cold (4 °C ± 2 °C).

Documentation and Record-Keeping:

Before sampling is commenced, each bottle will be labeled with a specific sample number, the project name, the run number, the sample description, and the date and time of sampling. The sampler will fill out a sample collection sheet for every sample collected of the makeup water. The time that each aliquot of the waste stream is collected will be logged as it is collected. The sample collection sheet will provide a place to record the sample number, the project name, the run number, the sampler's name, the sample type, the sample description, the sample source, the bottle type, and the date and time of each grab collection. The sampling coordinator also will record all samples collected into a field logbook. This logbook will serve as the master document listing of all of the trial burn samples collected.

Quality Assurance and Quality Control:

The required number of analyses for these samples is defined in Table 10-1 of the quality assurance project plan. The laboratory is required to analyze separately all of the field samples, field quality control samples, and laboratory quality control samples specified in Table 10-1.

A complete MM5 blank train will be prepared once during the test burn series; it will be set up near the base of the stack similar to the actual MM5 sampling train and will apply an equivalent number of associated leak checks. The train will remain sealed with the filter holder and will be probe heated to the required temperature at that location for a period equivalent to one test run. The blank train samples will be recovered using the same procedures described above for the actual train samples.

All of the MM5 sample components will be assigned unique sample tracking numbers and labeled with date and test run number. The samples will be recovered by the sample coordinator, and the stack sampling engineer and the sample collection documentation will be recorded. The sample coordinator will record the appropriate data in the field logbook and pack the samples on ice in a storage cooler.

An XAD-2 field blank will be collected once during each run. The field blank XAD-2 tube will be opened in the field for the same length of time as is required to assemble the MM5 train. Field blanks will be analyzed for the same analytical parameters as the actual test samples.

An XAD-2 trip blank will be collected at least once for each shipment of samples. The trip blank will be transported from the laboratory to the sampling site, stored at the sampling site with the other XAD-2 samples, and transported back to the laboratory with the samples. Trip blanks will be analyzed for the same analytical parameters as the actual test samples.

Reagent blanks of the probe rinse solvents, particulate filter, and deionized water will be collected once during the trial burn.

Method References:

"Modified Method 5 Sampling Train" [appropriate for sampling stack gas for semivolatiles]. Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods.* SW-846 Method 0010, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). U.S. Environmental Protection Agency (EPA), Office of Solid Waste and Emergency Response (OSWER), Washington, D.C. 20460.

"Extraction of Semivolatile Analytes Collected Using Method 0010 Modified Method 5 Sampling Train." Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods.* SW-846 Method 3542, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). EPA, OSWER, Washington, D.C. 20460.

"Determination of Polycyclic Aromatic Hydrocarbon (PAH) Emissions from Stationary Sources," State of California Air Resources Board Method 429. Adopted September 12, 1989.

"Method 8290 - Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) by High Resolution Gas Chromatography/High Resolution Mass Spectrometry (HRGC/HRMS)." Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods.* SW-847 Method 8290, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). EPA, OSWER, Washington, D.C. 20460.

"Method 5 - Determination of Particulate Emissions from Stationary Sources" [appropriate for sampling stack gas isokinetically]. 40 CFR 60 Appendix A, July 1990.

Procedure Number: ***13***

Procedure Title: ***Sampling Procedure for Semivolatile and Nonvolatile Unspeciated Mass in the Stack Gases***

Sample Name: Modified Method 5 (MM5) semivolatile sampling train

Sampler: Stack sampling engineer

Process Sample Location: The samples will be collected at the stack sampling platform.

Sampling and Health and Safety Equipment: MM5 sampling train, using an XAD-2 resin tube (approximately 30 grams XAD-2 resin), particulate filter, organic-free deionized water, aluminum foil, glass sample bottles with Teflon™-lined lids, and latex gloves

Sample Collection Frequency: Samples will be collected continuously for approximately 3 hours until at least 3 cubic meters (m^3) of stack sample is collected for each run; the sampling rate will be less than or equal to 0.75 m^3 per hour. Three runs will constitute a test.

Sampling Procedures: This MM5 train will be used to sample for unspeciated mass emissions in the stack gas. As such, the train requirements are a combination of specifications from the prepared method for total chromatographable organics (TCO) and gravimetric (GRAV) analysis and U.S. Environmental Protection Agency (EPA) SW-846 Method 0010. Also included are the requirements for separate train components from SW-846 Method 3542. Probe rinse solvents will be acetone and methylene chloride. The use of a 50:50 mixture of methanol and methylene chloride will be abandoned.

XAD-2 Tube Preparation—The laboratory will prepare the XAD-2 resin tubes and deliver them to the sampling team for use during the project. The procedures for preparing, handling, storing, and analyzing the tubes are those described in EPA SW-846 Method 0010. As described in Method 0010, the XAD-2 resin material will be cleaned by Soxhlet extraction and dried. Precleaned XAD-2 resin also is commercially available (Supelco). Using the prepared or purchased resin, two XAD-2 resin tubes will be spiked with a matrix spike mixture and analyzed as laboratory resin blanks to confirm that the resin is free from significant background contamination and to assess recovery of the analytes from the resin.

For storage and transport to the field, the resin tubes will have their ends sealed with Teflon™ tape. They will be wrapped in aluminum foil, sealed in Ziplock™ bags, and packed in a clean sample cooler. In the field, the cooler will be stored in the sample recovery trailer, and resin tubes will be removed only when ready for labeling and installation in the sampling train.

Before each sampling run, the sampling coordinator will supply a XAD-2 resin tube and a field blank tube to the stack sampling engineer who will operate the MM5 train. At the end of each run, the sample coordinator will recover the XAD-2 resin tubes and other train components and prepare the sample documentation. The MM5 stack samples will be stored on ice at approximately 4 ^oC in insulated coolers in a storage area away from sources of fugitive contamination.

MM5 Train Operation—The MM5 train components will be provided by the stack sampling team. With the exception of the necessary modification for installing and recovering the resin tubes, the sampling procedures will be as specified in EPA Methods 1 and 2 for stack flow measurements and EPA Methods 4 and 5 for moisture content and particulate. An initial traverse is made with a pitot tube at each sample point following Methods 1 and 2 to establish the stack velocity profile, temperature, and flow rate, and to check for cyclonic air flow. Sample point location will be in accordance with Method 1. The sampling team will record the data as recommended in Method 5.

Note: The sampling rate for this train will not exceed 0.75 m^3 per hour. Faster rates can lead to a low bias in the semivolatile compound (TCOs) with relatively low boiling points and relatively high vapor pressures. Lowered removal efficiency and desorbing of organics by stripping are potential problems at the higher sampling rates.

The sampling equipment will be calibrated before and after the test. The pretest calibrations will be available for agency review before testing commences.

The first impinger will be an empty condensate knockout impinger. The MM5 train will be charged with 100 milliliters of organic-free deionized water in the second and third impingers. The fourth impinger will contain indicating silica gel that is tare weighed to the nearest 0.5 gram.

The sampling train will be leak tested according to EPA Method 5 protocols. An activated charcoal filter will be placed on the end of the probe to ensure that no ambient contaminants are allowed to enter the train during leak checks.

MM5 Train Sample Recovery—The samples will be recovered from the MM5 train, as follows:

- Particulate Filter - The filter will be removed from its holder and carefully placed in its original, labeled petri dish. The dish will be sealed with Teflon™ tape and sealed in a Ziplock™ plastic bag for shipment to the laboratory.

- Solvent Probe Rinse - The nozzle, probe, and the front half of the filter holder will be brushed and rinsed three times with acetone followed by brushing and rinsing three times each with methylene chloride. The rinses will be combined and placed in a labeled sample collection bottle with a Teflon™-lined lid.

- Back-Half Filter Holder and Coil Condenser Solvent Rinse - The back half of the filter holder, coil, condenser, and connecting glassware will be rinsed three times with acetone and three times with methylene chloride. These rinses will be placed in a separate, labeled sample container with a Teflon-lined lid.

- XAD-2 Resin Tube - The XAD-2 resin tube will be removed from the sampling train, and its ends will be sealed with Teflon™ tape. It will be wrapped in aluminum foil, sealed in a Ziplock™ bag, and stored for shipment to the laboratory.

- Condensate Impinger Composite and Solvent Rinses - The contents of each impinger (1 through 3) will be measured volumetrically to the nearest milliliter and combined into a glass sample bottle with a Teflon™-lined lid. The total volume before rinsing is required in order to calculate the moisture gain for this train. Each impinger and connecting glassware is rinsed three times each with methylene chloride. Solvent rinses will be placed into the same container as the aqueous condensate. Before the solvent rinses are added to the sample, but after the deionized water rinses are completed and added to the sample, the total aqueous sample volume will be measured volumetrically to the nearest milliliter and recorded on the sample collection sheet. All three impingers are included in this sample because carryover of moisture and organic compounds are entrained into impingers 2 and 3.

- Indicating Silica Gel - The silica gel impinger will be reweighed to the nearest 0.5 gram, and the weight gain will be calculated as moisture gain in the train.

Sample Preservation:	When the samples are shipped to the analytical laboratory, they will be shipped with a sufficient amount of ice and will arrive at the laboratory cold (4 ^{o}C ± 2 ^{o}C).
Documentation and	

Record-Keeping:

Before sampling is commenced, each bottle will be labeled with a specific sample number, the project name, the run number, the sample description, and the date and time of sampling. The sampler will fill out a sample collection sheet for every sample collected of the makeup water. The time that each aliquot of the waste stream is collected will be logged as it is collected. The sample collection sheet will provide a place to record the sample number, the project name, the run number, the sampler's name, the sample type, the sample description, the sample source, the bottle type, and the date and time of each grab collection. The sampling coordinator also will record all samples collected into a field logbook. This logbook will serve as the master document listing of all of the trial burn samples collected.

Quality Assurance and Quality Control:

A complete MM5 blank train will be prepared once during the test burn series, set up near the base of the stack similar to the actual MM5 sampling train, and will apply an equivalent number of associated leak checks. The train will remain sealed with the filter holder and will be probe heated to the required temperature at that location for a period equivalent to one test run. The blank train samples will be recovered using the same procedures described above for the actual train samples.

All of the MM5 sample components will be assigned unique sample tracking numbers and labeled with date and test run number. The samples will be recovered by the sample coordinator and the stack sampling engineer, and the sample collection documentation will be recorded. The sample coordinator will record the appropriate data in the field logbook and pack the samples on ice in a storage cooler.

The required number of analyses for these samples is defined in Table 10-1 of the quality assurance project plan. The laboratory is required to analyze separately all of the field samples, field quality control samples, and laboratory quality control samples specified in Table 10-1.

An XAD-2 field blank will be collected once during each run. The field blank XAD-2 tube will be opened in the field for the same length of time as that required to assemble the MM5 train. Field blanks will be analyzed for the same analytical parameters as the actual test samples.

An XAD-2 trip blank will be collected at least once for each shipment of samples. The trip blank will be transported from the laboratory to the sampling site, stored at the sampling site with the other XAD-2 samples, and transported back to the laboratory with the samples. Trip blanks will be analyzed for the same analytical parameters as the actual test samples.

Reagent blanks of the probe rinse solvents, particulate filter, and deionized water will be collected once during the trial burn.

Method References:

“Modified Method 5 Sampling Train,” [appropriate for sampling stack gas for semivolatiles]. Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods.* SW-846 Method 0010, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). U.S. Environmental Protection Agency (EPA), Office of Solid Waste and Emergency Response (OSWER), Washington, D.C. 20460.

“Extraction of Semivolatile Analytes Collected Using Method 0010 (Modified Method 5 Sampling Train).” Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods.* SW-846 Method 3542, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). EPA, OSWER, Washington, D.C. 20460.

“Method 5 - Determination of Particulate Emissions from Stationary Sources” [appropriate for sampling stack gas isokinetically]. 40 CFR 60 Appendix A, July 1990.

Guidance for Total Organics. Second Edition, Proposed. Prepared by Eastern Research Group, Inc., Morrisville, North Carolina, for EPA National Exposure Research Laboratory, Air Measurements Research Division, Methods Branch, Research Triangle Park, North Carolina.

Procedure Number:	***14***
Procedure Title:	***Sampling Procedure for Volatile Unspeciated Mass in the Stack Gases***
Sample Name:	Stack Gas Sampling for Volatile Unspeciated Mass Determination
Sampler:	Stack sampling engineer
Process Sample Location:	The samples will be collected at the stack sampling platform.
Sampling and Health and Safety Equipment:	Method 0040 probe, particulate filter, ice bath, condenser, condensate impinger, Tedlar™ bag, control console, and latex gloves
Sample Collection Frequency:	An integrated sample will be collected over a 2-hour period during the test. The stack gas will be samples at a rate of 0.25 liters (L) per minute for 120 minutes to yield a nominal sample volume of approximately 30 L.
Sampling Procedures:	Method 0040 is a draft method that was originally intended for use in the sampling and analysis of specific compounds. It has been adopted as part of the draft U.S. Environmental Protection Agency (EPA) guidance for unspeciated mass and will be used to quantify the low boiling (less that 100 °F) compounds in the C_1-C_4 range.

The sampling train consists of a heated probe, condensing ice bath, moisture knockout impinger, Tedlar™ bag container and sample bag, and control console. Because the stack gas flow will be determined on as many as four other concurrently operated trains, it does not have to be determined on this train.

In this method, a representative sample will be drawn from a source through a heated sample probe and filter. Then, the sample will pass through a heated three-way valve and into a condenser where the moisture and condensable components will be removed; then it will be collected in a Tedlar™ gas held in a rigid opaque container. Next, the dry gas sample will be analyzed on site. The condensate will be analyzed off site using a laboratory gas chromatograph. The total amount of the analyte in the sample will be determined by summing the individual amounts in the bag and the condensate. The particulate catch will not be analyzed or archived.

Sampling will begin after a pretest leak check and system purge (at least 10 minutes). The probe will be placed at a location in the stack that provides two options for sampling proportional and constant. Because the stack gas flow is not expected to vary more than 20 percent, constant sampling will be employed. The sampling will coincide with the isokinetic total chromatographable organics (TCO) and gravimetric (GRAV) samples being collected during the same period. The average stack gas flow rate and properties from the other concurrently operated isokinetic trains may be used for data reduction.

The condensate sample will be recovered by removing the condensate trap, the condenser and the sample line (from the trap to the bag) from the sample train. The contents of the condensate trap will be poured into a clean graduated cylinder. The condenser, the condensate trap, and the sample will be rinsed three times with 10 milliliters of high-performance liquid chromatogtrapy grade water, and the rinsate will be added to the measuring cylinder containing the condensate. The final volume of the condensate and rinse mixture will be recorded on the field sampling data form. Septum volatile organic analysis vials must be used to recover the sample, providing for zero headspace.

Sample Preservation:

Tedlar™ bags should not be placed on ice.

Documentation and Record-Keeping:

Before sampling is commenced, each bottle and Tedlar™ bag will be labeled with a specific sample number, the project name, the run number, the sample description, and the date and time of sampling. The sampler will fill out a sample collection sheet for every sample collected of the makeup water. The time that each aliquot of the waste stream is collected will be logged as it is collected. The sample collection sheet will provide a place to record the sample number, the project name, the run number, the sampler's name, the sample type, the sample description, the sample source, the bottle type, and the date and time of each grab collection. The sampling coordinator also will record all samples collected into a field logbook. This logbook will serve as the master document listing of all of the trial burn samples collected.

Quality Assurance and Quality Control:

The required number of analyses for these samples is defined in Table 10-1 of the quality assurance project plan. The laboratory is required to analyze separately all of the field samples, field quality control samples, and laboratory quality control samples specified in Table 10-1.

Three train sample sets will be collected during a trial burn. One Tedlar™ bag will be filled in the Method 0040 setup per run. One field blank per run will be collected and analyzed. Two trip blanks will be collected and analyzed during the test. Every bag sample will be analyzed in duplicate. A field spike of the target compounds will be performed during every run. One blank spike and one blank spike duplicate will be collected during the test.

Method References:	“Sampling of Principal Organic Hazardous Constituents from Combustion Sources Using Tedlar™ Bags.” Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods.* SW-846 Modified Method 0040, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). EPA, Office of Solid Waste and Emergency Response (OSWER), Washington, D.C. 20460. “Guidance for Total Organics, Final Report” [Uniform flame ionization detector response for varying compound classes is assumed in this methodology. Compounds found with retention times prior to the C_4 retention time are quantified with an appropriate response factor and the value is reported as C_4 with the other organic result]. March 1996. Prepared for the U.S. Environmental Protection Agency (EPA). Washington, D.C. 20460. “Guidance for Total Organics, Final Report.” March 1996. Prepared for Atmospheric Research and Exposure Assessment Laboratory Methods Research and Development Division Source Method Research Branch, EPA, Washington, D.C. 20460. “Nonhalogenated Organics Using GC/FID.” Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846, SW-8015, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). EPA, OSWER, Washington, D.C. 20460.

Procedure Number: ***15***

Procedure Title: ***Sampling Procedure for Formaldehyde in the Stack Gases***

Sample Name: Method 0011 aldehyde and ketone sampling train

Sampler: Stack sampling engineer

Process Sample Location: The samples will be collected at the stack sampling platform.

Sampling and Health and Safety Equipment: Method 0011 sampling train, 2,4-dinitrophenylhydrazine (DNPH) solution, organic-free deionized water, aluminum foil, glass sample bottles with Teflon™-lined lids, and latex gloves

Sample Collection Frequency: The samples will be collected continuously for approximately 2 hours until at least 2 cubic meters (m^3) of stack sample is collected for each run; sampling rate will be less than or equal to 0.75 m^3 per hour. Three runs will constitute a test.

Sampling Procedures: This Method 0011 train will be used to sample aldehyde (and ketones, if required) emissions in the stack gas. As such, the train requirements are specifications from U.S. Environmental Protection Agency (EPA) SW-846 Method 0011. Also included are the requirements for separate train components. Probe rinse solvents will be deionized water and methylene chloride.

Before each sampling run, the sampling coordinator will supply the train reagent and field blank reagents to the stack sampling engineer who will operate the Method 0011 train. At the end of each run, the sample coordinator will recover the train components and prepare the sample documentation. The Method 0011 stack samples will be stored on ice at approximately 4 $^{\circ}$C in insulated coolers in a storage area removed from sources of fugitive contamination.

<u>Method 0011 Train Operation</u>—The Method 0011 train components will be provided by the stack sampling team. With the exception of the necessary modification for installing and recovering the train reagents, the sampling procedures will be as specified in EPA Methods 1 and 2 for stack flow measurements and EPA Methods 4 and 5 for moisture content and particulate. An initial traverse is made with a pitot tube at each sample point following EPA Methods 1 and 2 in order to establish the stack velocity profile, temperature, and flow rate and to check for cyclonic air flow. Sample point location will be in accordance with Method 1. The sampling team will record the data as recommended in Method 5.

Note: The sampling rate for this train will not exceed 0.75 m^3 per hour. Faster rates can lead to a low bias in the aldehydes caused by lower scrubbing efficiency at the higher sampling rates.

The sampling equipment will be calibrated before and after the test. The pretest calibrations will be available for agency review before testing commences.

The first impinger will be an empty condensate knockout impinger. The inclusion of an empty knockout impinger is optional but will be considered when stack gas with a high moisture content is being tested. A knockout impinger prevents high levels of dilution of the reagents in the impingers.

The train will be charged with 100 milliliters of freshly prepared DNPH solution in the second and third impingers. If additional capacity is required for high expected concentrations of formaldehyde in the stack gas, 200 milliliters of DNPH per impinger may be used. The fourth impinger will remain empty during the test. The fifth impinger will contain indicating silica gel that is tare weighed to the nearest 0.5 gram.

The sampling train will be leak tested according to EPA Method 5 protocols. An activated charcoal filter will be placed on the end of the probe to ensure that no ambient contaminants are allowed to enter the train during leak checks.

<u>Method 0011 Train Sample Recovery</u>—The samples will be recovered from the Method 0011 train as follows:

- Solvent Probe Rinse - The nozzle, probe liner, and connecting glassware will be brushed and rinsed three times with water, followed by brushing and rinsing three times each with methylene chloride. The rinses will be combined and placed in a labeled sample collection bottle with a Teflon™-lined lid.

- Condensate Impinger Composite and Solvent Rinses - The contents of each impinger (1 through 3) will be volumetrically measured to the nearest milliliter, and the contents of the first (empty at start) and second impingers will be combined into a glass sample bottle with a Teflon™-lined lid. The contents of the third and fourth impingers will be combined into a separate sample bottle. The total volume of all four impingers before rinsing is required in order to calculate the moisture gain for this train. Each impinger and connecting glassware is rinsed three times each with methylene chloride. Solvent rinses will be placed into the same sample container as their respective aqueous condensate and DNPH solutions. Before the solvent rinses are added to the sample, but after the deionized water rinses are completed and added to the sample, the total aqueous sample volume will be volumetrically measured to the nearest milliliter and recorded on the sample collection sheet.

- Indicating Silica Gel - The silica gel impinger will be reweighed to the nearest 0.5 gram and the weight gain will be calculated as moisture gain in the train.

Each of the Method 0011 sample components will be assigned unique sample tracking numbers and labeled with date and test run number. The samples will be recovered by the sample coordinator and the stack sampling engineer and the sample collection documentation will be recorded. The sample coordinator will record the appropriate data in the field logbook and pack the samples on ice in a storage cooler.

The empty knockout impinger and the first impinger containing DNPH will be analyzed separately from the second and third impingers to demonstrate relative breakthrough in the train and recovery efficiency.

Sample Preservation:

When the samples are shipped to the analytical laboratory, they will be shipped with a sufficient amount of ice and will arrive at the laboratory cold (4 °C ± 2 °C).

Documentation and Record-Keeping:

Before sampling is commenced, each bottle will be labeled with a specific sample number, the project name, the run number, the sample description, and the date and time of sampling. The sampler will fill out a sample collection sheet for every sample collected of the makeup water. The time that each aliquot of the waste stream is collected will be logged as it is collected. The sample collection sheet will provide a place to record the sample number, the project name, the run number, the sampler's name, the sample type, the sample description, the sample source, the bottle type, and the date and time of each grab collection. The sampling coordinator also will record all samples collected into a field logbook. This logbook will serve as the master document listing of all of the trial burn samples collected.

Quality Assurance and Quality Control:

The required number of analyses for these samples is defined in Table 10-1 of the quality assurance project plan. The laboratory is required to analyze separately all of the field samples, field quality control samples, and laboratory quality control samples specified in Table 10-1.

A complete Method 0011 blank train will be prepared once during the test burn series, set up near the base of the stack similar to the actual Method 0011 sampling train, and will apply an equivalent number of associated leak checks. The train will remain sealed with the probe heated to the required temperature at that location for a period equivalent to one test run. The blank train samples will be recovered using the same procedures described above for the actual train samples.

Field spikes will be applied to aliquots of samples in the field as a quality demonstration of accuracy and recovery efficiency.

Reagent blanks of the methylene chloride probe rinse solvents, DNPH impinger solution, and deionized water will be collected once during the trial burn.

Method References:

"Method 0011- Sampling for Formaldehyde Emissions from Stationary Sources." Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method SW-0011, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). U.S. Environmental Protection Agency (EPA), Office of Solid Waste and Emergency Response (OSWER), Washington, D.C. 20460.

"Formaldehyde by High Performance Liquid Chromatography." Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method SW-8315, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). EPA, OSWER, Washington, D.C. 20460.

"Method 5 - Determination of Particulate Emissions from Stationary Sources" [appropriate for sampling stack gas isokinetically]. 40 CFR 60 Appendix A, July 1990.

Procedure Number: ***16***

Procedure Title: ***Sampling Procedure for Hydrogen Chloride, Chlorine, and Particulate in the Stack Gases***

Sample Name: Method 0050 hydrogen chloride, chlorine, and particulate sampling train

Sampler: Stack sampling engineer

Process Sample Location: The samples will be collected at the stack sampling platform.

Sampling and Health and Safety Equipment: Method 0050 sampling train, petri dish with tare-weighed particulate filter, impinger reagents, glass sample collection bottles with Teflon™-lined lids, wide-range pH strips, and latex gloves

Sample Collection Frequency: The samples will be collected continuously for approximately 3 hours during each sampling run. The sampling volume will be 3 cubic meters (m^3) at a rate not to exceed 0.75 m^3 per hour.

Sampling Procedures: Particulate Filter Preparation—A set of quartz fiber filters will be prepared individually by weighing to a constant weight on a calibrated analytical balance capable of measuring 0.0001 gram. The filter will then be sealed with Teflon™ tape in a numbered, clean, glass petri dish for transport to the field.

Hydrogen Chloride, Chlorine, and Particulate Train Operation—The sampling train will be assembled with a tare-weighted particulate filter with a heated glass probe and empty first impinger for the collection of condensate. If a large amount of condensate moisture is expected, the first impinger volume will be large such that bumping of the contents of impinger 1 into impinger 2 is avoided. The accumulation of condensate in impinger 2 affects the pH of the sulfuric acid solution by dilution. The second and third impingers will contain 100 milliliters (mL) each of 0.1 normality (N) sulfuric acid. The fourth impinger will remain empty in order to protect the 0.1N sodium hydroxide impingers from carryover of the sulfuric acid, which would neutralize it. The fifth impinger and sixth impinger will contain 100 mL of 0.1N sodium hydroxide. A seventh impinger is a indicating silica gel moisture trap that is pre-weighed for the purpose of moisture gain. The impinger train will be connected to a control box, which contains flow controls, thermocouple readouts, and a dry gas meter capable of accurately measuring the gas sample volume. After assembly, the train will be leak checked prior to and following each sampling run according to Method 0050 criteria.

An initial traverse is made with a pitot tube at each sample port following U.S. Environmental Protection Agency (EPA) Methods 1 and 2 to establish the stack velocity profile, temperature, and flow rate and to check for cyclonic air flow. Sample point location will be in accordance with Method 1. The total sampling time during a run will be approximately 4 hours, and a nominal 3 dry standard cubic meters (dscm) of stack will be sampled. EPA Method 5 procedures are followed for pre-test and post-test leak checks, isokinetic sampling rate, filter changeouts (if needed), and data recording.

Hydrogen Chloride, Chlorine, and Particulate Train Sample Recovery—The impinger section of the sampling train is moved intact to the cleanup area for sample recovery, as follows:

The particulate filter is removed from its holder and placed carefully into its original glass petri dish, which is then sealed with Teflon™ tape and further sealed in a Ziplock™ bag. The internal surfaces of the nozzle, probe, and front half of the filter holder are cleaned by thoroughly rinsing, brushing, and final rinsing with acetone. These acetone rinsates are collected together into a prelabeled, numbered, sample 250-mL glass collection bottle. The samples will be recovered from the sampling train by disconnecting the first four impingers, volumetrically measuring their individual moisture catches, and transferring the catches into a single glass sample bottle with a Teflon™-lined lid. The moisture gain is recorded for these impingers. The impingers will be then rinsed with 0.1N sulfuric acid and this rinse will be combined with the impinger sample. The total sulfuric acid impinger sample and rinse volumes will be recorded on the sample collection sheet. The pH of the final sample also will be measured using appropriate pH test strips and recorded on the sample collection sheet. The samples will be packed and shipped to the laboratory where they will be analyzed for chloride by ion chromatography. The impingers containing the 0.1N sodium hydroxide will be volumetrically measured and transferred to a separate, numbered, pre-labeled sample bottle. The pH of the final sample, before the addition of rinses, also will be measured using appropriate pH test strips and recorded on the sample collection sheet. These impingers will be rinsed with 0.1N sodium hydroxide and the rinsate will be combined with the sodium hydroxide impinger sample. The total sodium hydroxide impinger sample and rinse volume will be recorded on the sample collection sheet. If the pH of the final sample, before rinses are added, is below pH 8.5, then the impinger capacity to capture chlorine gas has been exceeded. Under these conditions, the chlorine sampling is invalid. The samples will be packed and shipped to the laboratory where they will be analyzed for chloride by ion chromatography.

Sample Preservation: When the samples are shipped to the analytical laboratory, they will be shipped with a sufficient amount of ice and will arrive at the laboratory cold (4 °C ± 2 °C).

Documentation and Record-Keeping: Before sampling is commenced, each bottle will be labeled with a specific sample number, the project name, the run number, the sample description, and the date and time of sampling. The sampler will fill out a sample collection sheet for every sample collected of the makeup water. The time that each aliquot of the waste stream is collected will be logged as it is collected. The sample collection sheet will provide a place to record the sample number, the project name, the run number, the sampler's name, the sample type, the sample description, the sample source, the bottle type, and the date and time of each grab collection. The sampling coordinator also will record all samples collected into a field logbook. This logbook will serve as the master document listing of all of the trial burn samples collected.

Quality Assurance and Quality Control: The required number of analyses for these samples is defined in Table 10-1 of the quality assurance project plan. The laboratory is required to analyze separately all of the field samples, field quality control samples, and laboratory quality control samples specified in Table 10-1.

All equipment, including the thermocouples, the rotameters, and the dry gas meter will be calibrated before the tests, and their calibrations verified after the completion of each test run.

Reagent blanks will be collected once during the trial burn for the particulate filter, the acetone probe rinse solvent, the 0.1N sulfuric acid solution, and the 0.1N sodium hydroxide solution.

Method References: "Test Methods." 40 CFR 60 Appendix A, EPA Methods 1, 2, 3, 4 and 5.

"Isokinetic HCl/CL$_2$ Emission Sampling Train." Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method 0050, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, D.C. 20460.

Procedure Number: ***17***

Procedure Title: ***Sampling Procedure for Carbon Monoxide in Stack Gases by CEM***

Sample Name: Stack continuous emission monitoring for carbon monoxide

Sampler: Monitoring system operator

Process Sample Location: The samples will be collected at the stack.

Sampling and Health and Safety Equipment: TECO Model 200 extractive prove, TECO Model 48 ambient carbon monoxide analyzer, and a Odessa Model DSM3260 data acquisition system

No specific health and safety equipment required.

Sample Collection Frequency: The samples will be collected continuously for the duration of each sampling run.

Sampling Procedures: TECO Model 200 will extract a sample, diluting it approximately 100 to 1 using clean, dry-compressed air (scrubbed of carbon monoxide). This sample will be delivered to TECO Model 48, which is capable of reading carbon monoxide concentrations as low as 0.01 parts per million (ppm). The sample will be “wet,” that is, it still will contain all of the moisture that is present in the combustion gases. The Model 48 will be programmed to analyze in two ranges at once, the 0 to 2 ppm range and the 0 to 20 ppm range. The analyzer is digital and will update the carbon monoxide reading approximately every 6 seconds. Both analyzer output signals (0 to 2 ppm range and 0 to 20 ppm range) will be sent to the data acquisition system (DAS) where they are corrected for dilution ratio, combustion gas oxygen, and moisture concentrations using a programmed algorithm. Dilution ratio correction will be accomplished by multiplying the Model 48 signals by 100. Moisture concentration will be assumed to be a fixed value, while oxygen concentration will be measured real-time, and the oxygen analyzer output signal will be sent to the DAS for use in the algorithm. The 0 to 2 ppm range carbon monoxide input signal will be corrected to 0 percent moisture and 7 percent oxygen and will be transformed into a 0 to 200 ppm range value. This signal will be used within the DAS to generate 1-minute averages, which will then be used to compute a rolling hourly average (RHA). The RHA will be computed by summing the last 60 1-minute averages and dividing by 60.

The instrument will be prepared and operated during the test using the procedure provided by the manufacturer. The monitor will be calibrated before each sampling run using a zero and three span gases that approximate the actual stack concentrations of carbon monoxide. The calibration of the instrument also will be verified following each test run.

Sample Preservation: No specific holding times apply to this procedure.

Documentation and Record-Keeping: Documentation of data recorded by the computer.

Quality Assurance and Quality Control: The required number of analyses for these samples is defined in Table 10-1 of the quality assurance project plan. The laboratory is required to analyze separately all of the field samples, field quality control samples, and laboratory quality control samples specified in Table 10-1.

During the testing program, the quality assurance measures specified in the referenced methods will be performed. The quality assurance project plan lists the specific protocols associated with determining continuous emission monitoring system performance.

Method References: “Specifications and Test Procedures for O_2 and CO_2 Continuous Emission Monitoring Systems in Stationary Sources.” 40 CFR 60 Appendix B, Performance Specification 3, July 1990.

Federal Register, Vol. 54, No. 206, October 1989.

“Performance Specifications for Continuous Emission Monitoring of Carbon Monoxide and Oxygen for Incinerators, Boilers, and Industrial Furnaces Burning Hazardous Waste.” Taken from *EPA Methods Manual for Compliance with the BIF Regulations Burning Hazardous Waste in Boilers and Industrial Furnaces*. USEPA 530-SW-91-010, U.S. Environmental Protection Agency, December 1990, and 40 CFR 266 Appendix IX, Part 2.1, July 1, 1994.

Procedure Number:	***18***
Procedure Title:	***Sampling Procedure for Oxygen in Stack Gases***
Sample Name:	Continuous emission monitoring for oxygen
Sampler:	Monitoring system operator
Process Sample Location:	The samples will be collected at the stack.
Sampling and Health and Safety Equipment:	Thermox™ Model CV-1 analyzer No specific health and safety equipment required.
Sample Collection Frequency:	The samples will be collected continuously for duration of each sampling run.
Sampling Procedures:	The CV-1 oxygen sensor uses convection to pull a sample of process gas through a protective porous filter on its probe. The sample passes into the analyzer, up and around the sensing house, and back into the process. The convection flow is caused by the temperature differences between the cell housing and the return tube. The analyzer produces an analog electronic signal that is input to the data acquisition system, where it is corrected to 0 percent moisture and then used to correct the carbon monoxide readings to a standard 7 percent oxygen concentration. The instrument will be prepared and operated during the test using the procedure provided by the manufacturer. The monitor will be calibrated before each sampling run using a zero and three span gases that approximate the actual stack concentration of oxygen. The calibration of each instrument also will be verified following each test run.
Sample Preservation:	No specific holding times apply to this procedure.
Documentation and Record-Keeping:	Documentation of data recorded by the computer.
Quality Assurance and Quality Control:	The required number of analyses for these samples is defined in Table 10-1 of the quality assurance project plan. The laboratory is required to analyze separately all of the field samples, field quality control samples, and laboratory quality control samples specified in Table 10-1. During the testing program, the quality assurance measures specified in the referenced methods will be performed. The quality assurance

project plan lists the specific protocols associated with determining continuous emissions monitoring system performance.

Method References:	“Specifications and Test Procedures for O_2 and CO_2 Continuous Emission Monitoring Systems in Stationary Sources,” 40 CFR 60 Appendix B, Performance Specification 3, July 1990. Federal Register, Vol. 54, No. 206, October 1989. “Performance Specifications for Continuous Emission Monitoring of Carbon Monoxide and Oxygen for Incinerators, Boilers, and Industrial Furnaces Burning Hazardous Waste.” Taken from *EPA Methods Manual for Compliance with the BIF Regulations Burning Hazardous Waste in Boilers and Industrial Furnaces*. USEPA 530-SW-91-010, U.S. Environmental Protection Agency, December 1990, and 40 CFR 266 Appendix IX, Part 2.1, July 1, 1994.

Procedure Number:	***19***
Procedure Title:	***Sampling Procedure for Total Hydrocarbon in Stack Gases***
Sample Name:	Stack total hydrocarbon (THC)
Sampler:	Stack sampling specialists
Process Sample location:	The samples will be collected at the stack.
Sampling and Health and Safety Equipment:	Stainless steel probe, heated Teflon™ sample transfer line, and flame ionization detector (FID) THC analyzer heated to 300 ° to 350 ° F. The probe will contain a pump system to introduce calibration gases (propane) and zero gas (less than 0.1 parts per million (ppm) hydrocarbon air) into the monitoring system. The FID fuel gas will be a mixture of 40 percent H_2 and 60 percent helium or 40 percent hydrogen and 60 percent nitrogen. No specific health and safety equipment required.
Sample Collection Frequency:	The samples will be collected continuously for the duration of each sampling run.
Sampling Procedures:	The gas stream will be drawn from the stack through a heated sampling line that is maintained above 220 °F to prevent condensation of water in the sampling line. The THC analyzer's output will be recorded on a strip chart recorder and by a data logger. The data logger will be used to report the hourly rolling averages, whereas the strip chart will report instantaneous results. The instrument probe will be placed in the stack stream as specified in the referenced methods. The unit will be prepared and operated during the test using the procedure provided by the manufacturer. The monitor will be calibrated before each sampling run using a zero and three span gases consisting of three concentrations of propane. The range of the calibration gases will approximate the actual stack THC concentration. The calibration of the instrument also will be verified following each sampling run. Because the THC analyzer will be calibrated against propane standards, the results of the analyzer will be reported as "THC as ppm propane."
Sample Preservation:	No specific holding times apply to this procedure.

Documentation and Record-Keeping:	Documentation of data recorded by the computer.
Quality Assurance and Quality Control:	The required number of analyses for these samples is defined in Table 10-1 of the quality assurance project plan. The laboratory is required to analyze separately all of the field samples, field quality control samples, and laboratory quality control samples specified in Table 10-1. During the testing program, the quality assurance measures specified in the referenced method will be performed. The quality assurance project plan lists the specific protocols associated with determining the THC continuous emissions monitoring performance.
Method References:	Federal Register, Vol. 54 No. 206, October 1989. "Performance Specifications for Continuous Emission Monitoring of Carbon Monoxide and Oxygen for Incinerators, Boilers, and Industrial Furnaces Burning Hazardous Waste." Taken from *EPA Methods Manual for Compliance with the BIF Regulations Burning Hazardous Waste in Boilers and Industrial Furnaces*. USEPA 530-SW-91-010, U.S. Environmental Protection Agency, December 1990, and 40 CFR 266 Appendix IX, Part 2.1, July 1, 1994.

Procedure Number: ***20***

Procedure Title: ***Sampling Procedure for Carbon Dioxide in the Stack Gases***

Sample Name: Continuous emission monitoring for carbon dioxide

Sampler: Monitoring system operator

Process Sample Location: The samples will be collected at the stack.

Sampling and Health and Safety Equipment: Stainless steel sonic orifice eductor probe, gas transport lines to instrument, infrared gas analyzer with strip chart recorder

No specific health and safety equipment required.

Sample Collection Frequency: The samples will be collected continuously for the duration of each sampling run.

Sampling Procedures: The gas steams drawn into the probe are heated and continuously transported to the analyzer.

The instrument will be placed in the stack gas steam as specified in the referenced methods. It will be prepared and operated during the test using the procedure provided by the manufacturer. The monitor will be calibrated before each sampling run using a zero and three span gases that approximate the actual stack concentration of carbon dioxide. The calibration of the instrument will also be verified following each test run.

Sample Preservation: No specific holding times apply to this procedure.

Documentation and Record-Keeping: Documentation of data recorded by the computer.

Quality Assurance and Quality Control: The required number of analyses for these samples is defined in Table 10-1 of the quality assurance project plan. The laboratory is required to analyze separately all of the field samples, field quality control samples, and laboratory quality control samples specified in Table 10-1.

During the testing program, the quality assurance measures specified in the referenced methods will be performed. The quality assurance project plan lists the specific protocols associated with determining continuous emissions monitoring system performance.

Method References:

"Specifications and Test Procedures for O_2 and CO_2 Continuous Emission Monitoring Systems in Stationary Sources." 40 CFR 60 Appendix B, Performance Specification 3, July 1990.

Federal Register, Vol. 54, No. 206, October 1989.

"Performance Specifications for Continuous Emission Monitoring of Carbon Monoxide and Oxygen for Incinerators, Boilers, and Industrial Furnaces Burning Hazardous Waste." Taken from *EPA Methods Manual for Compliance with the BIF Regulations Burning Hazardous Waste in Boilers and Industrial Furnaces*. USEPA 530-SW-91-010, U.S. Environmental Protection Agency, December 1990, and 40 CFR 266 Appendix IX, Part 2.1, July 1, 1994.

Procedure Number: ***21***

Procedure Title: ***Sampling Procedure for Sulfur Dioxide in the Stack Gases***

Sample Name: Continuous emission monitoring for sulfur dioxide

Sampler: Monitoring system operator

Process Sample Location: The samples will be collected at the stack.

Sampling and Health and Safety Equipment: Stainless-steel probe; heated Teflon™ sample transfer line; and nondispersive infrared, ultraviolet, or fluorescence analyzer with strip chart recorder

No specific health and safety equipment required.

Sample Collection Frequency: The samples will be collected continuously for the duration of each sampling run.

Sampling Procedures: The instrument will be placed in the stack gas steam, as specified in the referenced methods. It will be prepared and operated during the test using the procedure provided by the manufacturer. The monitor will be calibrated before each sampling run using a zero and three span gases that approximate the actual stack concentration of sulfur dioxide. The calibration of the instrument also will be verified following each test run.

Sample Preservation: No specific holding times apply to this procedure.

Documentation and Record-Keeping: Documentation of data recorded by the computer.

Quality Assurance and Quality Control: The required number of analyses for these samples is defined in Table 10-1 of the quality assurance project plan. The laboratory is required to analyze separately all of the field samples, field quality control samples, and laboratory quality control samples specified in Table 10-1.

During the testing program, the quality assurance measures specified in the referenced methods will be performed. The quality assurance project plan lists the specific protocols associated with determining continuous emissions monitoring system performance.

Method Reference: “Determination of Sulfur Dioxide Emissions from Stationary Sources (Instrumental Analyzer Procedure).” 40 CFR 60 Appendix A, Method 6C, July 1, 1991.

Procedure Number: ***22***

Procedure Title: ***Sampling Procedure for Nitrogen Oxides in the Stack Gases***

Sample Name: Continuous emission monitoring for nitrogen oxides

Sampler: Monitoring system operator

Process Sample Location: The samples will be collected at the stack.

Sampling and Health and Safety Equipment: Stainless-steel probe; heated Teflon™ sample transfer line; and nondispersive infrared, chemiluminescent analyzer with strip chart recorder

No specific health and safety equipment required.

Sample Collection Frequency: The samples will be collected continuously for the duration of each sampling run.

Sampling Procedures: The instrument will be placed in the stack gas steam as specified in the referenced methods. It will be prepared and operated during the test using the procedure provided by the manufacturer. The monitor will be calibrated before each sampling run using a zero and three span gases that approximate the actual stack concentration of nitrogen oxides. The calibration of each instrument also will be verified following each test run.

Sample Preservation: No specific holding times apply to this procedure.

Documentation and Record-Keeping: Documentation of data recorded by the computer.

Quality Assurance and Quality Control: The required number of analyses for these samples is defined in Table 10-1 of the quality assurance project plan. The laboratory is required to analyze separately all of the field samples, field quality control samples, and laboratory quality control samples specified in Table 10-1.

During the testing program, the quality assurance measures specified in the referenced methods will be performed. The quality assurance project plan lists the specific protocols associated with determining continuous emission monitoring system performance.

Method Reference: "Determination of Nitrogen Oxides Emissions from Stationary Sources (Instrumental Analyzer Procedure)." 40 CFR 60 Appendix A, Method 7E, July 1, 1991.

Procedure Number:	***23***
Procedure Title:	***Sampling Procedure for Oxygen and Carbon Dioxide in Stack by Orsat***
Sample Name:	Stack oxygen and carbon dioxide by Orsat.
Sampler:	Stack sampling specialists
Process Sample Location:	Samples will be collected at the stack.
Sampling and Health and Safety Equipment:	Orsat apparatus, Tedlar™ gas bags No specific health and safety equipment required.
Sample Collection Frequency:	One integrated sample collected from each isokinetic stack sampling train.
Sampling Procedures:	Collect an integrated sample of approximately 1 cubic foot in a clean Tedlar™ bag using EPA Method 3. Analyze after the sampling run for oxygen, and carbon dioxide by instructions provided with the Orsat apparatus.
Sample Preservation:	No specific holding times apply to this procedure.
Documentation and Record-Keeping:	Documentation of data recorded by the computer.
Quality Assurance and Quality Control:	The required number of analyses for these samples is defined in Table 10-1 of the quality assurance project plan. The laboratory is required to analyze separately all of the field samples, field quality control samples, and laboratory quality control samples specified in Table 10-1.
Method Reference:	“Gas Analysis for the Determination of Dry Molecular Weight.” 40 CFR 60 Appendix A, Method 3, July 1, 1991.

Procedure Number: ***24***

Procedure Title: ***Sampling Procedure for Opacity in the Stack Gases***

Sample Name: Stack gas continuous emissions opacity monitoring

Sampler: Stack sampling specialists

Process Sample Location: Samples will be collected at the stack.

Sampling and Health and Safety Equipment: In situ, continuous monitoring system for opacity, calibration attenuators

No specific health and safety equipment required.

Sample Collection Frequency: The samples will be collected continuously for the duration of each sampling run.

Sampling Procedures: The opacity monitor is a 2-pass, in situ monitor with an internal reference cell, automated calibration , and continuously cleaning analyzer optics. The monitor has a peak and mean spectral response between 500 to 600 nanometers with an angle of view of less than 5 °C and an angle of projection of less than 5 °C.

The instrument will be prepared and operated during the test using the procedure provided by the manufacturer. The monitor will be calibrated before each sampling run using three calibration attenuators with an absorbance approximating the opacity range of the stack gas. The calibration of the instrument will also be verified following each test run.

Sample Preservation: No specific holding times apply to this procedure.

Documentation and Record-Keeping: Documentation of data recorded by the computer.

Quality Assurance and Quality Control: The required number of analyses for these samples is defined in Table 10-1 of the quality assurance project plan. The laboratory is required to analyze separately all of the field samples, field quality control samples, and laboratory quality control samples specified in Table 10-1.

During the testing program, the quality assurance measures specified in the referenced methods will be performed. The quality assurance project plan lists the specific protocols associated with determining continuous emission monitoring system performance.

Method Reference: “Specifications and Test Procedures for Opacity Continuous Emission Monitoring Systems in Stationary Sources.” 40 CFR 60 Appendix B, Performance Specification 1, July 1, 1991.

Procedure Number: ***25***

Procedure Title: ***Density Measurement***

Sample Name: High-British thermal unit (Btu) liquid waste feed
Low-Btu liquid waste feed

Sample Holding Time: None, perform in a timely manner (generally within 30 days).

Analytical Procedures: A measured volume of the liquid waste feed material will be weighed to the nearest 0.1 gram on a calibrated analytical balance. All graduated cylinders will be calibrated with Type II water at the specified temperature in the method.

Solid volumes will be determined by displacement.

Quality Assurance and Quality Control: The required number of analyses for these samples is defined in Table 10-1 of the quality assurance project plan. The laboratory is required to analyze separately all of the field samples, field quality control samples, and laboratory quality control samples specified in Table 10-1.

Method References: “Standard Test Method for Specific Gravity and Density of Semi-Solid Bituminous Material.” ASTM D-70-82. Taken from *Annual Book of ASTM Standards.* D-1989-93. American Society for Testing and Materials, ASTM: Philadelphia, PA, 1996.

“Standard Test Method for Specific Gravity of Soils.” ASTM D-854. Taken from *Annual Book of ASTM Standards.* D-1989-93. American Society for Testing and Materials, ASTM: Philadelphia, PA, 1996.

“Test Method for Specific Gravity of Liquid Industrial Chemicals.” ASTM D-891-89. Taken from *Annual Book of ASTM Standards.* D-1989-93. American Society for Testing and Materials, ASTM: Philadelphia, PA, 1996.

“Test Method for Specific Gravity of Water and Brine.” ASTM D-1429-86. Taken from *Annual Book of ASTM Standards.* D-1989-93. American Society for Testing and Materials, ASTM: Philadelphia, PA, 1996.

Procedure Number:	***26***
Procedure Title:	***Viscosity Measurement***
Sample Name:	High-Btu liquid waste feed Low-Btu liquid waste feed
Sample Holding Time:	None, perform in a timely manner (generally within 30 days).
Analytical Procedures:	The time necessary for a fixed volume of sample to pass through the viscometer will be measured. The temperature will be recorded and the viscosity will be determined in accordance with the procedures specified in the apparatus manual.
Quality Assurance and Quality Control:	The required number of analyses for these samples is defined in Table 10-1 of the quality assurance project plan. The laboratory is required to analyze separately all of the field samples, field quality control samples, and laboratory quality control samples specified in Table 10-1.
Method Reference:	"Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and the Calculation of Dynamic Viscosity)." ASTM D-445. Taken from *Annual Book of ASTM Standards.* D-1989-93. American Society for Testing and Materials, ASTM: Philadelphia, PA, 1996.

Procedure Number:	***27***
Procedure Title:	***Heat Content (Btu) Analysis***
Sample Name:	High-British thermal unit (Btu) liquid waste feed Low-Btu liquid waste feed Solid waste feed
Sample Holding Time:	None, perform in a timely manner (generally within 30 days).
Analytical Procedures:	A weighed sample aliquot will be mixed thoroughly and prepared. A sample aliquot will be burned in an adiabatic bomb calorimeter.
Quality Assurance and Quality Control:	The required number of analyses for these samples is defined in Table 10-1 of the quality assurance project plan. The laboratory is required to analyze separately all of the field samples, field quality control samples, and laboratory quality control samples specified in Table 10-1.
Method References:	"Standard Test Method for Gross Calorific Value of Solid Fuel by Adiabatic Bomb Calorimeter." ASTM D-2015-77. Taken from *Annual Book of ASTM Standards.* D-1989-93. American Society for Testing and Materials, ASTM: Philadelphia, PA, 1996. "Standard Test Method for Heat of Combustion of Liquid Hydrocarbon Fuels by Bomb Calorimeter." ASTM D-240-92. Taken from *Annual Book of ASTM Standards.* D-1989-93. American Society for Testing and Materials, ASTM: Philadelphia, PA, 1996.

Procedure Number:	***28***
Procedure Title:	***Total Chlorine Analysis***
Sample Name:	High-British thermal unit (Btu) liquid waste feed Low-Btu liquid waste feed Solid waste feed
Sample Holding Time:	None, perform in a timely manner (generally within 30 days).
Analytical Procedures:	An aliquot of the sample will be prepared by Parr bomb combustion. Next, the bomb washings will be analyzed for total chlorine by silver nitrate titration or ion chromatography detection methods.
Quality Assurance and Quality Control:	The required number of analyses for these samples is defined in Table 10-1 of the quality assurance project plan. The laboratory is required to analyze separately all of the field samples, field quality control samples, and laboratory quality control samples specified in Table 10-1.
Method References:	"Standard Test Method for Chlorine in New and Used Petroleum Products (Bomb Method)." ASTM D-808-81. Taken from *Annual Book of ASTM Standards.* D-1989-93. American Society for Testing and Materials, ASTM: Philadelphia, PA, 1996. "Standard Test Method for Chlorine, Bromine, or Iodine in Organic Compounds by Oxygen Flask Combustion." ASTM E-442-74. Taken from *Annual Book of ASTM Standards.* D-1989-93. American Society for Testing and Materials, ASTM: Philadelphia, PA, 1996.

Procedure Number: ***29***

Procedure Title: ***Ash Content Analysis***

Sample Name:
High-British thermal unit (Btu) liquid waste feed
Low-Btu liquid waste feed
Solid waste feed
Ash spike

Sampler Holding Time: None, perform in a timely manner (generally within 30 days).

Analytical Procedures: An aliquot of a well-mixed sample will be transferred to a prepared crucible and weighed.

The sample will be dried to constant weight at 103 °C.

The dried sample will be ashed to constant weight in muffle furnace at 900 °C.

Quality Assurance and Quality Control: The required number of analyses for these samples is defined in Table 10-1 of the quality assurance project plan. The laboratory is required to analyze separately all of the field samples, field quality control samples, and laboratory quality control samples specified in Table 10-1.

Method Reference: “Test Method for Ash from Petroleum Products.” ASTM D-482-87. Taken from *Annual Book of ASTM Standards.* D-1989-93. American Society for Testing and Materials; ASTM: Philadelphia, PA, 1996.

Procedure Number: ***30***

Procedure Title: ***Elemental Analysis***

Sample Name:
High-British thermal unit (Btu) liquid waste feed
Low-Btu liquid waste feed

Sample Holding Time: None, perform in a timely manner (generally within 30 days).

Analytical Procedures: This procedure (ASTM D-3176) incorporates several American Society for Testing and Materials (ASTM) methods for analysis including determination of carbon and hydrogen (ASTM D-3178), nitrogen (ASTM D-3179), ash (ASTM D-3174), moisture (ASTM D-3173), and oxygen by difference.

The analysis of nitrogen involves converting nitrogen to ammonium salts with a hot catalyzed mixture of concentrated sulfuric acid and potassium sulfate. These salts are decomposed subsequently in a hot alkaline solution from which the ammonia is recovered by distillation and finally determined by alkalimetric or acidimetric titration. Ash is determined by weighing the residue remaining after burning the sample under rigidly controlled conditions of sample weight, temperature, time, atmosphere, and equipment specifications. The moisture is determined by drying to a constant weight. Carbon and hydrogen are analyzed by burning a weighed quantity of sample in a closed system and fixing the products of combustion in an adsorption train (carbon dioxide absorption bulb and water absorption bulb) after complete oxidation and purification from interfering substances.

Quality Assurance and Quality Control: The required number of analyses for these samples is defined in Table 10-1 of the quality assurance project plan. The laboratory is required to analyze separately all of the field samples, field quality control samples, and laboratory quality control samples specified in Table 10-1.

Method References: “Practices of Elemental Analysis of Coal and Coke.” ASTM D-3176. Taken from *Annual Book of ASTM Standards.* D-1989-93. American Society for Testing and Materials; ASTM: Philadelphia, PA, 1996.

ASTM D-3173. Taken from *Annual Book of ASTM Standards.* D-1989-93. American Society for Testing and Materials; ASTM: Philadelphia, PA, 1996.

ASTM D-3174. Taken from *Annual Book of ASTM Standards.* D-1989-93. American Society for Testing and Materials; ASTM: Philadelphia, PA, 1996.

Procedure Number: ***31***

Procedure Title: ***Total Dissolved Solids and Total Suspended Solids Analysis***

Sample Name: Scrubber Purge Water

Sample Holding Time: Analysis will be done within 7 days of collection.

Analytical Procedures: The volume of a sample aliquot is determined, well mixed, and filtered through a standard glass fiber filter. Sample filters will be Reeve Angel, type 934-AH; Gelman, type AE; or equivalent. The filtering apparatus is tare weighed prior to testing.

Total dissolved solids is determined by evaporating and drying the liquid passing through the filter to a constant weight at 180 °C. The results are reported as milligrams per liter of total dissolved solids.

Total suspended solids is determined by drying the residue on the filter to a constant weight at 103 °C to 105 °C. The results are reported as milligrams per liter of total suspended solids.

Quality Assurance and Quality Control: The required number of analyses for these samples is defined in Table 10-1 of the quality assurance project plan. The laboratory is required to analyze separately all of the field samples, field quality control samples, and laboratory quality control samples specified in Table 10-1.

Method Reference: “Method 160.1 - Residue, Filterable (Gravimetric, Dried at 180 °C), Method 160.2 - Residue, Non-filterable (Gravimetric, Dried at 103 °C to 105 °C), and Method 160.3 - Residue, Total (Gravimetric, Dried at 103 °C to 105 °C).” EPA 600 - Method 160. Taken from *Methods for Chemical Analysis of Water and Waste*. EPA-600/4-79-020. U.S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Cincinnati, OH, 1979.

Procedure Number: ***32***

Procedure Title: ***Stack Moisture Content***

Sample Name: Multi-metals train
Method 5 hydrogen chloride, chlorine, and particulate train
Modified Method 5 trains

Sample Holding Time: None, it will be performed upon collection.

Analytical Procedures: An increase in volume of impinger water will be measured by weighing to nearest 0.1 gram.

An increase in weight of indicating silica gel will be measured to nearest 0.1 gram.

Stack moisture content will be calculated using equations provided in the method referenced.

Quality Assurance and Quality Control: The required number of analyses for these samples is defined in Table 10-1 of the quality assurance project plan. The laboratory is required to analyze separately all of the field samples, field quality control samples, and laboratory quality control samples specified in Table 10-1.

Method Reference: “Determination of Moisture Content in Stack Gases.” 40 CFR 60 Appendix A, Method 4, revised July 1, 1996.

Procedure Number: ***33***

Procedure Title: ***Analysis of Semivolatile PICs and Dioxins and Furans in MM5 Samples***

Sample Name: The samples from the modified method 5 train for semivolatile principal organic hazardous constituents (POHC) and products of incomplete combustion (PIC) and dioxins and furans analysis will be analyzed under the three sample portions:

- Particulate Filter, Front Half of the Filter Holder and Probe Solvent Rinses
- XAD-2 Resin Tube, Back Half of the Filter Holder, and Coil Condenser Solvent Rinses
- Impingers 1, 2, and 3 Composite and Glassware Solvent Rinses

Sample Holding Time: Extraction will be done within 14 days, and analysis will be done within 40 days from extraction.

Analytical Procedures: <u>Particulate Filter, Front Half of the Filter Holder and Probe Solvent Rinses</u>—These components will be sequentially Soxhlet extracted using methylene chloride followed by a separate extraction using toluene. The acetone and methylene chloride solvent rinses will be extracted with the methylene chloride (first Soxhlet extraction). The toluene solvent rinses will be extracted in with the toluene (second Soxhlet extraction). The extracts will be concentrated being blown down. Fifty percent of the methylene chloride extract will be analyzed for semivolatile POHCs and PICs by Method 8270. The other 50 percent of the methylene chloride extract will be combined with 50 percent of the toluene extract and analyzed by Method 8290 for dioxins and furans (2,3,7,8 isomers and totals). The second portion of the toluene extraction will be archived.

<u>XAD-2 Resin Tube, Back Half of the Filter Holder and Coil Condenser Solvent Rinses</u>—These components will be sequentially Soxhlet extracted using methylene chloride followed by a separate extraction using toluene. The acetone and methylene chloride solvent rinses will be placed in the Soxhlet extractor during the methylene chloride extraction (first Soxhlet extraction) and the toluene will be placed in the extractor during the toluene extraction (second Soxhlet extraction). The extract splitting and analytical schemes for semivolatile POHCs, PICs, dioxins, and furans are the same as the particulate filter fraction. The extracts will be concentrated because they will be blown down. Fifty percent of the methylene chloride extract will be analyzed for semivolatile POHC and PICs by Method 8270. The other 50 percent of the methylene

chloride extract will be combined with 50 percent of the toluene extract and analyzed by Method 8290 for dioxins and furans (2,3,7,8 isomers and totals). The second portion of the toluene extraction will be archived.

Impinger 1, 2, and 3 Composite and Glassware Solvent Rinses—These components will be extracted using a liquid-liquid extraction (Method 3510). The total volume of the impinger composite will be recorded at the beginning of the extraction so that total analyte masses can be calculated. A 1-liter portion of the impinger composite and the total amount of glassware solvent rinses will be extracted as base neutral and acid extractable fractions. The final combined extract will be blown down and analyzed for semivolatile POHC and PICs using Method 8270.

Quality Assurance and Quality Control:

The required number of analyses for these samples is defined in Table 10-1 of the quality assurance project plan. The laboratory is required to analyze separately all of the field samples, field quality control samples, and laboratory quality control samples specified in Table 10-1.

Method References:

“Method 3510 - Separatory Funnel Liquid-Liquid Extraction.” Taken from *SW-846 Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method SW-3510, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). U.S. Environmental Protection Agency (EPA), Office of Solid Waste and Emergency Response (OSWER), Washington, D.C. 20460.

“Method 3540 - Soxhlet Extraction.” Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method SW-3540, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996).EPA, OSWER, Washington, D.C. 20460.

“Method 3542 - Extraction of Semivolatile Analytes Collected Using Method 0010 (Modified Method 5 Sampling Train).” Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method SW-3542, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). EPA, OSWER, Washington, D.C. 20460.

“Method 8270 - Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS): Capillary Column Technique.” Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method SW-8270, Third Edition,

September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). EPA, OSWER, Washington, D.C. 20460.

"Method 8290 - Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) by High Resolution Gas Chromatography/High Resolution Mass Spectrometry (HRGC/HRMS)." Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method SW-8290, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). EPA, OSWER, Washington, D.C. 20460.

Procedure Number: ***34***

Procedure Title: ***Analysis of Polynuclear Aromatic Hydrocarbons in MM5 Samples***

Sample Name: Particulate Filter, Front Half of the Filter Holder, and Probe Solvent Rinses

XAD-2 Resin Tube Back Half of the Filter Holder and Coil Condenser Solvent Rinses

Impingers 1, 2, and 3 Composite and Glassware Solvent Rinses

Sample Holding Time: Extraction will be done within 14 days, and analysis will be done within 40 days from extraction.

Analytical Procedures: <u>Particulate Filter, Front Half of the Filter Holder and Probe Solvent Rinses</u>—These components will be Soxhlet extracted using toluene. The toluene extract will be blown down, and analyzed by Modified Method 8290/California Air Resources Board (CARB) Method 429 for the target analyte list of polynuclear aromatic hydrocarbons (PAH).

<u>XAD-2 Resin Tube, Back Half of the Filter Holder and Coil Condenser Solvent Rinses</u>—These components will be Soxhlet extracted using toluene. The acetone and methylene chloride solvent rinses and the toluene will be placed in the extractor during the toluene extraction (second Soxhlet extraction). The toluene extract will be blown down and analyzed by Modified Method 8290/CARB 429 for the target analyte list of PAHs.

<u>Impinger 1, 2, and 3 Composite and Glassware Solvent Rinses</u>—These components will be extracted using liquid-liquid extraction (Method 3510). The total volume of the impinger composite will be recorded so that total analyte masses can be calculated. A 1-liter portion of the impinger composite and the glassware solvent rinses will be extracted as base-neutral and acid-extractable fractions. The final, combined extract will be blown down and analyzed by Modified Method 8290/CARB 429 for the target analyte list of PAHs.

Quality Assurance and Quality Control: The required number of analyses for these samples is defined in Table 10-1 of the quality assurance project plan. The laboratory is required to analyze separately all of the field samples, field quality control samples, and laboratory quality control samples specified in Table 10-1.

Method References: "Method 3510 - Separatory Funnel Liquid-Liquid Extraction." Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method SW-3510, Third Edition, September 1986.

Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). U.S. Environmental Protection Agency (EPA), Office of Solid Waste and Emergency Response (OSWER), Washington, D.C. 20460.

“Method 3540 - Soxhlet Extraction.” Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method SW-3540, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). EPA, OSWER, Washington, D.C. 20460.

“Method 3542 - Extraction of Semivolatile Analytes Collected Using Method 0010 (Modified Method 5 Sampling Train).” Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, (SW-846 Method SW-3542, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). EPA, OSWER, Washington, D.C. 20460.

“Method 8290 - Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) by High Resolution Gas Chromatography/High Resolution Mass Spectrometry (HRGC/HRMS).” Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). EPA, OSWER, Washington, D.C. 20460.

“Method 429 - Determination of Polycyclic Aromatic Hydrocarbon Emissions from Stationary Sources.” CARB 429. State of California, Air Resources Board. September 12, 1989.

Procedure Number: ***35***

Procedure Title: ***Analysis of Semivolatile and Nonvolatile Unspeciated Mass in MM5 Samples***

Sample Name: Particulate Filter, Front Half of the Filter Holder and Probe Solvent Rinses

XAD-2 Resin Tube Back Half of the Filter Holder, and Coil Condenser Solvent Rinses

Impingers 1, 2, and 3 Composite and Glassware Solvent Rinses

Sample Holding Time: Extraction will be done within 14 days, and analysis will be done within 40 days from extraction.

Analytical Procedures: <u>Particulate Filter, Front Half of the Filter Holder and Probe Solvent Rinses</u>—These components will be Soxhlet extracted sequentially using methylene chloride and toluene. The acetone and methylene chloride solvent rinses will be extracted in with the methylene chloride (first Soxhlet extraction). The toluene solvent rinses will be extracted with the toluene (second Soxhlet extraction). The extracts will be blown down. Fifty percent of the methylene chloride extract will be analyzed for semivolatile principal organic hazardous constituents (POHC) and products of incomplete combustion (PIC) by Method 8270. The other 50 percent of the methylene chloride extract will be combined 50 percent of the toluene extract and analyzed by Method 8290 for dioxins and furans (2,3,7,8 isomers and totals).

<u>XAD-2 Resin Tube, Back Half of the Filter Holder and Coil Condenser Solvent Rinses</u>—These components will be Soxhlet extracted sequentially using methylene chloride followed by toluene. The acetone and methylene chloride solvent rinses will be placed in the Soxhlet extractor during the methylene chloride extraction (first Soxhlet extraction) and the toluene will be placed in the extractor during the toluene extraction (second Soxhlet extraction). The extract splitting and analytical schemes for semivolatile POHCs, PICs, dioxins, and furans will be the same as for the particulate filter fraction.

<u>Impinger 1, 2, and 3 Composite and Glassware Solvent Rinses</u>—These components will be extracted using liquid-liquid extraction (Method 3510). The total volume of the impinger composite will be recorded so that total analyte masses can be calculated. A 1-liter portion of the impinger composite and the glassware solvent rinses will be extracted as base neutral and acid extractable fractions. The final, combined extract

will be blown down and analyzed for semivolatile POHC and PICs using Method 8270.

Quality Assurance and Quality Control:

The required number of analyses for these samples is defined in Table 10-1 of the quality assurance project plan. The laboratory is required to analyze separately all of the field samples, field quality control samples, and laboratory quality control samples specified in Table 10-1.

Method References:

“Method 3510 - Separatory Funnel Liquid-Liquid Extraction.” Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method SW-3510, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). U.S. Environmental Protection Agency (EPA), Office of Solid Waste and Emergency Response (OSWER), Washington, D.C. 20460.

“Method 3540 - Soxhlet Extraction.” Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method SW-3540, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). EPA, OSWER, Washington, D.C. 20460.

“Method 3542 - Extraction of Semivolatile Analytes Collected Using Method 0010 (Modified Method 5 Sampling Train).” Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method SW-3542, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). EPA, OSWER, Washington, D.C. 20460.

“Method 8270 - Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS): Capillary Column Technique.” Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method SW-8270, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). EPA, OSWER, Washington, D.C. 20460.

Procedure Number:	***36***
Procedure Title:	***Analysis of Formaldehyde in MM5 Samples***
Sample Name:	Method 0011 stack gas samples for aldehydes
Sample Holding Time:	Analysis will be done within 30 days of collection.
Analytical Procedures:	Samples will be analyzed for formaldehyde and other aldehydes by high-performance liquid chromatography (HPLC) Method 8315. The following procedures will be used during analysis: <u>Sample Preparation</u>—The samples will be extracted using methylene chloride and concentrated to 10 milliliters. <u>Sample Analysis</u>—The samples will be analyzed by HPLC following Method 8315. HPLC conditions will be set up that provide separation of the target carbonyl compounds in the extract. Ultra-violet-visible detection will be used to measure derivatized samples; the wavelength of the detector will be set at 360 nanometers.
Quality Assurance and Quality Control:	The required number of analyses for these samples is defined in Table 10-1 of the quality assurance project plan. The laboratory is required to analyze separately all of the field samples, field quality control samples, and laboratory quality control samples specified in Table 10-1.
Method References:	“Method 0011 - Sampling for Formaldehyde Emissions from Stationary Sources.” Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method SW-0011, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). U.S. Environmental Protection Agency (EPA), Office of Solid Waste and Emergency Response (OSWER), Washington, D.C. 20460. “Formaldehyde by High Performance Liquid Chromatography.” Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method SW-8315, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). EPA, OSWER, Washington, D.C. 20460.

Procedure Number: ***37***

Procedure Title: ***Analysis of Metals in Liquids and Solid Waste***

Sample Name:

Organic liquid
Aqueous liquid
Solid waste feed
Metals spike solution(s)

Sample Holding Time:

Analysis will be performed by Method 6010 within 6 months of the date of collection, and by Method 7470 or 7471 for mercury within 28 days.

Analytical Procedures:

An aliquot of the composite sample will be prepared by total metals digestion prep Method 3050 for liquid and solid samples. Analysis will be done by Method 6010 (ICAP) or 6020 (ICP-MS) for antimony, arsenic, barium, beryllium, cadmium, chromium, lead, silver, nickel, selenium, and thallium and by Method 7470 or Method 7471 (CVAA) for mercury.

Quality Assurance and Quality Control:

The required number of analyses for these samples is defined in Table 10-1 of the quality assurance project plan. The laboratory is required to analyze separately all of the field samples, field quality control samples, and laboratory quality control samples specified in Table 10-1.

Method References:

"Method 3050 - Acid Digestion of Sediments, Sludges, and Soils." Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method SW-3050, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). U.S. Environmental Protection Agency (EPA), Office of Solid Waste and Emergency Response (OSWER), Washington, D.C. 20460.

"Method 6010 - Inductively Coupled Plasma-Atomic Emission Spectroscopy." Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method SW-6010, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). EPA, OSWER, Washington, D.C. 20460.

"Method 6020 - Inductively Coupled Plasma-Mass Spectroscopy." Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method SW-6020, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January

1995), and Final Update III (December 1996). EPA, OSWER, Washington, D.C. 20460.

"Method 7470 - Mercury in Liquid Waste (Manual Cold-Vapor Technique)." Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method SW-7470, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). EPA, OSWER, Washington, D.C. 20460.

"Method 7471 - Mercury in Solid or Semisolid Waste (Manual Cold-Vapor Technique)." Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods.* SW-846 Method SW-7471, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). EPA, OSWER, Washington, D.C. 20460.

Procedure Number: ***38***

Procedure Title: ***Analysis of Multi-Metals Train Samples***

Sample Name:

The samples from the MMT will be analyzed separately as the following sample types: Probe rinse (0.1N nitric acid and acetone), particulate filter (glass fiber), impingers 1, 2, and 3 catches (5 percent nitric acid and 10 percent hydrogen peroxide), 4th impinger (empty at start), 4 percent potassium permanganate and 10 percent sulfuric acid impingers and 8N hydrogen chloride rinse

Sample Holding Time:

Analysis will be performed within 6 months from date of collection and 28 days from collection for mercury.

Analytical Procedures:

The nitric acid probe rinse sample will be added to the acetone sample residue (if collected) and particulate filter. The composite will be digested with hydrofluoric acid and nitric acid (Methods 3050 and 0060 modified to include hydrofluoric acid).

The digestate is then analyzed by inductively coupled plasma-atomic emission spectroscopy (ICAP) (Method 6010) or inductively coupled plasma-mass spectroscopy (ICP-MS) (Method 6020) for the following metals: antimony, arsenic, barium, beryllium, cadmium, chromium, lead, silver, nickel, selenium, and thallium and by Method 7470 (manual cold-vapor technique) for mercury.

<u>Back Half Sample Preparation</u>—The composited back half impinger sample is prepared by digestion Method 3050/0060. The sample is then analyzed by ICAP (Method 6010) or ICP-MS (Method 6020) for the following metals: antimony, arsenic, barium, beryllium, cadmium, chromium, lead, silver, nickel, selenium, and thallium. A portion of the digestate will be analyzed for mercury by cold vapor atomic absorption, Method 7470.

Each of the remaining train portions will receive separate preps and separate analyses for mercury by Method 0060/Method 7470.

For each of the metals analyzed, a total multi-metals train content will be reported by summarizing the total micrograms (μg) in the front-half and the total μg in the back-half samples.

Quality Assurance and Quality Control:

The required number of analyses for these samples is defined in Table 10-1 of the quality assurance project plan. The laboratory is required to analyze separately all of the field samples, field quality control samples, and laboratory quality control samples specified in Table 10-1.

Method References:	"Method 3050 - Acid Digestion of Sediments, Sludges, and Soils." Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method SW-3050, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). U.S. Environmental Protection Agency (EPA), Office of Solid Waste and Emergency Response (OSWER), Washington, D.C. 20460. "Method 6010 - Inductively Coupled Plasma-Atomic Emission Spectroscopy." Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method SW-6010, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). EPA, OSWER, Washington, D.C. 20460. "Method 6020 - Inductively Coupled Plasma-Mass Spectroscopy." Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method SW-6020). Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). EPA, OSWER, Washington, D.C. 20460. "Method 7470 - Mercury in Liquid Waste (Manual Cold-Vapor Technique)." Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method SW-7470). Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). EPA, OSWER, Washington, D.C. 20460.

Procedure Number: ***39***

Procedure Title: ***Analysis of POHCs in Liquids, Solid and Ash Samples***

Sample Name:

High-British thermal unit (Btu) liquid waste feed
Low-Btu liquid waste feed
Scrubber purge water
Solid waste feed
Incinerator ash
Makeup water
Caustic

Sample Holding Time: Analysis will be done within 14 days from date of collection.

Analytical Procedures:

Grab samples will be syringe composited to form one representative sample in the laboratory. Solids will be composited by combining portions of equal weight in the laboratory. Internal standards and surrogates will be added.

The analysis will proceed per reference method. The method involves analysis of composite samples for volatile principal organic hazardous constituents (POHC) using purge and trap gas chromatography and mass spectroscopy following Method 8260.

Caustic samples may be neutralized with sulfuric acid before analysis, if necessary, to demonstrate method performance.

Quality Assurance and Quality Control:

The required number of analyses for these samples is defined in Table 10-1 of the quality assurance project plan. The laboratory is required to analyze separately all of the field samples, field quality control samples, and laboratory quality control samples specified in Table 10-1.

Method Reference:

“Method 8260 - Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS): Capillary Column Technique.” Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method SW-8260, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, D.C. 20460.

Procedure Number:	***40***
Procedure Title:	***Analysis of Volatile PICs in Volatile Organic Sampling Train (VOST) Samples***
Sample Name:	Volatile organic sampling train (VOST) sorbent resins (Tenax™ and Anasorb™ 747), VOST condensate
Sample Holding Time:	Analysis will be done within 14 days.
Analytical Procedures:	VOST tubes will be spiked with the appropriate surrogate and internal standard compounds before analysis. Tubes will be desorbed thermally by using a Nutech desorption apparatus or equivalent. The two Tenax™ resin tubes and the Anasorb™ 747 sample tubes will be analyzed separately for volatile principal organic hazardous constituents and products of incomplete combustion following Method 8260/5041. Field blank and travel blank tubes may be analyzed as a sample sets. VOST condensate samples will be analyzed by Method 8260.
Quality Assurance and Quality Control:	The required number of analyses for these samples is defined in Table 10-1 of the quality assurance project plan. The laboratory is required to analyze separately all of the field samples, field quality control samples, and laboratory quality control samples specified in Table 10-1.
Method References:	"Method 5041 - Analysis of Desorption of Sorbent Cartridges from Volatile Organic Sampling Train (VOST): Capillary GC/MS Technique." Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method SW-5041, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). U.S. Environmental Protection Agency (EPA), Office of Solid Waste and Emergency Response (OSWER), Washington, D.C. 20460. "Method 8260 - Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS): Capillary Column Technique." Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method SW-8260). Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB

(January 1995), and Final Update III (December 1996). EPA, OSWER, Washington, D.C. 20460.

Procedure Number: ***41***

Procedure Title: ***Analysis of Hydrogen Chloride, Chlorine, and Particulate Train Samples***

Sample Name:

Particulate sample
Impinger catches (0.1 normality [N] sulfuric acid solution and 0.1N sodium hydroxide solution)

Sample Holding Time:

Particulate—none, but analysis will be performed in a timely manner.
Impingers—analysis will be done within 28 days of sample collection.

Analytical Procedures:

Particulate Sample—The acetone probe rinse sample will be evaporated to near dryness, and the residue will be prepared by oven drying at 105 °C for 24 hours. The dried residue will be weighed to a constant weight on a calibrated analytical balance capable of weighing to the nearest 0.0001 gram.

The particulate filter sample will be conditioned by oven drying for 24 hours at 105 °C, followed by 2 hours of desiccation. Replicate weighings of the filter will be conducted every 6 hours while continuing to desiccate between weighings until a constant weight has been achieved. The filter sample will be weighed using a calibrated analytical balance capable of weighing to the nearest 0.0001 gram.

Impinger Samples—The 0.1N sulfuric acid and the 0.1N sodium hydroxide impinger samples will be analyzed separately for chloride using an ion chromatograph. Results will be reported as hydrogen chloride and chlorine catches, respectively.

Quality Assurance and Quality Control:

The required number of analyses for these samples is defined in Table 10-1 of the quality assurance project plan. The laboratory is required to analyze separately all of the field samples, field quality control samples, and laboratory quality control samples specified in Table 10-1.

Method References:

"Isokinetic HCl/Cl_2 Emission Sampling Train." Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method 0050, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December

1996). U.S. Environmental Protection Agency (EPA), Office of Solid Waste and Emergency Response (OSWER), Washington, D.C. 20460.

"Method 9056 - Determination of Inorganic Anions by Ion Chromatography." Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method 9056, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). EPA, OSWER, Washington, D.C. 20460.

"Method 9057 - Determination of Chloride from HCl/Cl_2 Emission Sampling Train (Methods 0050 and 0051) by Anion Chromatography." Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method SW-9057, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). EPA, OSWER, Washington, D.C. 20460.

Procedure Number: ***42***

Procedure Title: ***Analysis of Hexavalent Chromium Samples from the Cr^{+6} Train***

Sample Name: Probe wash, glassware rinses, and impinger catch (0.1 normality [N] potassium hydroxide and deionized water) sample

Sample Holding Time: A 24-hour holding time applies unless field spikes are applied. If field spikes are applied, then analysis will be done within 30 days from sampling initiation.

Analytical Procedures: Samples will be analyzed for hexavalent chromium by ion chromatography and post-column reactor (IC/PCR) using a spectrophotometric detector (Method 7199). The following procedures will be used during analysis:

<u>Sample Preparation</u>—The samples will be nitrogen purged and filtered on site before shipment. The total volume of the 0.1N potassium hydroxide solution will be recorded in order that total hexavalent chromium can be calculated.

<u>Sample Analysis</u>—The filtered samples will be injected into the IC sample loop and introduced to the column. The IC eluent will be a solution of 250 millimoles (mM) of ammonium sulfate and 100 mM of ammonium hydroxide. The IC will use a guard column (Dionex IonPac NG1) to remove organics, followed by a separator column (Dionex IonPac AS7), which is a high-capacity ion-exchange resin column. In the post-column reactor, hexavalent chromium will be derivatized with a 2 mM diphenylcarbazide and 10 percent methanol solution, forming a colored chromium complex. This colored complex will be quantitated spectrophotometrically at 520 nanometers using a low volume, flow-through cell equipped with an ultraviolet-visible lamp detector. The detector and IC will be connected to an integration unit for data recording.

Note: a preconcentrator column preparation will be added to the analysis procedure, if required, to achieve a lower method detection limit.

<u>Data Reporting</u>—The anticipated detection limit of the method is 1 micrograms per liter (parts per billion). Data will be reported in units of micrograms per liter on the certificates of analysis and will be multiplied by the total sample volume of the original sample in the final report.

Quality Assurance and Quality Control: The required number of analyses for these samples is defined in Table 10-1 of the quality assurance project plan. The laboratory is required to analyze separately all of the field samples, field quality control samples, and laboratory quality control samples specified in Table 10-1.

Method References: “Determination of Hexavalent Chromium Emissions from Stationary Sources.” Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method 0061, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). U.S. Environmental Protection Agency (EPA), Office of Solid Waste and Emergency Response (OSWER), Washington, D.C. 20460.

“Determination of Hexavalent Chromium in Drinking Water, Groundwater and Industrial Wastewater Effluents by Ion Chromatography.” Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method 7199, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). EPA, OSWER, Washington, D.C. 20460.

Procedure Number: ***43***

Procedure Title: ***Analysis of Volatile Total Chromatographable Organics in SW-0040 Samples***

Sample Name: Method 0040 train volatile unspeciated mass

Sample Holding Time: Field samples will be analyzed within 2 hours following collection and not more than 4 hours following collection.

Analytical Procedures: Samples will be analyzed for hexavalent chromium by ion chromatography and post column reactor (IC/PCR) using a spectrophotometric detector (Method 7199). The following procedures will be used during analysis:

<u>Sample Preparation</u>—The samples will be nitrogen purged and filtered on site before shipment. The total volume of the 0.1 normality (N) potassium hydroxide solution will be recorded in order that total hexavalent chromium can be calculated.

<u>Sample Analysis</u>—The filtered samples will be injected into the IC sample loop and introduced to the column. The IC eluent will be a solution of 250 millimoles (mM) of ammonium sulfate and 100 mM of ammonium hydroxide. The IC will use a guard column (Dionex IonPac NG1) to remove organics followed by a separator column (Dionex IonPac AS7), which is a high-capacity ion-exchange resin column. In the post-column reactor, hexavalent chromium will be derivatized with a 2 mM diphenylcarbazide and 10 percent methanol solution, forming a colored chromium complex. This colored complex will be quantitated spectrophotometrically at 520 nanometers using a low volume, flow-through cell equipped with an ultra-violet-visible lamp detector. The detector and IC will be connected to an integration unit for data recording.

Note: A preconcentrator column preparation will be added to the analysis procedure, if required, to achieve a lower method detection limit.

<u>Data Reporting</u>—The anticipated detection limit of the method is 1 microgram per liter (parts per billion). Data will be reported in units of micrograms per liter on the certificates of analysis and will be multiplied by the total sample volume of the original sample in the final report.

Quality Assurance and Quality Control: The required number of analyses for these samples is defined in Table 10-1 of the quality assurance project plan. The laboratory is required to analyze separately all of the field samples, field quality control samples, and laboratory quality control samples specified in Table 10-1.

Method References:

"Determination of Hexavalent Chromium Emissions from Stationary Sources." Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method 0061, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). U.S. Environmental Protection Agency (EPA), Office of Solid Waste and Emergency Response (OSWER), Washington, D.C. 20460.

"Determination of Hexavalent Chromium in Drinking Water, Groundwater and Industrial Wastewater Effluents by Ion Chromatography." Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method 7199, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). EPA, OSWER, Washington, D.C. 20460.

Procedure Number: ***44***

Procedure Title: ***Analysis of Semivolatile Total Chromatographable Organics***

Sample Name: MM5 Train Semivolatile Unspeciated Mass

Sample Holding Time: Samples must be extracted within 14 days following collection, and analyzed within 40 days of extraction.

Analytical Procedures: The total chromatographable organics (TCO) method will be used to quantify compounds with boiling points between 100 °C and 300 °C using a gas chromatograph (GC) with a flame ionization detector (FID). The TCO procedure will be done by analysis of a dichloromethane extract (a combination of the extracts from the two major components of the sampling train). The analysis will be performed in the laboratory after extraction and compositing of the extracts of the individual components of the Method SW-0010 sampling train.

The front half will be extracted following SW-3540 using Soxhlet extraction, and the back half will be extracted using a separatory funnel technique, SW-3510. No spikes or internal standards will be added other than boiling point markers described below.

The TCO method is a capillary GC/FID method quantifying chromatographable material in the 100 °C to 300 °C boiling point range. An aliquot of the Method SW-0010 dichloromethane extract from Train C will be injected onto a capillary GC column with an FID detector, and the peak areas are summed over the retention time window that encompasses the TCO boiling point range. The entire analysis window will be established by injecting n-heptane and N-heptadecane as the reference peaks between which the TCO integration will occur. As described in the method, heptane and heptadecane will be used as retention time referenced peaks for boiling point.

The TCO value will be determined from the calibration standard curve, generated with hydrocarbon standards which fall within the TCO range, specifically decane, dodecane, and tetradecane. An integrator or GC data system will be used to record the data points as they are obtained from the injections of calibration standards and samples. The organics identified in the prescribed boiling point range will be quantified and summed (totaled) to obtain the TCO portion of the total organics number.

Analysis may be performed using a capillary (preferred) or packed column GC. A non-polar or slightly polar column will be used to provide adequate resolution and analysis in a total run time of approximately 45 minutes. A 15- to 30-meter, nonpolar, wide-bore column

(0.32 millimeter) has been found to be effective for TCO analysis. As a capillary or packed column procedure, the GC/FID will be operated in a manner consistent with the manufacturer's recommendations for gas flow, temperature zones, and injection volume. Analysis will be performed most easily using a GC with a liquid autosampler, so that calibrations and sample injections can be performed in a consistent and automated fashion. The GC used for TCO analysis will be calibrated using specific hydrocarbon standard. A multipoint calibration of at least three different concentrations in duplicate will be required for this procedure. After calibration has been performed, a daily quality control check sample will be run to verify that the GC is performing correctly. The GC check sample will be run with a standard in the middle of the working range of the GC calibration standards.

Quality Assurance and Quality Control:

The required number of analyses for these samples is defined in Table 10-1 of the quality assurance project plan. The laboratory is required to analyze separately all of the field samples, field quality control samples, and laboratory quality control samples specified in Table 10-1.

Method References:

"Guidance for Total Organics, Final Report." March 1996. Prepared for Atmospheric Research and Exposure Assessment Laboratory Methods Research and Development Division Source Method Research Branch, U.S. Environmental Protection Agency.

"Method 3510 - Separatory Funnel Liquid-Liquid Extraction." Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method SW-9057, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). U.S. Environmental Protection Agency (EPA), Office of Solid Waste and Emergency Response (OSWER), Washington, D.C. 20460.

"Method 3540 - Soxhlet Extraction." Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method SW-3540, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). EPA, OSWER, Washington, D.C. 20460.

"Modified Method 5 Sampling Train" (MM5) appropriate for sampling stack gas for semivolatiles. Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method 0010, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB

(January 1995), and Final Update III (December 1996). EPA, OSWER, Washington, D.C. 20460.

Procedure Number: ***45***

Procedure Title: ***Analysis of GRAV in Organic Extracts***

Sample Name: Modified Method 5 Train Nonvolatile Unspeciated Mass

Sample Holding Time: Extraction will be done within 14 days following collection, and analysis will be done within 40 days following extraction.

Analytical Procedures: The method will determine the total organic compounds with boiling points of 300 °C and higher, after extraction, and drying to constant weight. The procedure will involve gravimetric (GRAV) determination following extraction and drying of sample to constant weight.

The front half will be extracted following SW-3540 using Soxhlet extraction, and the back half will be extracted using the SW-3510 separatory funnel technique.

The GRAV method will quantify nonvolatile organic material with a boiling point greater than 300 °C. A carefully measured aliquot of the Method SW-0010 dichloromethane extract will be placed in a precleaned aluminum weighing pan and allowed to dry in air at room temperature, then will come to complete dryness in a room temperature desiccator, while exposure to dust and contaminants will be minimized. The residue in the pan will be weighed accurately, and the mass will be recorded to determine the GRAV value. For this procedure, two individual dichloromethane extracts from Method SW-0010 will be pooled and reduced to a final volume of 5.0 mL. A volume of 1 milliliters (mL) of the pooled extract is used for the GRAV determinations, which are performed in duplicate. Other final extract and GRAV aliquot volumes may be used, but the sample extraction and concentration procedures will be followed closely to avoid loss of more volatile organics. The GRAV organics in the greater than 300 °C range will be measured on an analytical balance and recorded for the GRAV portion of the total organics number.

Quality Assurance and Quality Control: The required number of analyses for these samples is defined in Table 10-1 of the quality assurance project plan. The laboratory is required to analyze separately all of the field samples, field quality control samples, and laboratory quality control samples specified in Table 10-1.

Method References: "Guidance for Total Organics, Final Report." March 1996. Prepared for Atmospheric Research and Exposure Assessment Laboratory Methods Research and Development Division Source Method Research Branch, U.S. Environmental Protection Agency (EPA).

"Method 3510 - Separatory Funnel Liquid-Liquid Extraction." Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method SW-3510, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). EPA, Office of Solid Waste and Emergency Response (OSWER), Washington, D.C. 20460.

"Method 3540 - Soxhlet Extraction." Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method SW-3540). Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). EPA, OSWER, Washington, D.C. 20460.

"Modified Method 5 Sampling Train" [(MM5) is appropriate for sampling stack gas for semivolatiles]. Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method 0010, Third Edition, September 1986. Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996). EPA, OSWER, Washington, D.C. 20460.

Procedure Number: ***46***

Procedure Title: ***Analysis of Volatile Total Chromatographable Organics in SW-0040 Samples***

Sample Name: Method 0040 Train Volatile Unspeciated Mass

Sample Holding Time: Field samples will be analyzed within 2 hours following collection, and not more than 4 hours following collection. Condensate samples shall be analyzed within 14 days following collection.

Analytical Procedures: Two portions (bag sample and condensate) of this stack gas sample will be analyzed separately and reported separately.

Bag Sample—This sample will be analyzed by field gas chromatography using a flame ionization detector (FID) to determine compounds in the C_1 to C_7 hydrocarbon range. Species eluting in the specified boiling range are quantified as n-alkanes.

Compounds with boiling points below 100 °C will be sampled and placed into Tedlar™ bags and will require on-site gas chronographic analysis of the collected sample. The range of applicable compounds will be very large. If a packed column is used to perform all of the gas chromatographic analysis, a very judicious selection of phases and analytical conditions will be made in order to achieve simultaneous chromatographic resolution for methane and a total analysis time limited to no more than 15 to 20 minutes.

The field GC may use two chromatographs, one with an appropriate column and conditions for C_1 to C_4, and the second with an appropriate column and conditions for the C_4 to C_6 range. A capillary column will be required to perform the analysis over the entire volatility range with adequate resolution. A capillary column with a length of 60 meters may be required to provide adequate resolution for the C_2 hydrocarbon isomers. The gas chromatographic analysis will be primarily the separation of compounds on the basis of boiling points, but the separation also will be influenced by the polarity of the compounds in some cases. Numerous chromatographic conditions, such as column temperature, ramp for temperature programming, duration of isothermal hold, and temperature of any transfer line, will have to be optimized for the best chromatographic results. An FID will be required to perform the analysis.

Condensate Sample—This sample will be analyzed by field chromatography using an FID and employing purge-and-trap techniques to determine compounds in the C_1 to C_7 hydrocarbon range. Species eluting in the specified boiling range are quantified as n-alkanes.

Note: A pre-trial burn survey may be required to set up calibration ranges, GC column, and temperature programming.

Compounds with boiling points below 100 °C will be sampled by SW-0040 into the condensate head of the Tedlar™ bag. This condensate requires purge and trap gas chromatographic analysis of the collected sample water. A gas chromatograph with an appropriate column and conditions for the C_5 to C_7 range will be required. A capillary column with a length of 60 meters may be required to provide adequate resolution for smaller organic and hydrocarbon isomers. An FID will be required to perform this analysis.

The purge and trap GC must be calibrated for quantitative analysis with a normal hydrocarbon curve. The curve will be prepared using liquid alkane standards containing the n-alkanes from C_5 to C_7. A multipoint calibration of at least three points (in duplicate) will be required. The alkane mixture will be used to calibrate the GC, and a point approximately in the middle of the calibration range will be analyzed at least once per day as a calibration check. The multipoint calibration will be achieved through the use of serial dilutions of the primarily stock standard mixture in methanol solution.

After full calibration, sample analysis will be initiated when an aliquot of the water sample in the volatile organic analysis (VOA) vial is transferred to the purge flask. The purge gas will be activated, purging the vapor with an inert gas to the sorbent trap (VOCOL, VOCARB, or equivalent). When the sample is sufficiently purged from the vessel into the trap, the valve will be actuated, and the trap contents will be desorbed by rapid heating onto the head of the GC column with the FID detector. The temperature programmer and the integrator/data system data acquisition will be started. Chromatograms and integrator/data system output will be collected.

The gas chromatograph must be calibrated for quantitative analysis with a normal hydrocarbon curve. The curve will be prepared using certified cylinders containing the n-alkanes from C_1 to C_6. A multipoint calibration of a least three points (in duplicate) will be required. Calibration for methane must be performed carefully so that the quantity of methane can be determined accurately. Methane will be found in significant quantities when combustion stacks are sampled, and it will be essential to be able to identify the compound correctly and provide an accurate quantitative measurement because the quantity of methane is a key parameter in risk assessment evaluation of unspeciated mass. The certified C_1 to C_6

standard gas mixture will be used to calibrate the field gas chromatograph, and a point approximately in the middle of the calibration range will be analyzed at least once per day as a calibration check. The multipoint calibration will be achieved either through the use of multiple cylinders at different concentrations or by the use of sample loops of varying sizes.

Note: A pre-trial burn survey may be required to set up calibration ranges, GC column, and temperature programming.

After full calibration, sample analysis will be initiated when the sample container (the Tedlar™ bag) is connected to the sampling valve and the sample gas is drawn through the valve and sample loop. When the valve is sufficiently purged, the valve will be actuated, and the contents of the loop will be injected into the chromatograph. Simultaneously with the injection of the sample, the temperature programmer and integrator/data system data acquisition will be started. Chromatograms and integrator/data system output will be collected. Retention times and responses must agree to within 5 percent relative standard deviation with the calibration curve. Uniform FID responses for varying compound classes will be assumed in this methodology. The resulting quantitative results therefore tend to be biased low for compounds that are not n-alkanes. In many, if not most, cases the species present will not be identical to those used for calibration of the on-site chromatograph; an exact correspondence between standard peaks and the peaks observed in the sample chromatograph will not be achieved.

Uniform FID responses for varying compound classes will be assumed in the methodology. Compounds found with retention times prior to the C_4 retention time will be quantified with an appropriate response factor and the value reported as C_4 with the other organic results.

Quality Assurance and Quality Control:

The required number of analyses for these samples is defined in Table 10-1 of the quality assurance project plan. The laboratory is required to analyze separately all of the field samples, field quality control samples, and laboratory quality control samples specified in Table 10-1.

Method Reference:

"Guidance for Total Organics, Final Report." March 1996. Prepared for Atmospheric Research and Exposure Assessment Laboratory Methods Research and Development Division Source Method Research Branch, U.S. Environmental Protection Agency.

APPENDIX D-5.8

POHC DRE SAMPLING TIME AND SPIKING CALCULATIONS

APPENDIX D-5.8

POHC DRE SAMPLING TIME AND SPIKING CALCULATIONS

Purpose

The purpose of this appendix is to confirm that 99.99 percent destruction and removal efficiency (DRE) can be validated using the proposed sampling times and analytical methods for the DRE portion of the trial burn. The principal organic hazardous constituents (POHC) to be sampled are chlorobenzene, carbon tetrachloride, and naphthalene. The stack gas will be sampled using the volatile organic sampling train (VOST, Method 0031) to identify any chlorobenzene and carbon tetrachloride POHCs. The stack gas will be sampled for the POHC naphthalene using the Modified Method 5 sampling train (MM5, Method 0010).

A minimum of 10 nanograms (ηg) of chlorobenzene and 10 ηg of carbon tetrachloride per VOST Tenax tube is required for analysis. A maximum of 1,000 ηg is required for analysis of these compounds. A minimum of 20 micrograms (µg) of naphthalene per XAD-2 resin tube and 100 µg for the MM5 train is required for analysis. The following calculations confirm that the amount of POHCs spiked will satisfy this requirement.

Actual stack gas flow rates and required POHC feed rates will be determined during the startup and shakedown period for the incinerator. The [*Enter State EPA Name*] ([*Enter State EPA Acronym*]) and the U.S. Environmental Protection Agency (EPA) will be notified at least 30 days before the trial burn of any necessary modifications to the test protocol or sampling methods.

POHCs spiked during trial burn Test 2 are for DRE demonstration. During trial burn Tests 1 and 2, perchloroethylene will be spiked to the solid wastes and high-British thermal unit (Btu) liquid wastes to provide chlorine loading only. No DRE sampling and analysis will be performed for perchloroethylene during Tests 1 and 2.

Chlorobenzene and Carbon Tetrachloride Sampling

The following stack gas concentration is the minimum required to achieve the minimum loading required:

(10 ηg/tube)(2 tubes/tube set)(1,000 L/m^3)/(20 L sample per tube set) = 1,000 ηg/m^3

Anticipated approximate stack gas flow rate = 4,300 dscf/min
= 122 dscm/min

where

ηg = nanograms
L/m^3 = liters per cubic meter
L = liter
ηg/m^3 = nanograms per cubic meter
dscf/min = dry standard cubic feet per minute
dscm/min = dry standard cubic meters per minute

The minimum spiking rate to demonstrate DRE is as follows (with the stated assumptions):

99.99% DRE,
(1,000 ηg/m^3)(122 m^3/min)(60 min/hr)(1x10^{-9}g/ηg)/(1-0.9999) = 73.2 g/hr
= 0.161 lb/hr

99.999% DRE,
(1,000 ηg/m^3)(122 m^3/min)(60 min/hr)(1x10^{-9}g/ηg)/(1-0.99999) = 732 g/hr
= 1.61 lb/hr

99.9999% DRE,
(1,000 ηg/m^3)(122 m^3/min)(60 min/hr)(1x10^{-9}g/ηg)/(1-0.999999=) 7,320 g/hr
= 16.1 lb/hr

where

$\eta g/m^3$ = nanograms per cubic meter
m^3/min = cubic meters per minute
min/hr = minutes per hour
g/ηg = grams per nanogram
g/hr = grams per hour
lb/hr = pounds per hour

Using the following assumptions, the amount of POHC per VOST tube set can be calculated:

- DRE of 99.9999 percent
- Nominal feed rate of 20 pounds per hour for each volatile POHC
- Collection of 0.5 liter per minute of stack gas for 40 minutes (slow VOST) for a total of 20 liters of stack gas

The amount of POHC collected per VOST tube set is estimated to be as follows:

$$\frac{(20\text{ lb/hr feed})(1-0.999999)(453.6\text{ g/lb})(1\text{x}10^{9}\eta\text{g/g})(20\text{ L/tube set})}{(122\text{ m}^{3}\text{/min})(60\text{ min/hr})(1000\text{ L/m}^{3})} = 25\eta\text{g}$$

where

lb/hr = pounds per hour
g/lb = grams per pound
ηg/g = nanograms per gram
L = liter
m^3/min = cubic meters per minute
min/hr = minutes per hour
L/m^3 = liters per cubic meter
ηg = nanograms

Naphthalene Sampling

The following stack gas concentration is the minimum required to achieve the minimum naphthalene loading required:

$(100\ \mu g/train)/(3\ m^3\ sample\ size) = 33.3\ \mu g/m^3$

Anticipated approximate stack gas flow rate = 4,300 dscf/min
= 122 dscm/min

where

µg/train = micrograms per train
m^3 = cubic meters
$\mu g/m^3$ = micrograms per cubic meter
dscf/min = dry standard cubic feet per minute
dscm/min = dry standard cubic meters per minute

The minimum spiking rate to demonstrate DRE is as follows (with the stated assumptions):

99.99% DRE,

$(33.3\ \mu g/m^3)(122\ m^3/min)(60\ min/hr)(1x10^{-6} g/\mu g)/(1-0.9999) = 2,440\ g/hr$
$= 5.38\ lb/hr$

99.999% DRE,

$(33.3\ \mu g/m^3)(122\ m^3/min)(60\ min/hr)(1x10^{-6} g/\mu g)/(1-0.99999) = 24,400\ g/hr$
$= 53.8\ lb/hr$

99.9999% DRE,

$(33.3\ \mu g/m^3)(122\ m^3/min)(60\ min/hr)(1x10^{-6} g/\mu g)/(1-0.999999) = 244,000\ g/hr$
$= 538\ lb/hr$

where

$\mu g/m^3$ = micrograms per cubic meter
m^3/min = cubic meters per minute
min/hr = minutes per hour
g/µg = grams per microgram
g/hr = grams per hour
lb/hr = pounds per hour

Using the following assumptions, the amount of napthalene per MM5 train can be calculated:

- DRE of 99.999 percent
- Nominal feed rate of 60 pounds per hour for naphthalene
- 3 cubic meters of stack gas collected

The amount of naphthalene collected per MM5 train is estimated to be as follows:

$$\frac{(60\ \text{lb/hr feed})(1-0.99999)(453.6\ \text{g/lb})(1\text{x}10^{6}\,\eta\text{g/g})(3\ \text{m}^{3}\ \text{sample})}{(122\ \text{m}^{3}/\text{min})(60\ \text{min/hr})} = 112\ \eta\text{g}$$

where

lb/hr = pounds per hour
g/lb = grams per pound
ηg/g = nanograms per gram
m^3 = cubic meters
m^3/min = cubic meters per minute
min/hr = minutes per hour
ηg = nanograms

APPENDIX D-5.9

MASS AND ENERGY BALANCE FOR TRIAL BURN

APPENDIX D-5.9

MASS AND ENERGY BALANCE FOR TRIAL BURN

This appendix must include a complete mass and energy balance for each trial burn test condition and normal operation showing, at a minimum, the following information:

- Mass flow rates, temperatures, and pressures of all process input streams
- Mass flow rates, temperatures, and pressures of all process output streams
- Mass and energy inputs and outputs at each discrete unit operation within the overall process (such as rotary kiln, secondary combustion chamber, quench, and wet scrubber)
- Operating conditions (such as temperature and pressure) of each unit operation

APPENDIX D-5.10

AIR DISPERSION MODELING REPORT

APPENDIX D-5.10

AIR DISPERSION MODELING REPORT

The preliminary air dispersion modeling report used to develop proposed Tier III limits should be provided in this appendix.

GENERIC TRIAL BURN PLAN

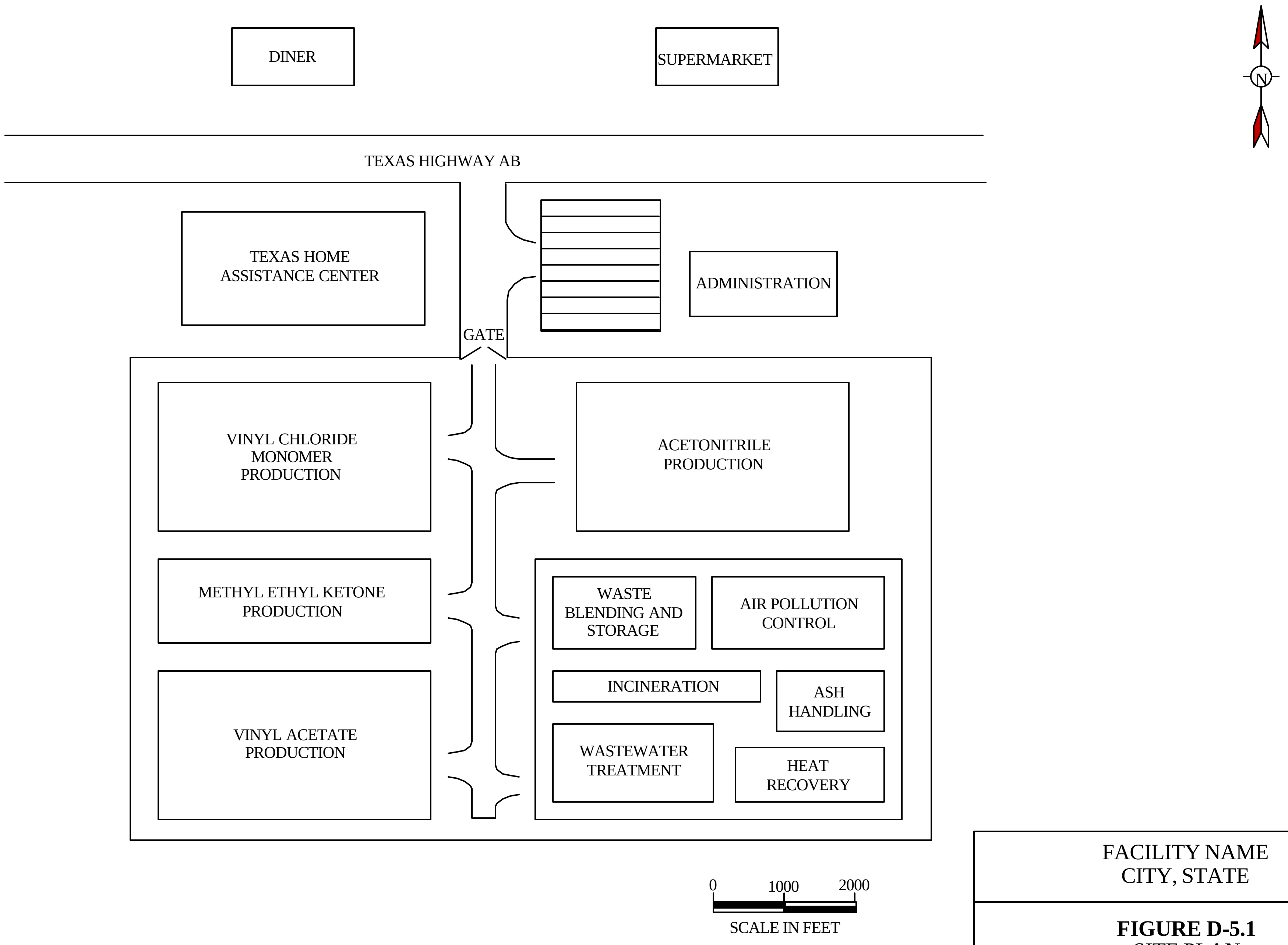
ATTACHMENT A

FIGURES

ATTACHMENT A-1

FIGURE D-5.1

SITE PLAN



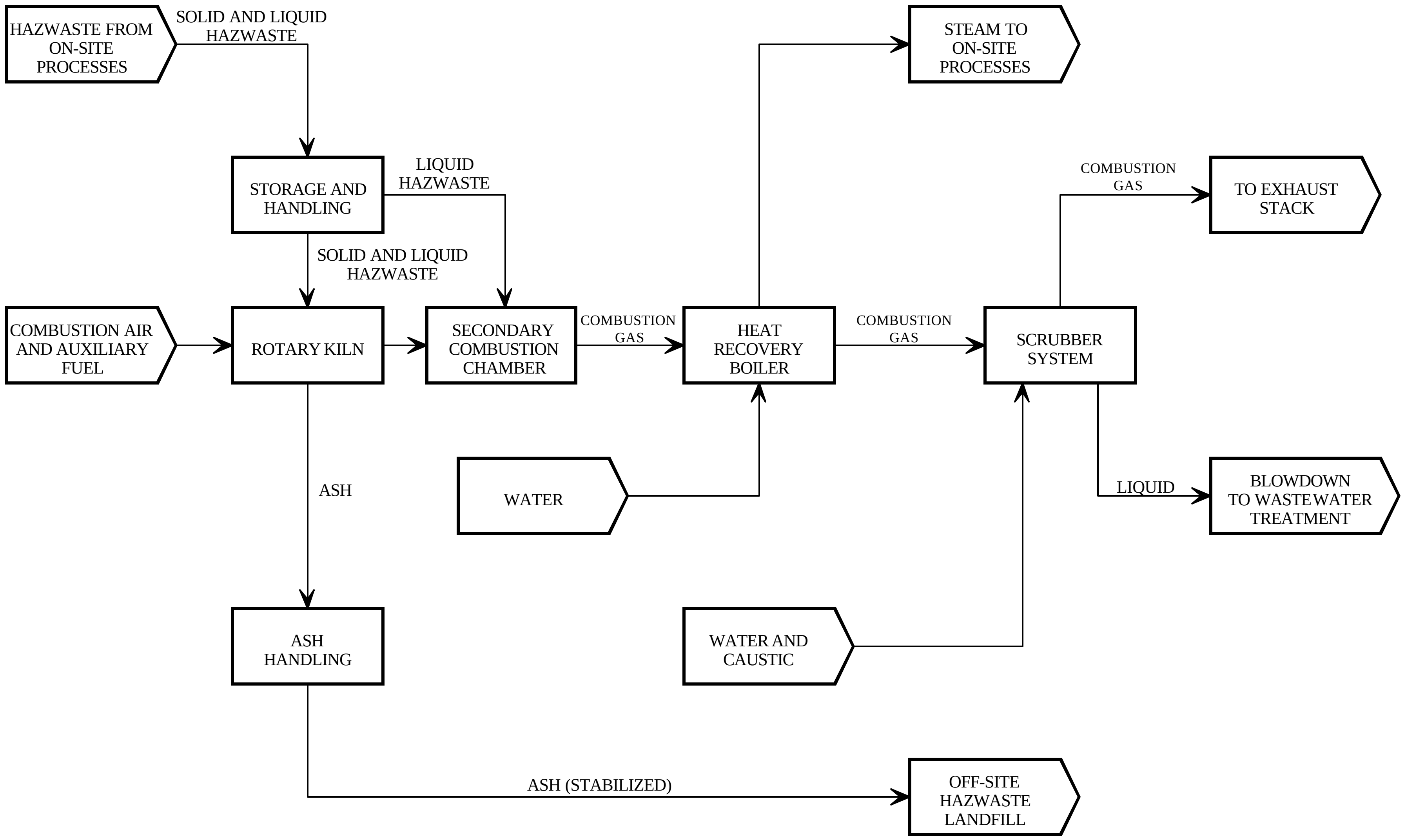
FACILITY NAME
CITY, STATE

FIGURE D-5.1
SITE PLAN

ATTACHMENT A-2

FIGURE D-5.2

WASTE TREATMENT SYSTEM FLOW DIAGRAM



NOTE:

HAZWASTE HAZARDOUS WASTE

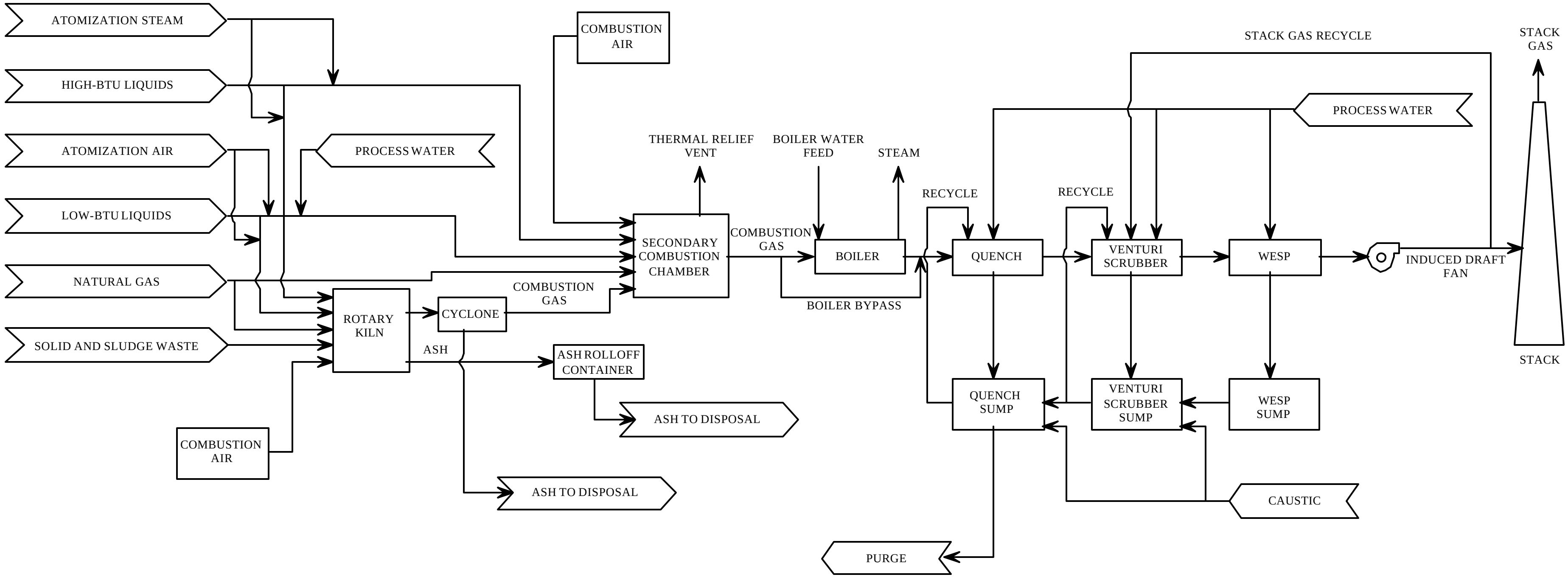
FACILITY NAME
CITY, STATE

FIGURE D-5.2
WASTE TREATMENT SYSTEM
FLOW DIAGRAM

ATTACHMENT A-3

FIGURE D-5.3

ROTARY KILN INCINERATOR SYSTEM BLOCK FLOW DIAGRAM



NOTES:

BTU	BRITISH THERMAL UNIT
WESP	WET ELECTROSTATIC PRECIPITATOR

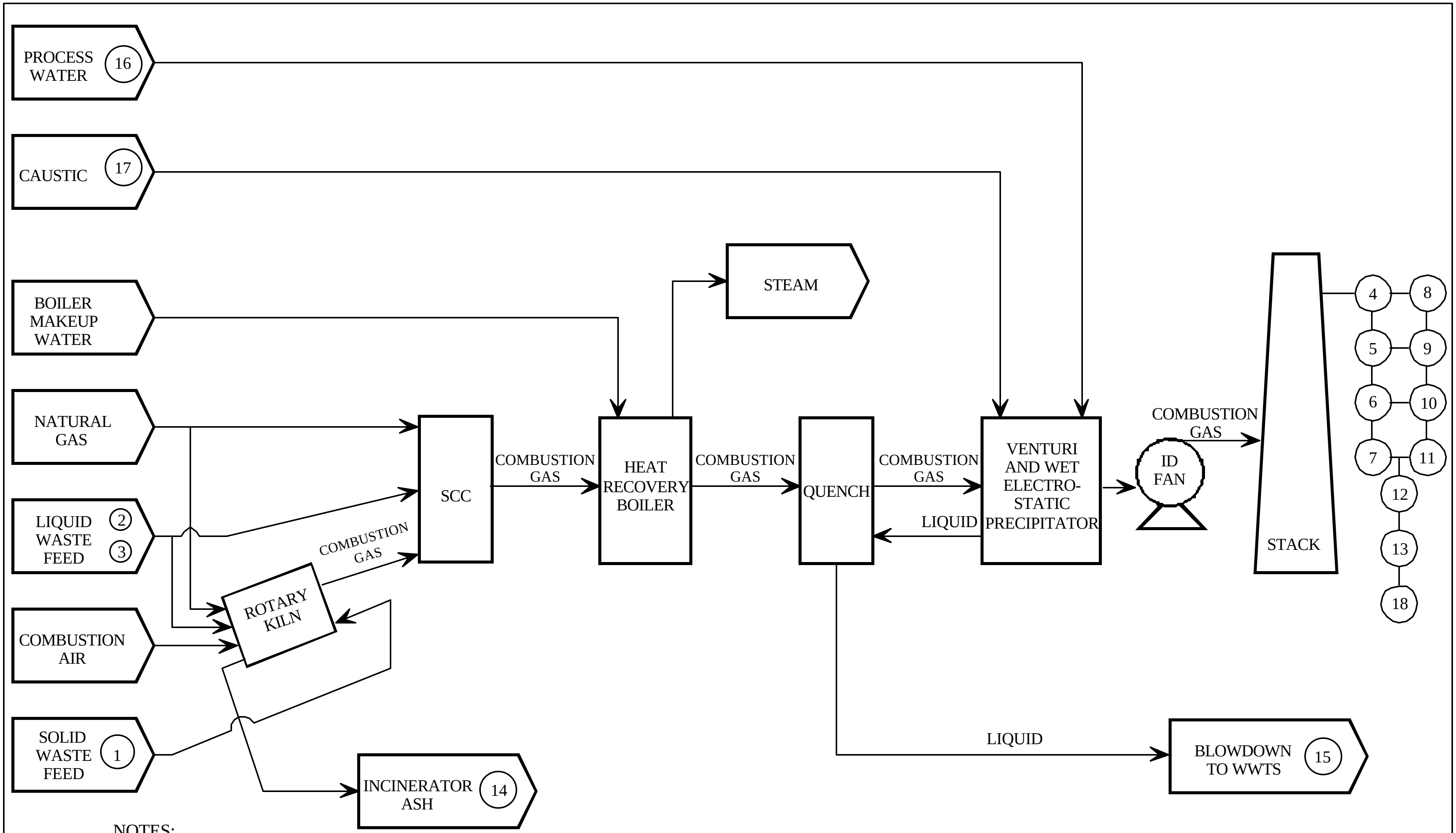
FACILITY NAME
CITY, STATE

FIGURE D-5.3
ROTARY KILN INCINERATOR SYSTEM
BLOCK FLOW DIAGRAM

ATTACHMENT A-4

FIGURE D-5.4

COMBUSTION PROCESS FLOW DIAGRAM WITH SAMPLING LOCATIONS



NOTES:

REFER TO TABLE D-5.4 FOR A SUMMARY OF SAMPLING AND ANALYSIS PROGRAM.

ID	INDUCED DRAFT
SCC	SECONDARY COMBUSTION CHAMBER
WWTS	WASTEWATER TREATMENT SYSTEM
○	SAMPLE LOCATION

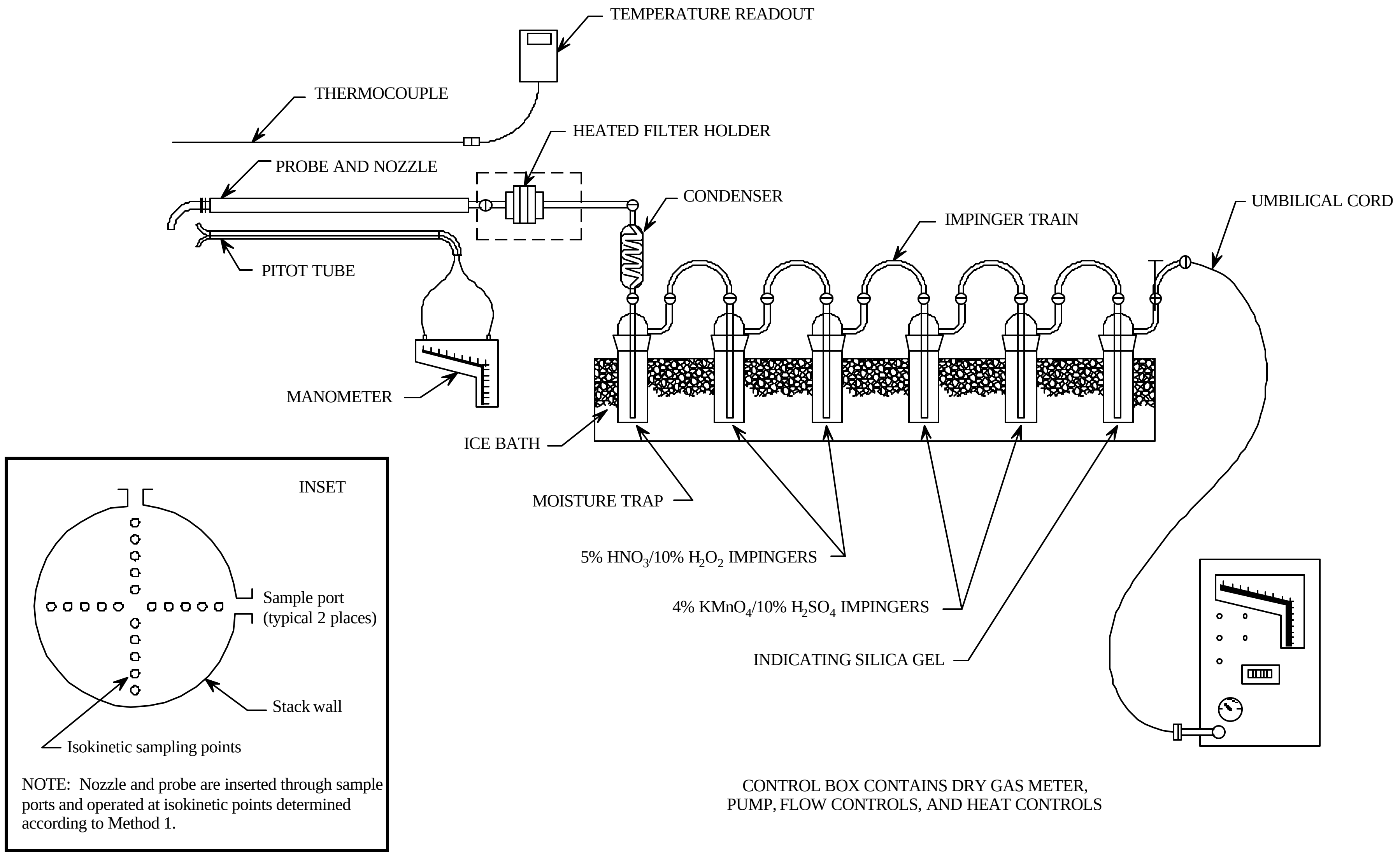
FACILITY NAME
CITY, STATE

FIGURE D-5.4
COMBUSTION PROCESS FLOW DIAGRAM
WITH SAMPLING LOCATIONS

ATTACHMENT A-5

FIGURE D-5.5

METHOD 0060—MULTI-METALS SAMPLING TRAIN



NOTE: Nozzle and probe are inserted through sample ports and operated at isokinetic points determined according to Method 1.

CONTROL BOX CONTAINS DRY GAS METER, PUMP, FLOW CONTROLS, AND HEAT CONTROLS

NOTES:

HNO_3	NITRIC ACID
H_2O_2	HYDROGEN PEROXIDE
$KMnO_4$	POTASSIUM PERMANGANATE
H_2SO_4	SULFURIC ACID

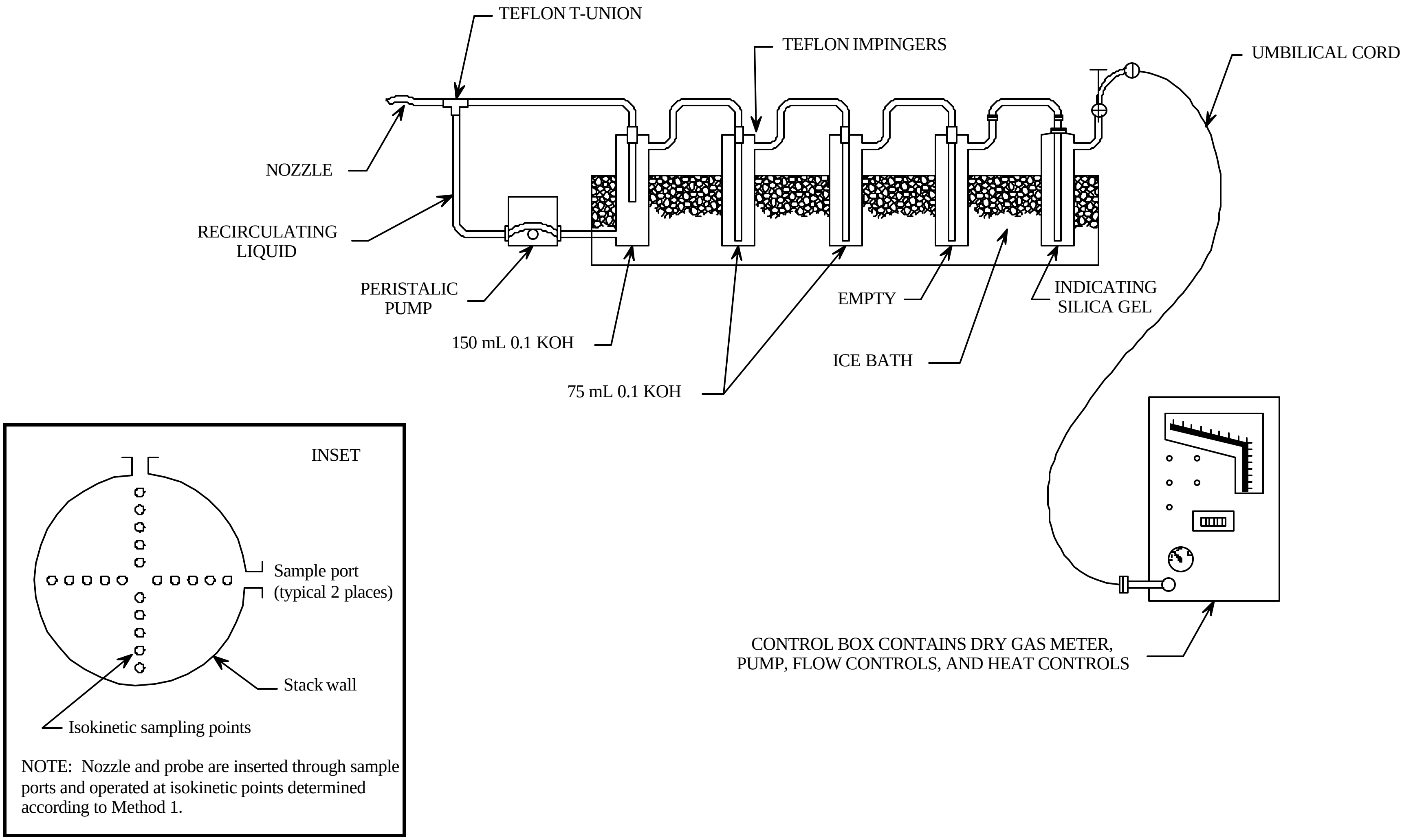
FACILITY NAME
CITY, STATE

FIGURE D-5.5
METHOD 0060 — MULTI-METALS
SAMPLING TRAIN

ATTACHMENT A-6

FIGURE D-5.6

METHOD 0061—HEXAVALENT CHROMIUM SAMPLING TRAIN



NOTE: Nozzle and probe are inserted through sample ports and operated at isokinetic points determined according to Method 1.

NOTES:

mL	MILLILITER
KOH	POTASSIUM HYDROXIDE

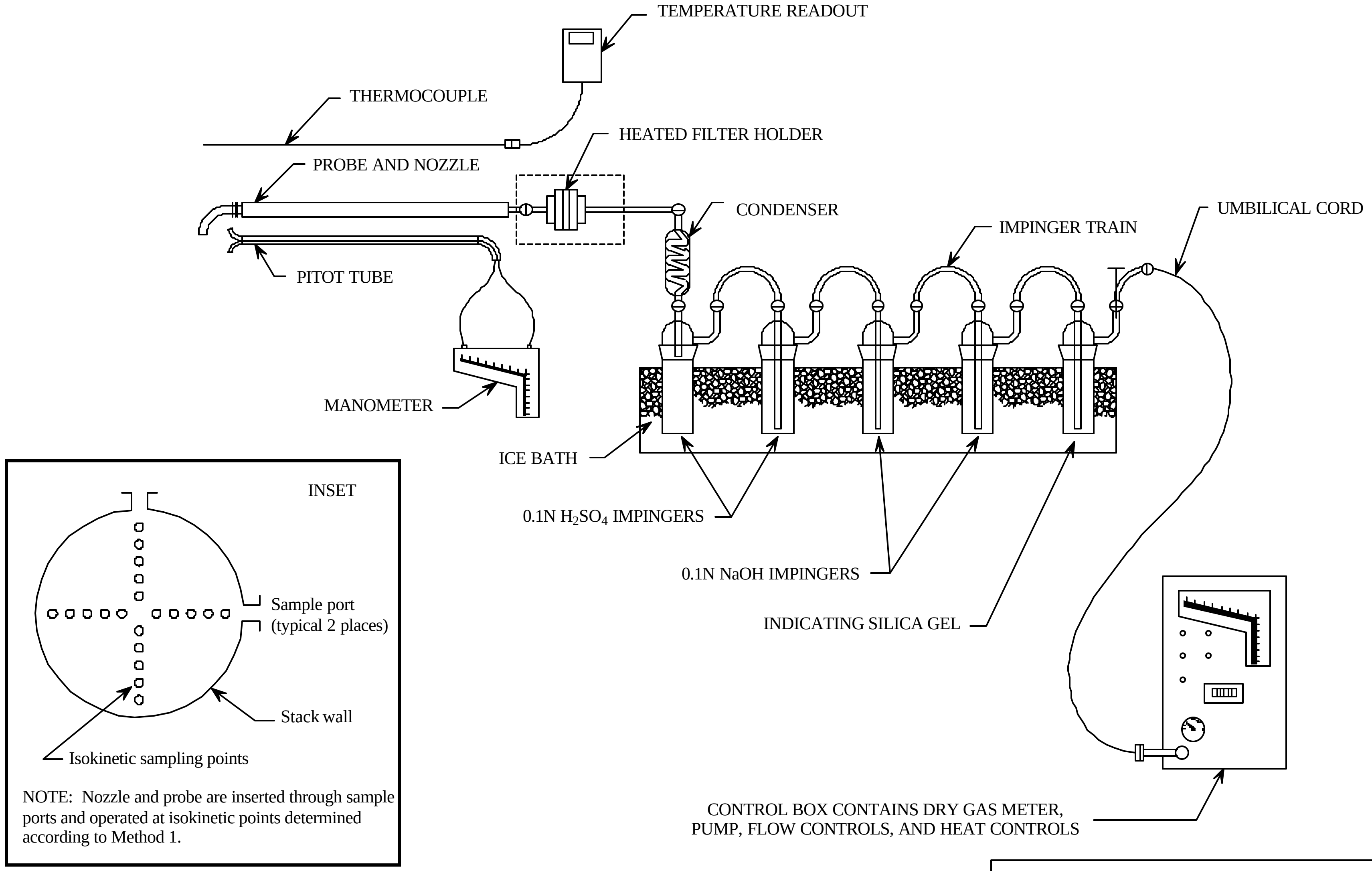
FACILITY NAME
CITY, STATE

FIGURE D-5.6
METHOD 0061 — HEXAVALENT
CHROMIUM SAMPLING TRAIN

ATTACHMENT A-7

FIGURE D-5.7

METHOD 0050—HYDROGEN CHLORIDE, CHLORINE, AND PARTICULATE MATTER SAMPLING TRAIN



NOTE: Nozzle and probe are inserted through sample ports and operated at isokinetic points determined according to Method 1.

NOTES:

N	NORMALITY
H_2SO_4	SULFURIC ACID
NaOH	SODIUM HYDROXIDE

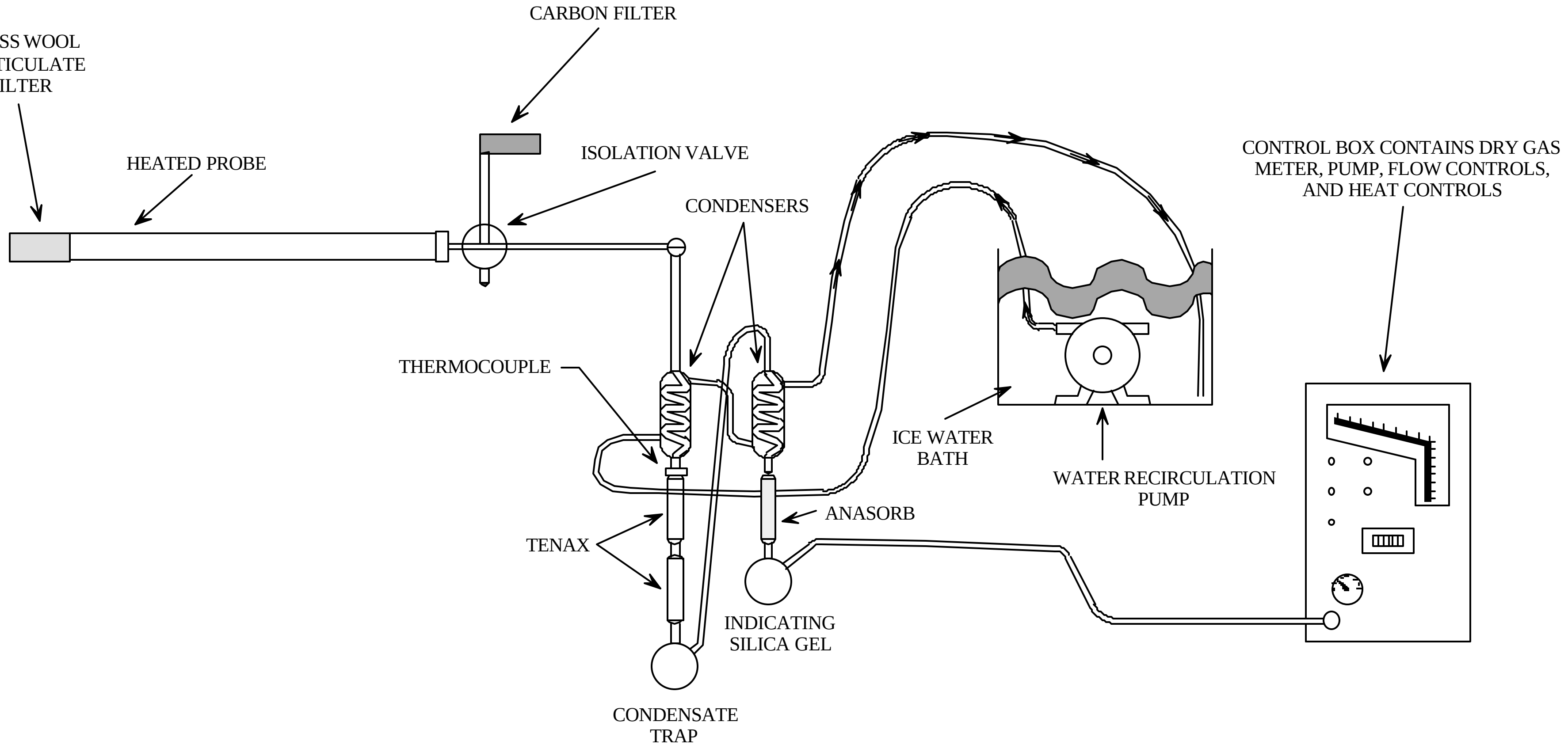
FACILITY NAME
CITY, STATE

FIGURE D-5.7
METHOD 0050 — HYDROGEN CHLORIDE, CHLORINE, AND PARTICULATE MATTER SAMPLING TRAIN

ATTACHMENT A-8

FIGURE D-5.8

METHOD 0031—VOLATILE ORGANIC SAMPLING TRAIN



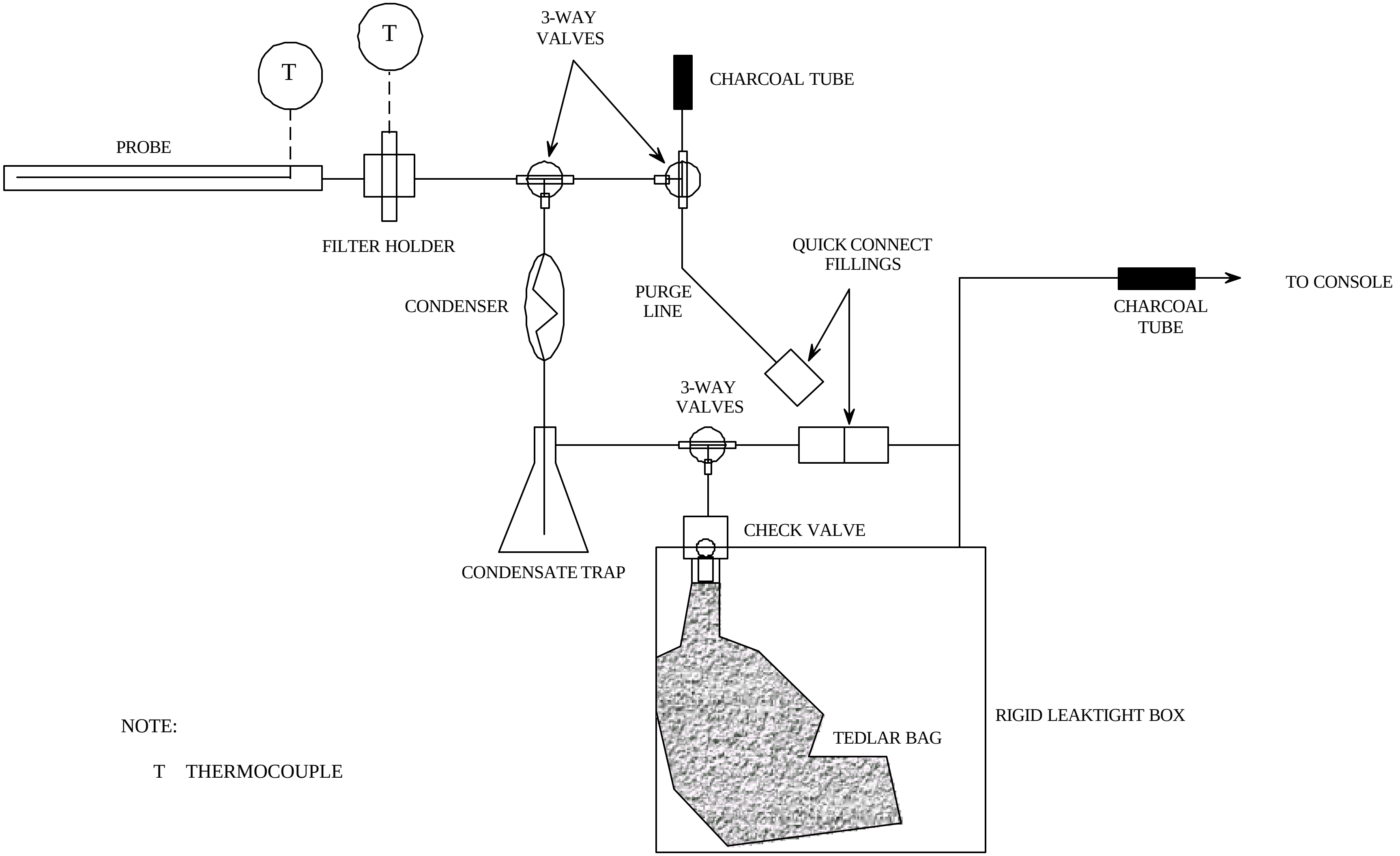
FACILITY NAME
CITY, STATE

FIGURE D-5.8
METHOD 0031 — VOLATILE ORGANIC SAMPLING TRAIN

ATTACHMENT A-9

FIGURE D-5.9

METHOD 0040—TEDLAR BAG ORGANIC SAMPLING TRAIN



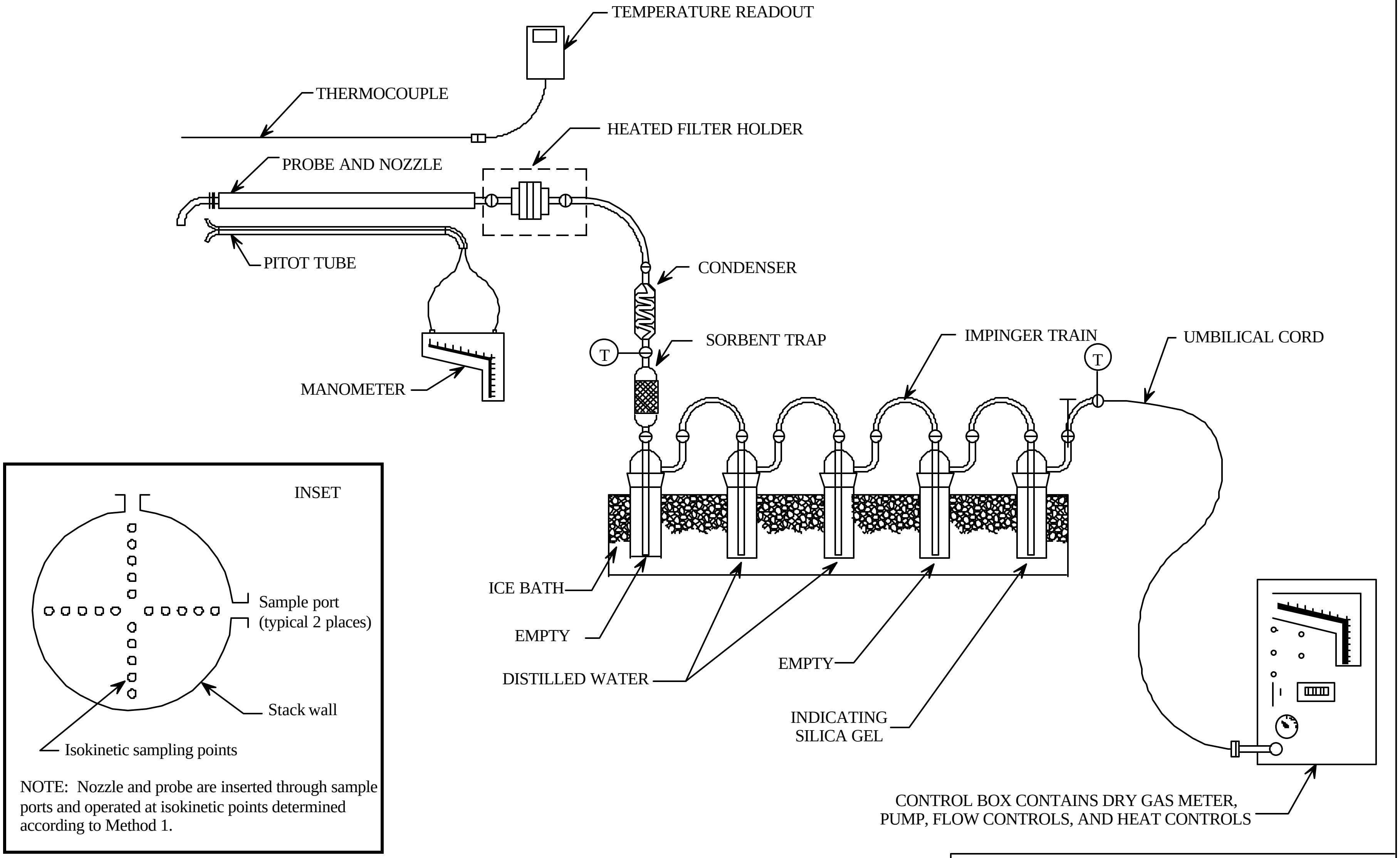
FACILITY NAME
CITY, STATE

FIGURE D-5.9
METHOD 0040 — TEDLAR BAG ORGANIC SAMPLING TRAIN

ATTACHMENT A-10

FIGURE D-5.10

MODIFIED METHOD 5—SEMIVOLATILE PIC, PCDD AND PCDF, AND PAH SAMPLING TRAIN



NOTE: Nozzle and probe are inserted through sample ports and operated at isokinetic points determined according to Method 1.

NOTES:

SAME BASIC CONFIGURATION FOR
MODIFIED METHOD 5A, 5B, AND 5C TRAINS

T THERMOCOUPLE

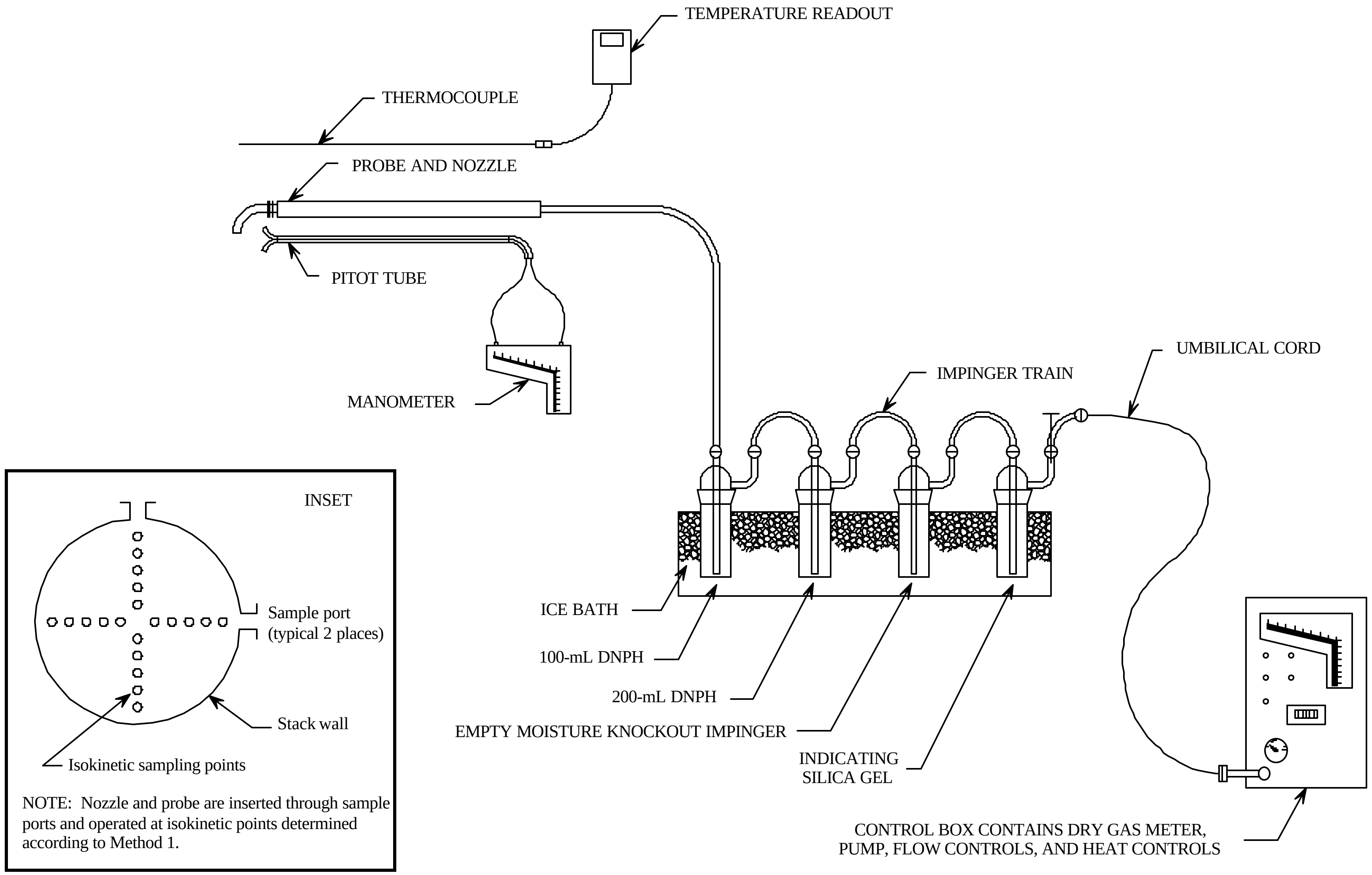
FACILITY NAME
CITY, STATE

FIGURE D-5.10
MODIFIED METHOD 5 — SEMIVOLATILE
PIC, PCDD AND PCDF, AND PAH
SAMPLING TRAIN

ATTACHMENT A-11

FIGURE D-5.11

METHOD 0011—ALDEHYDE AND KETONE SAMPLING TRAIN



NOTE: Nozzle and probe are inserted through sample ports and operated at isokinetic points determined according to Method 1.

NOTES:

DNPH	DINITROPHENYLHYDRAZINE
mL	MILLILITER

FACILITY NAME
CITY, STATE

FIGURE D-5.11
METHOD 0011 — ALDEHYDE AND KETONE SAMPLING TRAIN

GENERIC TRIAL BURN PLAN

ATTACHMENT B

TABLES

ATTACHMENT B-1

TABLE D-5.1

INCINERATION SYSTEM WASTE ACCEPTANCE CRITERIA

TABLE D-5.1

INCINERATION SYSTEM WASTE ACCEPTANCE CRITERIA

Parameter	Limit or Constraint	Basis	Notes
Heat Value • Solids • Liquids	 [###] - [###] Btu/lb [###] - [###] Btu/lb	Ensures proper combustion chamber temperature	May change as a result of trial burn testing
Chlorine Content (all wastes)	[###] ppm	Tier III limit	May change as a result of trial burn testing
PCB Content (all wastes)	Prohibited	Unit is not permitted under TSCA	Will not change as a result of trial burn testing
Viscosity (liquid waste streams only)	[###] centipoise	Ensures proper burner performance	Will not change as a result of trial burn testing because it is a Group C parameter
Total Suspended Solids (liquid waste streams only)	[###] ppm	Higher levels could damage or plug burners	Will not change as a result of trial burn testing because it is a Group C parameter
Nitrogen Content (all wastes)	[###] ppm	Air permit limitations on NO_X	Will not change as a result of trial burn testing (This acceptance criteria is driven by an air permit.)
Noncarcinogenic Metals Content (all wastes)	Antimony [###] ppm Barium [###] ppm Chromium [###] ppm (total) Lead [###] ppm Mercury [###] ppm Nickel [###] ppm Selenium [###] ppm Silver [###] ppm Thallium [###] ppm	Tier I limit	Will not change as a result of trial burn testing (Constraints on metal concentrations are backcalculated from Tier I emissions limits, which are independent of trial burn testing.)

TABLE D-5.1

INCINERATION SYSTEM WASTE ACCEPTANCE CRITERIA

Parameter	Limit or Constraint	Basis	Notes
Carcinogenic Metals Content (all wastes)	Arsenic [###] ppm Beryllium [###] ppm Cadmium [###] ppm Hexavalent chromium [###] ppm	Tier III limit	May change as a result of trial burn testing
Ash Content (liquid wastes only)	15 wt. %	Ensures compliance with PM standard	May change as a result of trial burn testing

Notes:

Btu/lb = British thermal units per pound
NO_x = Nitrogen oxide
PCB = Polychlorinated biphenyl
PM = Particulate matter
ppm = Parts per million
TSCA = Toxic Substances Control Act
wt. % = Weight percent

ATTACHMENT B-2

TABLE D-5.2

WASTE CHARACTERISTICS

TABLE D-5.2

WASTE CHARACTERISTICS

Waste Stream	Heat Value (Btu/lb)	Constituents and Other Characteristics	40 CFR 261 Appendix VIII Constituents	Quantity Burned per Year	Waste Codes
Low-Btu liquid wastes	5,000 to 8,000	Water, 40 to 70 wt. % Methanol, 10 to 30 wt. % Acetone, 0 to 20 wt. % Chlorides, [###] to [###] wt. % Various metals in ppm concentrations Viscosity, [###] to [###] centipoise Solids content, [###] to [###] wt. %	[*List Appendix VIII Constituents and Their Concentrations in the Waste*]	[*Enter Quantity to be Burned*]	F003, D001, D004, D009, D011
High-Btu liquid wastes	8,000 to 14,000	Water, 0 to 10 wt. % Methanol, 10 to 70 wt. % Acetone, 10 to 60 wt. % Benzene, 5 to 50 wt. % Chlorides, [###] to [###] wt. % Various metals in ppm concentrations Viscosity, [###] to [###] centipoise Solids Content, [###] to [###] wt. %	[*List Appendix VIII Constituents and Their Concentrations in the Waste*]	[*Enter Quantity to be Burned*]	F003, F005, D001, D004, D005, D008, D018
Solid Wastes	5,000 to 11,000	Water, 30 to 50 wt. % Fibrous filter and packaging media, 10 to 30 wt. % Diatomaceous earth, 20 to 30 wt. % Plastics, 5 to 25 wt. % Chlorides, [###] to [###] wt. % Metals and organics contained in liquid streams at ppm levels	[*List Appendix VIII Constituents and Their Concentrations in the Waste*]	[*Enter Quantity to be Burned*]	F003, F005, D004, D005, D008, D009, D011, D018

TABLE D-5.2 (Continued)

WASTE CHARACTERISTICS

Notes:

Btu	=	British thermal unit
Btu/lb	=	British thermal unit per pound
CFR	=	Code of Federal Regulations
ppm	=	Parts per million
wt. %	=	Weight percent

ATTACHMENT B-3

TABLE D-5-3

TARGET TRIAL BURN OPERATING CONDITIONS

TABLE D-5.3

TARGET TRIAL BURN OPERATING CONDITIONS

Parameter	Test 1 High Temperature	Test 2 Low Temperature	Test 3 Risk Burn
Rotary kiln combustion zone temperature (°F)	[###]	[###]	[###]
SCC temperature (°F)	[###]	[###]	[###]
Solid hazardous waste feed rate to kiln (lb/hr)	[###]	[###]	[###]
Liquid hazardous waste feed rate to kiln (lb/hr)	[###]	[###]	[###]
Natural gas feed rate to kiln (cfh)	[###]	[###]	[###]
Total heat input to kiln (Btu/hr)	[###]	[###]	[###]
Liquid hazardous waste feed rate to SCC (lb/hr)	[###]	[###]	[###]
Natural gas feed rate to SCC (cfh)	[###]	[###]	[###]
Total heat input to SCC (Btu/hr)	[###]	[###]	[###]
Total metals feed rates to kiln and SCC (lb/hr)	[###]	[###]	[###]
Total chlorine feed rate to kiln and SCC (lb/hr)	[###]	[###]	[###]
Total ash feed rate to kiln and SCC (lb/hr)	[###]	[###]	[###]
Boiler inlet temperature (°F)	[###]	[###]	[###]
Combustion gas stack velocity (ft/sec or cfm)	[###]	[###]	[###]
Vane separator liquid flow rate (gpm)	[###]	[###]	[###]
Venturi scrubber differential pressure (inches of water column)	[###]	[###]	[###]
Venturi scrubber pH	[###]	[###]	[###]
Venturi liquid/gas ratio	[###]	[###]	[###]
Scrubber liquid blowdown rate (gpm)	[###]	[###]	[###]
WESP liquid flow rate (gpm)	[###]	[###]	[###]
WESP power input (kVA)	[###]	[###]	[###]
Stack gas excess oxygen (vol. %)	[###]	[###]	[###]
Stack gas carbon monoxide (ppm, corrected to 7% oxygen)	[###]	[###]	[###]

TABLE D-5.3 (Continued)

TARGET TRIAL BURN OPERATING CONDITIONS

Notes:

Btu/hr = British thermal units per hour
cfh = Cubic feet per hour
cfm = Cubic feet per minute
ft/sec = Feet per second
gpm = Gallons per minute
kVA = Kilovolt amperes
lb/hr = Pounds per hour
ppm = Parts per million
SCC = Secondary combustion chamber
vol. % = Volume percent
WESP = Wet electrostatic precipitator

ATTACHMENT B-4

TABLE D-5.4

SUMMARY OF SAMPLING AND ANALYSIS PROGRAM

TABLE D-5.4

SUMMARY OF SAMPLING AND ANALYSIS PROGRAM

Sample No./Type	Parameters	Sampling Method	Sample Frequency	Field QA/QC Samples	Analytical Methods
1/Solid waste feed	Metals	Grab, 250 mL, collected at each sample interval (One composite prepared for each run.)	Every 15 minutes; each run; test conditions 1, 2, and 3	None	ICP, SW-3050/3051, 6010/6020 Mercury by CVAA (SW-7470/7471)
	Ash			None	ASTM D-482
	Chlorine and hydrogen chloride			None	ASTM D-808, E-442, D-4327-88
	Organics			None	Volatile POHCs by SW-8260, semivolatile POHCs by SW-3550 and -8270
	Heat value			None	ASTM D-2015, D-2382, D-240
	Elemental analysis			None	ASTM D-3176
	Density			None	ASTM D-70/D-854
2/High-Btu Liquid Waste	Metals	Grab, 250 mL, collected at each sample interval (One composite prepared for each run.)	Every 15 minutes; each run; test conditions 1, 2, and 3	None	ICP, SW-3050/3051, 6010/6020 Mercury by CVAA (SW-7470/7471
	Ash			None	ASTM D-482
	Chlorine and hydrogen chloride			None	ASTM D-808, E-442, D-4327-88
	Organics			None	Volatile POHCs by SW-8260, semivolatile POHCs by SW-3550 and -8270
	Heat value			None	ASTM D-2015, D-2382, D-240
	Elemental analysis			None	ASTM D-3176
	Density			None	ASTM D-70/D-891
	Viscosity			None	ASTM D-445

TABLE D-5.4 (Continued)

SUMMARY OF SAMPLING AND ANALYSIS PROGRAM

Sample No./Type	Parameters	Sampling Method	Sample Frequency	Field QA/QC Samples	Analytical Methods
3/Low-Btu Liquid Waste	Metals	Grab, 250 mL, collected at each sample interval (One composite prepared for each run.)	Every 15 minutes; each run; test conditions 1, 2, and 3	None	ICP (SW-3050/3051, 6010/6020) Mercury by CVAA (SW-7470/7471
	Ash			None	ASTM D-482
	Chlorine and hydrogen chloride			None	ASTM D-808, E-442, D-4327-88
	Organics			None	Volatile POHCs by SW-8260, semivolatile POHCs by SW-3550 and -8270
	Heat value			None	ASTM D-2015, D-2382, D-240
	Elemental analysis			None	ASTM D-3176
	Density			None	ASTM D-70/D-1429
	Viscosity			None	ASTM D-445
4/Stack gas metals - MMT	Ag, As, Ba, Be, Cd, Cr, Hg, Ni, Pb, Sb, Se, Tl	Method 0060, MMT, isokinetic sample	180 minutes, each run; test conditions 1 and 3	Reagent blanks (filter, probe rinse solution)	Digestion, ICP (SW-0060, 6010/6020) Mercury by CVAA (SW-7470)
5/Stack gas hexavalent chromium sampling train	Hexavalent chromium	Method 0061, Cr^{+6} sampling train, isokinetic sample	180 minutes, each run; test conditions 1 and 3	Reagent blank (KOH impinger solution)	IC/PCR (Method 218.6, SW-0061)
6/Stack gas hydrogen chloride, chlorine, and particulate matter - M0050 sampling train	Hydrogen chloride and chlorine	Method 0050, isokinetic sample	180 minutes, each run; test conditions 1, 2, and 3	Reagent blanks (H_2SO_4 and NaOH impinger solutions)	Ion chromatography (SW-9056/9057)
	Particulate matter			None	Gravimteric

TABLE D-5.4 (Continued)

SUMMARY OF SAMPLING AND ANALYSIS PROGRAM

Sample No./Type	Parameters	Sampling Method	Sample Frequency	Field QA/QC Samples	Analytical Methods
7/Stack gas particulate size distribution	Particle size distribution	Anderson cascade impactor	120 minutes; each run; test condition 3	None	Gravimetric
8a/Stack gas volatile organics (speciated) - VOST	Volatile organics	Method 0031, VOST train, 4 tube pairs	160 minutes; each run; test conditions 2 and 3	One condensate trip blank One pair VOST tube trip blank One set field blank tubes (four pairs each) per test condition One set (four pairs) VOST audit sample	Purge and trap (SW-0031, 8260/5041)
8b/Stack gas volatile organics (unspeciated) - M0040	Volatile organics	Method 0040, Tedlar™ bag sample	120 minutes; each run ; test condition 3	Three field blanks Two trip blanks Three field spikes 1 train blank	On-site GC/FID

TABLE D-5.4 (Continued)

SUMMARY OF SAMPLING AND ANALYSIS PROGRAM

Sample No./Type	Parameters	Sampling Method	Sample Frequency	Field QA/QC Samples	Analytical Methods
10/Stack gas semivolatiles (speciated), PCDDs/PCDFs - MM5A	Semivolatile organics (Test 2 and 3), PCDDs/PCDFs (Test 3)	Combined Method 0010/0023A	240 minutes; each run; test conditions 2 and 3	One field blank per test condition One train blank per test condition One trip blank resin tube One deionized water reagent blank	Soxhlet extraction, GC/MS (semivolatiles by SW-3542, 3540, 8270, PCDDs/PCDFs by SW-8290, 0023A)
11/Stack gas semivolatiles (total) - MM5B	Semivolatile and nonvolatile organics (unspeciated)	Method 0010	240 minutes; each run; test condition 3	One field blank per test condition One train blank per test condition One trip blank resin tube One deionized water reagent blank	<u>Semivolatiles</u> Front-half Soxhlet extraction, GC/FID (SW-3540, 8015) Back-half liquid-liquid extraction, GC/MS (SW-3510, 8015) <u>Nonvolatiles</u> Front-half Soxhlet extraction, Gravimetric (SW-3540/EPA 160.3) Back-half liquid-liquid extraction, Gravimetric (SW-3510/EPA 160.3)

TABLE D-5.4 (Continued)

SUMMARY OF SAMPLING AND ANALYSIS PROGRAM

Sample No./Type	Parameters	Sampling Method	Sample Frequency	Field QA/QC Samples	Analytical Methods
12/Stack gas PAHs	PAHs	Method 0010	240 minutes; each run; test condition 3	One field blank per test condition One train blank per test condition One trip blank resin tube	Front-half Soxhlet extraction, GC/MS (SW-3540, 8290, CARB 429) Back-half Soxhlet extraction, GC/MS (SW-3540, 8290, CARB 429) Impinger composite liquid-liquid extraction, GC/MS (SW-3510, 8290, CARB 429)
13/Stack gas aldehyde and ketone - M011	Aldehyde and ketone PICs	Method 0011	120 minutes; each run; test condition 3	Reagent blanks (DNPH impinger solution, methylene chloride, deionized water)	SW-846 Method 8315, SW-0011
14/Incinerator ash	volatile organics	Grab, 100 grams	Once per run, test conditions 1, 2, and 3	None	Purge and trap, GC/MS (SW-8260)
	semivolatile organics			None	Sonication, extraction, GC/MS (SW-3550, 8270)
15/Scrubber blowdown	TDS/TSS	Grab, 250 mL, collected at each sample interval (One composite prepared for each run.)	Every 15 minutes during each run; test conditions 1, 2, and 3	None	Gravimetric (EPA 600- Method 160)
	volatile organics			None	Purge and trap, GC/MS (SW-8260)
	organics			None	Liquid-liquid extraction, GC/MS (SW-3510, 8270)
16/Process water	metals	Grab, 250 mL, collected at each sample interval (One composite prepared for each run.)	Every 15 minutes during each run; test conditions 1, 2, and 3	None	ICP (SW-6010/6020)
	volatile organics			None	Purge and trap, GC/MS (SW-8260)
	organics			None	Liquid-liquid extraction, GC/MS (SW-3510, 8270)

TABLE D-5.4 (Continued)

SUMMARY OF SAMPLING AND ANALYSIS PROGRAM

Sample No./Type	Parameters	Sampling Method	Sample Frequency	Field QA/QC Samples	Analytical Methods
17/Caustic	volatile organics	Grab, 250 mL, collected at each sample interval (One composite prepared for each run.)	Every 15 minutes during each run; test conditions 1, 2, and 3	None	Purge and trap, GC/MS (SW-8260)
	semivolatile organics			None	Liquid-liquid extraction, GC/MS (SW-3510, 8270)
18/Stack gas carbon monoxide and oxygen	carbon monoxide	Continuous, extractive	Continuous during each run; test conditions 1, 2, and 3	None	NDIR
	oxygen	Continuous, extractive	Continuous during each run; test conditions 1, 2, and 3	None	Paramagnetic

Notes:

Ag = Silver
As = Arsenic
ASTM = American Society for Testing and Materials
Ba = Barium
Be = Beryllium
Btu = British thermal units
CVAA = Cold vapor atomic absorption
Cd = Cadmium
Cr = Chromium
Cr^{+6} = Hexavalent chromium
DNPH = 2,4-dinitrophenylhydrazine
GC/MS = Gas chromatography and mass spectroscopy
GC/FID = Gas chromatography and flame ionization detector

TABLE D-5.4 (Continued)

SUMMARY OF SAMPLING AND ANALYSIS PROGRAM

Hg = Mercury
H_2S0_4 = Sulfuric acid
ICP = Inductively coupled argon plasma spectroscopy
IC/PCR = Ion chromatography with a post-column reactor
KOH = Potassium hydroxide
mL = Milliliter
M0011 = EPA Method 0011
M0040 = EPA Method 0040
M0050 = EPA Method 0050
MM5 = Modified Method 5
MMT = Multi-metals train
NaOH = Sodium hydroxide
NDIR = Nondispersive infrared
Ni = Nickel
PAH = Polynuclear aromatic hydrocarbon
Pb = Lead
PCDD = Dioxin
PCDF = Furan
PIC = Products of incomplete combustion
POHC = Principal organic hazardous constituents
QA/QC = Quality assurance and quality control
Sb = Antimony
Se = Selenium
TDS = Total dissolved solids
TSS = Total suspended solids
Tl = Thallium
VOST = Volatile organic sampling train

ATTACHMENT B-5

TABLE D-5.5

ANTICIPATED INCINERATOR OPERATING LIMITS

TABLE D-5.5

ANTICIPATED INCINERATOR OPERATING LIMITS

Parameters	Value	Basis
Group A		
Maximum solid hazardous waste feed rate to kiln	[###] pounds per hour, hourly rolling average	Mean of the highest hourly rolling average waste feed rates recorded during each run of Test 2
Maximum high-Btu liquid hazardous waste feed rate to kiln	[###] pounds per hour, hourly rolling average	Mean of the highest hourly rolling average waste feed rates recorded during each run of Test 2
Maximum low-Btu liquid hazardous waste feed rate to kiln	[###] pounds per hour, hourly rolling average	Mean of the highest hourly rolling average waste feed rates recorded during each run of Test 2
Maximum high-Btu liquid hazardous waste feed rate to SCC	[###] pounds per hour, hourly rolling average	Mean of the highest hourly rolling average waste feed rates recorded during each run of Test 2
Maximum low-Btu liquid hazardous waste feed rate to SCC	[###] pounds per hour, hourly rolling average	Mean of the highest hourly rolling average waste feed rates recorded during each run of Test 2
Minimum rotary kiln temperature	[###] °F, hourly rolling average	Mean of the lowest hourly rolling average combustion zone temperatures measured during the three runs in Test 2
Maximum rotary kiln temperature	[###] °F, hourly rolling average	Mean of the highest hourly rolling average combustion zone temperatures measured during the three runs in Test 1
Maximum SCC temperature	[###] °F, hourly rolling average	Mean of the highest hourly rolling average SCC temperatures measured during the three runs in Test 1
Minimum SCC temperature	[###] °F, hourly rolling average	Mean of the lowest hourly rolling average SCC temperatures measured during the three runs in Test 2
Maximum combustion gas velocity	[###] cfm, hourly rolling average	Mean of the highest hourly rolling average combustion gas velocities measured during each run of Test 2
Maximum boiler inlet temperature	[###] °F, hourly rolling average	Mean of highest hourly rolling average temperatures measured during each run of Test 3

TABLE D-5.5 (Continued)

ANTICIPATED INCINERATOR OPERATING LIMITS

Parameters	Value	Basis
Minimum vane separator process water flow rate	[###] gpm, hourly rolling average	Mean of the lowest hourly rolling average differential pressures recorded during each of the six runs of the Tests 1 and 2
Minimum venturi scrubber differential pressure	[###] inches water column, hourly rolling average	Mean of the lowest hourly rolling average differential pressures recorded during each of the six runs of the Tests 1 and 2
Minimum venturi scrubber liquid to gas ratio	[#:#] hourly rolling average	Mean of the lowest hourly rolling average liquid to gas ratios recorded during each of the six runs of Tests 1 and 2
Minimum venturi scrubber recycle pH	[###] pH, hourly rolling average	Mean of the lowest hourly rolling average pH recorded during each of the six runs of the Tests 1 and 2
Minimum scrubber blowdown flow rate	[###] gpm	Mean of the lowest hourly rolling average flow rates recorded during each of the six runs of Tests 1 and 2
Minimum WESP power input	[###] kVA, hourly rolling average	Mean of the lowest hourly rolling average kVA recorded during each of the six runs of the Tests 1 and 2
Minimum WESP liquid flow rate	[###] gpm	Mean of the lowest hourly rolling average flow rates recorded during each of the six runs of Tests 1 and 2
Maximum carbon monoxide concentration in the stack	[###] ppm at 7 % oxygen, dry basis, hourly rolling average	Statutory limit
Minimum oxygen concentration in the stack	[###] vol. %, dry basis, hourly rolling average	Mean of the lowest hourly rolling average oxygen recorded during each of the three runs under Test 2
Group B		
Maximum antimony feed rate	[###] pounds per hour, hourly rolling average	Tier I limit
Maximum total arsenic feed rate	[###] pounds per hour, hourly rolling average	Mean of the highest hourly rolling average feed rates measured during the three runs of Test 1

TABLE D-5.5 (Continued)

ANTICIPATED INCINERATOR OPERATING LIMITS

Parameters	Value	Basis
Maximum pumpable arsenic feed rate	[###] pounds per hour, hourly rolling average	Mean of the highest hourly rolling average feed rates measured during the three runs of Test 1
Maximum barium feed rate	[###] pounds per hour, hourly rolling average	Tier I limit
Maximum beryllium feed rate	[###] pounds per hour, hourly rolling average	Mean of the highest hourly rolling average feed rates measured during the three runs of Test 1
Maximum pumpable beryllium feed rate	[###] pounds per hour, hourly rolling average	Mean of the highest hourly rolling average feed rates measured during the three runs of Test 1
Maximum cadmium feed rate	[###] pounds per hour, hourly rolling average	Mean of the highest hourly rolling average feed rates measured during the three runs of Test 1
Maximum pumpable cadmium feed rate	[###] pounds per hour, hourly rolling average	Mean of the highest hourly rolling average feed rates measured during the three runs of Test 1
Maximum chromium feed rate	[###] pounds per hour, hourly rolling average	Mean of the highest hourly rolling average feed rates measured during the three runs of Test 1
Maximum pumpable chromium feed rate	[###] pounds per hour, hourly rolling average	Mean of the highest hourly rolling average feed rates measured during the three runs of Test 1
Maximum lead feed rate	[###] pounds per hour, hourly rolling average	Tier I limit
Maximum mercury feed rate	[###] pounds per hour, hourly rolling average	Tier I limit
Maximum selenium feed rate	[###] pounds per hour, hourly rolling average	Tier I limit
Maximum silver feed rate	[###] pounds per hour, hourly rolling average	Tier I limit
Maximum thallium feed rate	[###] pounds per hour, hourly rolling average	Tier I limit
Maximum chlorine feed rate	[###] pounds per hour, hourly rolling average	Mean of the highest hourly rolling average feed rates measured during the six runs of Tests 1 and 2

TABLE D-5.5 (Continued)

ANTICIPATED INCINERATOR OPERATING LIMITS

Parameters	Value	Basis
POHC DRE	99.99 %	Statutory requirement
Maximum particulate matter emissions	0.08 gr/dscf	Statutory limit
Maximum ash content of waste	[###] %, hourly rolling average	Mean of the ash contents measured during the six runs under Tests 1 and 2
Maximum emissions of chlorine and hydrogen chloride	4 lbs/hr	Statutory limit
Maximum dioxin and furan emissions	0.20 ng/dscm TEQ	Proposed standard
Maximum annual average solids waste feed rate	[###] tph	Mean of run-average feed rates in three runs under Test 3
Maximum annual average low-Btu liquids feed rate	[###] lb/hr	Mean of run-average feed rates in three runs under Test 3
Maximum annual average high-Btu liquids feed rate	[###] lb/hr	Mean of run-average feed rates in three runs under Test 3
Minimum annual average rotary kiln temperature	[###] °F	Mean of the lowest hourly rolling average temperatures recorded during the three runs under Test 3
Maximum annual average rotary kiln temperature	[###] °F	Mean of the highest hourly rolling average temperatures recorded during the three runs under Test 3
Maximum annual average SCC temperature	[###] °F	Mean of the highest hourly rolling average temperatures recorded during the three runs under Test 3
Minimum annual average SCC temperature	[###] °F	Mean of the lowest hourly rolling average temperatures recorded during the three runs under Test 3
Maximum annual average combustion gas flow rate	[###] acfm	Mean of highest hourly rolling average flow rates recorded during the three runs under Test 3
Group C		
CEM system operation	The CEM system must be operating whenever hazardous wastes are being fed to the kiln or SCC	Regulatory requirement

TABLE D-5.5 (Continued)

ANTICIPATED INCINERATOR OPERATING LIMITS

Parameters	Value	Basis
Maximum rotary kiln pressure	[###] inches of water column vacuum, instantaneous limit	Mean of the highest hourly rolling average kiln pressures recorded during each of the nine runs of the trial burn
Maximum quench exit temperature	[###] °F, instantaneous limit (interlocked with AWFCO)	Manufacturer's recommendations
Minimum heating value	[###] Btu per pound	Calculated on the basis of heat balance
Maximum liquid waste viscosity	[###] centipoise	Manufacturer's recommendations
Maximum thermal input to kiln	[###] million Btu/hr	Manufacturer's recommendations
Maximum thermal input to SCC	[###] million Btu/hr	Manufacturer's recommendations
Maximum solids content of liquid wastes	[###] % solids	Manufacturer's recommendations
Maximum burner turndown	[#:#]	Manufacturer's recommendations
Minimum venturi scrubber nozzle pressure	[###] psig	Manufacturer's recommendations
Minimum WESP nozzle pressure	[###] psig	Manufacturer's recommendations
Minimum differential pressure between atomizing steam and high-Btu liquid waste	[###] psig, instantaneous limit (interlocked with AWFCO)	Manufacturer's recommendations
Minimum differential pressure between atomizing air and low-Btu liquid waste	[###] psig, instantaneous limit (interlocked with AWFCO)	Manufacturer's recommendations

TABLE D-5.5 (Continued)

ANTICIPATED INCINERATOR OPERATING LIMITS

Parameters	Value	Basis

Notes:

acfm = Actual cubic feet per minute
AWFCO = Automatic waste feed cutoff
Btu = British thermal unit
DRE = Destruction and removal efficiency
gpm = Gallons per minute
gr/dscf = Grains per dry standard cubic foot
kVA = Kilovolt amperes
lbs/hour = Pounds per hour
ng/dscm = Nanograms per dry standard cubic meter
POHC = Principal organic hazardous constituent
ppm = Parts per million
psig = Pounds per square inch gauge
SCC = Secondary combustion chamber
TEQ = Toxicity-equivalent quality
vol. % = Volume percent
WESP = Wet electrostatic precipitator

ATTACHMENT B-6

TABLE D-5.6

AUTOMATIC WASTE FEED CUTOFF SYSTEM SETTINGS STARTUP AND SHAKEDOWN PERIOD

TABLE 5-6

AUTOMATIC WASTE FEED CUTOFF SYSTEM SETTINGS STARTUP AND SHAKEDOWN PERIOD

Parameter	Setting
Maximum solids waste feed rate to kiln (hourly rolling average)	[###] tph
Maximum high-Btu liquids waste feed rate to kiln (hourly rolling average)	[###] lb/hr
Maximum low-Btu liquids waste feed rate to kiln (hourly rolling average)	[###] lb/hr
Maximum high-Btu liquids waste feed rate to SCC (hourly rolling average)	[###] lb/hr
Maximum low-Btu liquids waste feed rate to SCC (hourly rolling average)	[###] lb/hr
Minimum rotary kiln combustion zone temperature (hourly rolling average)	[###] °F
Maximum rotary kiln combustion zone temperature (hourly rolling average)	[###] °F
Minimum SCC temperature (hourly rolling average)	[###] °F
Maximum SCC temperature (hourly rolling average)	[###] °F
Maximum combustion gas velocity (hourly rolling average)	[###] cfm or ft/sec
Maximum heat recovery boiler inlet temperature	[###] °F
Minimum vane separator water flow rate (hourly rolling average)	[###] gpm
Minimum venturi scrubber liquid to gas ratio (hourly rolling average)	[#:#]
Minimum venturi scrubber differential pressure (hourly rolling average)	[###] inches of water column
Minimum venturi scrubber liquid pH (hourly rolling average)	[###] standard units
Minimum scrubber blowdown flow rate (hourly rolling average)	[###] gpm
Minimum WESP liquid flow rate (hourly rolling average)	[###] gpm
Minimum WESP power input (hourly rolling average)	[###] kVA
Maximum rotary kiln pressure (instantaneous)	[###] inches of water column vacuum
Maximum carbon monoxide in stack gas (hourly rolling average)	[###] ppm, dry basis, at 7 % oxygen
Minimum oxygen in stack gas (hourly rolling average)	[###] vol. %, dry basis
Maximum quench tower exit temperature (hourly rolling average)	[###] °F
Minimum differential pressure between atomizing gas atomization and liquid waste fuel feed (hourly rolling average)	[###] psig

TABLE 5-6 (Continued)

AUTOMATIC WASTE FEED CUTOFF SYSTEM SETTINGS START-UP AND SHAKEDOWN PERIOD

Parameter	Setting
Flameout	Immediately upon detection
TRV opening	Immediately upon detection

Notes:

Btu = British thermal unit
cfm = Cubic feet per minute
CO = Carbon monoxide
ft/sec = Feet per second
gpm = Gallons per minute
kVA = Kilovolt amperes
lb/hr = Pounds per hour
ppm = Parts per million
psig = Pounds per square inch gauge
SCC = Secondary combustion chamber
tph = Tons per hour
TRV = Thermal relief vent
vol. % = Volume percent
WESP = Wet electrostatic precipitator

ATTACHMENT B-7

TABLE D-5.7

DESIGN BASIS, MAJOR SYSTEMS

TABLE D-5.7

DESIGN BASIS, MAJOR SYSTEMS

System	Purpose	Design Basis
Rotary kiln	Volatilization and combustion of organic constituents of hazardous waste feed streams	Length: [###] feet Diameter: [###] feet Installed slope: [###] feet per feet Maximum thermal input: [###] Btu/hr Maximum solid waste feed rate: [###] tons per hour Design combustion gas residence time: [###] seconds
Secondary combustion chamber	Destruction of organic vapors	Width: [###] feet Height: [###] feet Length: [###] feet Maximum thermal input: [###] Btu/hr Design combustion gas flow rate: [###] acfm Design combustion gas residence time: [###] seconds Design combustion gas inlet temperature: [###] °F Design combustion gas exit temperature: [###] °F
Heat recovery boiler	Recovery of waste heat from combustion gases via the production of steam	Design steam generating capacity: [###] lb/hr Design steam pressure: [###] psig Design steam temperature: [###] °F Design gas flow rate: [###] acfm Design gas inlet temperature: [###] °F ASME Boiler and Pressure Vessel Code, Section VIII
Quench tower	Rapid reduction of combustion gas temperature and saturation of combustion gases	Height: [###] feet Diameter: [###] feet Adiabatic cooling capacity: [###] Btu/hr Design inlet gas flow rate: [###] acfm Design inlet gas temperature: [###] °F

TABLE D-5.7 (Continued)

DESIGN BASIS, MAJOR SYSTEMS

System	Purpose	Design Basis
Venturi scrubber and vane separator	Control of emissions of particulate matter and acid gases	Gas volume: [###] acfm Particle loading: [###] grains per cubic foot Particle-size distribution: [###] to [###] microns Particle removal efficiency: [###] % Acid gas removal efficiency: [###] %
Wet electrostatic precipitator	Control of particulate emissions	Gas volume: [###] acfm Particle loading: [###] grains per cubic foot Particle-size distribution: [###] to [###] microns Particle removal efficiency: [###] %
Induced draft fan	Primary mover of combustion gases	Design capacity: [acfm] at [###] °F and [###] inches of water column discharge head
Process exhaust stack	Atmospheric dispersion of process exhaust gases	Design gas flow rate: [###] acfm Design gas temperature: [###] °F Stack height (to tip): [###] feet Stack diameter (at tip): [###] feet Stack diameter (at gas inlet): [###] feet

Notes:

ASME = American Society for Testing and Materials
acfm = Actual cubic feet per minute
Btu/hr = British thermal units per hour
cfm = Cubic feet per minute
psig = Pounds per square inch gauge

ATTACHMENT B-8

TABLE D-5.8

INCINERATOR FEED SYSTEMS DESIGN INFORMATION

TABLE D-5.8

INCINERATOR FEED SYSTEMS DESIGN INFORMATION

Type	**Capacity**	**Maximum Specific Gravity**	**Maximum Viscosity**	**Maximum Ash Content (%)**	**Maximum Particle Size**	**Maximum Moisture Content (%)**	**Heat Value (Btu/lb)**
Solid waste	[###] cubic yard hopper, [###] tph auger-shredder	[###]	--	--	[###] inches	[###]	[###] to [###]
High-Btu liquid waste	[###] lb/hr	[###]	[###] centipoise	[###]	[###] microns	[###]	[###] to [###]
Low-Btu liquid waste	[###] lb/hr	[###]	[###] centipoise	[###]	[###] microns	[###]	[###] to [###]

Notes:

Btu = British thermal units
Btu/lb = British thermal units per pound
lb/hr = Pounds per hour
tph = Tons per hour
-- = Not applicable

ATTACHMENT B-9

TABLE D-5.9

AUTOMATIC WASTE FEED CUTOFF PARAMETERS, INSTRUMENTS, AND SETTINGS

TABLE D-5.9

AUTOMATIC WASTE FEED CUTOFF PARAMETERS, INSTRUMENTS, AND SETTINGS

Parameter	Instrument Tag No.	Cutoff	Type	Make and Model	Range	Accuracy
High rotary kiln combustion zone temperature	[###]	[###]	[###]	[###]	[###]	[###]
Low rotary kiln combustion zone temperature	[###]	[###]	[###]	[###]	[###]	[###]
High SCC temperature	[###]	[###]	[###]	[###]	[###]	[###]
Low SCC temperature	[###]	[###]	[###]	[###]	[###]	[###]
High solids waste feed rate	[###]	[###]	[###]	[###]	[###]	[###]
High high-Btu liquid waste feed to kiln	[###]	[###]	[###]	[###]	[###]	[###]
High high-Btu waste feed to SCC	[###]	[###]	[###]	[###]	[###]	[###]
High low-Btu liquid waste feed to kiln	[###]	[###]	[###]	[###]	[###]	[###]
High low-Btu waste feed to SCC	[###]	[###]	[###]	[###]	[###]	[###]
Minimum differential pressure between atomizing steam and high-Btu liquid wastes	[###]	[###]	[###]	[###]	[###]	[###]
Minimum differential pressure between atomizing air and low-Btu liquid wastes	[###]	[###]	[###]	[###]	[###]	[###]
High stack gas carbon monoxide	[###]	[###]	[###]	[###]	[###]	[###]
Low stack gas oxygen	[###]	[###]	[###]	[###]	[###]	[###]
High combustion gas velocity	[###]	[###]	[###]	[###]	[###]	[###]
High boiler inlet gas temperature	[###]	[###]	[###]	[###]	[###]	[###]
High rotary kiln pressure	[###]	[###]	[###]	[###]	[###]	[###]

TABLE D-5.9 (Continued)

AUTOMATIC WASTE FEED CUTOFF PARAMETERS INSTRUMENTS AND SETTINGS

Parameter	Instrument Tag No.	Cutoff	Type	Make and Model	Range	Accuracy
High quench tower outlet temperature	[###]	[###]	[###]	[###]	[###]	[###]
Low venturi liquid to gas ratio	[###]	[###]	[###]	[###]	[###]	[###]
Low venturi scrubber differential pressure	[###]	[###]	[###]	[###]	[###]	[###]
Low venturi scrubber pH	[###]	[###]	[###]	[###]	[###]	[###]
Low vane separator water flow	[###]	[###]	[###]	[###]	[###]	[###]
Low scrubber blowdown flow rate	[###]	[###]	[###]	[###]	[###]	[###]
Low WESP liquid flow rate	[###]	[###]	[###]	[###]	[###]	[###]
Low WESP power input	[###]	[###]	[###]	[###]	[###]	[###]
Flameout	[###]	[###]	[###]	[###]	[###]	[###]
TRV Opening	[###]	[###]	[###]	[###]	[###]	[###]

Notes:

Btu = British thermal unit
SCC = Secondary combustion chamber
TRV = Thermal relief unit
WESP = Wet electrostatic precipitator

ATTACHMENT B-10

TABLE D-5.10

CONSTRUCTION MATERIALS

TABLE D-5.10

CONSTRUCTION MATERIALS

Component	Construction Materials
Solids hopper	[*Enter Materials of Construction*]
Solids shredder-auger system	[*Enter Materials of Construction of Shredder, Feed Screw, and Housing*]
Rotary kiln	[*Enter Construction Materials and Thicknesses of Shell and Refractory*]
High-temperature ducting	[*Enter Construction Materials and Thicknesses of Shell and Refractory*]
Secondary combustion chamber	[*Enter Construction Materials and Thicknesses of Shell and Refractory*]
Heat recovery boiler	[*Enter Construction Materials and Thicknesses of Shell and Internals*]
Quench	[*Enter Construction Materials and Thicknesses of Shell and Internals*]
Quench sump, induced draft fan housing, all other APCS equipment, and stack	[*Enter Construction Materials and Thicknesses of Shell and Internals*]
Venturi scrubber and vane separator	[*Enter Construction Materials and Thicknesses of Shell and Internals*]
WESP	[*Enter Construction Materials and Thicknesses of Shell and Internals*]
Induced draft fan wheel, wetted metal parts in scrubbers	[*Enter Construction Materials and Thicknesses of Shell and Internals*]

Notes:

APCS = Air pollution control system
WESP = Wet electrostatic precipitator

ATTACHMENT B-11

TABLE D-5.11

PROCESS MONITORING INSTRUMENTS

TABLE D-5.11

PROCESS MONITORING INSTRUMENTS

Parameter	Location	Instrument Number(s)	Type of Instrument	Instrument Range	Expected Operating Range	Accuracy	Alarm Conditions
Solid waste feed rate	Solid waste feed auger	SS[###]	Speed sensor	[###] to [###] rpm	[###] to [###] rpm	+/- [###] %FS	High: [###] lb/hr, High-high: [###] lb/hr
High-Btu liquid waste feed rate	Rotary kiln burner system	FE[###]	Micromotion	0 to [###] lb/min	[###] to [###] lb/min	+/-[###] %FS	High: [###] lb/hr, High-high: [###] lb/hr
	SCC burner system	FE[###]	Micromotion	0 to [###] lb/min	[###] to [###] lb/min	+/-[###] %FS	High: [###] lb/hr, High-high: [###] lb/hr
Low-Btu liquid waste feed rate	Rotary kiln burner system	FE[###]	Micromotion	0 to [###] lb/min	[###] to [###] lb/min	+/-[###] %FS	High: [###] lb/hr, High-high: [###] lb/hr
	SCC burner system	FE[###]	Micromotion	0 to [###] lb/min	[###] to [###] lb/min	+/-[###] %FS	High: [###] lb/hr, High-high: [###] lb/hr
Rotary kiln pressure	Rotary kiln	PIT[###] and PIT[###]	Pressure transmitter	-5 to +5 inches of water	[###] to [###] inches of water	+/-0.5 %FS	High: [###] inches of water vacuum High-high: [###] inches of water vacuum
Rotary kiln combustion gas temperature	Rotary kiln	TT[###]	Type K thermocouple	0 to 2000 °F	[###] to [###] °F	+/- 1.8 °F	High: [###] °F, High-high: [###] °F
SCC temperature	SCC exit plenum	TT[###]	Type K thermocouple	0 to 2500 °F	[###] to [###] °F	+/- 1.8 °F	Low: [###] °F, Low-low: [###] °F
SCC excess oxygen	SCC exit plenum	AIT[###]	Extractive paramagnetic type	0 to 25 % dry	[###] to [###]%	+/- 1 %FS	Low: [###] %, Low-low: [###] %
Heat recovery boiler inlet temperature	Inlet plenum	TT[###]	Type K thermocouple	0 to 2000 °F	[###] to [###] °F	+/- 1.8 °F	High: [###] °F, High-high: [###] °F

TABLE D-5.11 (Continued)

PROCESS MONITORING INSTRUMENTS

Parameter	Location	Instrument Number(s)	Type of Instrument	Instrument Range	Expected Operating Range	Accuracy	Alarm Conditions
Quench tower outlet gas temperature	Quench outlet	TT[###]	Type K thermocouple	0 to 1000 °F	[###] to [###] °F	+/- 1.8 °F	High: [###] °F, High-high: [###] °F
Venturi scrubber liquid flow	Venturi liquid inlet	FE[###]	Foxboro mass flow meter	0 to [###] gpm	[###] to [###] gpm	+/-[###] %FS	Low: [###] gpm, Low-low: [###] gpm
Venturi scrubber differential pressure	Across venturi scrubber	PIT[###]	Differential pressure transmitter	[###] to [###] inches of water	[###] to [###] inches of water	+/-0.5 %FS	Low: [###] inches of water, Low-low: [###] inches of water
Venturi scrubber pH	Venturi scrubber sump	AR[###]	Electrometric pH	[###] to [###] standard units	[###] to [###] standard units	+/-0.1 standard units	Low: [###], Low-low: [###]
Scrubber blowdown flow	Venturi liquid inlet	FE[###]	Foxboro mass flow meter	0 to [###] gpm	[###] to [###] gpm	+/-[###] %FS	Low: [###] gpm, Low-low: [###] gpm
WESP liquid flow	Venturi liquid inlet	FE[###]	Foxboro mass flow meter	0 to [###] gpm	[###] to [###] gpm	+/-[###] %FS	Low: [###] gpm, Low-low: [###] gpm
WESP power input	Power feed	EI[###], II[###]	Voltmeter, ammeter	[###] to [###]kVA	[###] to [###] kVA	+/-0.1 %FS	Low: [###] kVA, Low-low: [###] kVA
Stack gas oxygen	Stack	AIT[###]	Extractive paramagnetic type	0 to 25 % dry	[###] to [###] %	+/- 1 %FS	Low: [###] %, Low-low: [###] %
Stack gas carbon monoxide	Stack	AIT[###]	NDIR type	dual range: 0 to 200 ppmv (dry) / 0 to 3000 ppmv (dry)	[###] to [###] ppmv (dry)	+/-1 %FS	High: [###] ppm, High-high: [###] ppm

TABLE D-5.11 (Continued)

PROCESS MONITORING INSTRUMENTS

Parameter	Location	Instrument Number(s)	Type of Instrument	Instrument Range	Expected Operating Range	Accuracy	Alarm Conditions
Stack gas flow rate	Stack	FE[###]	Annubar	[###] to [###] acfm	[###] to [###] acfm	+/-1 %FS	High: [###] acfm, High-high: [###] acfm

Notes:

acfm = Actual cubic feet per minute
AIT = Attribute indicator transmitter
AR = Attribute recorder
Btu = British thermal unit
EI = Element indicator
FE = Flow element
FS = Full scale
gpm = Gallons per minute
II = Amperage Indicator
kVA = Kilovolt amperes
lb/hr = Pounds per hour
lb/min = Pounds per minute
NDIR = Nondispersive infrared
PIT = Pressure indicator transmitter
ppmv = Parts per million by volume
rpm = Revolutions per minute
SCC = Secondary combustion chamber
SS = Speed sensor
TT = Temperature transmitter
WESP = Wet electrostatic precipitator

ATTACHMENT B-12

TABLE D-5.12

PROCESS MONITORING INSTRUMENTS, CALIBRATION, AND PREVENTIVE MAINTENANCE

TABLE D-5.12

PROCESS MONITORING INSTRUMENTS, CALIBRATION, AND PREVENTIVE MAINTENANCE

Parameter	Location	Instrument Number(s)	Calibration Procedure	Calibration Frequency	Preventive Maintenance Procedure	Preventive Maintenance Frequency
Solid waste feed rate	Solid waste feed auger	SS[###]	[*Enter Procedure*]	[*Enter Frequency*]	[*Enter Procedure*]	[*Enter Frequency*]
High-Btu liquid waste feed rate	Rotary kiln burner system	FE[###]	[*Enter Procedure*]	[*Enter Frequency*]	[*Enter Procedure*]	[*Enter Frequency*]
	SCC burner system	FE[###]	[*Enter Procedure*]	[*Enter Frequency*]	[*Enter Procedure*]	[*Enter Frequency*]
Low-Btu liquid waste feed rate	Rotary kiln burner system	FE[###]	[*Enter Procedure*]	[*Enter Frequency*]	[*Enter Procedure*]	[*Enter Frequency*]
	SCC burner system	FE[###]	[*Enter Procedure*]	[*Enter Frequency*]	[*Enter Procedure*]	[*Enter Frequency*]
Rotary kiln pressure	Rotary kiln burner system	PIT[###] and PIT[###]	[*Enter Procedure*]	[*Enter Frequency*]	[*Enter Procedure*]	[*Enter Frequency*]
Rotary kiln combustion gas temperature	Rotary kiln	TT[###]	[*Enter Procedure*]	[*Enter Frequency*]	[*Enter Procedure*]	[*Enter Frequency*]
SCC temperature	SCC exit plenum	TT[###]	[*Enter Procedure*]	[*Enter Frequency*]	[*Enter Procedure*]	[*Enter Frequency*]
SCC excess oxygen	SCC exit plenum	AIT[###]	[*Enter Procedure*]	[*Enter Frequency*]	[*Enter Procedure*]	[*Enter Frequency*]
Boiler inlet temperature	Boiler inlet plenum	TT[###]	[*Enter Procedure*]	[*Enter Frequency*]	[*Enter Procedure*]	[*Enter Frequency*]
Quench tower outlet gas temperature	Quench outlet	TT[###]	[*Enter Procedure*]	[*Enter Frequency*]	[*Enter Procedure*]	[*Enter Frequency*]
Venturi scrubber liquid flow	Venturi liquid inlet	FE[###]	[*Enter Procedure*]	[*Enter Frequency*]	[*Enter Procedure*]	[*Enter Frequency*]
Venturi scrubber differential pressure	Across venturi scrubber	PIT[###]	[*Enter Procedure*]	[*Enter Frequency*]	[*Enter Procedure*]	[*Enter Frequency*]

TABLE D-5.12 (Continued)

PROCESS MONITORING INSTRUMENTS, CALIBRATION, AND PREVENTIVE MAINTENANCE

Parameter	Location	Instrument Number(s)	Calibration Procedure	Calibration Frequency	Preventive Maintenance Procedure	Preventive Maintenance Frequency
Venturi scrubber pH	Venturi scrubber sump	AR[###]	[*Enter Procedure*]	[*Enter Frequency*]	[*Enter Procedure*]	[*Enter Frequency*]
Scrubber blowdown flow	Scrubber effluent line	FE[###]	[*Enter Procedure*]	[*Enter Frequency*]	[*Enter Procedure*]	[*Enter Frequency*]
WESP liquid flow	WESP liquid inlet	FE[###]	[*Enter Procedure*]	[*Enter Frequency*]	[*Enter Procedure*]	[*Enter Frequency*]
WESP power input	Power feed	EI[###], II[###]	[*Enter Procedure*]	[*Enter Frequency*]	[*Enter Procedure*]	[*Enter Frequency*]
Stack gas oxygen	Stack	AIT[###]	[*Enter Procedure*]	[*Enter Frequency*]	[*Enter Procedure*]	[*Enter Frequency*]
Stack gas carbon monoxide	Stack	AIT[###]	[*Enter Procedure*]	[*Enter Frequency*]	[*Enter Procedure*]	[*Enter Frequency*]
Stack gas flow rate	Stack	FE[###]	[*Enter Procedure*]	[*Enter Frequency*]	[*Enter Procedure*]	[*Enter Frequency*]

Notes:

AIT = Attribute indicator transmitter
AR = Attribute recorder
Btu = British thermal unit
EI = Element indicator
FE = Flow element
II = Amperage indicator
PIT = Pressure indicator transmitter
SCC = Secondary combustion chamber
SS = Speed sensor
TT = Temperature transmitter
WESP = Wet electrostatic precipitator

ATTACHMENT B-13

TABLE D-5.13

TRIAL BURN SCHEDULE

TABLE D-5.13

TRIAL BURN SCHEDULE

Day	Test/ Run	Activity	Total Activity Duration (minutes)	Start Time	Finish Time	Notes
1	--	Set-up	480	0800	1600	--
2	1/1	Process stabilization	30	0800	0900	60-minute stabilization on hazardous waste feed
		Multi-metals sampling train - M0060	300	0900	1300	180 minutes for sampling, 60 minutes for port changes and leak checks
		Hexavalent chromium sampling train - M0013	300	0900	1300	180 minutes for sampling, 60 minutes for port changes and leak checks
		PM, hydrogen chloride, and chlorine sampling train - M0050	240	1300	1700	180 minutes sampling, 60 minutes for port changes and leak checks
		Sample recovery	60	1700	1800	--
3	1/2	Process stabilization	30	0800	0900	60-minute stabilization on hazardous waste feed
		Multi-metals sampling train - M0060	300	0900	1300	180 minutes for sampling, 60 minutes for port changes and leak checks
		Hexavalent chromium sampling train - M0013	300	0900	1300	180 minutes for sampling, 60 minutes for port changes and leak checks
		PM, hydrogen chloride, and chlorine sampling train - M0050	240	1300	1700	180 minutes for sampling, 60 minutes for port changes and leak checks
		Sample recovery	60	1700	1800	--
4	1/3	Process stabilization	30	0800	0900	60-minute stabilization on hazardous waste feed
		Multi-metals sampling train - M0060	300	0900	1300	180 minutes for sampling, 60 minutes for port changes and leak checks
4 (Cont.)	1/3 (Cont.)	Hexavalent chromium sampling train - M0013	300	0900	1300	180 minutes for sampling, 60 minutes for port changes and leak checks

TABLE D-5.13 (Continued)

TRIAL BURN SCHEDULE

Day	Test/ Run	Activity	Total Activity Duration (minutes)	Start Time	Finish Time	Notes
		PM, Hydrogen chloride, and chlorine sampling train - M0050	240	1300	1700	180 minutes for sampling, 60 minutes for port changes and leak checks
		Sample recovery	60	1700	1800	--
5	2/1	Process stabilization	30	0800	0900	60-minute stabilization on hazardous waste feed
		Semivolatile POHC - M0010	240	0900	1400	240 minutes for sampling, 60 minutes for port changes and leak checks
		Volatile POHCs - VOST	200	0900	1220	160 minutes for sampling, 40 minutes for tube changes and leak checks
		PM, hydrogen chloride, and chlorine sampling train - M0050	240	0930	1330	180 minutes for sampling, 60 minutes for port changes and leak checks
		Sample recovery	60	1330	1430	--
6	2/2	Process stabilization	30	0800	0900	60-minute stabilization on hazardous waste feed
		Semivolatile POHC - M0010	240	0900	1400	240 minutes for sampling, 60 minutes for port changes and leak checks
		Volatile POHCs - VOST	200	0900	1220	160 minutes for sampling, 40 minutes for tube changes and leak checks
		PM, hydrogen chloride, and chlorine sampling train - M0050	240	0930	1330	180 minutes for sampling, 60 minutes for port changes and leak checks
		Sample recovery	60	1330	1430	--
7	2/3	Process stabilization	30	0800	0900	60-minute stabilization on hazardous waste feed
		Semivolatile POHC - M0010	240	0900	1400	240 minutes for sampling, 60 minutes for port changes and leak checks

TABLE D-5.13 (Continued)

TRIAL BURN SCHEDULE

Day	Test/ Run	Activity	Total Activity Duration (minutes)	Start Time	Finish Time	Notes
		Volatile POHCs - VOST	200	0900	1220	160 minutes for sampling, 40 minutes for tube changes and leak checks
		PM, hydrogen chloride, and chlorine sampling train - M0050	240	0930	1330	180 minutes for sampling, 60 minutes for port changes and leak checks
		Sample recovery	60	1330	1430	--
8	3/1	Process stabilization	60	0800	0900	60-minute stabilization on hazardous waste feed
		Multi-metals sampling train - M0060	300	0900	1300	180 minutes for sampling, 60 minutes for port changes and leak checks
		Hexavalent chromium sampling train - M0013	300	0900	1300	180 minutes for sampling, 60 minutes for port changes and leak checks
		Semivolatiles and PCDD/PCDF sampling train (speciated) - M0010/0023A	240	0900	1400	240 minutes for sampling, 60 minutes for port changes and leak checks
		Semivolatiles sampling train (unspeciated) - M0010	240	0900	1400	240 minutes for sampling, 60 minutes for port changes and leak checks
		PAH sampling train - M0010	240	1000	1500	240 minutes for sampling, 60 minutes for port changes and leak checks
		Aldehyde and ketone sampling train - M0011	180	1000	1300	120 minutes for sampling, 60 minutes for port changes and leak checks
8 (Cont.)	3/1 (Cont.)	Volatile bag sampling train - M0040	150	1130	1400	120 minutes for sampling, 30 minutes for leak checks
		VOST	200	1130	1450	160 minutes for sampling, 40 minutes for tube changes and leak checks

TABLE D-5.13 (Continued)

TRIAL BURN SCHEDULE

Day	Test/ Run	Activity	Total Activity Duration (minutes)	Start Time	Finish Time	Notes
		PM, hydrogen chloride, and chlorine sampling train - M0050	300	1330	1730	180 minutes for sampling, 60 minutes for port changes and leak checks
		Cascade impactor	120	1330	1530	120 minutes for sampling
		Sample recovery	60	1830	1930	--
9	3/2	Process stabilization	60	0800	0900	60-minute stabilization on hazardous waste feed
		Multi-metals sampling train - M0060	300	0900	1300	180 minutes for sampling, 60 minutes for port changes and leak checks
		Hexavalent chromium sampling train - M0013	300	0900	1300	180 minutes for sampling, 60 minutes for port changes and leak checks
		Semivolatiles and PCDD/PCDF sampling train (speciated) - M0010/0023A	240	0900	1400	240 minutes for sampling, 60 minutes for port changes and leak checks
		Semivolatiles sampling train (unspeciated) - M0010	240	0900	1400	240 minutes for sampling, 60 minutes for port changes and leak checks
		PAH sampling train - M0010	240	1000	1500	240 minutes for sampling, 60 minutes for port changes and leak checks
		Aldehyde and ketone sampling train - M0011	180	1000	1300	120 minutes for sampling, 60 minutes for port changes and leak checks
		Volatile bag sampling train - M0040	150	1130	1400	120 minutes for sampling, 30 minutes for leak checks
9 (Cont.)	3/2 (Cont.)	VOST	200	1130	1450	160 minutes for sampling, 40 minutes for tube changes and leak checks
		PM, hydrogen chlorine, and chlorine sampling train - M0050	300	1330	1730	180 minutes for sampling, 60 minutes for port changes and leak checks

TABLE D-5.13 (Continued)

TRIAL BURN SCHEDULE

Day	Test/ Run	Activity	Total Activity Duration (minutes)	Start Time	Finish Time	Notes
		Cascade impactor	120	1330	1530	120 minutes for sampling
		Sample recovery	60	1830	1930	--
10	3/3	Process stabilization	60	0800	0900	60-minute stabilization on hazardous waste feed
		Multi-metals sampling train - M0060	300	0900	1300	180 minutes for sampling, 60 minutes for port changes and leak checks
		Hexavalent chromium sampling train - M0013	300	0900	1300	180 minutes for sampling, 60 minutes for port changes and leak checks
		Semivolatiles and PCDD/PCDF sampling train (speciated) - M0010/0023A	240	0900	1400	240 minutes for sampling, 60 minutes for port changes and leak checks
		Semivolatiles sampling train (unspeciated) - M0010	240	0900	1400	240 minutes for sampling, 60 minutes for port changes and leak checks
		PAH sampling train - M0010	240	1000	1500	240 minutes for sampling, 60 minutes for port changes and leak checks
		Aldehyde and ketone sampling train - M0011	180	1000	1300	120 minutes for sampling, 60 minutes for port changes and leak checks
		Volatile bag sampling train - M0040	150	1130	1400	120 minutes for sampling, 30 minutes for leak checks
10 (Cont.)	3/3 (Cont.)	VOST	200	1130	1450	160 minutes for sampling, 40 minutes for tube changes and leak checks
		PM, hydrogen chloride, and chlorine sampling train - M0050	300	1330	1730	180 minutes for sampling, 60 minutes for port changes and leak checks
		Cascade impactor	120	1330	1530	120 minutes for sampling
		Sample recovery	60	1830	1930	--

TABLE D-5.13 (Continued)

TRIAL BURN SCHEDULE

Day	Test/ Run	Activity	Total Activity Duration (minutes)	Start Time	Finish Time	Notes
11	--	Demobilization	480	0800	1600	--

Notes:

M0010 = EPA Method 0010
M0013 = EPA Method 0013
M0050 = EPA Method 0050
M0060 = EPA Method 0060
PAH = Polynuclear aromatic hydrocarbon
PCDD = Polychlorinated dibenzodioxin
PCDF = Polychlorinated dibenzofuran
PM = Particulate matter
POHC = Principal organic hazardous constituent
VOST = Volatile organic sampling train
-- = Not applicable

ATTACHMENT B-14

TABLE D-5.14

POHC AND METAL SPIKING COMPOUNDS

TABLE D-5.14

POHC AND METAL SPIKING COMPOUNDS

Spiking Compound	Rationale for Selection	Spiking Rate (lb/hr)
POHCs Spiked During Test 2		
Chlorobenzene, [###] purity, certified analysis	Class 1 compound	[###] lb/hr total [###] lb/hr to solid waste [###] lb/hr to liquid waste
Napthalene, [###] purity solid, certified analysis, dissolved in mineral oil	Class 1 compound	[###] lb/hr total [###] lb/hr to solid waste [###] lb/hr to liquid waste
Carbon tetrachloride, [###] purity, certified analysis	Low heating value	[###] lb/hr total [###] lb/hr to solid waste [###] lb/hr to liquid waste
Organic Chlorine Spiked During Tests 1 and 2		
Perchloroethylene, [###] purity, certified analysis	Readily available material High chlorine content	[###] lb/hr total [###] lb/hr to solid waste [###] lb/hr to liquid waste
Metals Spiked During Test 1		
Arsenic [###], [###] % solution in petroleum distillate, certified analysis	Readily available material Chemically similar (that is, organically based) to the form of arsenic in actual wastes Acceptable from a fire safety and health hazard aspect	[###] lb/hr to liquid waste only
Beryllium [###], [###] % solution in petroleum distillate, certified analysis	Readily available material Chemically similar (that is, organically based) to the form of arsenic in actual wastes Acceptable from a fire safety and health hazard aspect	[###] lb/hr to liquid waste only

TABLE D-5.14 (Continued)

POHC AND METAL SPIKING COMPOUNDS

Spiking Compound	Rationale for Selection	Spiking Rate (lb/hr)
Cadmium [###], [###] % solution in petroleum distillate, certified analysis	Readily available material Chemically similar (that is, organically based) to the form of arsenic in actual wastes Acceptable from a fire safety and health hazard aspect	[###] lb/hr to liquid waste only
Chromium [###], [###]% solution in petroleum distillate, certified analysis	Readily available material Chemically similar (that is, organically based) to the form of arsenic in actual wastes Acceptable from a fire safety and health hazard aspect	[###] lb/hr to liquid waste only

Notes:

lb/hr = Pounds per hour
POHC = Principal organic hazardous constituents

ATTACHMENT B-15

TABLE D-5.15

TRIAL BURN REPORT OUTLINE

TABLE D-5.15

TRIAL BURN REPORT OUTLINE

Section	Description
TABLE OF CONTENTS	--
CERTIFICATION FORM	--
EXECUTIVE SUMMARY	Summary Presentation of Stack Gas Parameters and Emission Rate Results
	Summary of Key Process System Parameters and Results
	Summary of Problems, Solutions, and Deviations from the Approved Trial Burn Plan and Quality Assurance Project Plan (QAPP)
	Conclusions Regarding the Success in Meeting the Trial Burn Plan's Objectives
1.0	INTRODUCTION
2.0	PROCESS DESCRIPTION
3.0	TESTING PROGRAM OVERVIEW
4.0	TEST OPERATING CONDITIONS
4.1	WASTE AND FUEL FEED RATE INFORMATION
4.2	WASTE GENERATION RATE INFORMATION
4.3	STACK GAS PARAMETER RATE INFORMATION
4.3.1	Stack Gas Carbon Monoxide
4.3.2	Stack Gas Flow Rate
4.3.3	Stack Gas Oxygen Concentration
4.3.4	Dry Air Pollution Control Equipment (APCE) Inlet Gas Temperature
4.3.5	Combustion Unit Temperature
4.3.6	APCE Control Parameters
4.4	SOURCES OF FUGITIVE EMISSIONS AND MEANS OF THEIR CONTROL
5.0	PROCESS AND STACK GAS SAMPLING
5.1	SUMMARY OF SAMPLING LOCATIONS AND METHODS

TABLE D-5.15 (Continued)

TRIAL BURN REPORT OUTLINE

Section	Description
5.2	SUMMARY OF WASTE AND FUEL FEED SAMPLING
5.3	SUMMARY OF AIR POLLUTION CONTROL SYSTEM GENERATED WASTE SAMPLING
5.3.1	Principal Organic Hazardous Constituent (POHC) Feed Rate
5.3.2	Ash Feed Rate
5.3.3	Chlorine Feed Rate
5.3.4	Hazardous Metal Feed Rate
5.3.5	Combustion Unit Heat Input Rate
5.4	SUMMARY OF STACK GAS SAMPLING
5.4.1	Summary of Sampling Methods
5.4.2	Data Tables for Stack Gas Characteristics
5.4.3	Data Tables for Emission Rates of Constituents of Potential Concern
6.0	LABORATORY PROCEDURES
6.1	SUMMARY OF ON-SITE ANALYTICAL PROCEDURES
6.2	SUMMARY OF OFF-SITE ANALYTICAL PROCEDURES
7.0	QUALITY ASSURANCE AND QUALITY CONTROL (QA/QC) RESULTS
7.1	SUMMARY OF ON-SITE QA/QC RESULTS
7.1.1	Stack Gas Samples
7.1.2	Process Samples
7.2	SUMMARY OF OFF-SITE QA/QC RESULTS
8.0	TRIAL BURN RESULTS SUMMARY AND PROPOSED PERMIT LIMITS
8.1	DESTRUCTION AND REMOVAL EFFICIENCIES
8.2	CONTINUOUS EMISSION MONITORING SYSTEM RESULTS

TABLE D-5.15 (Continued)

TRIAL BURN REPORT OUTLINE

Section	Description
8.3	STACK GAS EMISSION RATE RESULTS
8.3.1	Particulate Matter Emission Rate Results
8.3.2	Hydrogen Chloride and Chlorine Gas Emission Rate Results
8.3.3	Metal Emission Rate Results
8.3.4	POHC Emission Rate Results
8.3.5	Product of Incomplete Combustion Emission Rate Results
8.3.6	Total Organic Emission Rate Results
8.3.7	Polychlorinated Dibenzodioxin and Polychlorinated Dibenzofuran Emission Rate Results
8.4	PROPOSED PROCESS LIMITS
8.5	PROPOSED WASTE FEED LIMITS
8.6	PROPOSED AUTOMATIC WASTE FEED CUTOFF LIMITS
8.6.1	Parameters for Combustion Units
8.6.2	Parameters for APCE
8.6.3	Parameters for Other Associated Equipment
8.7	PROPOSED DATA FOR USE IN THE RISK ASSESSMENT
APPENDICES	
A	TRIAL BURN PLAN
B	TRIAL BURN QAPP
C	STACK SAMPLING REPORT
	Method 0010 Field Data Sheets and Emission Rate Calculations
	Method 0010/0023A Field Data Sheets and Emission Rate Calculations
	Method 0060 Field Data Sheets and Emission Rate Calculations
	Method 0061 Field Data Sheets and Emission Rate Calculations

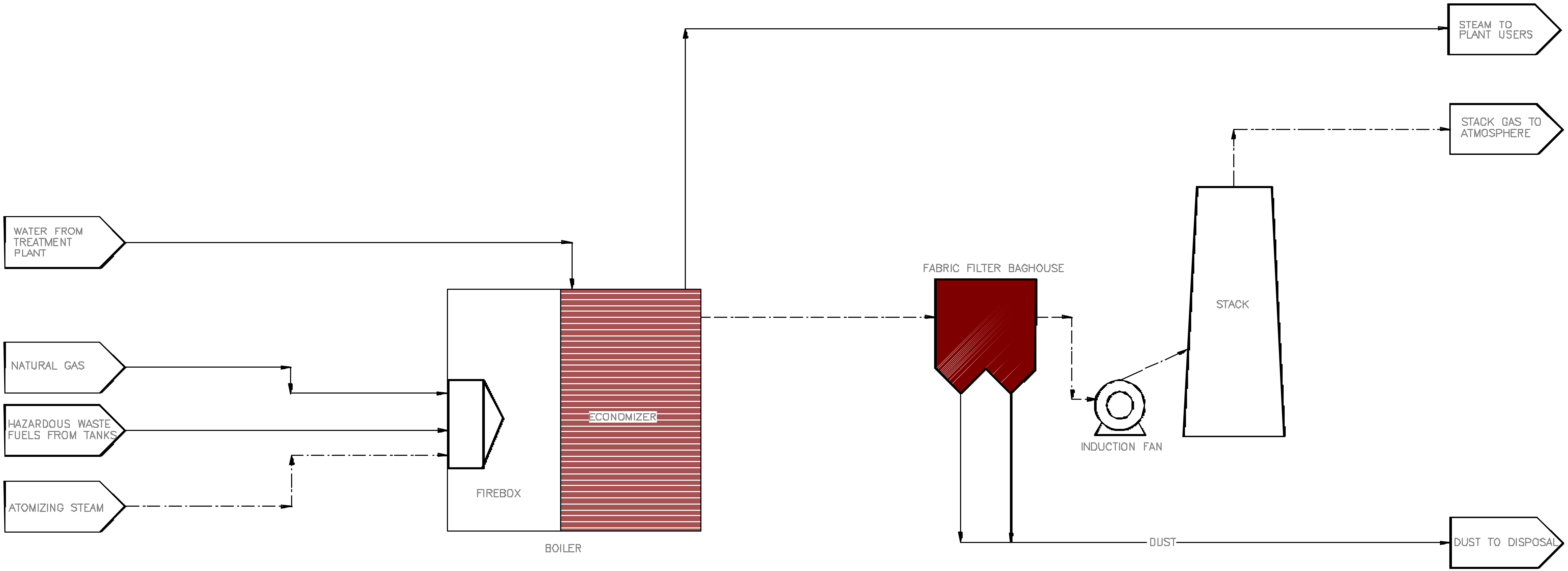
TABLE D-5.15 (Continued)

TRIAL BURN REPORT OUTLINE

Section	Description
	Method 0031 Field Data Sheets and Emission Rate Calculations
	Total Organics Field Data Sheets and Emission Rate Calculations
	Method 0050 Field Data Sheets and Emission Rate Calculations
D	PROCESS SAMPLING REPORT
	Raw Data
	Data Summary Calculations
E	QA/QC REPORT
	Field Sampling QA/QC Report
	Laboratory Data Summary Report
	Chain of Custody Forms
F	INSTRUMENT CALIBRATION RECORDS
	Calibration Records for Process Monitoring Equipment
	Calibration Records for Process Control Equipment
	Calibration Records for Continuous Emission Monitoring Equipment
	Calibration Records for Stack Gas Sampling Equipment
	Calibration Records for Field Analytical Equipment
G	PERFORMANCE CALCULATIONS
H	FIELD LOGS
I	ANALYTICAL DATA PACKAGES

ATTACHMENT B

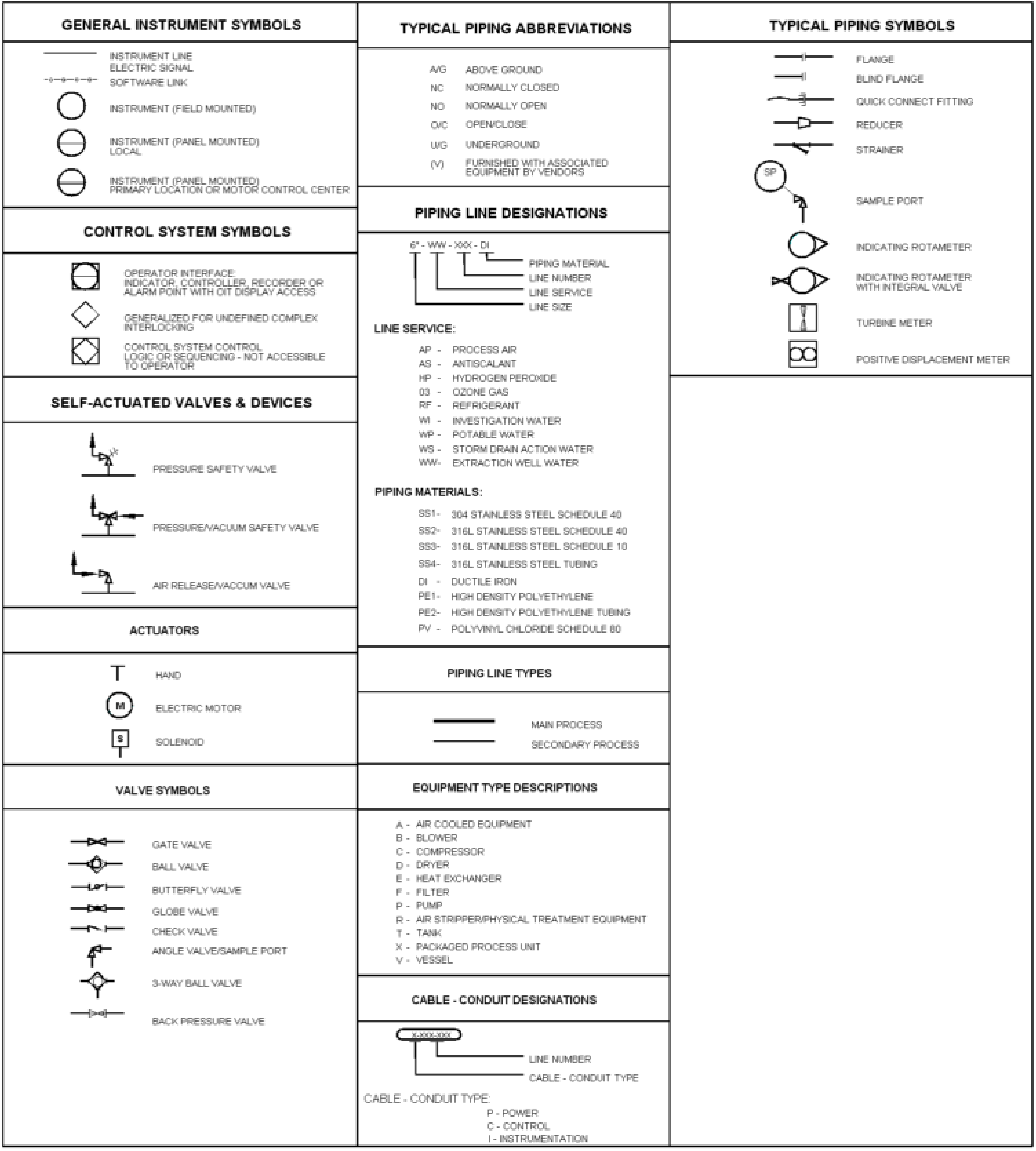
EXAMPLE PROCESS FLOW DIAGRAM AND PIPING AND INSTRUMENTATION DIAGRAMS



EXAMPLE
BOILER PROCESS
FLOW DIAGRAM

FILE NAME: R:\CAD\270\R0607601\FLOW-DIAG.DWG

DATE: 01/07/98 MVT DN



GENERAL INSTRUMENT SYMBOLS

- INSTRUMENT LINE
- ELECTRIC SIGNAL
- SOFTWARE LINK
- INSTRUMENT (FIELD MOUNTED)
- INSTRUMENT (PANEL MOUNTED) LOCAL
- INSTRUMENT (PANEL MOUNTED) PRIMARY LOCATION OR MOTOR CONTROL CENTER

CONTROL SYSTEM SYMBOLS

- OPERATOR INTERFACE: INDICATOR, CONTROLLER, RECORDER OR ALARM POINT WITH OIT DISPLAY ACCESS
- GENERALIZED FOR UNDEFINED COMPLEX INTERLOCKING
- CONTROL SYSTEM CONTROL LOGIC OR SEQUENCING - NOT ACCESSIBLE TO OPERATOR

SELF-ACTUATED VALVES & DEVICES

- PRESSURE SAFETY VALVE
- PRESSURE/VACUUM SAFETY VALVE
- AIR RELEASE/VACCUM VALVE

ACTUATORS

- T HAND
- M ELECTRIC MOTOR
- S SOLENOID

VALVE SYMBOLS

- GATE VALVE
- BALL VALVE
- BUTTERFLY VALVE
- GLOBE VALVE
- CHECK VALVE
- ANGLE VALVE/SAMPLE PORT
- 3-WAY BALL VALVE
- BACK PRESSURE VALVE

TYPICAL PIPING ABBREVIATIONS

A/G	ABOVE GROUND
NC	NORMALLY CLOSED
NO	NORMALLY OPEN
O/C	OPEN/CLOSE
U/G	UNDERGROUND
(V)	FURNISHED WITH ASSOCIATED EQUIPMENT BY VENDORS

PIPING LINE DESIGNATIONS

6" - WW - XXX - DI

- PIPING MATERIAL
- LINE NUMBER
- LINE SERVICE
- LINE SIZE

LINE SERVICE:

AP - PROCESS AIR
AS - ANTISCALANT
HP - HYDROGEN PEROXIDE
03 - OZONE GAS
RF - REFRIGERANT
WI - INVESTIGATION WATER
WP - POTABLE WATER
WS - STORM DRAIN ACTION WATER
WW- EXTRACTION WELL WATER

PIPING MATERIALS:

SS1- 304 STAINLESS STEEL SCHEDULE 40
SS2- 316L STAINLESS STEEL SCHEDULE 40
SS3- 316L STAINLESS STEEL SCHEDULE 10
SS4- 316L STAINLESS STEEL TUBING
DI - DUCTILE IRON
PE1- HIGH DENSITY POLYETHYLENE
PE2- HIGH DENSITY POLYETHYLENE TUBING
PV - POLYVINYL CHLORIDE SCHEDULE 80

PIPING LINE TYPES

- MAIN PROCESS
- SECONDARY PROCESS

EQUIPMENT TYPE DESCRIPTIONS

A - AIR COOLED EQUIPMENT
B - BLOWER
C - COMPRESSOR
D - DRYER
E - HEAT EXCHANGER
F - FILTER
P - PUMP
R - AIR STRIPPER/PHYSICAL TREATMENT EQUIPMENT
T - TANK
X - PACKAGED PROCESS UNIT
V - VESSEL

CABLE - CONDUIT DESIGNATIONS

X-XXX-XXX

- LINE NUMBER
- CABLE - CONDUIT TYPE

CABLE - CONDUIT TYPE:
P - POWER
C - CONTROL
I - INSTRUMENTATION

TYPICAL PIPING SYMBOLS

- FLANGE
- BLIND FLANGE
- QUICK CONNECT FITTING
- REDUCER
- STRAINER
- SP SAMPLE PORT
- INDICATING ROTAMETER
- INDICATING ROTAMETER WITH INTEGRAL VALVE
- TURBINE METER
- POSITIVE DISPLACEMENT METER

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FIGURE 1
EXAMPLE PROCESS AND
INSTURMENTATION DIAGRAM LEGEND