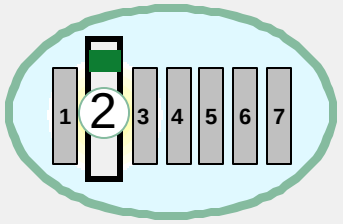
Hazardous Waste Combustion Unit Permitting Manual



COMPONENT 2

How To Review A Quality Assurance Project Plan

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

Tetra Tech EM Inc.

COMPONENT TWO

HOW TO REVIEW A TRIAL BURN QUALITY ASSURANCE PROJECT PLAN

JANUARY 1998

CONTENTS

Section **Page**

ABBREVIATIONS AND ACRONYMS iv

BIBLIOGRAPHY vi

1.0 OVERVIEW OF TRIAL BURN QUALITY ASSURANCE PROJECT PLAN REVIEW . . 2-1
2.0 HOW TO REVIEW ELEMENT 1—TITLE PAGE WITH APPROVALS 2-4
3.0 HOW TO REVIEW ELEMENT 2—TABLE OF CONTENTS 2-7
4.0 HOW TO REVIEW ELEMENT 3—PROJECT DESCRIPTION 2-9
5.0 HOW TO REVIEW ELEMENT 4—PROJECT ORGANIZATION OF PERSONNEL, RESPONSIBILITIES, AND QUALIFICATIONS 2-13
6.0 HOW TO REVIEW ELEMENT 5—QUALITY ASSURANCE AND QUALITY CONTROL OBJECTIVES 2-16
7.0 HOW TO REVIEW ELEMENT 6—SAMPLING AND MONITORING PROCEDURES 2-20

7.1 HOW TO REVIEW FIELD QUALITY CONTROL SAMPLING PROCEDURES 2-23

7.1.1 Reviewing Procedures For Spiked Resin Blanks 2-25
7.1.2 Reviewing Procedures for Reagent Blanks 2-26
7.1.3 Reviewing Procedures for Field Blanks 2-27
7.1.4 Reviewing Procedures for Trip Blanks 2-29
7.1.5 Reviewing Procedures for Hexavalent Chromium Train Stability Samples 2-31
7.1.6 Reviewing Procedures for Formaldehyde Field Spikes 2-33

7.2 HOW TO REVIEW WASTE FEED AND PROCESS SAMPLING PROCEDURES 2-34
7.3 HOW TO REVIEW STACK GAS SAMPLING PROCEDURES 2-36

7.3.1 Reviewing Velocity and Traverse Point Selection 2-38
7.3.2 Reviewing Procedures For Determining Oxygen and Carbon Dioxide Concentrations 2-40
7.3.3 Reviewing Volatile Organic Sampling Train Procedures 2-42
7.3.4 Reviewing Modified U.S. EPA Method 5 Sampling Train Procedures . . 2-45

7.3.4.1 Semivolatile Organic Compounds, Dioxins, and Furan 2-47
7.3.4.2 Polynuclear Aromatic Hydrocarbons 2-49
7.3.4.3 Volatile, Semivolatile, and Nonvolatile Unspeciated Mass 2-51

7.3.5 Preventing Saturation of Resin Tubes 2-53
7.3.6 Planning for Analytical Nondetects 2-55

7.4 HOW TO REVIEW PROCESS MONITORING EQUIPMENT STANDARDS . . 2-57

7.5 HOW TO REVIEW CONTINUOUS EMISSION MONITORING EQUIPMENT STANDARDS 2-59

CONTENTS (Continued)

Section **Page**

8.0 HOW TO REVIEW ELEMENT 7—SAMPLE HANDLING, TRACEABILITY, AND HOLDING TIMES 2-61
9.0 HOW TO REVIEW ELEMENT 8—SPECIFIC CALIBRATION PROCEDURES AND FREQUENCY 2-64
10.0 HOW TO REVIEW ELEMENT 9—ANALYTICAL PROCEDURES 2-66
11.0 HOW TO REVIEW ELEMENT 10—SPECIFIC INTERNAL QUALITY CONTROL CHECKS 2-69
12.0 HOW TO REVIEW ELEMENT 11—DATA REDUCTION, DATA VERIFICATION, AND DATA REPORTING 2-72
13.0 HOW TO REVIEW ELEMENT 12—ROUTINE MAINTENANCE PROCEDURES AND SCHEDULES 2-77
14.0 HOW TO REVIEW ELEMENT 13—ASSESSMENT PROCEDURES FOR ACCURACY, PRECISION, AND COMPLETENESS 2-79
15.0 HOW TO REVIEW ELEMENT 14—AUDIT PROCEDURES, CORRECTIVE ACTION, AND QUALITY ASSURANCE REPORTING 2-81

ATTACHMENTS

A U.S. EPA REGION 6 GENERIC TRIAL BURN QUALITY ASSURANCE PROJECT PLAN (QAPP)
B SUPPORTING INFORMATION FOR SECTION 2.0
HOW TO REVIEW ELEMENT 1—THE TITLE PAGE WITH APPROVAL
C SUPPORTING INFORMATION FOR SECTION 3.0
HOW TO REVIEW ELEMENT 2—TABLE OF CONTENTS
D SUPPORTING INFORMATION FOR SECTION 4.0
HOW TO REVIEW ELEMENT 3—THE PROJECT DESCRIPTION
E SUPPORTING INFORMATION FOR SECTION 5.0
HOW TO REVIEW ELEMENT 4—PROJECT ORGANIZATION AND PERSONNEL, RESPONSIBILITIES, AND QUALIFICATIONS
F SUPPORTING INFORMATION FOR SECTION 6.0
HOW TO REVIEW ELEMENT 5—THE QUALITY ASSURANCE AND QUALITY CONTROL OBJECTIVES
G SUPPORTING INFORMATION FOR SECTION 7.0
HOW TO REVIEW ELEMENT 6—SAMPLING AND MONITORING PROCEDURES
H SUPPORTING INFORMATION FOR SECTION 8.0
HOW TO REVIEW ELEMENT 7—SAMPLE HANDLING, TRACEABILITY, AND HOLDING TIMES
I SUPPORTING INFORMATION FOR SECTION 9.0
HOW TO REVIEW ELEMENT 8—SPECIFIC CALIBRATION PROCEDURES AND FREQUENCY
J SUPPORTING INFORMATION FOR SECTION 10.0
HOW TO REVIEW ELEMENT 9—ANALYTICAL PROCEDURES
K SUPPORTING INFORMATION FOR SECTION 11.0
HOW TO REVIEW ELEMENT 10—SPECIFIC INTERNAL QUALITY CONTROL CHECKS
L SUPPORTING INFORMATION FOR SECTION 12.0
HOW TO REVIEW ELEMENT 11—DATA REDUCTION, DATA VERIFICATION, AND DATA REPORTING
M SUPPORTING INFORMATION FOR SECTION 14.0
HOW TO REVIEW ELEMENT 13—ASSESSMENT PROCEDURES FOR ACCURACY, PRECISION, AND COMPLETENESS
N SUPPORTING INFORMATION FOR SECTION 15.0
HOW TO REVIEW ELEMENT 14—AUDIT PROCEDURES, CORRECTIVE ACTION, AND
QUALITY ASSURANCE REPORTING

ABBREVIATIONS AND ACRONYMS

AREAL	U.S. EPA Atmospheric Research and Exposure Assessment Laboratory
ASTM	American Society for Testing and Materials
AWFCO	Automatic waste feed cutoff
BIF	Boiler and industrial furnace
BTU	British thermal unit
CEMS	Continuous emissions monitoring system
CFR	Code of Federal Regulations
Cl_2	Chlorine gas
CO	Carbon monoxide
CO_2	Carbon dioxide
COC	Chain of custody
^oC	Degrees Celsius
DCF	Document control format
DCS	Document control system
DNPH	Dinitrophenylhydrazine
DQO	Data quality objective
DRE	Destruction and removal efficiency
EDL	Estimated detection limit
^oF	Degrees Fahrenheit
GC/MS	Gas chromatography/mass spectrometry
HCl	Hydrogen chloride
HWCU	Hazardous waste combustion unit
ICAP	Inductively coupled argon plasma spectroscopy
mL	Milliliter
MDL	Method detection limit
MM	Modified method
MS	Matrix spike
MSD	Matrix spike duplicates
NO_2	Nitrogen dioxide
NO_X	Nitrogen oxides
NIST	National Institute of Standards and Technology
NOD	Notice of Deficiency
O_2	Oxygen
ORD	U.S. EPA Office of Research and Development
OSWER	Office of Solid Waste and Emergency Response
PAH	Polynuclear aromatic hydrocarbon
PCB	Polychlorinated biphenyl
PCDD/PCDF	Polychlorinated dibenzopdioxins/polychlorinated dibenzofurans
PIC	Product of incomplete combustion
PM	Particulate matter
POHC	Principal organic hazardous constituent
PSD	Particle size distribution
QAMS	U.S. EPA Quality Assurance Management Staff
QAPP	Quality assurance project plan

QA/QC	Quality assurance/quality control
RAWP	Risk assessment work plan

ABBREVIATIONS AND ACRONYMS (Continued)

RBP	Risk burn plan
RCRA	Resource Conservation and Recovery Act
RPD	Relative percent difference
RSD	Relative standard deviation
SO_2	Sulfur dioxide
SOP	Standard operating procedure
SQL	Sample quantitation limit
SVOC	Semivolatile organic compound
SVOST	Semivolatile organic sampling train
TBP	Trial burn plan
THC	Total hydrocarbon content
TO	Total organic
U.S. EPA	U.S. Environmental Protection Agency
VOC	Volatile organic compound
VOST	Volatile organic sampling train
WDF	Waste derived fuel

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1.0 OVERVIEW OF TRIAL BURN QUALITY ASSURANCE PROJECT PLAN REVIEW

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

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

Explanation: A trial burn quality assurance project plan (QAPP) serves as a blueprint for obtaining the type and quality of results needed to determine how a facility burning hazardous wastes should be permitted.

The following paragraphs (1) provide background information on documents relevant to preparation and review of trial burn QAPPs, (2) present the purpose and organization of this guidance document, and (3) provide an overview of the review process.

U.S. EPA general requirements for trial burn QAPPs are presented in U.S. EPA 1994 QA/R-5, U.S. EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations, Draft Interim Final. General guidance on how to prepare and review trial burn QAPPs will soon be available from a companion document, Guidance on Quality Assurance Project Plans, U.S. EPA QA/G-5. This document will be available in late 1997. The U.S. EPA Region 6 quality assurance (QA) staff should be consulted for region-specific modifications to these general guidance documents. Specific guidance on trial burn QAPPs is available from the U.S. EPA 1990 quality assurance and quality control (QA/QC) Handbook: QA/QC Procedures for Hazardous Waste Incineration. In addition, U.S. EPA Region 6 has prepared a generic trial burn QAPP to offer additional guidance on trial burn QAPP preparation. The generic trial burn QAPP is included as Attachment A to this component.

Table 2-2 of the U.S. EPA QA/QC Handbook recommends an outline for trial burn QAPPs that is based on format and general content requirements specified in U.S. EPA 1980, Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans, U.S. EPA QAMS-005/80. However, current guidance on U.S. EPA trial burn QAPP requirements states that U.S. EPA QA/R-5 replaces U.S. EPA QAMS-005/80. The U.S. EPA Region 6 generic trial burn QAPP follows the outline recommended by the U.S. EPA 1990 QA/QC Handbook in Section 2.1.1. Confusion resulting from multiple guidance documents is eliminated by Appendix A of U.S. EPA QA/R-5, which provides a crosswalk between the 16 QAPP elements identified in U.S. EPA QAMS-005/80 and the 25 QAPP elements identified in U.S. EPA QA/R-5.

In the past, trial burns were limited to test conditions that demonstrated compliance with the performance standards for destruction and removal efficiency (DRE), particulate matter, hydrogen chloride, chlorine, and metals. Recently, the scope of the trial burn has been expanded to produce data to

support a multipathway human health and ecological risk assessment. Consequently, the trial burn is more complex today. It involves some forms of sampling, especially for products of incomplete combustion (PICs), that were not commonly done in the past. For this reason, the QAPP should be carefully examined upon receipt to ensure that it addresses the sampling and analysis activities that are required for the risk assessment (such as, the total organics [TO] emissions test). Refer to the U.S. EPA Region 6 generic trial burn QAPP (Attachment A) for an example of a trial burn QAPP that encompasses risk assessment sampling.

The contemporary practice of conducting a multipathway indirect risk assessment also results in more scrutiny of the detection limits of the sampling and analysis systems. The U.S. EPA 1998 Region 6 risk protocols, for example, require that detection limit values for nondetected compounds be statistically transformed into finite risk assessment inputs. See Section 7.3.6 of this component for guidance on this matter.

The purpose of this guidance document is to assist the permit writer in reviewing QAPPs associated with trial burn tests. The guidance presented in this component applies uniformly to QAPPs associated with either the collection of risk assessment data outlined in a risk burn plan (RBP) or performance data outlined in a trial burn plan (TBP). Reference to these documents can be used interchangeably throughout this component. This document follows the U.S. EPA Region 6 generic trial burn QAPP outline but also addresses applicable trial burn QAPP requirements specified in U.S. EPA QA/R-5. Each of the following sections of this component provides guidance on how to review a particular trial burn QAPP element discussed in the U.S. EPA Region 6 generic trial burn QAPP.

Tables, figures, and appendices identified in example sections are included as attachments to this guidance document. To provide a real-world perspective, actual comments made on trial burn QAPPs submitted to U.S. EPA are included as example comments in this document.

A trial burn QAPP reviewer should also review the TBP because the trial burn QAPP is considered to be a companion document to the TBP. In general, the TBP covers topics related to the objectives and experimental design of the trial burn, sampling design and methods, and analytical methods, whereas, the trial burn QAPP covers all QA/QC procedures required to fulfill trial burn objectives. In many areas, the TBP and trial burn QAPP will overlap; however, the TBP is usually considered to be the primary document, and the trial burn QAPP will often refer to the TBP. The TBP and trial burn QAPP review requires a thorough understanding of regulations, the facility background, trial burn objectives and experimental design, sampling and analytical methods, and QA/QC procedures. If the permit writer does not possess all of these skills, additional reviewers should be involved to complement the permit writer's experience.

Although reviewers may possess complementary skills, they should independently evaluate the TBP and trial burn QAPP.

Check For: All trial burn QAPPs should be screened for completeness before the review begins. The following checklist may be used to evaluate whether the trial burn QAPP is ready for regulatory review.

- ❑ Whether the title page contains approval signatures of key, non-U.S. EPA project personnel (for example, the project and QA managers of the facility, trial burn QAPP preparer, sampling firm, and analytical laboratories); if not, the trial burn QAPP was probably not reviewed by key personnel before it was submitted to U.S. EPA
- ❑ Whether the TBP preparation date precedes the trial burn QAPP preparation date; if not, the trial burn QAPP is probably not based on the most current, project-specific information
- ❑ Whether the trial burn QAPP contains summary tables for the sampling and monitoring program; QA objectives; analytical, measurement, and monitoring methods; calibration procedures and frequencies; and internal QC checks
- ❑ Whether the trial burn QAPP contains field and laboratory standard operating procedures (SOP) for sampling, monitoring, and analysis, as applicable
- ❑ Whether the trial burn QAPP summarizes project-specific QA objectives and procedures
- ❑ Whether the trial burn QAPP identifies those who will perform sampling and analysis activities for the trial burn

Example Comments: If any of these items are deficient for the subject trial burn QAPP, the permit writer should discuss the deficiencies with the facility and resolve the issues before beginning a detailed trial burn QAPP review. After the reviews have been completed, the permit writer should compile all reviewer comments and review them for consistency. The comments may be grouped into two categories: general and specific comments. Major deficiencies, inaccuracies, and inconsistencies regarding a particular subject (for example, QA objectives) may be presented as general comments. Issues specific to a small portion of the trial burn QAPP may be presented as specific comments.

If all review comments are minor, the facility may be asked to submit only the revised pages for review. These pages should clearly identify all additions and deletions so that the permit writer needs to review only the revisions for

approving the trial burn QAPP. However, if the review comments are major, the facility should be asked to (1) respond to the comments in writing and (2) revise the trial burn QAPP only after the facility's response has been approved.

Notes: _____

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2.0 HOW TO REVIEW ELEMENT 1—TITLE PAGE WITH APPROVALS

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

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

Explanation: Section 2.1.2 of the U.S. EPA 1990 QA/QC Handbook describes the requirements for a title page of a trial burn QAPP, and Section 1.0 of the U.S. EPA Region 6 generic trial burn QAPP presents an example title page. The title page should provide the complete title of the program and investigation that is being conducted, including the name, location, and U.S. EPA identification number of the subject facility. The title page should also identify the firm that prepared the trial burn QAPP and the organization for which it was prepared. The date of the trial burn QAPP and the revision number should also be listed (the initial draft trial burn QAPP is considered to be Revision 0, with subsequent drafts numbered Revision 1, Revision 2, and so on).

With the approval signatures that it contains, the title page serves as a record that the trial burn QAPP has been reviewed and approved by all parties responsible for implementing or reviewing the results of sampling, monitoring, and analytical procedures described in the document. Analytical laboratories, stack sampling firms, and other organizations that are responsible for implementing portions of the trial burn QAPP may not have been directly involved in preparing the trial burn QAPP. It is particularly important that these organizations are fully aware of all project requirements and their particular roles in the project.

For example, the trial burn QAPP may propose that U.S. EPA Method 0010 stack samples be analyzed for semivolatile organic compounds (SVOC) and polychlorinated biphenyls (PCB). The laboratory that analyzes U.S. EPA Method 0010 samples must be aware of this requirement and should have experience in analyzing samples for these two parameter groups. The signature of the laboratory analysis coordinator on the title page provides assurance that the laboratory has reviewed, and can meet, these requirements. The names and titles of the individuals listed on the title page should be consistent with references to these individuals in other sections of the trial burn QAPP (in particular, Section 4.0 of the QAPP, Project Organization of Personnel, Responsibilities, and Qualifications; and Section 14.0 of the QAPP, Audit Procedures, Corrective Action, and Quality Assurance Reporting).

Check For: The trial burn QAPP reviewer should check for the following information:

- ❒ Complete title of trial burn project
- ❒ Facility name, location, and U.S. EPA identification number
- ❒ Name of organization that prepared the trial burn QAPP
- ❒ Name of organization for which the trial burn QAPP was prepared
- ❒ Date submitted and trial burn QAPP revision number
- ❒ Approval signatures of facility project manager, QA officer, and designated signatory (as described in 40 Code of Federal Regulations [CFR] Part 270.11)
- ❒ Approval signatures of project manager and QA officer of the organization with primary responsibility for implementing the QAPP
- ❒ Approval signatures of key individuals from other organizations with a role in implementing the trial burn QAPP (such as laboratories and stack sampling firms)
- ❒ Approval signatures of U.S. EPA Region 6 permit writer and approving official (note: the U.S. EPA Region 6 approving official is defined as "the Region 6 Program Office Manager or staff person designated and authorized by Certification of the Region 6 QA Officer to approve QAPPs"
- ❒ Approval signatures of other state and federal agencies, if appropriate

Example Situation: Lois and Clark of Metropolis have been selected to review the facility trial burn QAPP information included in Attachment B.

In reviewing Attachment B—Section 1.0, the title/approval page—Lois and Clark note that the form does not include individuals from any of the four analytical laboratories listed in Table 8-1. In addition, they note discrepancies between individuals listed on the approval form and key project personnel discussed in Section 2.0. For example, a "Facility Project Manager" is listed on the approval form, but this individual is not identified in Section 2.0.

Example Action: Lois and Clark ask that the facility revise the information in Attachment B as follows: revise the title page to include the names, titles, and signatures of all key personnel from all organizations participating in the trial burn—including all laboratories—to confirm review and approval. Lois and Clark also ask that the

facility revise the titles to be consistent with project organization as described in Section 4.0 of the U.S. EPA Region 6 generic trial burn QAPP.

For a similar project based on the information presented in Attachment B, Lois and Clark ask that the facility revise the trial burn QAPP title/approval page to include the following information: (1) complete title of the trial burn project; (2) name and location of the facility; and (3) names of the trial burn QAPP preparer; and (4) the organization for which the trial burn QAPP is prepared.

Notes:

3.0 HOW TO REVIEW ELEMENT 2—TABLE OF CONTENTS

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

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

Explanation: Section 2.1.2 and Table 2-2 of the U.S. EPA 1990 QA/QC Handbook describe the requirements for a trial burn QAPP table of contents, and Section 2.0 of the U.S. EPA Region 6 generic trial burn QAPP presents an example table of contents. The table of contents should list all sections, figures, tables, and appendices. The table of contents should also include the page number on which each section, figure, and table begins.

The table of contents should also list all individuals and their organizations who will receive copies of the trial burn QAPP and subsequent revisions. This list can be useful for verifying that all key individuals in the project organization have a copy of the trial burn QAPP. For example, the process and stack sampling coordinators must each have a copy of the trial burn QAPP to complete their responsibilities. However, because these individuals are not responsible for approving the trial burn QAPP, it is not possible to determine from the title page and approval signatures that they received a copy. It may also be useful to include, immediately following the distribution list, a list of all acronyms and abbreviations used in the trial burn QAPP.

Within the body of the trial burn QAPP, each page should be numbered by using standard document control format (DCF). DCF typically displays a header in the upper right-hand corner of each page following the title page to identify the section number, trial burn QAPP revision number, revision date, and page number within a section (for example, Page 6 of 14). DCF use ensures that no pages are missing and it facilitates revisions to the trial burn QAPP.

Check For: The trial burn QAPP reviewer should check for the following information:

- ❒ Complete trial burn QAPP section list, with page numbers
- ❒ Figures and tables list, with page numbers
- ❒ Appendices list
- ❒ Acronyms and abbreviations list, with definitions
- ❒ Trial burn QAPP distribution list
- ❒ DCF page numbering

Example Situation: In reviewing the trial burn QAPP information included in Attachment C, Lois notes that Section 5.0 in the table of contents, is incomplete. For example, Section 5.0 through 5.9 are listed but Sections 5.10 through 5.15 are not. Lois also notes that the page numbering is incomplete.

Example Action: Lois asks that the facility revise the table of contents to list all trial burn QAPP sections, figures, tables, and appendices and to include page numbers for all listed items. In addition, Lois asks that the facility revise the page numbering so that the DCF appears on all trial burn QAPP pages, including figures, tables, attachments, and appendices. Lois also requests that the page numbering contain all required information (section number, trial burn QAPP revision number and date, and page number), and identify the page number in relation to the total number of pages in a specific section (for example, Page 6 of 14).

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4.0 HOW TO REVIEW ELEMENT 3—PROJECT DESCRIPTION

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

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

Explanation: Section 2.1.3 of the U.S. EPA 1990 QA/QC Handbook and Section 3.0 of the U.S. EPA Region 6 generic trial burn QAPP describe the information that should be included in the project description section of a trial burn QAPP. The project description section can be brief if the TBP contains a more detailed project description; this section should reference specific TBP sections that contain the detailed description. However, a brief project description must still be provided and should include key information. This section of the trial burn QAPP should describe the hazardous waste combustion unit (HWCU) and include a diagram showing key components of the unit and proposed sampling and monitoring points. This section should also describe waste types (physical state and primary hazardous constituents) that will be burned during the trial burn and the waste types that are burned during normal operations of the HWCU.

The project description should also briefly state trial burn objectives, identify applicable regulatory requirements, and summarize decisions that will be made on the basis of trial burn results. To support the discussion of trial burn objectives, this section should include a summary table of sampling and monitoring requirements. The table should identify sample matrixes, proposed sampling and monitoring methods (in particular, stack sampling methods), sample collection frequency, numbers of samples to be collected (including QC samples), and analytical methods. Field measurements should also be described. The discussion should specifically identify samples and measurements that will be used to satisfy each trial burn objective. The discussion should also identify the samples and measurements that are considered to be critical to trial burn objectives.

The project description should briefly identify and discuss both critical and noncritical measurements. Critical measurements are those that are necessary to achieve trial burn objectives. These include measurements that will be used to determine DRE, conduct the site-specific risk assessment, establish permit limits, or evaluate regulatory compliance. Noncritical measurements are those used for process control or background information.

Finally, the project description section should provide a schedule for the trial burn and should identify any special personnel, equipment, or reporting that are needed to satisfy trial burn objectives.

Check For: The trial burn QAPP reviewer should check for the following information:

- ❒ Brief project description with reference to the TBP for more detailed information
- ❒ HWCU description and wastes burned
- ❒ HWCU diagram showing all sampling and monitoring points
- ❒ Concise statement of trial burn purpose and objectives
- ❒ Sampling and analysis program summary
    - ❒ Sample matrixes and parameters
    - ❒ Sampling methods
    - ❒ Collection frequency and number of samples
    - ❒ Analytical methods
    - ❒ Field measurements and monitoring methods
- ❒ Clear discussion of relationship between sampling and analysis results and project objectives
- ❒ Differentiation between critical and noncritical measurements
- ❒ Trial burn schedule
- ❒ Identification of any special personnel, equipment, or reporting requirements

Example Situation: In reviewing the trial burn QAPP and TBP information included as Attachment D, Clark notes that there is a brief description of the purpose and objectives of the trial burn, including operating limits to be established and performance standards to be demonstrated. It also describes the HWCU that will be evaluated and includes a trial burn schedule. Table 1-1 summarizes the sampling and analysis program that will be carried out to meet trial burn objectives.

Example Action: Clark determines that the trial burn QAPP and TBP do not present a clear and consistent description of project objectives and the target compounds and parameters that will be measured to meet the objectives. Clark finds the current presentation of this information confusing and contradictory. For example, Page 3-4 of the trial burn QAPP lists stack emissions of volatile and semivolatile principal organic hazardous constituent (POHC) as critical parameters for Condition 1, and Note "a" of Table 1-1 states that DRE testing will be conducted during Condition 1. However, Table 1-4 implies that POHCs will not be added to the hazardous waste feed during Condition 1. Clark also notes inconsistencies between Table 1-1 of the trial burn QAPP and Tables 4-3 and 4-6 of the TBP concerning operating limits to be established under Conditions 1 and 2. For

example, Table 1-1 of the trial burn QAPP indicates that an operating limit for maximum secondary air temperature will be established during Condition 1, but this parameter is not listed in Tables 4-3 and 4-6 of the TBP.

Clark asks that the facility revise Section 1.0 of the QAPP to include a concise summary table that identifies (1) all sampling and monitoring parameters for each condition, (2) specific operating limits that will be established, and (3) performance standards that will be demonstrated on the basis of these parameters. The summary table should also include the intended data use for parameters not directly related to an operating limit or performance standard (for example, stack gas carbon monoxide [CO] and carbon dioxide [CO_2] concentrations under Condition 1). The trial burn QAPP summary table should be consistent with the TBP.

In addition, Clark notes that the trial burn QAPP and TBP do not clearly demonstrate how the following project objectives will be met during the trial burn: (1) documenting worst-case operating conditions to establish permit limits; (2) demonstrating that the hazardous waste feed stream during the trial burn is representative of the worst-case hazardous waste feed stream during normal operations; (3) evaluating PIC formation during test conditions; and (4) generating emissions data to support the multipathway direct and indirect risk assessment.

Clark asks that the facility revise both the trial burn QAPP and TBP to more completely discuss proposed kiln operating conditions during the trial burn to demonstrate that conditions represent the worst-case scenario. Although the trial burn should be conducted while the kiln is operating under worst-case conditions, the trial burn QAPP and TBP do not provide justification for the claim that the conditions are worst-case conditions. As part of the justification, Clark requests that the trial burn QAPP and TBP provide a rationale for choosing combustion zone and secondary air temperatures for all three test conditions and that they explain how these test conditions will result in permit conditions that reflect standard industry practices for producing quality product.

The waste-derived fuel (WDF) used during the trial burn should represent the worst-case fuel mix expected during normal kiln operations. Although the trial burn QAPP and TBP include protocols for collecting and analyzing WDF, it is not clear which steps, if any, will be taken to provide a WDF mixture that represents the worst-case scenario. British thermal unit (Btu) content of, and chemical compounds present in, the feed stream during the trial burn should be considered, in addition to waste physical characteristics. Also, the highest expected WDF chlorine gas (Cl_2) content should be represented during all trial burn conditions, because the Cl_2 content of the WDF during the trial burn will be used to develop Cl_2 concentration permit conditions. Clark asks that the facility revise these sections accordingly.

Table 1-1 of the trial burn QAPP and Section 4.0 of the TBP indicate that data collected during Condition 1 will be used to determine permitted emission limits for Tier III metals, hydrogen chloride (HCl), Cl_2, and particulate matter (PM). Because Condition 1 is designed to demonstrate compliance at maximum temperatures, feed rate, and stack gas flow rate, the shortest residence time in the combustion zone should occur under Condition 1. These conditions may affect DRE and PIC formation. Therefore, Condition 1 should include waste feed spiking with POHC, DRE measurement and evaluation, and PIC formation. Waste feed spiking with POHCs under Condition 1 appears to be excluded from Table 1-4 of the trial burn QAPP but is included in Table 4-3 of the TBP. Finally, Clark asks that the facility revise Condition 1 and the related tables accordingly.

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5.0 HOW TO REVIEW ELEMENT 4—PROJECT ORGANIZATION OF PERSONNEL, RESPONSIBILITIES, AND QUALIFICATIONS

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

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

Explanation: Section 2.1.4 of the EPA 1990 QA/QC Handbook and Section 4.0 of the U.S. EPA Region 6 generic trial burn QAPP describe the information that should be included in the project organization section of the trial burn QAPP. This section should fully describe the trial burn project organization, identify key personnel, describe their qualifications and responsibilities, and specifically address QA/QC responsibilities.

At a minimum, the project organization should include the following key personnel (or their equivalent): combustion unit project manager, facility QA officer, trial burn manager (typically, the project manager for the organization with primary responsibility for carrying out the sampling and analysis program described in the trial burn QAPP), and trial burn QA officer. The trial burn QA officer should be one individual with overall QA authority for all aspects of the trial burn.

The trial burn QAPP must demonstrate that the trial burn QA officer is organizationally independent of the trial burn technical staff and is not directly responsible for making measurements during the trial burn. If appropriate, project organization should also include a process sampling coordinator, stack sampling coordinator, and laboratory analysis coordinator. An appendix to the trial burn QAPP should include resumes for these key personnel, demonstrating their qualifications and addressing any special training or certification requirements related to trial burn responsibilities.

The trial burn QAPP should include a figure showing trial burn project organization and lines of communication within the organization. It is particularly important that all groups participating in the trial burn be clearly identified. For example, if several analytical laboratories will be used, Section 4.0 of a trial burn QAPP should specify analytical parameters for which each laboratory is responsible and should provide the name and location (city and state) of each laboratory. Section 4.0 of a trial burn QAPP should also identify project management and QA personnel from each laboratory. It should identify any subcontractors that will be used to conduct trial burn activities and clearly define their roles in the project organization. Project management and QA personnel from each subcontractor should also be identified.

The project organization section should also identify the U.S. EPA Region 6 permit writer and approving official and briefly describe their roles and responsibilities in overseeing trial burn activities. If personnel from state agencies

or other organizations will oversee the trial burn, their roles should also be described.

To avoid confusion, the organization, individuals, titles, and responsibilities described in Section 4.0 should be consistent with other trial burn QAPP elements. In particular, the auditing, corrective action, and QA reporting procedures and responsibilities addressed in Section 14.0 should follow from the project organization.

Check For: The trial burn QAPP reviewer should check for the following information:

- ❒ Figure showing trial burn project organization
- ❒ Names, qualifications, and responsibilities of key personnel, including (but not limited to) the following:
  - ❒ Combustion unit project manager and QA officer
  - ❒ Trial burn manager
  - ❒ Trial burn QA officer
  - ❒ Process sampling coordinator
  - ❒ Stack sampling coordinator
  - ❒ Laboratory analysis coordinator
- ❒ Trial burn QA officer independent of trial burn technical activities
- ❒ Identification of laboratories and laboratory personnel and description of their responsibilities
- ❒ Identification of subcontractors and subcontractor personnel and description of their responsibilities
- ❒ Identification of U.S. EPA and other organizations overseeing trial burn and description of their responsibilities
- ❒ Organization, titles, individuals, and responsibilities consistent with other trial burn QAPP elements

Example Situation: In reviewing the facility trial burn QAPP information included as Attachment E-1, Clark notes that Section 2.0 presents the trial burn organization and describes the roles and responsibilities of individuals within the organization. Figure 2-1 is an organizational chart that shows lines of communication and responsibility within the trial burn organization.

Example Action: The project organization section focuses almost entirely on the roles and responsibilities of personnel that prepared the trial burn QAPP. Clark asks that

the facility expand this section to include key personnel from other organizations participating in the trial burn and that the facility address the following specific deficiencies:

- The roles and responsibilities of U.S. EPA Region 6 personnel should be included in Section 2.0. In addition, if state agency personnel will participate in the trial burn, their roles and responsibilities should be described in Section 2.0.

- Facility personnel responsible for QA issues should be identified and included in Figure 2-1, the project organization diagram. Section 2.0 should also describe the roles and responsibilities of these personnel.

- Management, QA, and key technical personnel should be identified for all analytical laboratories that will analyze trial burn samples. The specific address of each laboratory should also be provided.

Finally, the QA officer is listed as being responsible for data validation. The trial burn QAPP should indicate whether the QA officer is independent from XYZ Analytical Services, which will conduct many of the analyses. If the QA officer is not independent, data validation responsibilities should be assigned to another individual who is not directly involved with XYZ Analytical Services.

For a similar situation based on the information in Attachment E-2, Clark makes the following observations:

The role and responsibilities of the QA officer should be more clearly described in the trial burn QAPP. Section 4.3.2 states that the QA officer is responsible for coordinating trial burn QA activities, and Section 16.0 states that the QA officer is responsible for reporting these activities to project management. However, subsequent sections of the trial burn QAPP do not demonstrate that the QA officer will be sufficiently involved in QA activities to fulfill these responsibilities. For example, Section 4.4.2 states that problems, corrective actions, and other QA issues related to analytical laboratories will be reported to the XYZ trial burn manager rather than the QA officer. In addition, Sections 12.1.1 and 12.2.1 of the trial burn QAPP state that internal field and laboratory audits will be carried out by the facility's environmental services management personnel and do not describe any participation by the QA officer in these audits. Similarly, Section 15.0 places field and laboratory corrective action responsibilities with the XYZ trial burn manager, with no apparent involvement by the QA officer. Clark asks that the facility revise the trial burn QAPP to demonstrate that the QA officer's involvement in audits, corrective actions, and QA activities will be consistent with the QA coordination, oversight, and reporting responsibilities of this position.

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6.0 HOW TO REVIEW ELEMENT 5—QUALITY ASSURANCE AND QUALITY CONTROL OBJECTIVES

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

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

Explanation: Section 2.1.5 of the U.S. EPA 1990 QA/QC Handbook and Section 5.0 of the U.S. EPA Region 6 generic trial burn QAPP provide general guidance on how to develop QA/QC objectives for the trial burn QAPP. Subsequent sections of the U.S. EPA 1990 QA/QC Handbook provide information that is more specific on developing QA/QC objectives for analytical parameters typically evaluated, and monitoring equipment typically used, during trial burns. These sections include 3.7.1, 5.1, 5.2, 5.3, 7.2, 7.3, 7.4, 7.5, 8.1, 8.2, 9.1, 9.2, and 10.2.

Section 5.0 of the trial burn QAPP should include QA objectives for each measurement that will be made during the trial burn. QA objectives should be consistent with overall trial burn objectives. That is, if all data collected during the trial burn meet QA objectives, the U.S. EPA permit writer should have sufficient information for making permitting decisions regarding the HWCU. U.S. EPA's data quality objective (DQO) process is a systematic procedure that, if followed, will result in QA objectives that support overall trial burn objectives.

Trial burn QA objectives should be presented in terms of specific data quality indicators: precision, accuracy, completeness, representativeness, and comparability. In addition, Section 5.0 of the trial burn QAPP should address sample quantitation limits (SQLs) for all measurements.

QA objectives for precision and accuracy are usually expressed in quantitative terms, and the trial burn QAPP should include a summary table of target precision and accuracy objectives for all parameters. The table should clearly identify specific QC samples that will be collected and measurements that will be made to evaluate precision and accuracy. For example, the relative percent difference (RPD) of field duplicate samples might be used to evaluate sampling and analytical precision for metals concentrations in waste feed. Similarly, the percent recovery of surrogate spikes might be used to evaluate the accuracy of dioxin results in stack gas samples. The table should also clearly specify acceptance criteria for each measurement of precision (for example, relative percent difference less than 30 percent) and accuracy (for example, 75 to 125 percent recovery). Section 13.0 of the trial burn QAPP should present specific equations used to calculate precision and accuracy. Sections 10.0 and 14.0 of the trial burn QAPP should define corrective actions that will be taken when results do not meet these criteria.

Section 5.0 should also present QA objectives for completeness. Completeness is usually defined as the percentage of valid data collected from a measurement system compared to the total amount of data planned for collection. This definition of completeness can be applied to each individual measurement made during the trial burn—for example, measurements of benzene concentrations in waste feed. Many trial burn QAPPs arbitrarily use 90 percent or 95 percent as the QA objective for completeness. However, the completeness QA objective should be meaningful for the specific project. That is, in a situation in which only four samples are planned, 75 percent (valid results for three of the four samples) and 100 percent (valid results for all four samples) are meaningful QA objectives, whereas 90 and 95 percent are not.

Section 5.0 of the trial burn QAPP should also directly address the issue of overall completeness of results for the trial burn. The U.S. EPA 1990 QA/QC Handbook states that, "for a hazardous waste combustion unit permit to be written, completeness should be 100 percent in that three valid test runs are needed for each test condition." Many trial burn QAPPs plan four test runs for each test condition. If significant data quality problems exist during one of the runs, valid results may still be available for the remaining three runs.

Section 5.0 should also address QA objectives for representativeness and comparability. These objectives are usually expressed qualitatively. For example, the use of standard U.S. EPA stack sampling methods should result in data that are representative of stack gas conditions and comparable with other data collected by these methods. Comparability also refers to the units in which trial burn results are reported. U.S. EPA's 1989 Guidance on Setting Permit Conditions and Reporting Trial Burn Results recommends standard reporting units for trial burn results.

Finally, Section 5.0 of the trial burn QAPP should address the method detection limit (MDL) issue for all analytical and field measurement parameters. MDLs must be consistent with the analytical SOPs that are specified in Section 9.0 of the trial burn QAPP and, possibly, included as an appendix to the QAPP. If MDLs are presented in another trial burn QAPP section (such as Section 9.0), that section can be referenced, and it is not necessary to repeat the MDLs in Section 5.0. However, Section 5.0 should provide some discussion to demonstrate that MDLs are consistent with overall trial burn objectives. For example, the MDLs for volatile and semivolatile POHCs in stack gas samples should be lower than the amounts that are expected if 99.99 percent of the POHCs in the waste feed are destroyed.

Check For: The trial burn QAPP reviewer should check for the following information:

- ❒ Table presenting QA objectives for precision and accuracy for all field and laboratory parameters, including quantitative acceptance criteria

- ❒ Clear presentation of the specific types of QC samples and checks that will be used to evaluate precision and accuracy
- ❒ Discussion of QA objectives for completeness of trial burn data, addressing completeness goals for individual measurements and overall completeness of trial burn results
- ❒ Discussion of representativeness and comparability of trial burn data
- ❒ Presentation or discussion of MDLs
- ❒ Consistency of MDLs with detection limits of proposed analytical methods
- ❒ Discussion sufficient to demonstrate that QA objectives for specific measurements are consistent with and support overall trial burn objectives

Example Situation: In reviewing the facility's trial burn QAPP (relevant sections are included as Attachment F), Lois notes that Section 3.0 presents QA/QC objectives. Table 3-1 lists precision and accuracy objectives and identifies the QC samples that will be used to measure precision and accuracy. Section 3.0 also discusses (1) QA objectives for completeness, representativeness, and comparability and (2) MDLs for analytical methods and continuous emission monitoring systems.

Lois notes several problems with this section and requests that the facility revise this section as follows:

- Field and laboratory precision objectives presented in Sections 3.3.2 and 3.1.3 and Table 3-1 are vague. The text should be augmented to discuss specific field and laboratory duplicate, and replicate samples and the types of blanks (field, trip, or reagent), and matrix spike duplicate samples that will be used to evaluate precision. Quantitative field and laboratory precision objectives should be presented for each measurement.

- Sections 3.2.1, 3.2.2, and 3.2.3 do not adequately address accuracy measurements. Methods of assessing accuracy should be project-specific and method-specific. For example, the text states that field and trip blanks will be used to assess accuracy; however, Tables 3-1 and 3-2 do not specify the types of blanks that will be used to assess accuracy for each sample parameter. Sections 3.2.1, 3.2.2, and 3.2.3 and Tables 3-1 and 3-2 should be revised to present complete information regarding QA/QC samples so that the trial burn data adequacy can be fully evaluated.

- Table 3-3 also contains deficiencies and inconsistencies regarding field measurements. First, the table does not list all of the field measurements proposed for the trial burn; for example, it fails to list stack gas velocity, stack gas total hydrocarbon (THC) concentration, and stack gas oxygen (O_2) concentration. Second, some of the precision and accuracy entries are listed as "not determinable." The trial burn QAPP should briefly explain the circumstances leading to this conclusion in each case.

- The definition of completeness presented in Section 3.3 should be clarified. This section lists a completeness objective of 95 percent for all measurements. However, it is unclear whether a test run, test condition, or group of test conditions will be considered one sampling event with respect to percent overall completeness. Section 3.3 should be expanded to define completeness for each parameter, at each sampling location, during each test run, and under each test condition, as appropriate.

- Finally, the audit material acceptance criterion for dioxins and furan presented in Table 3-4 should be clarified. The acceptance criterion is listed as "within 50 percent of the 90 percent confidence interval" for dioxins and furans. The definition of a 90 percent confidence interval in this context is unclear. The term "confidence interval" should be more clearly defined, and the acceptable range should be clarified.

Example Action: The facility revises the trial burn QAPP based on these comments, as presented in Attachment F. Lois reviews the revisions, finds that her comments have been addressed, and approves the trial burn QAPP.

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7.0 HOW TO REVIEW ELEMENT 6—SAMPLING AND MONITORING PROCEDURES

Regulations: 40 CFR Part 270.62(b)(2)(iii)
40 CFR Part 60, Appendix A.

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

Explanation: Section 6.0 of the U.S. EPA Region 6 generic trial burn QAPP and Chapters 4, 6, 9, 10, and 11 of the U.S. EPA 1990 QA/QC Handbook describe sampling and monitoring procedure requirements for the trial burn. The U.S. EPA 1998 Region 6 risk protocols for conducting human health and screening level ecological risk assessments describe sampling and monitoring procedure requirements for the risk burn. The TBP usually describes procedures in detail; the trial burn QAPP does not need to repeat these details. However, the trial burn QAPP must contain a table listing all sampling and monitoring points, sampling and monitoring frequency, sampling and monitoring methods, types of sample containers, sample volumes, and numbers of investigative and QC samples. This information should be provided for each matrix (for example, stack gas, waste feed, and ash) and sampling or monitoring parameter.

Reference to U.S. EPA method numbers is sufficient for stack sampling; however, if the methods contain options, the trial burn QAPP should specify and justify the option that will be used. For waste feed and ash sampling, the trial burn QAPP should summarize procedures and include detailed, step-by-step procedures in an appendix (an example is included as Attachment G).

Sampling procedures should demonstrate that POHC mass is sufficient for accurate detection and quantitation of POHC and verification of 99.99 percent DRE (at 99.99 percent DRE, POHC mass in the stack sample should be within the calibration range and at least 10 times the lowest calibration point). For example, if the analytical instrument calibration range for a POHC is 10 to 500 nanograms, the calculated POHC mass in the stack gas sample should be from 100 to 500 nanograms.

Check For: The trial burn QAPP reviewer should check for the following information:

- ❑ Sampling and monitoring summary table that clearly identifies all of the sampling and monitoring points, sampling and monitoring frequency, sampling and monitoring methods, types of sample containers, sample volumes, and number of investigative and QC samples for each matrix and parameter
- ❑ Sampling and monitoring design for characterizing representative samples

- ❑ Proposed standard, current, and appropriate sampling and monitoring methods for characterizing various media and process conditions to accomplish trial burn objectives
- ❑ Specific options, as appropriate, to be included if published standard sampling and monitoring methods are of inadequate detail
- ❑ New, rewritten SOPs are included if the published standard sampling and monitoring methods are of inadequate detail
- ❒ Step-by-step procedures for collecting QC samples

Example Situation: In reviewing the facility's trial burn QAPP (relevant sections are not available and have not been included). Clark notes that Table 6-1 summarizes the sampling and monitoring program planned for the trial burn and Appendix A contains SOPs for sampling and monitoring procedures.

Example Action: Clark has three major concerns related to stack gas sampling procedures: (1) the selection of 40 CFR Part 60, Appendix A, U.S. EPA Method 18 for volatile organic compounds (VOC) and (2) lack of quantification of the unspeciated organics and particle size distribution (PSD). To address these concerns, Clark asks that the facility revise these sections as follows:

- The facility should re-evaluate the selection of U.S. EPA Method 18 for sampling VOCs in stack gas emissions. For HWCUs, U.S. EPA prefers the volatile organic sampling train (VOST), U.S. EPA Method 0031, as the stack gas sampling method. This method is relatively simple and generally provides acceptable detection limits needed to set permit operating conditions and to use in risk assessments. If the facility decides to not change its current VOC sampling method, the trial burn QAPP should clearly explain the rationale for the selection of U.S. EPA Method 18 for this application. If this proposal cannot be justified, the trial burn QAPP should be revised to specify that a VOST will be used for collection of VOC samples.
- Table 6-1 does not address the quantification of unspeciated organic compounds and PSD in stack gas emissions for the risk assessment. U.S. EPA 1996 Guidance for Total Organics provides draft guidance on methods of sampling and analyzing unspeciated organic compound emissions. Guidance on how to use these emissions data in the risk assessment to more comprehensively evaluate health risks associated with these emissions is provided in U.S. EPA 1994 Exposure Assessment Guidance. The stack gas PSD should also be determined for input into the risk assessment. Methods of obtaining the PSD for

stack gas emissions is provided in U.S. EPA 1994 Exposure Assessment Guidance. The facility should review these guidance documents and propose methods for quantifying the unspeciated organic compounds and the PSD of stack gas emissions.

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7.1 HOW TO REVIEW FIELD QUALITY CONTROL SAMPLING PROCEDURES

Regulations: 40 CFR Part 60, Appendix A
40 CFR Part 270.62(b)(2)(iii)

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

Explanation: The trial burn QAPP should contain specific information on procedures used to measure the quality of the data generated from a trial burn. The trial burn QAPP will refer to the TBP for process and site-specific information. Methods referenced in the TBP and trial burn QAPP contain specific guidance on the type, quantity, and content of QC samples. The trial burn QAPP should contain separate sections or subsections that describe the approach used for individual sampling and analytical techniques. Trial burn QAPP review requires familiarity with the methods specified for each measurement. Efficient review of a trial burn QAPP usually requires ready access to the most recent copy of the test methods.

The following subsections describe details regarding QA/QC sample procedures:

- ❑ Spiked resin blanks (Section 7.1.1)
- ❑ Reagent blanks (Section 7.1.2)
- ❑ Field blanks (Section 7.1.3)
- ❑ Trip blanks (Section 7.1.4)
- ❑ Hexavalent chromium train stability samples (Section 7.1.5)
- ❑ Formaldehyde field spikes (Section 7.1.6)

Check For: During the review of this information, the trial burn QAPP reviewer should evaluate the following:

- ❑ Whether sampling and analytical method referenced in the summary table has an associated QC sample discussion
- ❑ Whether the specified QC sample frequency agrees with or exceeds the method specification
- ❑ Step-by-step procedures for collecting the QC samples
- ❑ Additional information and explanation on QC samples for nonstandard or modified monitoring methods

- ❑ Whether field, trip, and reagent blanks and spiking solutions are all included in QC sample discussions

Example Situation: In reviewing the facility's trial burn QAPP, Lois notes that Appendix A contains SOPs for sampling and analytical procedures.

Example Action: Lois realizes that U.S. EPA has different guidance for QC spikes of 40 CFR Part 266, Appendix IX, U.S. EPA Method 23 and U.S. EPA Method 0023A. In U.S. EPA Method 23, spiking and analysis are completed on the combined filter and sorbent samples immediately before extraction. The U.S. EPA Method 0023A variation for dioxins and furans includes a separate spiking, preparation, and analysis of filter and sorbent samples. Lois takes extra care in reviewing the trial burn QAPP to determine whether the correct spiking approach has been applied.

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7.1.1 Reviewing Procedures For Spiked Resin Blanks

Regulations: 40 CFR Part 60, Appendix A
40 CFR Part 270.62(b)(2)(iii)

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

Explanation: Sorbent collection media (resins) are used to collect VOCs, SVOCs, and dioxin and furan organic compounds. Each of these sampling methods contains specific sorbent spiking requirements. The trial burn QAPP should be reviewed thoroughly against specified methods to determine whether the correct procedure is being used. VOST sorbent is not spiked. U.S. EPA Method 0010 sorbent is spiked immediately before extraction in the analytical laboratory. U.S. EPA Method 0023A sorbent for dioxins and furans is prespiked with isotopically labeled compounds before sampling, and is spiked again with different compounds before extraction and sample recovery.

Check For: The trial burn QAPP reviewer should check for the following information:

- ❑ Whether spiking procedures agree with method requirements
- ❑ Whether spiked compounds concentrations have been specified, and the concentration of the spiking solution and the spiking volume are in the proper range for determining spiked compound loss or recovery
- ❑ Whether the trial burn QAPP specifies how spike recoveries will be used in data interpretation

Example Situation: In reviewing the facility's TBP and trial burn QAPP, Clark notes that both the TBP and trial burn QAPP indicate that U.S. EPA Method 0010 will be used to collect SVOCs for analysis by U.S. EPA Method 8270 and that a portion of the sample will be used to determine the total semivolatile and nonvolatile organic content of the stack gas. The documents specify spiking sorbent samples with labeled compounds before extraction; however, they do not mention concentration of spiked standards from total organic content measurements.

Example Action: Clark asks that the facility revise these documents to include collection of a separate sample to determine the total organic content of stack emissions. This separate sample is not spiked with any surrogate compounds, and no after-the-fact mathematical correction is needed.

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7.1.2 Reviewing Procedures for Reagent Blanks

Regulations: 40 CFR Part 60, Appendix A
40 CFR Part 270.62(b)(2)(iii)

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

Explanation: Reagent blanks are used to determine whether chemicals used in preparation and recovery of sampling trains, sampling media, or samples have been contaminated and biased the results of the emissions testing. Different reagent blanks will be required for each method. The field sampling and analytical laboratory should retain an aliquot of each lot of reagent or solvent. Reagent blanks include unspiked sorbents; unspiked filter media; and solvents used for recovery, dilution, and sample preparation and calibration standards. Reagent blanks also include special chemical mixtures, such as 2,4-dinitro phenylhydrazine-coated (DNPH) sorbent for formaldehyde sampling and sodium hydroxide solutions for measurement of hexavalent chromium. Reagent blanks also include solvents used during instrumental analysis.

Check For: The trial burn QAPP reviewer should check for the following information:

- ❑ Whether the trial burn QAPP specifies a reagent blank for all field sample recovery efforts
- ❑ Whether the trial burn QAPP specifies reagent blanks for all laboratory sample preparation and recovery efforts
- ❑ Whether any special reagents are used in the trial burn and whether reagent blanks have been specified for them
- ❑ Whether the trial burn QAPP specifies reagent blanks from the same lot of solvent or reagent
- ❑ Whether all of the reagent blanks being analyzed by the same analytical method(s) are used to quantify samples requiring the reagents

Example Situation: In reviewing the facility's trial burn QAPP, Clark notes that DNPH is prepared as a saturated solution in 1 normal (N) HCl for use formaldehyde emissions samples analysis. Analysis is conducted by using high performance liquid chromatography, with methanol, acetonitrile, and water as reagents. Analysis of the DNPH/HCl solution is not planned prior to using the reagent for sampling.

Example Action: Analysis of the reagent solution is necessary before it is used in the field. Clark asks that the facility revise the trial burn QAPP to specify this requirement.

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7.1.3 Reviewing Procedures for Field Blanks

Regulations: 40 CFR Part 60, Appendix A
40 CFR 270.62(b)(2)(iii)

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

Explanation: Field blanks are used to determine whether chemicals and sampling media have been contaminated during the process of (1) shipping chemicals and sampling media to the field, (2) putting them into and taking them out of the sampling train (which does not subject the media to the gaseous matrix being sampled), and (3) shipping the media to the laboratory. Field blanks typically include chemicals and all of the sampling media (filters, sorbents, specialized reagents) used during the sampling program. For example, for U.S. EPA Method 0010, a clean filter and a clean XAD-2® module are put into the U.S. EPA Method 0010 sampling train and removed without taking a sample; the filter and the XAD-2® module are then returned to the laboratory to be prepared and analyzed with field samples. For the U.S. EPA Method 0010 sampling train, reagent water can be poured into the impingers to serve as a condensate field blank. Field blanks are taken from the same lot of chemical or material used during field sampling, and these blanks are usually taken after samples have been recovered. Field blank data are useful for tracing the source of contaminated samples.

Check For: The trial burn QAPP reviewer should check for the following:

- ❑ Whether the plan specifies collection of field blanks for all field sampling methods
- ❑ Whether the plan specifies a field blank collection frequency
- ❑ Whether there are any special reagents used in the TBP, that require field blanks
- ❑ Whether the TBP specified field blanks from the same lot of solvent or reagent
- ❑ Whether all of the field blanks being analyzed by the same analytical methods are used to quantify samples requiring reagents
- ❑ Whether the trial burn QAPP specifies how field blank data will be used to interpret sampling data

Example Situation: In reviewing the facility's trial burn QAPP and TBP, Lois notes that after sample collection (which will be conducted using a U.S. EPA Method 0010 train), a field blank is planned for the filter and sorbent. The TBP and trial burn QAPP propose to archive the field blank and analyze only the field blank sample if field samples show contamination.

Example Action: Although this approach will lower costs, Lois determines that the entire project may be compromised or delayed if the field blank and other QC samples are not included as if they were in the normal queue for sample analysis. Lois advises the facility that if timing is critical for permit issuance, field blanks should be analyzed in the same timeframe as source samples, and the trial burn QAPP should be revised accordingly.

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7.1.4 Reviewing Procedures for Trip Blanks

Regulations: 40 CFR Part 60, Appendix A
40 CFR 270.62(b)(2)(iii)

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

Explanation: Trip blanks are used to determine whether chemicals and sampling media have been contaminated during the process of shipping them to and from the site. Trip blanks typically include chemicals and sampling media (filters, sorbents and specialized reagents) used during the sampling program. Trip blanks should be taken to parallel field blanks, with one important difference: trip blanks are not opened or used on site and are not exposed to potential contamination from the site. For example, a trip blank for U.S. EPA Method 0010 sampling may be taken from an unused (and, therefore, unopened) package of filters and unused (and, therefore, unopened) XAD-2® sorbent modules.

Check For: The trial burn QAPP reviewer should check for the following information:

- ❑ Whether the plan specifies collection of a trip blank for all field sampling methods
- ❑ Whether any special reagents used in the TBP require trip blanks
- ❑ Whether the TBP specifies trip blanks from the same lot of solvent or reagent
- ❑ Whether all of the trip blanks being analyzed by the same analytical methods are used to quantify samples requiring reagents
- ❑ Whether the trial burn QAPP specifies how trip blank data will be used to interpret sampling data

Example Situation: In reviewing the facility's trial burn QAPP, Clark notes that a trip blank is not planned for the Tenax® tubes used for sampling in U.S. EPA Method 0031; the field test plan and trial burn QAPP propose to use the field blank for the trip blank and the field blank.

Example Action: Although this approach will lower costs, Clark realizes that if the field blank proves to be contaminated, and the project requires resampling, the sampling contractor will not know whether (1) there was a problem with the way in which the tubes were shipped, or (2) there was contamination caused by the on-site handling of the samples. The sampling contractor is at risk of being unable to resolve the contamination problem. Clark asks that the facility revise the trial burn QAPP to include collection and analysis of the trip blank so that

contamination problems can be tracked to their potential source and eliminated in subsequent testing.

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7.1.5 Reviewing Procedures for Hexavalent Chromium Train Stability Samples

Regulations: 40 CFR Part 60, Appendix A
40 CFR Part 270.62(b)(2)(iii)

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

Explanation: Hexavalent chromium train stability samples consist of field spikes that are analyzed to demonstrate that native hexavalent chromium, when collected in the potassium hydroxide impinger solution matrix and preserved in accordance with U.S. EPA Method 0061, is stable between sample collection and subsequent sample analysis. Aliquots of actual hexavalent chromium field samples are spiked, at the time of sample recovery, with the hexavalent chromium spiking standard that the sampling team will prepare in the field. In addition to train stability samples, one aliquot of impinger samples will be analyzed without any spike to determine the native concentration of hexavalent chromium in each train sample during each run. Hexavalent chromium train stability samples are prepared and analyzed in lieu of applying the 24-hour sample holding time to the hexavalent chromium field samples, as specified by the method. Acceptable hexavalent chromium recovery from the train stability samples indicates that the hexavalent chromium trapped in the potassium hydroxide matrix remains in that oxidation state through analysis and verifies that the matrix sample concentrations are representative of true hexavalent chromium concentrations in the stack gas.

Check For: The trial burn QAPP reviewer should check for the following information:

- ❑ Whether the plan specifies collection of one or more hexavalent chromium train stability samples
- ❑ Whether a hexavalent chromium train stability sample from the same lot of reagent has been specified in the trial burn QAPP
- ❑ Whether the hexavalent chromium train stability sample is being analyzed by the same analytical methods used to quantify samples requiring the same reagents
- ❑ Whether the trial burn QAPP specifies how the data for hexavalent chromium train stability samples will be used to interpret sampling data

Example Situation: In reviewing the facility's trial burn QAPP (which is based on an older version of U.S. EPA Method 0061), Lois notes that it does not specify use of a hexavalent chromium train stability sample. Field samples are shipped to the laboratory by overnight carrier but are misplaced and delayed in shipment for 3 days. When analysis is conducted, observed levels of hexavalent chromium in the field samples are about 10 percent of expected levels.

Example Action: Lois realizes that without one or more hexavalent chromium train stability samples to verify the stability of hexavalent chromium in the potassium hydroxide impinger solution, it is impossible to evaluate whether the relatively low levels observed for hexavalent chromium in the field samples are correct values or are low because of losses resulting from the shipping delay. Lois asks that the facility revise the trial burn QAPP to include collection of a hexavalent chromium train stability sample.

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7.1.6 Reviewing Procedures for Formaldehyde Field Spikes

Regulations: 40 CFR Part 60, Appendix A
40 CFR Part 270.62(b)(2)(iii)

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

Explanation: A formaldehyde field spike is conducted in the field by introducing field spike standard into an impinger containing DNPH solution. Standard impinger recovery procedures for the U.S. EPA Method 0011 sampling train are followed, and the field spike sample is returned to the laboratory for analysis with the field samples. The field spike is used as a check on field handling and recovery procedures. An aliquot of the field spike standard is retained in the laboratory for derivatization and comparative analysis.

Check For: The trial burn QAPP reviewer should check for the following information:

- ❑ Whether the trial burn QAPP specifies collection of one or more formaldehyde field spikes for the field sampling effort
- ❑ Whether the trial burn QAPP describes preparation of the field spike standard
- ❑ Whether all field spike samples being analyzed by the same analytical methods are used to quantify field samples
- ❑ Whether the trial burn QAPP specifies how field spike data will be used to interpret sampling data
- ❑ Whether the trial burn QAPP specifies retaining an aliquot of the field spike standard in the laboratory for comparative analysis

Example Situation: In reviewing the facility's trial burn QAPP, Clark notes that it discusses preparation of a field spike standard and describes procedures for preparation of a field spike sample in the laboratory after completion of the field sampling effort.

Example Action: The field spike standard sample should be prepared in the field during field sampling activity; because the field spike is intended to serve as a check on field handling and recovery procedures. Clark asks that the facility revise the trial burn QAPP to reflect this correction.

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7.2 HOW TO REVIEW WASTE FEED AND PROCESS SAMPLING PROCEDURES

Regulations: 40 CFR Part 60, Appendix A
40 CFR Part 270.62(b)(2)(iii)

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

Explanation: The wide diversity of waste feeds, process samples, and trial burn experimental designs precludes establishing firm QA/QC procedures that apply to all situations. The general guide for the trial burn QAPP is to establish written procedures and ensure that those written procedures are followed. The basic objective of sampling is to obtain a representative sample; that is, one that exhibits the average properties of the medium being sampled. This sample must be collected over a period of time that is sufficient to represent the time-dependent variability inherent in the relatively continuous process of combustion.

The physical state of each type of medium must be sampled—liquid, solid, slurry, homogeneous, or heterogeneous. The composition of the media to be sampled should be specified because sample composition is used to determine the amount of sample needed to produce a sufficient sample size to exceed the detection limit of the analyte. The total volume of waste feed or process sample should be specified to determine whether a sample point is appropriate and whether sample size is adequate. Frequently, a composite sample of the waste feed is necessary. Explicit directions for collection of the components of the composite sample (grab samples) and directions for making the composite sample should be presented.

Most TBPs and QAPPs rely on American Society for Testing and Materials (ASTM) analytical procedures for waste feed and process samples, or the procedures discussed in U.S. EPA 1984 Sampling and Analysis Methods for Hazardous Waste Combustion. These procedures are too general for use on a trial burn; a specific set of instructions should be developed for waste feed and process samples.

Check For: The trial burn QAPP reviewer should check for the following information:

- ❑ Whether the sampling design addresses production of a representative sample
- ❑ Specific written procedures for sampling waste feed and process samples
- ❑ Step-by-step procedures for generating QC samples
- ❑ Additional information and explanation on QC samples for nonstandard media

- ❑ Clean instruction for collecting grab samples
- ❑ Clear instructions for preparing a composite sample, if a composite is required
- ❑ Clear instructions for handling unusual situations because waste feed and process samples may be too heterogeneous or viscous to flow
- ❑ Specific instructions for waste feed and process samples analysis

Example Situation: In reviewing the facility's trial burn QAPP, Lois notes that a table in the trial burn QAPP specifies only that waste feed samples should be collected and analyzed, and lists the number of samples that should be collected.

Example Action: Lois asks that the facility revise the trial burn QAPP to present detailed procedures for sample collection to ensure that the samples will be representative. Sampling procedures should specify the exact location for collecting a waste feed or process sample, including instructions for ensuring that the tap is providing homogeneous liquid. If composites are being made in the field, detailed instructions should address the number and frequency of grab samples over the sampling period and the amount and manner of making the composite.

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7.3 HOW TO REVIEW STACK GAS SAMPLING PROCEDURES

Regulations: 40 CFR Part 60, Appendix A
40 CFR Part 270.62(b)(2)(iii)

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

Explanation: The TBP should specify stack gas procedures to be used in the trial burn and during continued operation of the facility. Sampling procedures should include sampling methods, sampling locations, sampling frequencies, sampling equipment, and data recording methods. All forms for recording sampling data should be included.

The trial burn QAPP should describe sampling procedures, with particular attention to any anticipated deviations from referenced stack gas sampling methods. The trial burn QAPP should describe all of the elements of sample traceability, including sample labeling, preservation, packing, shipping, and laboratory receiving and storage procedures. It should define calibration procedures for all monitoring and sampling equipment to be calibrated. The trial burn QAPP should describe analytical procedures. All procedures for the reduction of monitoring, sampling, and analytical data collected should be specified. All internal QC methods should be described for monitoring, sampling, and analysis activities. The trial burn QAPP should also describe the types of performance and system audits that will be conducted and identify the responsible individuals. It should address the frequency and types of scheduled preventive maintenance procedures used for process monitoring, sampling, and analytical equipment and instrumentation. It should identify the proposed MDLs for all sampling and analytical methods; any available information to support the expected emission rates should also be provided. It should also describe specific procedures that will be used to routinely assess measurement data precision and accuracy, including equations for calculating precision and accuracy.

The following subsections describe detailed procedures for reviewing stack gas sampling:

- ❑ Velocity and traverse point selection (Section 7.3.1).
- ❑ Determining oxygen and carbon dioxide concentrations (Section 7.3.2)
- ❑ Volatile organic sampling train procedures (Section 7.3.3)
- ❑ Modified U.S. EPA Method 5 sampling train procedure (Section 7.3.4)

Check For: When reviewing these sections, the trial burn QAPP reviewer should determine:

- ❑ Whether adequate information has been provided to support the proposed emission rates
- ❑ Whether the description of sampling and analytical methods includes applicable analytes and their MDLs
- ❑ Whether the correct analytes are assigned to the correct sampling and analytical methodology
- ❑ Whether sampling and analytical methods are included as actual copies or included by reference to cover all aspects of sampling and analysis
- ❑ Whether any deviations from, or modifications to, cited methods are clearly identified and thoroughly documented
- ❑ Whether detailed procedures are provided for any field or laboratory activities that are not covered directly by a referenced method
- ❑ Whether documentation and record keeping forms are shown or clearly described
- ❑ Whether procedures are specified for validating the analytical data

Example Situation: In reviewing the facility's trial burn QAPP, Clark notes that the description of sampling methods reflects VOST as the sampling method of choice for SVOCs, and a lengthy table of analytes with MDLs is provided.

Example Action: Clark realizes that the assignment of sampling methodology is in error: the VOST methodology is applicable only to a carefully selected group of VOCs. Clark asks the facility to revise the trial burn QAPP to reflect an appropriate SVOC sampling method.

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7.3.1 Reviewing Velocity and Traverse Point Selection

Regulations: 40 CFR Part 60, Appendix A
40 CFR Part 270.62(b)(2)(iii)

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

Explanation: QA procedures required for sample site selection and velocity traverses consist of ensuring that required operations have been properly carried out and that equipment has been calibrated. These operations cannot be checked by a performance audit, but must be controlled by strict adherence to specified procedures. For use in representative measurement of pollutant emissions and total volumetric flow rate from a stationary source, a measurement site where the effluent stream is flowing in a known direction is selected, and the cross section of the stack is divided into a number of equal areas. A traverse point is then located within each of these equal areas.

Applicable methods for determinating velocity and traverse points are U.S. EPA Methods 1 and 2 (40 CFR Part 60 Appendix A).

Check For: The trial burn QAPP reviewer should check for the following information:

- ❑ Whether the appropriate U.S. EPA method has been selected in the trial burn QAPP
  - ❒ U.S. EPA Method 1 applies to flowing gas streams in ducts, stacks, and flues
  - ❒ U.S. EPA Method 1A applies to stacks or ducts less than about 0.30 meter in diameter
  - ❒ U.S. EPA Method 2 applies to determination of stack gas velocity and volumetric flow rate
  - ❒ U.S. EPA Method 2A addresses the direct measurement of gas volumes through pipes and small ducts
  - ❒ U.S. EPA Method 2B applies to the determination of exhaust gas volume flow rate from gasoline vapor incinerators
  - ❒ U.S. EPA Method 2C applies to the determination of stack gas velocity and volumetric flow rate in small stacks or ducts
  - ❒ U.S. EPA Method 2D applies to the measurement of gas volumetric flow rates in small pipes and ducts
  - ❒ U.S. EPA Method 2E applies to the determination of landfill gas
- ❑ Whether the proper number of sampling points have been selected
- ❑ Whether sampling ports are properly located, as determined from a site presurvey

- ❑ Whether calibration of pitot tubes is against a National Institute for Standards and Technology (NIST) standard pitot tube or the design specification proposed

- ❑ Whether the stack temperature sensor will be compared to an ASTM reference thermometer

Example Situation: In reviewing the facility's trial burn QAPP, Lois notes that the sampling location at Facility X is specified as a large duct at ground level for ease of access, with the sampling port located at a bend in the duct.

Example Action: U.S. EPA Method 1 for sample and velocity traverses for stationary sources cannot be used when the measurement site is less than 2 stack or duct diameters downstream, or less than half the diameter upstream, from a flow disturbance, such as a bend in the duct. Lois asks that the facility revise the trial burn QAPP to reflect the duct sampling port location to be in accordance with U.S. EPA Method 1 parameters.

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7.3.2 Reviewing Procedures For Determining Oxygen and Carbon Dioxide Concentrations

Regulations: 40 CFR Part 60, Appendix A
40 CFR Part 270.62(b)(2)(iii)

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

Explanation: QC procedures for molecular weight, CO_2, and O_2 analysis are included in U.S. EPA Methods 3 and 3A (40 CFR Part 60, Appendix A). QA procedures consist of ensuring that the procedure has been accurately followed and documented. The review should determine that the proper method was used, that required leak checks were completed, and that the sampling rate was constant (± 10 percent). A performance audit should be conducted with a cylinder gas of known concentration.

Check For: The trial burn QAPP reviewer should check for the following information:

- ❑ Whether the appropriate method has been selected in the trial burn QAPP
  - U.S. EPA Method 3 addresses stack gas analysis for the determination of dry molecular weight
  - U.S. EPA Method 3A pertains to the determination of CO, O_2 and CO_2 concentrations in emissions from stationary sources (instrument analyzer procedure)
- ❑ Whether compounds other than CO_2, O_2, CO, and nitrogen are expected in high concentrations. If so, U.S. EPA Method 3 is not applicable, and U.S. EPA Method 3A must be used
- ❑ Whether appropriate calibration gases are available for the instrumental system being used for the analysis
- ❑ Whether the trial burn QAPP specifies appropriate validation procedures

Example Situation: Lois notes that the trial burn QAPP states that U.S. EPA Method 3 will be used to determine O_2 and CO_2 using the facility continuous emissions monitoring (CEMS). However, there is no discussion in the trial burn QAPP regarding CEMS calibration procedures system.

Example Action: CEMS calibration requirements for U.S. EPA Method 3 and 3A are very strict. As part of the Notice of Deficiency (NOD), Lois requires the facility to use U.S. EPA protocol gases to calibrate and verify calibration of the CEMS. She also requires this information to be presented as part of the trial burn QAPP.

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7.3.3 Reviewing Volatile Organic Sampling Train Procedures

Regulations: 40 CFR Part 60, Appendix A
40 CFR Part 270.62(b)(2)(iii)

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

Explanation: The trial burn QAPP must propose stack gas emission sampling using the VOST method to be approved. The most recent sampling method description for VOST is available in U.S. EPA 1996 Method 0030 (two-sorbent-tube sampling train) and Method 0031 (three-sorbent-tube sampling train). The most recent analytical method descriptions for VOST analysis are available in U.S. EPA Methods 5041 and 5041A.

Note that a common misconception is that U.S. EPA Methods 8240A or 8260 are appropriate for VOST analysis. Several target compounds listed for these methods are inappropriate VOST analytes, and only U.S. EPA Methods 5041 or 5041A should be specified.

The trial burn QAPP must describe the sampling train and sampling procedure in detail, including any options in the method and any deviations from the method. For example, the standard sampling rate for the VOST method is 1 liter per minute for 20 minutes for a sample size of 20 liters. Method detection limits are based on a sample size of 20 liters. If a slow VOST option is exercised, 0.25 liters per minute for 20 minutes, the total sample size will be 5 liters, and the effect on method detection limits should be noted in the trial burn QAPP.

The VOST analytical method is based on the quantitative thermal desorption of VOCs from the Tenax® and Tenax®/charcoal traps (2 trap method) or Anasorb® trap (3 trap method) with analysis by purge-and-trap gas chromatography and mass spectrometry (GC/MS).

Breakthrough of the sorbent is a major concern in the VOST methodology. Sorbent breakthrough can be determined definitively only upon analysis of the exposed sorbent tubes. VOST samples are considered valid (that is, no breakthrough) if the back trap contains no more than 30 percent of the quantity collected on the front sorbent tube, unless the quantity of sample on the last trap is less than 75 nanograms. If sorbent breakthrough occurred in the field, sampling runs are invalidated. Any analytical results obtained from sorbent tubes in which breakthrough has occurred will represent a minimum value (that is, the true amount of analytes present in the stationary source may be far higher than the value determined upon analysis.)

Selection of appropriate analytes for application of the VOST methodology is another area of concern. VOST sampling methods specify temperature limits for

analytes. The sampling methodology cannot be validly applied to analytes above the specified temperature limits because quantitative sampling will not be assured. Further limitations are imposed on applicable analytes by the purging of VOST samples through water in the analytical procedure. Polar water-soluble compounds will not be purged quantitatively from the water, and analytical results will, therefore, represent a minimum value for these analytes (that is, the true amount of the polar water-soluble analyte present in the stationary source may be far higher than the value determined upon analysis).

Check For:

- ❑ The TBP and the trial burn QAPP should state clearly how many pairs of sorbent tubes will be collected for each run. Actual sampling time (total of all tube pairs) should add to at least 1 hour.
- ❑ The trial burn QAPP should discuss the collection of field, laboratory, and trip blanks, specifying the procedure and the frequency.
- ❑ The trial burn QAPP should specify the collection of an appropriate number of field blanks.
- ❑ The trial burn QAPP should specify procedures for determining whether breakthrough has occurred. These procedures may include separate analyses of all of the tubes or separate analyses of a percentage of the tubes.
- ❑ The trial burn QAPP should incorporate procedures for verifying that breakthrough of VOST tubes has not occurred.
- ❑ The trial burn QAPP should (1) describe sorbent tubes that will be used, (2) describe the method of preparing and cleaning the tubes, (3) discuss the purchase of commercially prepared and precleaned sorbent tubes, (4) describe the storage and shipment of VOST tubes, and (5) describe the methodology for verifying sorbent tube cleanliness.
- ❑ The trial burn QAPP should specify the collection of an appropriate number of trip blanks.
- ❑ The trial burn QAPP should specify how blank results will be used to qualify data.
- ❑ The trial burn QAPP should specify appropriate analytical instrument calibration procedures.

Many laboratories use the U.S. EPA Method 8240/8260 standard to calibrate the analytical system for VOST because the standards are commercially available. However, not all of the organic compounds in these commercial standard solutions are appropriate VOST analytes, and quantitative results should not be reported for compounds that are not appropriate VOST analytes.

- ❑ A sample quantitation limit should be available for all proposed VOST analytes or the trial burn QAPP specifies a procedure for determining the sample quantitation limit.

- ❑ The trial burn QAPP should discuss the analysis of the VOST condensate.

Example Situation: In reviewing the facility's trial burn QAPP, Lois notes that the trial burn QAPP lists analytes for the VOST method, including ethylbenzene, *m*-, *p*-, and *o*-xylene, together with sample quantitation limits that have been determined by U.S. EPA Method 8240 analysis.

Example Action: Lois realizes that the listed analytes are significantly above the upper boiling point temperature limit specified for the VOST method and cannot be sampled quantitatively by the VOST methodology. Any numerical values reported from VOST analysis of these analytes would represent a minimum value (that is, the true value for these compounds in the stationary source could be far higher than the reported value). Lois asks that the facility revise the trial burn QAPP to include the appropriate VOST analytes.

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7.3.4 Reviewing Modified U.S. EPA Method 5 Sampling Train Procedures

Regulations: 40 CFR Part 60, Appendix A
40 CFR Part 270.62(b)(2)(iii)

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

Explanation: The trial burn QAPP must propose PIC sampling using the U.S. EPA Method 0010 train to be approved. The most recent sampling method description can be found in the December 1996 version of SW-846 as Method 0010. Sample preparation is addressed by U.S. EPA Method 3542. Because the product of the U.S. EPA Method 3542 sample preparation procedures is a liquid extract containing SVOCs of interest, the analytical procedures of U.S. EPA Method 8270 are usually used for the analysis of these samples.

In field sampling procedures, the temperature of the gas entering the sorbent trap must be monitored to ensure that an upper limit of 20 (degrees Celsius) °C is not exceeded. The trial burn QAPP must specify that the temperature is monitored. It must also specify appropriate calibration procedures for testing instrumentation.

U.S. EPA Method 3542 sample preparation procedures produce three matrixes from the U.S. EPA Method 0010 sampling train:

- The filter and front half rinse of the U.S. EPA Method 0010 sampling train yields a 5-milliliter (mL) methylene chloride extract for analysis.
- The XAD-2® sorbent module and corresponding train rinses yield a 5-mL methylene chloride extract for analysis.
- The condensate and condensate rinse yield a 5-mL methylene chloride extract for analysis.

Analytical values from the three-train media must be combined to yield an analytical value for the sampling train. The three individual analytical values show the distribution of the analyte among the train media.

Detailed procedures for reviewing MM5 trains are presented in the following subsections:

- ❑ SVOC, dioxins, and furan (Section 7.3.4.1).
- ❑ Polynuclear aromatic hydrocarbons (PAH) (Section 7.3.4.2).

- ❑ Volatile, semivolatiles, and nonvolatile unspeciated mass (Section 7.3.4.3).

Check For: During the review of these procedures, the trial burn QAPP reviewer should determine:

- ❑ Whether the required sampling volume has been collected
- ❑ Whether sampling points are clearly defined
- ❑ Whether the trial burn QAPP specifies how XAD-2® will be cleaned and how the cleanliness of the XAD-2® will be verified
- ❑ Whether the trial burn QAPP specifies appropriate analytical instrument calibration procedures
- ❑ Whether a MDL is available for all proposed analytes or whether the trial burn QAPP specifies a procedure for determining the MDL
- ❑ Whether the trial burn QAPP discusses appropriate field and laboratory QC samples

Because the standards are commercially available, many laboratories use the U.S. EPA Method 8270 standard to calibrate the analytical system. However, not all of the organic compounds present in these commercial standard solutions are appropriate analytes, and quantitative results should not be reported for compounds that are not appropriate analytes.

Example Situation: In reviewing the facility's trial burn QAPP, Clark notes that routine U.S. EPA Method 8270 analysis will be conducted by using a 1-mL extract generated from the combination of all of the U.S. EPA Method 0010 train media.

Example Action: The standard methodology for sample preparation from the U.S. EPA Method 0010 sampling train requires preparation and analysis of three separate 5-mL extracts from the different media of the sampling train. Clark realizes that preparation and analysis of a 1-mL extract representing the combined U.S. EPA Method 0010 sampling train media is not a routine sample preparation and analysis. Clark asks that the facility revise the trial burn QAPP to reflect detailed procedures for preparation, combination, and concentration of the extracts to generate a 1-mL final volume.

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7.3.4.1 Semivolatile Organic Compounds, Dioxins, and Furan

Regulations: 40 CFR Part 60, Appendix A
40 CFR Part 270.62(b)(2)(iii)

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

Explanation: Sampling for SVOCs, dioxins, and furan, is required to collect information for the risk assessment. U.S. EPA Method 0010 states that SVOCs have a boiling point above 100°C. Because polychlorinated dibenzopdioxin/polychlorinated dibenzofuran (PCDD/PCDF) all have boiling points above 100°C, these compounds fall under the definition of SVOCs. However, U.S. EPA Method 23A is specified as the sampling method for dioxins and furans. U.S. EPA Method 23A is similar to U.S. EPA Method 0010; physically, the same sampling train is used. However, U.S. EPA Method 23A requires special treatment of the XAD-2® sorbent module: (1) isotopically labeled dioxins and furans are spiked on the XAD-2® before the sampling module is used in the field, (2) U.S. EPA Method 3542 is not applicable as a sample preparation method for dioxins and furans, and (3) analytical techniques for dioxins and furans require high-resolution GC, coupled with high-resolution MS. U.S. EPA Method 23A also specifies field recovery procedures that are different from the procedures specified for U.S. EPA Method 0010.

In addition, U.S. EPA Method 23A requires a highly specialized cleanup procedure for preparation of samples from stationary sources. It is possible, while conducting this cleanup procedure, to perform a separation procedure for SVOCs (or for some subset of the U.S. EPA Method 8270 analyte list). However, analysis of one field sample for SVOCs and dioxins and furans is not a routine laboratory procedure. The trial burn QAPP must discuss, in detail, (1) the procedure that the laboratory proposes to follow, and (2) how division of the sample will effect the SQL for SVOCs and dioxins and furans. Because there is no numbered U.S. EPA method for such a combined sample, U.S. EPA Method 23A field procedures must be followed, and any laboratory conducting analysis for both classes of compounds from one field sample will have its own unique procedures, which must be specified in the trial burn QAPP so that they can be reviewed for appropriateness.

Check For: The trial burn QAPP reviewer should check for the following information:

- ❑ Whether the appropriate sampling methodology has been determined
- ❑ Whether the sample preparation procedure is described in detail
- ❑ Whether the sample preparation procedure proposed by the laboratory is appropriate for both groups of organic compounds

- ❑ Whether the trial burn QAPP specifies appropriate analytical instrument calibration procedures for two different analyses
- ❑ Whether MDL is available for all proposed analytes using the procedure proposed by the laboratory or the trial burn QAPP specifies a procedure for determining the MDL
- ❑ Whether the trial burn QAPP discusses appropriate field and laboratory QC samples for both analyses

Example Situation: In reviewing the facility's trial burn QAPP, Lois notes that the trial burn QAPP states that routine U.S. EPA Method 8270 analysis will be conducted for SVOCs, and U.S. EPA Method 8290 will be used for dioxins and furans.

Example Action: Lois realizes that attempting to prepare and analyze the same field sample for SVOCs and dioxins and furans represents a savings in the field, because fewer samples are required. However, the sample may be invalid for both groups of analytes if the correct field procedures are not followed, and laboratory sample preparation procedures are not carefully followed. Lois asks that the facility revise the trial burn QAPP to discuss, in detail, the sample preparation procedure for the extract that will be analyzed for SVOCs and the extract that will be analyzed for dioxins and furans. The revisions should document any deviations from the standard U.S. EPA Method 8270 analysis for SVOCs and the standard U.S. EPA Method 8290 analysis for dioxins and furans.

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7.3.4.2 Polynuclear Aromatic Hydrocarbons

Regulations: 40 CFR Part 60, Appendix A
40 CFR Part 270.62(b)(2)(iii)

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

Explanation: Sampling for several PAHs is necessary to collect information for the risk assessment. U.S. EPA Method 0010 states that SVOCs have a boiling point above 100°C. Because PAHs have boiling points above 100°C, these compounds fall under the definition of SVOCs. However, the category of PAHs is extremely large, encompassing all organic compounds having more than one benzene ring. Because all PAHs are SVOCs, U.S. EPA Method 0010 is appropriate as a sampling method, and all of the considerations for reviewing MM5 sampling train procedures apply.

Several analytical procedures could be used for PAH samples generated at a stationary source. Analytical procedures may involve the use of GC (U.S. EPA Method 8100), high performance liquid chromatography (U.S. EPA Method 8310), GC coupled with low-resolution MS (U.S. EPA Method 8270), or high-resolution GC coupled with high-resolution MS (no numbered U.S. EPA method). Each analytical method has different sample preparation procedures and a different list of applicable analytes. The trial burn QAPP must specify the analytical and the sample preparation methodology, and the analyte list. If the methodology that will be used does not correspond to a numbered U.S. EPA method, the trial burn QAPP must describe methodology in detail.

Check For: The trial burn QAPP reviewer should check for the following information:

- ❑ Whether the appropriate analytical methodology has been determined
- ❑ Whether the trial burn QAPP describes the sample preparation procedure in detail
- ❑ Whether the trial burn QAPP describes appropriate analytical instrument calibration procedures for the applicable analytical instrumentation
- ❑ Whether a MDL is available for all proposed analytes using the procedure proposed by the laboratory or whether the trial burn QAPP specifies a procedure for determining the MDL
- ❑ Whether the trial burn QAPP discusses appropriate field and laboratory QC samples

Example Situation: In reviewing the facility's trial burn QAPP, Clark notes that PAHs will be analyzed by high-resolution GC coupled with high-resolution MS.

Example Action: Clark determines that a mere statement of the analytical methodology to be used is insufficient. Clark asks that the facility revise the trial burn QAPP to specify in detail any sorbent pre-spiking procedures and the compounds that will be used, and any instrument calibration and analytical procedures that will be employed.

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7.3.4.3 Volatile, Semivolatile, and Nonvolatile Unspeciated Mass

Regulations: 40 CFR Part 60, Appendix A
40 CFR Part 270.62(b)(2)(iii)

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

Explanation: Revisions to the guidance for conducting risk assessments at RCRA HWCUs have recently included the requirements to (1) conduct TO analysis and (2) measure the portion of organic emissions that have not been specifically identified and quantified by other methods. Knowledge of the amounts of previously uncharacterized organic material will result in risk assessment estimates that are more accurate.

Three specific boiling point and vapor pressure classes must be measured: light hydrocarbons and VOCs (boiling point <100°C), SVOCs (boiling point >100°C and <300°C), and nonvolatile organic compounds (boiling point >300°C). Collectively, the sum of these three fractions are known as TO. Procedures for measuring these fractions are presented in the U.S. EPA 1996 Guidance for Total Organics.

Volatile unspeciated mass is collected by using U.S. EPA Method 0040 and analyzed by using field GC. Condensate is analyzed by using purge-and-trap GC. The guidance for determination of TO describes several options for measurement of volatile unspeciated mass; the trial burn QAPP should specify options selected and the collection of appropriate QC samples.

A separate sample for the semivolatile and nonvolatile unspeciated mass is collected by using the U.S. EPA Method 0010 sampling train and following standard sample collection procedures. For an accurate determination of unspeciated mass, neither surrogate compounds nor U.S. EPA Method 8270 quantitation standards should be added to the sample. The semivolatile unspeciated mass should be determined by GC analysis (GC/MS is an option) in accordance with the TO method procedures. The nonvolatile unspeciated mass is determined gravimetrically (microgravimetric procedures are an option).

The trial burn QAPP should describe specific sampling and analytical methods to be used in the determination of unspeciated organic mass.

Check For: The trial burn QAPP reviewer should check for the following information:

- ❑ Whether the trial burn QAPP specifies procedures for the sampling and analysis of the volatile, semivolatile, and nonvolatile components

- ❑ Whether the trial burn QAPP discusses appropriate field and laboratory QC samples
- ❑ Whether the trial burn QAPP describes appropriate analytical instrument calibration procedures for the applicable analytical instrumentation
- ❑ Whether the trial burn QAPP discusses calculation procedures that will produce the final result in correct reporting units

Example Situation: In reviewing the facility's trial burn QAPP, Lois notes that the same field blank will be used for two types of samples because semivolatile and nonvolatile unspeciated mass samples are collected by using the U.S. EPA Method 0010 sampling train, which is also used to collect samples for VOC.

Example Action: Lois realizes that if the only analysis conducted is the speciated SVOC analysis, valid blank data for the unspeciated application will not be generated. Lois asks that the facility revise the trial burn QAPP to specify how the field blank will be analyzed to produce valid blank data for speciated SVOCs and unspeciated mass.

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7.3.5 Preventing Saturation of Resin Tubes

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

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

Explanation: During the trial burn, significant quantities of POHC and other organic constituents may be spiked into the waste feeds. In the absence of complete destruction of these compounds, there is a potential for substantial fractions of the POHC and other organic constituents to be emitted from the stack. If the concentrations of POHC and other organic constituents in the stack gases are high enough, the resin tubes in the VOST and U.S. EPA Method 0010 sampling trains may become saturated. In this event, the samples will be biased low and may also be too concentrated for laboratory analysis (that is, they may "flood" the analytical instruments).

The prevention of resin tube saturation is accomplished before the trial burn as follows:

- The injection rate of POHC is proposed.
- The emission rate of the POHC, assuming 99.99 percent DRE, is calculated.
- The concentration of emitted POHC in the stack gas is calculated based on proposed combustion gas flow rates for the trial burn.
- The mass of POHC collected in the sampling train resin tubes is calculated based on proposed sampling rates and frequencies.
- The analytical laboratory is consulted to assure that the mass of POHC collected in the resin tubes is sufficient for analysis, yet low enough to prevent saturation.
- Adjustments to the proposed POHC injection rate are made based on the consultation with the laboratory.

Another way to ensure that resin tube saturation will not occur is to conduct a "mini-burn" before the trial burn. During the "mini-burn," POHC injection and sampling procedures will be the same as those proposed for the trial burn. If resin tube saturation occurs during the "mini-burn," the POHC injection rate will be adjusted to prevent reoccurrence during the trial burn.

Check For:

- ❑ Calculations of POHC emission rates and concentrations in the stack gas

- ❑ Calculations of POHC mass collected in resin tubes
- ❑ Documentation that the analytical laboratory has been consulted to determine that instrument flooding will not occur
- ❑ Provisions for conducting a "mini-burn" in advance of the trial burn.

Example Situation: Clark reviews a trial burn plan and QAPP. The trial burn plan calls for spiking with the POHC chlorobenzene. He notes that the calculations completed by the facility operator indicate that the Tenax® resin tubes in the VOST sampling train will collect 5,000 nanograms of chlorobenzene. Checking with the analytical laboratory, Clark is informed that any mass above 1,000 nanograms of chlorobenzene will flood the GC/MS in the laboratory and cause the analytical data to be "qualified."

Example Action: Clark contacts the trial burn coordinator and suggests that the facility operator adjust the chlorobenzene injection rate downward and repeat the calculations to assure that the Tenax® resin tubes will collect less than 1,000 nanograms of chlorobenzene.

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7.3.6 Planning for Analytical Nondetects

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

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

Explanation: Often in trial burns, the concentrations of compounds of concern in the stack gases are present below levels that can be reliably quantitated using the sampling and analysis methods prescribed in the trial burn plan and QAPP. In such cases, the laboratory will report analytical results as "below detection limits," with that term generically referring to the MDL, the SQL, or the estimated detection limit (EDL).

The U.S. EPA Region 6 risk protocol provides guidance on translating results reported as "below detection limits" into risk assessment inputs. Given that the MDL, SQL, and EDL are derived differently, the procedure used to translate "below detection limits" results into risk assessment inputs can have a significant effect on imputed risk. In rare cases, results reported as "below detection limits" may correlate with significant risk (incremental cancer risk $>10^{-5}$ or HI>1). Accordingly, when conducting the risk assessment, the treatment of nondetects must be afforded careful consideration.

There are several classes of quantitation and detection limits that can be used. The MDL is the minimum concentration that can be measured at the 99 percent confidence limit and is derived statistically. There is the SQL that can be 5 to 10 times higher than the MDL and is matrix dependent. Many analytical laboratories use a procedure to produce an EDL. It entails looking at the noise in the analytical instrument in the area where the analyte would be expected. The laboratories will convert the noise to an area and multiply it by 2.5. This value is then plugged into calculations used to calculate a concentration. This is treated as a peak and reported as the EDL. In most cases, the EDL reports a lower value than the MDL but this is questionable from a statistical validity standpoint.

Check For: The trial burn QAPP reviewer should check for the following information:

- ❑ Estimates of MDLs, SQLs, and EDLs
- ❑ Documented procedures for translating "Below Detection Limit" results into risk assessment inputs
- ❑ Results of screening level risk assessments based on detection limits determined using the above procedures

Example Situation: In reviewing the trial burn QAPP, Clark notes that although proposed detection limits are presented, a detailed discussion of what value the detection limits represent is not included.

Example Action: Clark recommends that the trial burn QAPP be revised to discuss the following for each detection limit: (1) what the limit represents, (2) how the proposed value was determined, (3) how the actual value will be determined following the trial burn (if the value varies), and (4) the factors during sampling or analysis that may affect the value of the detection limit.

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7.4 HOW TO REVIEW PROCESS MONITORING EQUIPMENT STANDARDS

Regulations: 40 CFR Part 60, Appendix A
40 CFR Part 270.62(b)(2)(iii)

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

Explanation: Various process operating parameters are monitored during trial burns. Some of these process parameters apply to all trial burns, whereas others are specific to a facility. Many of the parameters can be monitored with a wide variety of instrument types; for example, many instruments are available for monitoring waste feed rates. Although instrument types and parameters vary widely across facilities, the trial burn QAPP must address general topics, such as calibration and operational checks, data records, and QA objectives.

Before a trial burn, all process monitors and instruments used to record process data should be calibrated, if appropriate, and checked for proper operation. Instrumentation should be calibrated, in accordance with the manufacturer's recommended procedures, and should meet the manufacturer's specifications. Many process monitoring instruments are received from the manufacturer already calibrated, in which case written records should be available showing the procedure and results of the calibration. The trial burn QAPP should address the issue of calibration of process monitoring instrumentation.

The trial burn QAPP should specify that all process monitors should be checked—on a schedule to be proposed by each facility—under incinerator operating conditions that are expected during the trial burn. Checks should include visual inspection, comparison of readings from redundant units (if available), back-up instruments, or alternative methods. If instruments are subject to drift on a short-term basis, these instruments should be recalibrated throughout the test period, either before each test run or daily.

Data records should be kept for process monitors to evaluate their performance. A logbook with maintenance records should be kept, with specific information available to the trial burn QAPP, as required.

Check For: The trial burn QAPP reviewer should check for the following information:

- ❑ Description of essential process monitoring parameters
- ❑ Description of process monitoring instrumentation
- ❑ Procedures for dealing with process interruptions, such as waste feed cutoffs or soot blowing

- ❑ Calibration records and record keeping procedures for all process monitoring instrumentation
- ❑ Inspection and calibration schedules for all process monitoring instrumentation
- ❑ Corrective action procedures

Example Situation: In reviewing the facility's trial burn QAPP, Clark notes that it does not address certain process interruptions. Boiler and industrial furnace (BIF) units, for example, are subject to process interruptions resulting from waste feed cutoffs, operational upsets, and soot blowing.

Example Comments: Clark asks that the facility revise the trial burn QAPP to (1) acknowledge process interruptions can occur, (2) establish an acceptable threshold for interruption of the sampling runs, and (3) describe operational alternatives for accommodating process interruptions.

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7.5 HOW TO REVIEW CONTINUOUS EMISSION MONITORING EQUIPMENT STANDARDS

Regulations: 40 CFR Part 60, Appendix A
40 CFR Part 270.62(b)(2)(iii)

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

Explanation: Instrumental analyzers are used to continuously monitor the concentrations of fixed gases such as CO, O_2, sulfur dioxide (SO_2), nitrogen oxides (NO_x), and THCs in combustion emissions. Many types of analyzers are available commercially from different instrument manufacturers, but the basic quality objectives are essentially the same for the different types of monitors. Calibration procedures used for each instrument will vary, and specific procedures are typically specified by the manufacturer of the instrumentation. For each CEMS, the trial burn QAPP should address the following:

- Conducting an initial performance test
- Conducting calibration checks during the trial burn
- Obtaining complete data records

The performance specification test on the CEMS must be conducted and passed before the trial burn is conducted to determine whether the monitor is capable of providing adequate data. Parameters to be measured include calibration error, calibration drift, instrument span range, relative accuracy, and response time. Calibration check procedures should be specified.

Check For: The trial burn QAPP reviewer should check for the following information:

- ❑ Whether the location specified in the trial burn QAPP for the CEMS meets the manufacturer's specifications for the instrument
- ❑ Whether the trial burn QAPP describes procedures for an initial performance test to be conducted upon installation of the instrumentation
- ❑ Whether the trial burn QAPP discusses procedures for calibration checks during the trial burn
- ❑ Whether the trial burn QAPP discusses the CEMS data collection

Example Situation: In reviewing the facility's trial burn QAPP, Lois notes that it lists a CO monitor with other measurement instrumentation. An initial performance test is

described, but no further information is presented regarding calibration check procedures.

Example Action: Lois asks that the facility revise the trial burn QAPP to describe calibration check procedures, including daily calibration checks to be conducted by challenging the CEMS with a known standard.

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8.0 HOW TO REVIEW ELEMENT 7—SAMPLE HANDLING, TRACEABILITY, AND HOLDING TIMES

Regulations: 40 CFR Part 136.3

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

Explanation: Section 7.0 of the U.S. EPA Region 6 generic trial burn QAPP and Sections 3.1 and 3.2 of the U.S. EPA 1990 QA/QC Handbook describe sample handling, traceability or custody, and holding time requirements for a trial burn. Sample handling procedures generally include sample labeling, preservation, packing, field storage, shipping, and laboratory storage procedures. Sample custody is demonstrated by maintaining field logbooks, field tracking reports, field chain-of-custody (COC) forms, airbills, and laboratory COC forms. Sample holding time is the maximum allowable time between the collection of the sample and the preparation or analysis of the sample in the laboratory. Holding time requirements apply to field and laboratory analyses. Some analyses involve sample preparation, such as extraction, prior to analysis. In such cases, the trial burn QAPP should specify the sample holding time for extraction and the extract holding time for analysis. A brief description of sample handling and custody procedures in the body of the trial burn QAPP is adequate if the trial burn QAPP contains detailed, project-specific SOPs, which address these topics, as appendices.

Section 3.1 of the U.S. EPA 1990 QA/QC Handbook states that "chain of custody (COC) is not required for trial burns; however, the permit applicant may choose to use COC procedures." The permit applicant should use COC procedures. For the data to be legally defensible, implementation of strict COC procedures is required. In future trial burns and other testing, COC will be required by all permitting agencies.

Check For: The trial burn QAPP reviewer should check for the following information:

- ❑ Whether sample handling and custody procedures are described in detail in the body of the trial burn QAPP. Alternatively, these procedures may be briefly described in the body of the trial burn QAPP, but details should be presented in SOPs included as appendices to the trial burn QAPP. These procedures should also contain examples of the forms that will be used to document sample handling and custody procedures (for example, sample labels, sample tags, field tracking forms, and COC forms.)

- ❑ Whether sample preservation and holding time requirements are included in a tabular form for all matrixes relevant to the trial burn or risk burn and whether the information is current and correct. Tables 3-1 and 3-2 of the U.S. EPA 1990 QA/QC Handbook and Table 7-1 of the U.S. EPA

Region 6 generic trial burn QAPP should be reviewed for details on format and content. Current information may be obtained from SW-846, or other sources, depending on the methods used. The table should specify that sample holding time begins at the time of sample collection, not the time at which samples arrive at the laboratory. If holding time requirements for a parameter in a specific matrix is not available, the trial burn QAPP should propose a holding time that is based on the holding time for that parameter in another matrix. (Note: If sample container and volume requirements are not presented in Section 6.0, they should be included in this section.)

- ❑ Whether the sample handling procedures address sample numbering, labeling, preservation, packing, field storage, shipping, and laboratory storage. The sample numbering system should describe how a unique sample identification number will be assigned to each investigative and QC sample. Sample tags may be used in addition to, but not in place of, sample labels. During sample handling, sample tags could accidentally become separated from sample containers, thereby resulting in loss of sample identity.

- ❒ Whether laboratory storage procedures discuss archive samples, which may be analyzed if reanalysis of some samples is necessary

- ❑ Whether sample custody procedures discuss the use of field logbooks, field tracking reports, field COC forms, airbills, and laboratory COC forms

- ❒ Whether the section discusses custody procedures for the field and laboratory data

- ❑ Whether the trial burn QAPP describes final evidence files and identifies the final evidence file custodian, maintenance and storage time, and disposal procedure

Example Situation: In reviewing a facility's trial burn QAPP—included as Attachment H—Lois notes that SOPs are included in the appendix for sample handling and custody procedures. These procedures are briefly described under "Example Comments." Table 6-1 summarizes sample preservation and holding time requirements for the trial burn.

Example Action: Lois notes several problems with these sections and asks that the facility revise the trial burn QAPP as follows:

- The sample handling section should be amended to include a sample numbering system. The sample numbering system should explain how a unique sample identification number will be

assigned to each investigative and QC sample collected during the trial burn.

- The trial burn QAPP states that preprinted tags and labels will be used during sample collection. It should be clarified that the tags and labels will not be preprinted with sample-specific information, such as sample collection date and time, but with items such as test run number, sampling location, and sampling parameter.

- According to Section 6.3 of the trial burn QAPP, samples will be stored in the field under conditions stated in the Sample Handling SOP; however, this SOP could not be located. The SOP should either be submitted with the revised trial burn QAPP, or the text in Section 6.3 should be expanded to describe the required sample storage conditions.

- Section 6.4 should be amended to include more detailed laboratory custody procedures. For example, the following types of information should be provided in this section: sample custodian's name, details of the internal sample tracking and numbering system, and how analytical data and custody records are transferred from the custody of the laboratory to the final evidence file. This section should also be amended to (1) include the length of time for which the final evidence file will be maintained and (2) state that the file will be offered to U.S. EPA Region 6 or state permitting agency before disposal.

- Table 6-1 inappropriately lists the maximum holding time for (1) pH measurement in water samples as “analyze as soon as possible;” (2) mercury in waste samples as 6 months; and (3) hexavalent chromium in stack gas samples as “not available.” The table should correctly list the holding times for pH, mercury, and hexavalent chromium as 6 hours, 28 days, and 24 hours, respectively. Although the literature does not contain the holding time for hexavalent chromium measurement in stack gas samples, the holding time for water samples (24 hours) may be used because hexavalent chromium is recovered in an alkaline solution in the proposed sampling method.

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9.0 HOW TO REVIEW ELEMENT 8—SPECIFIC CALIBRATION PROCEDURES AND FREQUENCY

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

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

Explanation: Sections 8.0 and 10.0 of the U.S. EPA Region 6 generic trial burn QAPP and various sections (3.3, 5.2.2, 5.3.2, 7.2.2, 7.3.4, 7.4.3, 7.5.3, 8.1.3, 8.2.3, 8.3.2, 8.4.2, 8.4.3, 9.1.2, 9.2.3, 10.2.1, and 11.1.2.1) of the U.S. EPA 1990 QA/QC Handbook summarize typical calibration procedures and frequency requirements for process monitoring, stack sampling, continuous emission monitoring, and laboratory analytical equipment.

The information presented in the U.S. EPA Region 6 generic trial burn QAPP and the US. EPA 1990 QA/QC Handbook should be used only as guidance because calibration procedures and frequency requirements vary, depending on the measurement method and the equipment used. In general, this section should include a summary table that identifies (1) initial and continuing calibration procedures and frequencies, (2) number of points and range for initial calibration, (3) acceptance criteria, and (4) corrective action for all process monitoring, stack sampling, continuous emission monitoring, and laboratory analytical equipment. Details regarding calibration procedures and frequencies for all field and laboratory equipment used for the trial burn should be included as part of the SOPs in an appendix to the trial burn QAPP.

The U.S. EPA Region 6 generic trial burn QAPP includes laboratory analytical equipment calibration procedures and frequencies in Section 10.0 as part of internal QC checks. This information should be included in Section 8.0 because calibration is not typically considered to be an internal QC check.

Check For: The trial burn QAPP reviewer should check for the following information:

- ❑ Whether the trial burn QAPP contains a calibration procedure and frequency summary table and whether detailed SOPs that address calibration are included in an appendix to the trial burn QAPP

- ❑ Whether the summary table (1) addresses all process monitoring, stack sampling, continuous emission monitoring, and laboratory analytical equipment planned for use during the trial burn, and (2) presents the type and frequency of initial calibration, number of points and range for initial calibration, frequency of continuing calibration, acceptance criteria, and corrective action for initial and continuing calibration

- ❑ Whether the SOPs are of adequate detail (cookbook-type) and consistent with the summary table and standard methods. If nonstandard methods are proposed, method validation data should be included as an attachment to the SOP

- ❑ Whether the SOPs address sources and ultimate standards for all reference materials used in calibrations (for example, stock standards, working standards, and gas cylinders)

Example Situation: In reviewing various sections of the facility trial burn QAPP—included as Attachment I—Clark notes that Table 6-1 summarizes calibration procedures and frequency for measurements planned for the trial burn.

Example Action: Clark notes several problems with these sections and asks that the facility revise these sections as follows:

- Table 6-1 should provide the following information: (1) for the boiler's process monitors, calibration procedures and frequency; (2) for the Orsat analyzer, corrective action steps; and (3) for the rotameter, quantitative acceptance criteria.

- Information discussed should be based on project-specific requirements. For example, the text states that calibration standards will be prepared for constituents of interest; it should specify constituents involved in this project.

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10.0 HOW TO REVIEW ELEMENT 9—ANALYTICAL PROCEDURES

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

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

Explanation: Section 9.0 of the U.S. EPA Region 6 generic trial burn QAPP and various sections (5.1.1, 5.2.1, 5.3.1, 7.1, 7.2.1, 7.3.1, 7.3.2, 7.4.1, 7.4.2, 7.5.2, 8.1.1, 8.2.1, 8.3.1, 8.4.1, 9, and 10) of the U.S. EPA 1990 QA/QC Handbook summarize typical analytical procedures that may be used to characterize trial burn or risk burn samples. In general, this section should include a summary table that identifies sample preparation (digestion, extraction, concentration, or dilution), cleanup, and analysis methods for each matrix and analytical parameter, as appropriate. Details regarding how each method will be implemented (see Attachment J-2 for an example) should be included as part of the SOPs in an appendix to the trial burn QAPP.

Because numerous methods are available for conducting a specific analysis, analytical methods should be selected on the basis of a careful review of the trial burn or risk burn objectives and method capabilities, which should be conducted by an experienced chemist. Examples of method capability elements include matrix applicability, target analytes, detection limits, sample quantitation limits, and interferences. Methods most commonly used during the trial burn are generally taken from (1) SW-846, ASTM publications, (2) Methods for Chemical Analysis of Water and Wastes, and (3) Methods Manual for Compliance with BIF Regulations. Within each of these documents, several methods are available for conducting a specific analysis. For example, SW-846 contains several (1) GC methods and GC/MS methods for VOC analysis and (2) inductively coupled argon plasma spectroscopy (ICAP), ICAP/mass spectroscopy, atomic adsorption, and colorimetric methods for metals analysis. These methods are constantly being updated and some of them contain options. Therefore, the trial burn QAPP should list the method source, number, version, selected option, and any deviations from the method (see Attachment J-3 for an example). SOPs containing a step-by-step procedure should be included in an appendix.

Check For: The trial burn QAPP reviewer should check for the following information:

- ❑ Whether the trial burn QAPP contains an analytical procedures summary table and whether detailed SOPs for these analytical procedures are included in an appendix to the trial burn QAPP

- ❑ Whether the summary table (1) addresses all analyses planned for each matrix for the trial burn; (2) lists sample preparation (digestion, extraction, concentration, or dilution), cleanup, and analysis methods for

each matrix and analytical parameter, as appropriate; and (3) provides a complete method reference, including the version

- ❑ Whether proposed methods are appropriate for the trial burn or risk burn based on matrix applicability, target analytes, detection limits, sample quantitation limits, interferences, and other factors specific to the trial burn

- ❑ Whether SOPs are of adequate detail (cookbook-type) and consistent with the summary table and standard methods.

If nonstandard methods are proposed, method validation data should be included as an attachment to the SOP. However, all nonstandard methods must be approved by the permitting agency.

Example Situation: In reviewing the facility's TBP and trial burn QAPP—included as Attachment J-1—Lois notes that Table 7-1 of the trial burn QAPP lists analytical methods planned for the trial burn and identifies laboratories that will conduct the analyses. Section 7.0 also notes that detailed procedures are included in the SOPs (excerpts of the SOPs and SOP deviation summaries are included as Attachments J-2 and J-3, respectively).

Example Action: Lois has seven major concerns regarding this table and asks that the facility revise the trial burn QAPP as follows:

- It may be necessary to amend the trial burn QAPP on the basis of any additional analytical requirements specified in the risk assessment work plan (RAWP). The RAWP may specify additional compounds for stack gas analysis and require lower detection limits than the current proposed methods can provide, thereby requiring either modifications to the method or methods providing higher resolution. The facility should revise the analytical sections of the trial burn QAPP and TBP as needed on the basis of RAWP objectives. The trial burn QAPP and TBP should be revised to demonstrate that SQLs achieved during the trial burn will satisfy risk assessment requirements.

- Ambient air risk-based concentrations can be converted to required stack gas detection limits by using the proposed stack gas flow rate during the emissions test and air dispersion modeling results. Proposing and supporting realistic project-specific SQLs are critical elements of a trial burn QAPP. The facility should thoroughly investigate and then select required sample quantitation limits that are relevant to risk assessment requirements and present this information in the TBP and trial burn QAPP.

- The trial burn QAPP should list the specific analytical method for each metal in the waste feed stream and stack gas samples, rather than only the method series number. Also, no separate digestion method is needed for mercury, because the analytical method proposed in the table already includes the digestion method.

- Many analytical methods and SOPs presented in the trial burn QAPP and TBP do not reflect current approved methods, and the methods are not consistently referred to within the documents. The trial burn QAPP and TBP should be revised to be internally consistent and to cite the most recently approved analytical methods.

- Many of the analytical methods listed in Table 9-1 present several options that the analyst may use. For example, several preparation methods are available for samples that will be analyzed for SVOCs. However, Table 9-1 does not specify preparation methods that will be implemented under specific conditions. The trial burn QAPP should be revised to include this information, and all appropriate SOPs planned for use on this project should be included.

- The trial burn QAPP does not provide laboratory SOPs for many analyses. Laboratory-specific SOPs must be provided for each sample preparation, extraction, cleanup, and analytical method identified in the trial burn QAPP. Without the SOPs, it is not possible to determine whether identified laboratories are capable of meeting QA objectives identified in Section 5.0 or conducting internal QC checks listed in Section 10.0.

- Several SOPs reference other SOPs that are not provided. In addition, some of the SOPs are missing effective dates and approval signatures. The trial burn QAPP should contain all project-specific, approved SOPs so that a complete stand-alone document is available for all personnel working on the project.

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11.0 HOW TO REVIEW ELEMENT 10—SPECIFIC INTERNAL QUALITY CONTROL CHECKS

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

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

Explanation: Section 10.0 of U.S. EPA Region 6 generic trial burn QAPP and various sections (3.4, 5.0, 6.0, 7.0, 8.0, 9.0, and 10.0) of the U.S. EPA QA/QC Handbook summarize typical internal QC checks used to evaluate the quality of trial burn analytical results. In general, this section should include a summary table that identifies internal QC checks for each matrix and analysis parameter, as appropriate. Examples of internal QC checks include field duplicates, check standards, matrix spikes (MS), matrix spike duplicates (MSD), postdigestion spikes, laboratory control samples, standard reference materials, surrogates, and blanks (field, trip, and method). For each QC check, the table should list the intended data use, frequency, acceptance criterion, and corrective action. The precision and accuracy acceptance criteria listed in this section should be consistent with precision and accuracy QA objectives presented in Section 5.0.

Because the manner in which a QC sample is prepared will have a significant impact on how the QC check sample result should be used, the trial burn QAPP should include a detailed description of QC sample preparation. For example, if the QC check is intended to evaluate only analytical precision, a sample from the same container should be aliquoted for unspiked, MS, and MSD analyses. Otherwise, the precision will represent both sampling and analytical procedures.

The application of surrogates to the samples is one aspect of internal quality control checks that should be discussed expressly in the QAPP. The analytical laboratory conducting the volatile organic analysis should spike all Tenax® and Tenax®/charcoal resin cartridges with an internal standard(s) to monitor continuing laboratory performance. In the purge-and-trap device, final solutions containing calibration standards, including surrogate standards, should be added directly to the purging device using a syringe.

The trial burn QAPP should also explain blank correction procedures. In general, the results should not be corrected for blank contamination. If blank contamination is strongly suspected because of multiple blank analyses, the trial burn report should present the results with and without blank correction.

Check For: The trial burn QAPP reviewer should check for the following information:

- ❑ Whether the trial burn QAPP contains an internal QC check summary table

- ❑ Whether the summary table (1) addresses all analyses and measurements planned for each matrix for the trial burn, and (2) lists the intended data use, frequency, acceptance criterion, and corrective action
- ❑ Whether the proposed frequency, acceptance criterion, and corrective action are at least as stringent as required by the U.S. EPA Region 6 generic trial burn QAPP, U.S. EPA QA/QC Handbook, and analytical methods
- ❑ Whether the precision and accuracy acceptance criteria listed in this section are consistent with the precision and accuracy QA objectives presented in Section 5.0
- ❑ Whether the trial burn QAPP (or SOPs) contains a detailed description of the QC sample collection or preparation procedure for each matrix and analytical parameter
- ❑ Whether the QC sample collection or preparation procedures are consistent with the intended data use
- ❑ Whether the trial burn QAPP addresses blank correction procedures

Example Situation: In reviewing the facility trial burn QAPP—the relevant sections are included as Attachment K—Clark notes that Table 9-1 summarizes internal QC checks for the trial burn and briefly describes QC sample collection and preparation procedures. The SOPs contain details on QC sample collection and preparation procedures.

Example Action: While Table 9-1 summarizes acceptance criteria, control limits, and corrective actions for various trial burn sampling and analysis method internal QC checks, Clark notes that many entries are blank, and some entries do not correspond to criteria previously listed in the trial burn QAPP (for example, precision and accuracy objectives listed in Section 5.0). Clark identifies specific problems with these sections and asks that the facility revise these sections as follows:

- This section is incomplete, because QC procedures for several parameters are omitted, including metals in all process samples (except WDF) and dioxins, furan, and PCBs in cement kiln dust. These procedures should be added.
- The trial burn QAPP should be revised to clearly define and describe each type of blank sample collected during the trial burn. For example, the text discusses media blanks and trip blanks but does not clearly explain the difference between these two sample types. Further, Table 10-1 does not identify trip blank samples as being collected during the trial burn. The text

also mentions reagent blank samples. Presumably, these blank samples are the same as the solvent recovery blanks listed in the SOPs. However, neither blank sample type is listed in Table 9-1, and the trial burn QAPP is not clear about whether the reagent and solvent recovery blanks are considered part of the field blank samples. The table and text should clearly and consistently identify the number and frequency of all blanks.

- The trial burn QAPP briefly describes MS and MSD samples, and Table 9-1 indicates that MS and MSD samples will be collected for VOCs, SVOCs, and metals in stack gases. If MS and MSD samples will be collected for these parameters, the trial burn QAPP or SOPs must provide additional discussion. Specifically, the trial burn QAPP or SOPs should describe whether (1) sorbent materials and filters recovered from these sampling trains will be split before matrix spiking solutions are added, (2) matrix spiking solutions will be added after extraction.

- The trial burn QAPP should also clearly identify matrix spiking compounds used for each sample type. In addition to standard matrix spiking compounds for the various analytical methods, matrix spiking compounds should include (1) volatile and semivolatile POHC, and (2) PICs that are considered critical to trial burn and associated risk assessment objectives.

- "Quality data" is listed as the corrective action for isokinetics. Although this is an obvious goal, the trial burn QAPP should instead describe corrective actions that will be taken if stack sampling conditions fall outside acceptable isokinetic limits.

- The table lists "QC sample" for each of the metals analysis methods; however, the table should also specify the type of sample that will be collected to conduct this QC check. In addition, a control limit is not listed for the triplicate analyses using atomic absorption spectroscopy. The purpose of this QC check sample is unclear if no control limit is established. The table should be revised to provide the control limit.

- The table's discussion of corrective action for duplicate samples should include corrective action if the reanalyzed sample still does not meet control limits.

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12.0 HOW TO REVIEW ELEMENT 11—DATA REDUCTION, DATA VERIFICATION, AND DATA REPORTING

Regulation: 40 CFR Part 270.62 (b) (7)

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

Explanation: Section 2.1.11 of the U.S. EPA 1990 QA/QC Handbook and Section 11.0 of the U.S. EPA Region 6 generic trial burn QAPP describe data reduction, verification, and data reporting requirements that should be addressed in a trial burn QAPP.

Section 11.0 of the trial burn QAPP should outline the data management scheme for the trial burn, from data collection to data use and final storage. Key elements of the data management scheme are data reduction, data verification or validation, and data reporting. Data reduction is the process of converting raw process data and analytical data into trial burn results expressed in proper reporting units. Data verification or validation is the process of reviewing and qualifying analytical data and field measurements on the basis of QA objectives defined in Section 5.0 of the trial burn QAPP. Data reporting is the process of preparing data deliverables that summarize trial burn analytical and QC results in required formats. Section 11.0 should identify individuals in the trial burn project organization who have primary responsibility for data reduction, data verification, and data reporting. The following paragraphs address each of these key elements in greater detail.

Section 11.0 should address trial burn record keeping procedures, data and document control procedures, and data storage and retrieval procedures. In particular, this section should address the final disposition of trial burn records, including where and for how long, the records will be stored. This section should also address any specialized data handling equipment or procedures (for example, special computer hardware or software requirements).

The trial burn QAPP should describe data reduction processes that will be followed for all trial burn results. For a data reduction process that is fully described in a standard method, a brief summary of the process with reference to the standard method is sufficient. Most standard analytical methods, for example, contain equations needed to calculate analyte concentrations on the basis of instrument outputs; a detailed discussion of data reduction is not necessary.

In other cases, the trial burn QAPP should present project-specific data reduction procedures, including specific equations and data inputs. For example, to evaluate whether a HWCU has achieved a 99.99 percent DRE for a particular POHC, the following process monitoring and analytical data are required: (1)

rate of waste feed to the HWCU; (2) POHC concentration in the waste feed; (3) mass of POHC collected in the stack gas sample; (4) stack gas sample volume; and (5) overall stack gas flow rate. Some of these data must be calculated on the basis of yet other measurements—for example, the stack gas sample volume depends on the stack gas temperature and pressure and the barometric pressure. The data reduction section of the trial burn QAPP should describe how all of these data will be combined to produce results that the permit writer can use to (1) determine whether the HWCU is operating in compliance with regulatory requirements and (2) establish permit limits.

The discussion of data reduction should also directly address two specific issues: (1) how blank data will be handled and (2) how analytical results below MDLs will be handled. In general, stack gas sample results should not be corrected for blank contamination. However, if such corrections are made, the results should also be presented without blank correction for comparison. It is certain that some trial burn analytical results will be reported as less than the MDL. The trial burn QAPP should state how these analytical results will be treated in calculating overall trial burn results, such as stack gas emission rates. This procedure should be consistent with the EPA Region 6 1998 Protocols for Human Health and Screening Level Ecological Risk Assessment at Hazardous Waste Combustion Facilities.

The trial burn QAPP should describe processes that will be used to validate and verify all laboratory and field measurement data. These processes should focus on (1) whether all laboratory and field QC measures specified in the trial burn QAPP or in SOPs were carried out and (2) whether the resulting data are within acceptance criteria. Section 11.0 of the trial burn QAPP should also discuss how data validation issues that have an impact on overall data usability will be resolved. If this information is included in other trial burn QAPP sections (such as 10.0 or 14.0), a reference to the other sections is sufficient.

For some field measurements, the data validation or verification process may be relatively simple and may involve confirming that data have been properly transcribed from logbooks or correctly summarized from strip charts. However, for laboratory analytical data, the process is more complex. The trial burn QAPP should specify that full data validation will be completed for 100 percent of trial burn analytical results. Personnel responsible for data validation should be independent of the laboratories generating the data. The data validation should be conducted in accordance with standard U.S. EPA procedures identified in U.S. EPA 1994 QA/R-5 and QA/G-4. For example, organic data package reviews include checking (1) COC documentation, (2) sample holding times, (3) surrogate recoveries, (4) recoveries and RPD values for MS/MSD samples, (5) method blank results, (6) initial and continuing calibration results, and (7) supporting raw data. In situations where standard U.S. EPA procedures do not directly apply, these procedures can serve as a basis for developing project-specific data validation procedures.

Section 11.0 should also discuss data reporting requirements for laboratory data, final trial burn results, and trial burn QA/QC data. Laboratory analytical data packages should contain all information needed to conduct data validation and verification procedures. The trial burn QAPP should specify the information that will be included within each organic and inorganic data package. For example, organic data packages typically include (1) a case narrative, (2) analytical data summary sheets, (3) surrogate recovery data, (4) MS/MSD results, (5) method blank results, (6) a GC/MS tuning and mass calibration summary, (7) initial and continuing calibration data, and (8) raw data, such as chromatograms and mass spectra.

Section 11.0 should discuss the expected trial burn results and QA/QC data to be presented in the trial burn report. Section 3.6 of the U.S. EPA 1990 QA/QC Handbook provides additional information on reporting QA/QC results. In general, the trial burn QAPP should specify that the trial burn report will include (1) all field records, (2) all calibration data (laboratory and field), (3) all precision and accuracy determinations associated with QA objectives, (4) all internal audit results, and (5) the results of any required performance evaluation samples. The U.S. EPA 1989 Handbook: Guidance on Setting Permit Conditions and Reporting Trial Burn Results identifies trial burn results that are required in 40 CFR Part 270.62 (b) (7) and provides general guidance on reporting and summarizing trial burn data. Section 11.0 of the trial burn QAPP should summarize the proposed format for reporting trial burn results and QA/QC data.

Check For: The trial burn QAPP reviewer should check for the following information:

❒ Supporting documentation, the following items at a minimum:

- Laboratory name and address
- Sample information (including unique sample identification, sample collection date and time, sample receipt date, and sample preparation and analysis dates)
- Complete field and laboratory COC records
- Analytical results reported with an appropriate number of significant figures
- Detection limits that reflect dilutions, interferences, or correction for equivalent dry weight
- Method reference
- Appropriate QC results for each batch of samples included in the report

- Data qualifiers with appropriate references
- Written narrative about the quality of the results

❒ Description of overall data management scheme for the trial burn, addressing record keeping, document control, and data storage and retrieval procedures

❒ Discussion of retention period for trial burn records and their storage location

❒ Description of any specialized data handling procedures or equipment, such as specialized computer hardware or software

❒ Identification of personnel in the trial burn project organization who have primary responsibility for data reduction, data verification or validation, and data reporting

❒ Discussion of data reduction processes, including project-specific procedures, such as specific equations and data inputs, that will be used to develop trial burn results

❒ Discussion of how blank results and analytical results below MDLs will be summarized and evaluated

❒ Discussion of data validation methods that will be used for analytical results

- Whether 100 percent of laboratory data will be validated
- Whether the personnel responsible for data validation are independent of laboratories generating the data

❒ Discussion of data verification processes for field measurements

❒ Discussion of reporting requirements for laboratory analytical data packages

- Whether the laboratory uses computer-aided reporting
- Whether computer software programs for data reduction are periodically verified with hand-calculated results
- Whether a manager or other senior laboratory staff member writes the case narrative

- Whether the case narrative provides information regarding any QC check that does not meet acceptance criteria established in the trial burn QAPP

- Whether the entire data package is reviewed by a manager or other senior laboratory staff member before submittal to the client.

❒ Description of final trial burn result format and QA/QC data that will be included in the trial burn report

Example Situation: In reviewing this section of the trial burn QAPP for several facilities—included as Attachment L—Lois notes several problems. Section 11.0 (Attachment L-1) discusses the overall data management scheme for the trial burn and specifically discusses data reduction, data verification and validation, and data reporting procedures for trial burn results. An appendix to the trial burn QAPP presents project-specific data reduction procedures that demonstrate how process data and analytical data will be converted into trial burn results. Section 11.0 also identifies personnel who are responsible for data reduction, data verification and validation, and data reporting.

Example Action: Lois notes several problems with these sections, and asks that the facility revise the trial burn QAPP as follows:

- The purpose of Figure 11-A is not clear. The figure does not provide any information about laboratory data reduction procedures as the title implies. The figure lists only laboratory analytical parameters and corresponding SOPs; this information is presented elsewhere in the trial burn QAPP. The figure should be revised to identify specific sections of the listed SOPs that discuss data reduction procedures.

- Section 5.10.1 (Attachment L-2) should also be revised to clarify data validation responsibilities. The section states that a project manager will perform data validation activities. The trial burn QAPP should identify the organization with which the project manager is affiliated and should include data validation as an additional responsibility of the project manager in Section 3.6—Project Organization of Personnel, Responsibilities, and Qualifications. The trial burn QAPP should also explain the trial burn QA officer's data validation responsibilities.

- Section 9.1.2 (Attachment L-3) states that the field sampling crew team leader will direct the review of process monitoring and other field data in the office after trial burn testing is complete. This position is neither mentioned in Section 2.0 of the trial burn QAPP nor listed in the organization chart. The trial burn QAPP should be

revised to clarify the roles and responsibilities of the field sampling crew team leader, and Section 2.0 and the organization chart should be revised, as appropriate.

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13.0 HOW TO REVIEW ELEMENT 12—ROUTINE MAINTENANCE PROCEDURES AND SCHEDULES

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

Guidance: No specific references are applicable to this manual.

Explanation: Section 12.0 of the U.S. EPA Region 6 generic trial burn QAPP provides an overview of the information that should be included in this section. Section 11.1.2.3 of the U.S. EPA 1990 QA/QC Handbook provides an example of the type of preventive maintenance and schedule information that should be included for a CEMS used in a trial burn. In general, this section should include a summary table that lists (1) the equipment necessary to maintain permit operating conditions and to demonstrate continuing compliance with the permit, and (2) preventive maintenance activities and schedules for each item of equipment. A list of spare parts necessary for equipment maintenance should also be included in a tabular format. A brief statement such as "the equipment will be maintained in accordance with the manufacturer's recommendations" is inadequate.

The facility operator should establish the preventive maintenance program for the field equipment on the basis of the manufacturers' recommendations and should identify the frequency for each maintenance activity. Example maintenance activities for a CEMS include the following: (1) checking the integrity of probe and sample line and back flushing as necessary; (2) checking and maintaining the sample conditioning system, including cleaning or replacing the filters; (3) cleaning optical lenses; and (4) checking the operation of recorders and dataloggers. All field equipment maintenance activities should be recorded in a logbook.

The laboratory operations manager should establish the preventive maintenance program for the analytical laboratory equipment on the basis of the manufacturers' recommendations and should identify the frequency for each maintenance activity. If preventive maintenance is conducted through vendor contracts, the trial burn QAPP should so state. Example maintenance activities for an ICAP instrument include checking the filters, gas flow, tubing, nebulizer, and auto sampler. All laboratory equipment maintenance activities should be recorded in a logbook.

Check For: The trial burn QAPP reviewer should check for the following information:

- ❑ Whether the trial burn QAPP contains a preventive maintenance schedule summary table for field and laboratory equipment needed to maintain permit operating conditions and to demonstrate continuing compliance with the permit

- ❑ Whether the trial burn QAPP contains a table that lists spare parts needed for equipment maintenance

Example Situation: In reviewing the facility's trial burn QAPP, Clark notes that it outlines the field and laboratory equipment maintenance schedule and the spare parts needed for equipment maintenance.

While the trial burn QAPP briefly states that preventive maintenance procedures will include those recommended by the manufacturer, Clark asks that, in addition to daily calibration checks, the facility expand this trial burn QAPP to list (1) all items included in the maintenance program, (2) maintenance procedures for each instrument, (3) maintenance frequencies, and (4) record keeping. Instruments should include field sampling equipment and process instruments that monitor, control, and record boiler operating conditions. The section should also indicate the type of standby equipment that will be brought to the site in case sampling equipment breaks or otherwise becomes inoperable.

Clark also asks that the trial burn QAPP contains only general statements for each laboratory regarding preventive maintenance procedures. Clark asks that the facility revise the trial burn QAPP to include a table or summary of each laboratory's service frequencies for components of key analytical instruments or equipment. Details on maintenance procedures may be provided in the "Preventive Maintenance" section of the SOPs included in the appendix.

Example Action: The facility revises the trial burn QAPP for Clark to rereview. Clark determines that the comments have been adequately addressed, and approves the trial burn QAPP.

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14.0 HOW TO REVIEW ELEMENT 13—ASSESSMENT PROCEDURES FOR ACCURACY, PRECISION, AND COMPLETENESS

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

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

Explanation: Section 2.1.13 of the U.S. EPA 1990 QA/QC Handbook and Section 13.0 of the U.S. EPA Region 6 generic trial burn QAPP describe the information that should be presented in this section of the trial burn QAPP. This section is closely related to Section 5.0 of the trial burn QAPP, which presents trial burn QA objectives for analytical and field measurements. Section 13.0 should clarify how equations for precision and accuracy will be applied to all QA objectives identified in Section 5.0. Section 13.0 should present all equations that will be used to calculate numerical values for precision, accuracy, and completeness. Precision is usually calculated as (1) the RPD between two duplicate measurements, or (2) the relative standard deviation (RSD) when three or more measurements are made. Accuracy is usually calculated as the percentage of an analyte that has been spiked into a sample that is recovered during analysis. Accuracy can also be calculated as percent bias or the difference between a measured result and the known value for the standard material that is being measured.

Completeness, which is typically expressed as a percentage, is usually defined as the amount of valid data collected from a measurement system compared to the total amount of data planned for collection. As noted in Section 6.0 of this document (How to Review Element 5—The Quality Assurance and Quality Control Objectives), this typical definition of completeness is applicable to individual measurements made during the trial burn. However, the U.S. EPA 1990 QA/QC Handbook states that for trial burn results to be considered sufficiently complete for a permit to be written, three valid test runs are needed for each test condition. Therefore, Section 13.0 of the trial burn QAPP should address how both types of completeness (individual measurements and the number of valid test runs) will be determined.

U.S. EPA 1996 Guidance for Data Quality Assessment describes how data should be scientifically and statistically evaluated to determine whether data obtained are of the right type, quality, and quantity to support its intended use. Although many of the statistical methods presented in this guidance are not directly applicable to trial burns, general concepts presented are useful in evaluating the precision, accuracy, and completeness of trial burn results.

Check For: The trial burn QAPP reviewer should check for the following information:

- ❒ Equations for calculating precision for all QA objectives identified in Section 5.0 of the trial burn QAPP
- ❒ Equations for calculating accuracy for all QA objectives identified in Section 5.0 of the trial burn QAPP
- ❒ Equations for calculating completeness for all QA objectives identified in Section 5.0 of the trial burn QAPP
- ❒ Clear discussion of how equations in this section will be applied to the QA objectives identified in Section 5.0 of the trial burn QAPP
- ❒ Discussion that addresses completeness of individual measurements made during the trial burn and number of valid test runs needed for overall trial burn data set to be considered complete

Example Situation: In reviewing the facility's trial burn QAPP—applicable sections are included as Attachment M-1—Lois notes that Section 11.0 presents equations that will be used to calculate precision, accuracy, and completeness for trial burn QA objectives identified in Section 3.0 of the trial burn QAPP.

Example Action: Lois notes some deficiencies and inconsistencies in this section and asks that the facility revise this section as follows:

- Table 3-1 in Section 3.0 of the trial burn QAPP indicates that both RPD and RSD will be used to assess precision. However, Section 11.0 discusses and presents an equation only for RPD. Section 11.0 should be revised to include an equation for percent RSD and to discuss how this measurement will be used to assess precision.
- Table 3-1 in Section 3.0 of the trial burn QAPP includes accuracy objectives for CEMs for O_2 and CO_2. Accuracy objectives are presented as "$\leq$ percent O_2" and "$\leq$ 0.5 percent full-scale," respectively. However, Section 11.0 does not discuss how these QA objectives will be assessed. Section 11.0 should be expanded to discuss items, such as the frequency of CEM calibration checks during the trial burn and whether low-level and high-level standards will both be used for these checks.

Lois is comfortable developing these comments because on her review of similar documents—included as Attachment M-2—has indicated that problems with the calculations presented in this section are recurring issues, as illustrated by a previous comment she had developed:

- The equation for completeness in Section 12.3 includes the term "total number of samples analyzed" in the denominator. The

equation does not consider samples that were planned as part of the trial burn sampling design but not collected or analyzed. The denominator of the equation should be revised to read "total number of samples planned."

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15.0 HOW TO REVIEW ELEMENT 14—AUDIT PROCEDURES, CORRECTIVE ACTION, AND QUALITY ASSURANCE REPORTING

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

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

Explanation: Section 14.0 of the U.S. EPA Region 6 generic trial burn QAPP and Sections 3.4 through 3.6 of the U.S. EPA 1990 QA/QC Handbook discuss the audit, corrective action, and QA/QC reporting procedures relevant to trial burn activities and the routine operation of the HWCU. In general, this section should (1) discuss the frequencies and procedures for internal performance and systems audits; (2) demonstrate the facility's readiness to accommodate external performance and systems audits; (3) discuss the corrective action procedures; and (4) discuss the type and frequency of QA reports that will be generated and identify to whom these reports will be distributed. This section should also identify individuals responsible for each item discussed in this section. These individuals and their responsibilities should be consistent with those listed in Section 4.0.

Section 3.4 of the U.S. EPA 1990 QA/QC Handbook discusses the scope of typical internal audits. During a trial burn, it is recommended that one internal audit, at a minimum, be conducted by the facility QA manager or his designee. These audits should include performance and systems audits of field and laboratory activities. The performance audits involve independent checks to evaluate data quality, which may be accomplished through the analysis of blind spikes or standard reference materials. The systems audits involve on-site review and evaluation of field and laboratory operations to ensure that the procedures specified in the TBP and trial burn QAPP are implemented. The trial burn QAPP should identify the type, frequency, and scope of these audits and the individuals who will perform them.

Section 3.5 of the U.S. EPA 1990 QA/QC handbook discusses the types of external audits that may be conducted by U.S. EPA for a trial burn. These audits may include laboratory analysis of the U.S. EPA control samples for critical compounds (for example, VOC audit cylinders for stack gas samples) and U.S. EPA review of field and laboratory operations. The trial burn QAPP should

state that U.S. EPA may conduct these audits announced or unannounced and that the facility will accommodate these audits.

Section 14.2 of the U.S. EPA Region 6 generic trial burn QAPP discusses corrective action procedures. Corrective actions may be required because of noncompliance with the TBP or trial burn QAPP and field or laboratory equipment problems. The trial burn QAPP should clearly identify the mechanism and the individuals responsible for triggering, initiating, developing, implementing, and documenting corrective actions during field, laboratory, and data validation and assessment activities.

Section 3.6 of the U.S. EPA 1990 QA/QC Handbook discusses reporting of QA/QC information. The trial burn QAPP should identify the scope and frequency of QA reports and individuals responsible for preparing these reports. The trial burn QAPP should also list individuals who will receive these reports. At a minimum, these reports should include the following: (1) internal and external audit results, (2) significant QA/QC problems, (3) data validation and assessment results, and (4) corrective actions.

Check For: The trial burn QAPP reviewer should check for the following information:

- ❑ Whether the trial burn QAPP discusses scope, frequencies, and procedures for internal performance and systems audits and demonstrates the facility's readiness to accommodate external performance and systems audits
- ❑ Whether the trial burn QAPP identifies the mechanism and individuals responsible for triggering, initiating, developing, implementing, and documenting corrective actions during field, laboratory, and data validation and assessment activities
- ❑ Whether the trial burn QAPP states that all corrective actions that are likely to affect data quality will be brought to the permit writer's attention before they are implemented
- ❑ Whether the trial burn QAPP describes the content and frequency of QA reports and identifies the preparers and recipients of these reports

Example Situation: In reviewing sections of the facility's trial burn QAPP, Clark notes that Section 10.1 discusses the scope, frequencies, and procedures for internal performance and systems audits and demonstrates the facility's readiness to accommodate external performance and systems audits. Section 13.2 identifies the mechanism and individuals responsible for triggering, initiating, developing, implementing, and documenting corrective actions during field, laboratory, and data validation and assessment activities. All corrective actions that are likely to affect data quality will be brought to the permit writer's attention before they are implemented.

Section 14.3 describes the content and frequency of QA reports and identifies the preparers and recipients of these reports.

Clark has several concerns about these sections and asks that the facility revise these sections as follows:

- The QAPP does not present a regular audit schedule of the data collection system (DCS). The QAPP states that the DCS, which monitors and controls operating parameters, will undergo audits only upon inclusion of new process parameters and after any change in the DCS configuration. This section should be revised to discuss the automatic waste feed cutoff (AWFCO) system testing that is conducted regularly (either weekly or every 30 days). Although the AWFCO test focuses only on parameters that may trigger an AWFCO and that will be covered under the RCRA Part B operating permit, the AWFCO test can be viewed as a type of internal field audit.

- The trial burn QAPP should be modified to state that, in the case of any nonconformance with the QAPP that affects data quality, the permit writer will be consulted before corrective action is implemented. In addition, the text should state that if an U.S. EPA project representative is available on site during the trial burn, any testing problems or deviations from the QAPP and TBP that arise during the trial burn will be brought to the U.S. EPA representative's attention immediately.

Example Action: Revisions based on Clark's comments are included in Attachment N-1. Clark is satisfied with these responses and approves the trial burn QAPP. However, Clark knows that he must be ever vigilant, since responses to comments on similar sections (see below) from other documents—see for example Attachment N-2—have required additional comments, as follows:

- This section fails to address external audits. U.S. EPA Region 6 may send audit gas cylinders to the facility for sampling and analysis for VOCs and dioxins and furan in stack gas. The facility should make the necessary preparations to receive and sample these audit gas cylinders during the trial burn. The trial burn QAPP should be revised to discuss these sampling procedures. Section 3.5 of the U.S. EPA 1990 QA/QC Handbook provides guidance on this activity.

- The trial burn QAPP states that the facility QA manager will receive a verbal QA report during the trial burn. This section should also identify the frequency of written QA reports during and after the trial

burn, because verbal reports will have no documentation for future reference and cannot be distributed to U.S. EPA QA staff members.

- This section should also summarize the type of information that will be included in the QA reports. Section 3.6 of the U.S. EPA 1990 QA/QC Handbook provides guidance on this subject.

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ATTACHMENT A

GENERIC TRIAL BURN QUALITY ASSURANCE PROJECT PLAN

QUALITY ASSURANCE PROJECT PLAN

APPENDIX A

PERSONNEL QUALIFICATIONS

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APPENDIX D-5.1

QUALITY ASSURANCE PROJECT PLAN

[*Enter Trial Burn Project Title*]

BIF Unit Name: [*Enter Number*]

BIF Unit Number: [*Enter Number*]

Facility EPA ID Number: [*Enter Number*]

Prepared for: [*Enter Company Name*]
[*Enter Company City, State*]

Prepared by: [*Enter Company Name*]
[*Enter Company City, State*]

Revision No.: [*Enter Number*]

Date: [*Enter Month and Year*]

1.0 TITLE PAGE

1.1 PROJECT TITLE

[*Enter QAPP Title*]

1.2 EXPECTED TRIAL BURN DATES

[*Enter Dates*]

1.3 PROJECT APPROVALS

Contractor Approvals

[*Incinerator or Boiler*] Project Manager	Date
Trial Burn Manager	Date
Quality Assurance Officer	Date

[*Enter Other*] Approvals

[*Incinerator or Boiler*] Project Manager	Date
Plant Manager	Date

2.0 TABLE OF CONTENTS

Section **Page**

1.0 TITLE PAGE 1-1

1.1 PROJECT TITLE 1-1
1.2 EXPECTED TRIAL BURN DATES 1-1
1.3 PROJECT APPROVALS 1-1

2.0 TABLE OF CONTENTS 2-1

LIST OF FIGURES 2-5
LIST OF TABLES 2-7
ACRONYMS AND ABBREVIATIONS 2-9

3.0 PROJECT DESCRIPTION 3-1

4.0 PROJECT ORGANIZATION OF PERSONNEL, RESPONSIBILITIES, AND QUALIFICATIONS 4-1

4.1 [*BOILER OR INCINERATOR*] PROJECT MANAGER 4-1
4.2 TRIAL BURN MANAGER 4-3
4.3 QUALITY ASSURANCE OFFICER 4-3
4.4 PROCESS SAMPLING COORDINATOR 4-4
4.5 LABORATORY ANALYSIS COORDINATOR 4-4
4.6 STACK SAMPLING COORDINATOR 4-5
4.7 INDEPENDENT THIRD-PARTY QUALITY ASSURANCE AUDITOR 4-6

5.0 QUALITY ASSURANCE AND QUALITY CONTROL OBJECTIVES 5-1

5.1 EVALUATION OF PRECISION 5-14
5.2 EVALUATION OF ACCURACY 5-16
5.3 DETECTION AND REPORTING LIMIT DETERMINATIONS 5-17
5.4 EVALUATION OF COMPLETENESS 5-21

6.0 SAMPLING AND MONITORING PROCEDURES 6-1

6.1 FIELD QUALITY CONTROL SAMPLES 6-27

6.1.1 Spiked Resin Blanks 6-27
6.1.2 Reagent Blanks 6-33
6.1.3 Field Blanks 6-33
6.1.4 Trip Blanks 6-34

6.1.5 Hexavalent Chromium Train Stability Samples 6-35
6.1.6 Formaldehyde Field Spikes 6-36
6.1.7 Blank Trains 6-36

2.0 TABLE OF CONTENTS (Continued)

Section **Page**

6.2 WASTE FEED AND PROCESS SAMPLING 6-37
6.3 STACK GAS SAMPLING 6-37

6.3.1 Velocity and Traverse-Point Selection (EPA Methods 1 and 2) 6-37
6.3.2 Orsat Determination of Oxygen and Carbon Dioxide (EPA Method 3) . . . 6-38
6.3.3 Volatile Organic Sampling Train (Method 0031) 6-38
6.3.4 Modified Method 5 Trains 6-39

6.3.4.1 MM5A Train Semivolatiles, Dioxins, and Furans (Combined Methods 0010 and 0023A) 6-39
6.3.4.2 MM5B Train Semivolatile and Nonvolatile Unspeciated Mass . . . 6-54
6.3.4.3 MM5C Train Polynuclear Aromatic Hydrocarbons 6-56

6.3.5 Multi-Metals and Mercury Train (Method 0060) 6-60
6.3.6 Hexavalent Chromium Train (Method 0061) 6-62
6.3.7 M5 Hydrogen Chloride, Chlorine, and Particulate Train (Method 0050) . 6-63
6.3.8 Formaldehyde Train (Method 0011) 6-64

6.4 PROCESS MONITORING EQUIPMENT 6-65
6.5 CONTINUOUS EMISSION MONITORING EQUIPMENT 6-65

7.0 SAMPLE HANDLING, TRACEABILITY, AND HOLDING TIMES 7-1

7.1 SAMPLE LABELING 7-2
7.2 SAMPLE COLLECTION SHEETS 7-2
7.3 SAMPLE COLLECTION CHECKLIST 7-4
7.4 SAMPLE COLLECTION LOGBOOK 7-4
7.5 REQUEST FOR ANALYSIS AND CHAIN OF CUSTODY 7-6
7.6 SAMPLE PRESERVATION AND HOLDING TIMES 7-6

8.0 SPECIFIC CALIBRATION PROCEDURES AND FREQUENCY 8-1

8.1 PROCESS MONITORING EQUIPMENT 8-1
8.2 STACK SAMPLING EQUIPMENT 8-2
8.3 CONTINUOUS EMISSION MONITORING SYSTEMS 8-2
8.4 ORSAT METHOD 3 8-7

9.0 ANALYTICAL OBJECTIVES AND PROCEDURES 9-1

2.0 TABLE OF CONTENTS (Continued)

Section **Page**

9.1 ANALYTICAL LABORATORY 9-1
9.2 ANALYTICAL PROCEDURES 9-1

10.0 SPECIFIC INTERNAL QUALITY CONTROL CHECKS 10-1

10.1 METHOD BLANKS 10-1
10.2 DUPLICATE ANALYSES 10-51
10.3 ANALYTICAL INSTRUMENT CALIBRATION 10-51
10.4 MATRIX SPIKES 10-51
10.5 SURROGATE SPIKES 10-52

11.0 DATA REPORTING, DATA REVIEW, AND DATA REDUCTION 11-1

11.1 DATA REPORTING 11-1

11.1.1 Analytical Data Packages 11-2
11.1.2 Certificates of Analysis 11-7
11.1.3 Analytical Data Results 11-8
11.1.4 Report Preparation 11-9

11.2 DATA REVIEW 11-11

11.2.1 CLP Format Data Package Review 11-13
11.2.2 Inorganic Analyses Data Review 11-13
11.2.3 CLP-Like Data Package Review 11-14
11.2.4 Classic Parameter Data Review 11-14

11.3 DATA REDUCTION 11-15

11.3.1 Analytical Data Summary 11-15
11.3.2 Quality Control Data Summary 11-17

11.4 TRAIN TOTAL CALCULATIONS 11-19

12.0 ROUTINE MAINTENANCE PROCEDURES AND SCHEDULES 12-1

13.0 ASSESSMENT PROCEDURES FOR ACCURACY, PRECISION, AND COMPLETENESS 13-1

13.1 ACCURACY 13-1

13.2 PRECISION 13-1
13.3 COMPLETENESS 13-2

2.0 TABLE OF CONTENTS (Continued)

Section **Page**

14.0 AUDIT PROCEDURES, CORRECTIVE ACTION, AND QUALITY ASSURANCE REPORTING 14-1

14.1 AUDIT PROCEDURES 14-1
14.2 CORRECTIVE ACTION 14-1
14.3 QUALITY ASSURANCE REPORTING 14-5
14.4 THIRD-PARTY AUDIT 14-6

Appendix

A PERSONNEL QUALIFICATIONS

B EXAMPLE CALIBRATION FORMS

LIST OF FIGURES

Figure **Page**

3-1 PROCESS FLOW DIAGRAM WITH SAMPLING LOCATIONS 3-2

4-1 TRIAL BURN ORGANIZATIONAL CHART 4-2

6-1 MM5A TRAIN SAMPLE-HANDLING AND EXTRACT-SPLITTING SCHEME FOR THE PARTICULATE FILTER AND FRONT HALF OF THE FILTER HOLDER AND PROBE SOLVENT RINSES (SEMIVOLATILE POHCS, DIOXINS, AND FURANS) 6-47

6-2 MM5A TRAIN SAMPLE-HANDLING AND EXTRACT-SPLITTING SCHEME FOR THE XAD-2 RESIN TUBE AND THE BACK HALF OF THE FILTER HOLDER AND COIL CONDENSER SOLVENT RINSES (SEMIVOLATILE POHCS, PICS, AND DIOXINS AND FURANS) 6-48

6-3 MM5A TRAIN SAMPLE-HANDLING AND EXTRACT-SPLITTING SCHEME FOR IMPINGERS 1, 2, AND 3 CONDENSATE COMPOSITE AND GLASSWARE SOLVENT RINSES (SEMIVOLATILE POHCS AND PICS) 6-49

6-4 MM5B TRAIN SAMPLE-HANDLING AND EXTRACT-SPLITTING SCHEME FOR SEMIVOLATILE AND NONVOLATILE UNSPECIATED MASS ANALYSIS 6-55

6-5 MM5C TRAIN SAMPLE-HANDLING AND EXTRACT-SPLITTING SCHEME FOR PARTICULATE FILTER AND FRONT HALF OF THE FILTER HOLDER AND PROBE SOLVENT RINSES (PAHS) 6-57

6-6 MM5C TRAIN SAMPLE-HANDLING AND EXTRACT-SPLITTING SCHEME FOR XAD-2 RESIN TUBE AND BACK HALF OF THE FILTER HOLDER AND COIL CONDENSER SOLVENT RINSES (PAHS) 6-58

6-7 MM5C TRAIN SAMPLE-HANDLING SCHEME FOR IMPINGERS 1, 2, AND 3 CONDENSATE COMPOSITE AND GLASSWARE SOLVENT RINSES (PAHS) 6-59

7-1 SAMPLE LABELING AND NUMBERING SCHEME 7-3

7-2 PROCESS SAMPLE COLLECTION SHEET 7-5

7-3 EXAMPLE REQUEST FOR ANALYSIS 7-7

7-4 EXAMPLE CHAIN-OF-CUSTODY FORM 7-8

11-1 INTERNAL DATA REVIEW PERFORMED BY THE LABORATORY 11-10

LIST OF FIGURES (Continued)

Figure **Page**

11-2 DATA VALIDATION AND REVIEW FLOW SCHEME 11-12

11-3 DATA REDUCTION FLOW SCHEME 11-16

14-1 EXAMPLE VARIANCE LOG 14-2

14-2 EXAMPLE NONCONFORMANCE REPORT 14-4

LIST OF TABLES

Table **Page**

5-1 SUMMARY OF TARGET DATA QUALITY OBJECTIVES FOR PRECISION AND ACCURACY 5-2

5-2 VOLATILE SURROGATE COMPOUNDS WITH TARGET RECOVERY CRITERIA . . 5-6

5-3 SEMIVOLATILE SURROGATE COMPOUNDS WITH TARGET RECOVERY CRITERIA 5-7

5-4 VOLATILE MATRIX SPIKE COMPOUNDS WITH TARGET RECOVERY CRITERIA 5-8

5-5 SEMIVOLATILE MATRIX SPIKE COMPOUNDS WITH TARGET RECOVERY CRITERIA 5-9

5-6 DIOXIN AND FURAN, SEMIVOLATILE, AND PAH SAMPLING SURROGATE SPIKE COMPOUNDS WITH TARGET RECOVERIES 5-10

5-7 DIOXIN AND FURAN ISOTOPE DILUTION INTERNAL STANDARD SPIKE COMPOUNDS WITH TARGET RECOVERIES 5-11

5-8 PAH ISOTOPE DILUTION INTERNAL STANDARD SPIKE COMPOUNDS WITH TARGET RECOVERIES 5-12

6-1A PLANNED SAMPLE COLLECTION METHODS, FREQUENCY, AND CONTAINERS, HIGH-TEMPERATURE METALS EMISSIONS BURN—3 RUNS 6-2

6-1B PLANNED SAMPLE COLLECTION METHODS, FREQUENCY, AND CONTAINERS, LOW-TEMPERATURE DRE PERFORMANCE DEMONSTRATION BURN—3 RUNS 6-7

6-1C PLANNED SAMPLE COLLECTION METHODS, FREQUENCY, AND CONTAINERS, STANDARD FACILITY OPERATING CONDITIONS, RISK ASSESSMENT EMISSIONS TEST—3 RUNS 6-14

6-2A SUMMARY OF FIELD QUALITY CONTROL SAMPLE REQUIREMENTS, HIGH-TEMPERATURE METALS EMISSIONS TEST—3 RUNS 6-28

6-2B SUMMARY OF FIELD QUALITY CONTROL SAMPLE REQUIREMENTS, LOW-TEMPERATURE DRE PERFORMANCE DEMONSTRATION TEST—3 RUNS 6-29

LIST OF TABLES (Continued)

Table **Page**

6-2C SUMMARY OF FIELD QUALITY CONTROL SAMPLE REQUIREMENTS, STANDARD FACILITY OPERATING CONDITIONS, RISK ASSESSMENT EMISSIONS TEST—3 RUNS 6-30

6-3 SUMMARY OF VOLATILE PIC COMPOUNDS FOR ANALYSIS 6-40

6-4 SUMMARY OF SEMIVOLATILE PIC COMPOUNDS FOR ANALYSIS 6-42

6-5 MM5 TRAIN SPIKE COMPOUNDS AND QUANTITY SPIKED 6-51

7-1 SAMPLE HOLDING TIME AND PRESERVATION TECHNIQUES 7-10

8-1 ACTIVITY MATRIX FOR CALIBRATION OF EQUIPMENT 8-3

8-2 SUMMARY OF CEM SYSTEM PERFORMANCE CHECK REQUIREMENTS 8-5

9-1 SUMMARY OF ANALYTICAL METHODS AND PROCEDURES 9-3

10-1A SUMMARY OF LABORATORY AND PROJECT-SPECIFIC QUALITY CONTROL SAMPLE ANALYSIS REQUIREMENTS, HIGH-TEMPERATURE METALS EMISSIONS TEST—3 RUNS 10-2

10-1B SUMMARY OF LABORATORY AND PROJECT-SPECIFIC QUALITY CONTROL SAMPLE ANALYSIS REQUIREMENTS, LOW-TEMPERATURE DRE PERFORMANCE DEMONSTRATION TEST—3 RUNS 10-13

10-1C SUMMARY OF LABORATORY AND PROJECT-SPECIFIC QUALITY CONTROL SAMPLE ANALYSIS REQUIREMENTS, STANDARD FACILITY OPERATING CONDITIONS, RISK ASSESSMENT EMISSIONS TEST—3 RUNS 10-25

10-2 SUMMARY OF ANALYTICAL QUALITY CONTROL CHECKS, FREQUENCIES, TARGET ACCEPTANCE CRITERIA, AND CORRECTIVE ACTION 10-42

ACRONYMS AND ABBREVIATIONS

μg	Microgram
μL	Microliter
ηg	Nanogram
ASTM	American Society for Testing and Materials
BIF	Boiler and industrial furnace
BNA	Base neutral analysis
B.P.	Boiling point
Btu	British thermal unit
CARB	California Air Resources Board
CCC	Calibration check compound
COC	Chain of custody
CEM	Continuous emission monitor or monitoring
CFR	Code of Federal Regulations
CLP	Contract Laboratory program
CVAA	Cold vapor atomic absorption
DNPH	Dinitrophenylhydrazine
DFTPP	Decafluorotriphenyl phosphine
DQO	Data quality objective
DRE	Destruction and removal efficiency
EPA	U.S. Environmental Protection Agency
FID	Flame ionization detector
g	Gram
GC	Gas chromatography
GRAV	Gravimetric
HPLC	High-performance liquid chromatography
hr	Hour
IC	Ion chromatography
ICAL	Initial calibration
ICP	Inductively coupled argon plasma spectroscopy
IDL	Instrument detection limit
L	Liter
LCS	Laboratory control sample
m^3	Cubic meter
M5	Method 5
MDL	Method detection limit
min	Minute
mL	Milliliter
MM5	Modified Method 5
MMT	Multi-metals train
MS	Mass spectroscopy
MS/MSD	Matrix spike and matrix spike duplicate

N	Normality
NBS	National Bureau of Standards
NIST	National Institute of Standards and Testing

ACRONYMS AND ABBREVIATIONS (Continued)

OSWER	Office of Solid Waste and Emergency Response
PAH	Polynuclear aromatic hydrocarbon
PCDD	Polychlorinated dibenzodioxin
PCDF	Polychlorinated dibenzofuran
PCR	Post-column reactor
PDS	Post-digestion spike
PIC	Product of incomplete combustion
POHC	Principal organic hazardous constituent
ppb	Parts per billion
PQL	Practical quantitation limit
psig	Pounds per square inch gauge
PST	Performance specification test
QA	Quality assurance
QAPP	Quality assurance project plan
QA/QC Handbook	*Quality Assurance/Quality Control Procedures for Hazardous Waste Incineration*
QC	Quality control
RFA	Request for analysis
RPD	Relative percent difference
RSD	Relative standard deviation
SCC	Secondary combustion chamber
S/N	Signal to noise
SPCC	System performance check compound
Sr_f	Final system response
Sr_i	Initial system response
SRM	Standard reference material
TBP	Trial burn plan
TCL	Target compound list
TCLP	Toxicity characteristic leaching procedure
TCO	Total chromatographable organics
TDS	Total dissolved solids
TEF	Toxicity equivalence factor
THC	Total hydrocarbon content
TIC	Tentatively identified compound
TS	Total solids
TSS	Total suspended solids
VOA	Volatile organic analysis
VOST	Volatile organic sampling train

WES	Wet electrostatic scrubber
WESP	Wet electrostatic precipitator

3.0 PROJECT DESCRIPTION

[*REQUIREMENT: In this section, the applicant shall include a short project description summary. This description must include a brief* [*incinerator or boiler*] *system description, a statement of the purpose of the trial burn, and a summary description of the sampling and analysis program.*]

[*Enter Company Name*] will conduct a trial burn on the [*incinerator or boiler*] at [*Enter Location*].

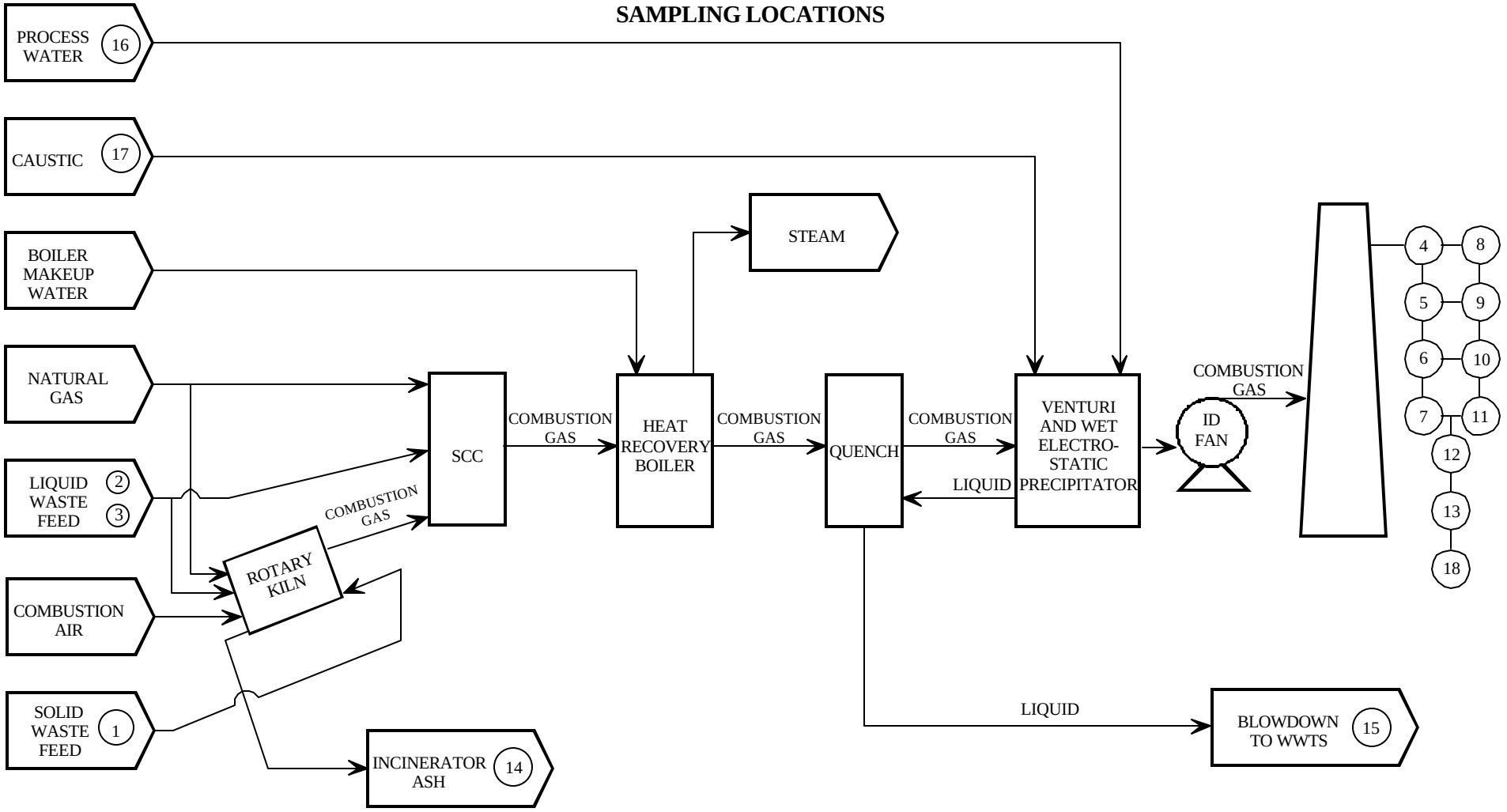
The purpose of this trial burn is to test and validate the performance level of the [*incinerator or boiler*] against the U.S. Environmental Protection Agency (EPA) permitting requirements in Title 40 of the Code of Federal Regulations (40 CFR) 270.19 and 270.22. To this end, the objectives of the trial burn will be to obtain the necessary data that demonstrate compliance with the performance standards of 40 CFR 264 Subpart O and 266 Subpart H and to develop data on stack emissions to facilitate the performance of direct and indirect human health and ecological risk assessments.

The process flow diagram is presented in Figure 3-1. As shown therein, the primary components of the incineration process are a [*rotary kiln or other*] primary combustion chamber and a secondary combustion chamber (SCC). [*Solid and liquid hazardous wastes, as applicable*] are burned in the [*rotary kiln or other*]. Liquid hazardous wastes are burned in the SCC. [*Natural gas or other*] is the auxiliary fuel in both combustion chambers. The [*rotary kiln or other*] normally operates at [*Enter Temperature*] °F. The SCC normally operates at [*Enter Temperature*] °F. During the trial burn, these combustion chambers will be operated at a range of temperatures bracketing those stated previously.

Hot combustion gases leaving the SCC pass through an energy recovery boiler that produces [*Enter Pressure*] pounds per square inch gauge (psig) and [*Enter Temperature*] °F steam that is used elsewhere on the plant site. Combustion gases then flow to the air pollution control system, which is composed of two major components in series—a [*high-energy venturi-type scrubber or other*] and a [*wet electrostatic precipitator (WESP) or other*]—before being discharged to the atmosphere through the main stack.

FIGURE 3-1

PROCESS FLOW DIAGRAM WITH SAMPLING LOCATIONS



NOTES:

ID INDUCED DRAFT
SCC SECONDARY COMBUSTION CHAMBER
WWTS WASTEWATER TREATMENT SYSTEM
◯ SAMPLE LOCATION

The proposed trial burn program involves sampling all of the [*incinerator or boiler*] feed streams, process residues, and stack emissions under three separate test conditions. Three replicate sampling runs will be completed at each test condition. Sample locations are shown in Figure 3-1.

This quality assurance project plan (QAPP) is an essential guidance document by which these test objectives will be demonstrated and met. The specific requirements that apply to this trial burn are as follows:

- Conduct a high temperature metals emissions test that will demonstrate the removal efficiency and the stack emissions of the target metals by measuring the stack gas metals under controlled conditions.
- Conduct a low-temperature destruction and removal efficiency (DRE) performance demonstration test, which will demonstrate that the DRE of 99.99 percent has been achieved for chlorobenzene and naphthalene, which will be used as the principal organic hazardous constituents (POHC).
- Conduct a risk assessment emissions test under normal operating conditions to measure the stack gas emissions of particulate; metals; hexavalent chromium; volatile and semivolatile organic products of incomplete combustion (PIC); polychlorinated dibenzodioxins (PCDD) and polychlorinated dibenzofurans (PCDF); polynuclear aromatic hydrocarbons (PAH); formaldehyde and other aldehydes; total organic compounds (less than 100 ^{o}C, 100 ^{o}C to 300 ^{o}C, and greater than 300 ^{o}C); volatile, semivolatile, and nonvolatile unspeciated mass; hydrogen chloride; and chlorine. Note: Data quality objectives for particle size distribution will be developed on a facility-specific basis.
- Perform continuous emissions monitoring (CEM) of the stack gas for carbon monoxide and oxygen under these sets of tests.
- Monitor the emissions of carbon dioxide and oxygen in the stack gas by the Orsat method under these sets of tests.

A pretest will be performed prior to the actual trial burn in order to ensure that the following objectives are met prior to performance testing:

- Confirm that the selection of sampling and analytical methods is appropriate and that identification of any project specific problems that arise during the pretest can be corrected.
- Demonstrate that operation of the system at full trial burn conditions is achievable and sustainable for the duration of the performance test.
- Demonstrate that the complete system and its individual components maintain specific performance capabilities.
- Determine the final target operating conditions that are to be established for the trial burn.

This QAPP defines all aspects of the project-specific quality assurance and quality control (QA/QC) procedures that will be applied to this trial burn, while establishing detailed sampling and analytical quality indicators that will demonstrate the complete achievement of the trial burn objectives. This QAPP is designed specifically to define appropriate precision and accuracy criteria for all chemical and physical measurements required for the trial burn and to set the acceptable quality boundaries that will be used for the evaluation of trial burn analytical data. Additionally, this QAPP will be used in the field by the on-site sampling team to ensure the collection of all of the required field data and samples that evaluate the project-specific objectives.

In general, this document describes procedures that will be implemented during the trial burn to demonstrate that all of the associated trial burn data are of sufficient quality to serve as the basis for regulatory permit decisions with regard to the [*boiler or incinerator*]'s operational performance.

[*REQUIREMENT: The applicant will provide a description of the system, equipment, test feed materials, and test conditions to be used for the trial burn.*]

The sampling methods that will be used during this trial burn are given in Tables 6-1A through 6-1C of this QAPP. The analytical methods that will be used are summarized in Table 9-1. This QAPP is written according to the specifications outlined in the following references:

- "Interim Guidelines and Specification for Preparing Quality Assurance Project Plans" (QAMS-005/80)
- "Sampling and Analysis Methods for Hazardous Waste Combustion" (EPA-600/8-84-002)
- "Handbook - Quality Assurance/Quality Control (QA/QC) Procedures for Hazardous Waste Incineration" (EPA-625/6-89-023)
- "Methods Manual for Compliance with the Boiler and Industrial Furnace (BIF) Regulations, Burning Hazardous Waste in Boilers and Industrial Furnaces" (EPA/530-SW-91-010, December 1990)
- "Hazardous Waste Burned in Boilers and Industrial Furnaces" (40 CFR 266 Subpart H)
- "Preparation Aids for the Development of Category I Quality Assurance Project Plans" (EPA/600/8-91/003, February 1991)
- "Methods Manual for Compliance with the BIF Regulations, Burning Hazardous Wastes in Boilers and Industrial Furnaces" (40 CFR 266 Appendix IX)

4.0 PROJECT ORGANIZATION OF PERSONNEL, RESPONSIBILITIES, AND QUALIFICATIONS

[*REQUIREMENT: In this section, the applicant shall identify the project key personnel, their qualifications, and their QA/QC responsibilities.*]

This project will be conducted by [*Enter Company Name*] and contractor personnel experienced in testing hazardous waste incinerators, boilers, and industrial furnaces. The project organization and lines of responsibility are shown in Figure 4-1. Appendix A to this QAPP contains the [*resumes, qualifications, or curriculum vitae*] of the individuals who have key responsibilities associated with this trial burn. The permit reviewer should examine these qualifications to determine that facility and contractor personnel are sufficiently experienced.

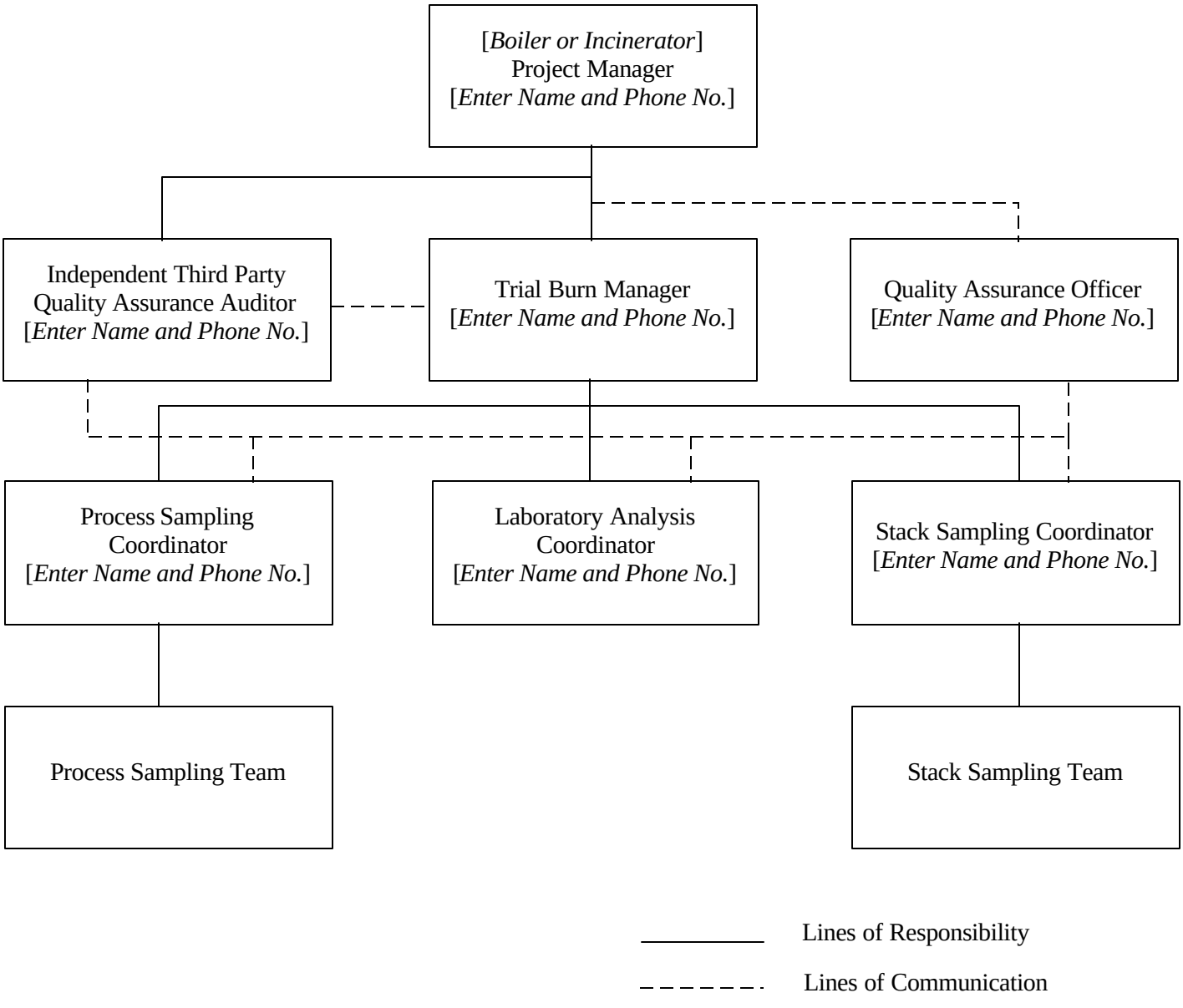
4.1 [*BOILER OR INCINERATOR*] PROJECT MANAGER

The [*boiler or incinerator*] project manager will be [*Enter Person's Name*], an employee of [*Enter Organization Name*]. [*Enter Person's Name*] will be responsible for all aspects of the trial burn including the following:

- Preparing the [*boiler or incineration*] system for the trial burn
- Preparing waste feed materials for the trial burn
- Operating the incineration system at the planned test conditions
- Providing all of the [*boiler or incinerator*] process data as required by the trial burn plan (TBP)
- Coordinating [*boiler or incinerator*] operation with the test team activities through communication with the trial burn manager
- Acting as liaison between regulatory observers and the trial burn manager

FIGURE 4-1

TRIAL BURN ORGANIZATIONAL CHART



4.2 TRIAL BURN MANAGER

The trial burn manager will be [*Enter Person's Name*], who will be responsible for implementing and coordinating all aspects of the trial burn. Other responsibilities during the project will be as follows:

- Final planning and implementation of the TBP
- Implementing or delegating the responsibility of the implementation of the QAPP
- Preparing and implementing a site health and safety plan
- Coordinating the [*boiler or incinerator*] operations and test activities with facility operators and the test team
- Monitoring [*boiler or incinerator*] operations to verify conformance with the trial burn objectives
- Acting as the focal point for communications between the test team, facility personnel, and regulatory observers during the execution of the trial burn program
- Deciding when a sampling run will be started, interrupted, resumed, or completed
- Providing a report of compliance on sampling activities with the TBP to be included in the trial burn report

4.3 QUALITY ASSURANCE OFFICER

The QA officer will be [*Enter Person's Name*], who will be responsible during the project for the following:

- Assisting in the preparation and implementation of the QAPP
- Providing independent data review, both operational and analytical
- Making recommendations to the trial burn manager if problems are encountered
- Verifying that appropriate corrective actions are taken if any problems occur

- Preparing a QA checklist and reporting and discussing QA/QC activities, data, and results for inclusion in the trial burn report

4.4 PROCESS SAMPLING COORDINATOR

The process sampling coordinator will report to the trial burn manager with lines of communication to the QA officer. [*His or Her*] responsibilities will be as follows:

- Preparing and shipping sampling equipment, chemicals reagents, and containers to the test site
- Assigning and recording field sample numbers
- Directing and participating, as appropriate, in sampling activities
- Overseeing sample preservation in the field
- Documenting sampling activities in a field logbook
- Preparing samples for shipment to the laboratory
- Carrying out assigned QA duties
- Preparing a complete sampling report for inclusion in the trial burn report

4.5 LABORATORY ANALYSIS COORDINATOR

The laboratory analysis coordinator will report to the trial burn manager, with lines of communication to the QA officer. [*His or Her*] responsibilities will be as follows:

- Coordinating specialized field sampling documentation, such as request for analysis (RFA) forms and sample collection sheets
- Initiating chain-of-custody (COC) records
- Receiving, verifying, and documenting that incoming field samples correspond to the COC

- Maintaining records of incoming samples
- Tracking samples through processing, analysis, and disposal
- Preparing project-specific QC samples for analysis during the project
- Verifying that laboratory QC and analytical procedures are being followed as specified in this QAPP
- Reviewing QC and sampling data and determining if additional samples or repeat analyses are needed
- Submitting certified QC and sample analysis results to the trial burn manager for all analyses requested for this test program
- Archiving storage of analytical data
- Preparing a complete analytical report for inclusion in the trial burn report

4.6 STACK SAMPLING COORDINATOR

The stack sampling coordinator will report to the trial burn manager and have lines of communication to the QA officer. [*His or Her*] responsibilities will be as follows:

- Working with site personnel to obtain sampling locations and platform facilities that are appropriate for the planned stack sampling activities
- Directing stack sampling activities
- Coordinating stack sample beginning and ending times with the trial burn manager
- Notifying the trial burn manager of any interruptions in the sampling activities and recommending corrective actions, if necessary
- Recording field test data required by the TBP
- Recording and transferring all trial burn and QC samples to the laboratory analytical coordinator or a designee

- Preparing a thoroughly documented stack sampling report for inclusion in the trial burn report

4.7 INDEPENDENT THIRD-PARTY QUALITY ASSURANCE AUDITOR

A QA auditor or audit team that is independent of [*Enter Company Name*], [*Enter Stack Sampling Company*], and [*Enter Laboratory Name*] will be assigned to this project and will have the following responsibilities:

- Perform inspections of process equipment, process controls, process operations, data acquisition, and recording systems, and perform sampling activities for compliance with this QAPP and the TBP.
- Perform audits of the analytical laboratories for compliance with this QAPP and the TBP.
- Review stack sampling and analytical reports for completeness and accuracy.
- Document the results of these inspections and audits in a written report that will be furnished to [*Enter Company Name*], [*Enter State Regulatory Agency*], and EPA within [*Enter Number*] days of the completion of field activities. These reports of audited aspects of the project will be submitted in the trial burn report. Variances and nonconformances will be documented in a compliance report by the third-party auditor and included in the trial burn report.

5.0 QUALITY ASSURANCE AND QUALITY CONTROL OBJECTIVES

[*REQUIREMENT: In this section, the applicant shall summarize in tabular form each major measurement parameter, including all pollutant measurement systems and QA objectives for precision, accuracy, and completeness*.]

The QA objectives of this trial burn project include identifying the complete data set, which must be generated in order to complete a quality assessment of the project during final reviews. This data set will include all data quality indicators produced during the project. In addition, the data acceptance criteria will be defined. The data acceptance criteria identify the target precision and accuracy limits that are used to assess the data quality. The overall data quality objective (DQO) is to produce a database that will be suitable for completing an assessment of the [*boiler or incinerator*]'s operational performance relative to the permitting activities of the trial burn.

The field and analytical data obtained from this trial burn will be reviewed by the laboratory analysis coordinator and the QA officer, and a complete assessment of the data quality indicators will be included in the trial burn report. The data quality will be discussed with regard to the planned data acceptance criteria and the overall project objectives. Data that are determined to be outside of the target data QC limits will be evaluated relative to the overall project objectives to determine their impact on defining the system's performance, and discussion of this evaluation will be included in the trial burn report. The trial burn, data collection phase will be documented formally to provide complete traceability of the information pertinent to the [*boiler or incinerator*]'s performance.

Table 5-1 displays the project's target accuracy and precision objectives, which have been defined for each type of analysis to be performed during the trial burn. The target precision and accuracy objectives for the CEM systems of the stack gas also are included.

TABLE 5-1

SUMMARY OF TARGET DATA QUALITY OBJECTIVES FOR PRECISION AND ACCURACY

Parameter	QC Type	Precision [a, b]	Accuracy [c]
Waste Feed Samples			
High-Btu Liquid Waste Feed			
Moisture, Btu, % ash, total chlorine, viscosity, elemental analysis[d], density	Duplicates	≤10% RPD	---
Volatile POHCs	Surrogate spikes	≤35% RPD	See Table 5-2[e]
Volatile POHCs	Duplicates	≤30% RPD	---
Metals[f]	Matrix spikes	≤30% RPD	±35%
Metals[f]	Duplicates	≤30% RPD	---
Density, Btu, total chlorine	Standard reference material	---	±10% of reference value
Semivolatile POHCs	Duplicates	≤35% RPD	See Table 5-3[e]
Semivolatile POHCs	Surrogate spikes	≤35% RPD	See Table 5-3[e]
Low-Btu Liquid Waste Feed			
Btu, % ash, total chlorine	Duplicates	≤10% RPD	---
Viscosity, density, elemental analysis	Duplicates	±30%	---
Volatile POHCs	Surrogate spikes	≤35% RPD	See Table 5-2[e]
Volatile POHCs	Duplicates	≤30% RPD	---
Metals[f]	Matrix spikes	---	±35%
Metals[f]	Duplicates	≤30% RPD	---
Btu, total chlorine	Standard reference material	---	±10% of reference value
Semivolatile POHCs	Duplicates	≤35% RPD	See Table 5-3[e]
Semivolatile POHCs	Surrogate spikes	≤35% RPD	See Table 5-3[e]
Solid Waste Feed			
Moisture, Btu, % ash, and total chlorine	Duplicates	≤10% RPD	---
Density, elemental analysis	Duplicates	±30%	---
Volatile POHCs	Surrogate spikes	≤35% RPD	See Table 5-2[e]
Volatile POHCs	Duplicates	≤30% RPD	---
Metals[f]	Matrix spikes	---	±35%
Metals[f]	Duplicates	≤35% RPD	---
Density, Btu, and total chlorine	Standard reference material	---	±10% of reference value
Semivolatile POHCs	Duplicates	≤35% RPD	See Table 5-3[e]
Semivolatile POHCs	Surrogate spikes	≤35% RPD	See Table 5-3[e]
Process Samples			
Makeup Water			

TABLE 5-1 (Continued)

SUMMARY OF TARGET DATA QUALITY OBJECTIVES FOR PRECISION AND ACCURACY

Volatile POHCs	Surrogate spikes	≤35% RPD	See Table 5-2[e]
Semivolatile POHCs	Surrogate spikes	≤35% RPD	See Table 5-3[e]
Volatile POHCs	Matrix spikes	≤35% RPD	See Table 5-4[g]
Semivolatile POHCs	Matrix spikes	≤35% RPD	See Table 5-5[g]

TABLE 5-1 (Continued)

SUMMARY OF TARGET DATA QUALITY OBJECTIVES FOR PRECISION AND ACCURACY

Parameter	QC Type	Precision [a, b]	Accuracy [c]
Scrubber Purge Water			
TDS/TSS/TS	Duplicates	≤ 35% RPD	---
Volatile POHCs	Surrogate spikes	≤ 35% RSD	See Table 5-2[e]
Semivolatile POHCs	Surrogate spikes	≤30% RPD	See Table 5-3[e]
Volatile POHCs	Matrix spikes	≤35% RPD	See Table 5-4[g]
Semivolatile POHCs	Matrix spikes	≤35% RPD	See Table 5-5
Caustic Feed			
Volatile POHCs	Surrogate spikes	≤35% RPD	See Table 5-2[e]
Semivolatile POHCs	Surrogate spikes	≤30% RPD	See Table 5-3[e]
Volatile POHCs	Matrix spikes	≤35% RPD	See Table 5-4[g]
Semivolatile POHCs	Matrix spikes	≤35% RPD	See Table 5-5[g]
Incinerator Ash			
Volatile POHCs	Surrogate spikes	≤35% RPD	See Table 5-2[e]
Semivolatile POHCs	Surrogate spikes	≤30% RPD	See Table 5-3[e]
Volatile POHCs	Matrix spikes	≤35% RPD	See Table 5-4[g]
Semivolatile POHCs	Matrix spikes	≤35% RPD	See Table 5-5[g]
Stack Gas Samples			
Particulate weight	Replicate weighings	± 0.5 mg	± 0.5 mg
Volatile organic sampling train audit	Audit sample	---	50 to 150%
Volatile organic sampling train	Spiked resin blanks	≤ 25% RPD	75 to 125 %
Volatile organic sampling train	Surrogate spikes	≤ 30% RSD	See Table 5-2[e, g]
Volatile organic sampling train condensate samples	Surrogate spikes	≤ 30% RSD	See Table 5-2[e, g]
Volatile organic sampling train	Breakthrough evaluation	---	30% POHC front[g, h] 75 ηg of POHC back[g, h]
Modified Method 5 semivolatile sampling train	Spiked resin blanks	≤ 25% RPD	75 to 125%
Modified Method 5 semivolatile sampling train	Surrogate spikes	≤ 35% RSD	See Table 5-3[e]
Modified Method 5 semivolatile sampling train	Matrix spikes	≤ 35% RSD	See Table 5-2[g]
Modified Method 5 semivolatile sampling train	Semivolatile - carbon-13 labeled sampling surrogate spikes	≤ 35% RSD	See Table 5-6[i]
Modified Method 5 dioxin and furan sampling train	Dioxin and furan - carbon-13 labeled sampling surrogate spikes	≤ 35% RSD	See Table 5-6[i]

TABLE 5-1 (Continued)

SUMMARY OF TARGET DATA QUALITY OBJECTIVES FOR PRECISION AND ACCURACY

Modified Method 5 dioxin and sampling train	Isotope dilution internal standard spikes	---	See Table 5-7[j]
Modified Method 5 dioxin and furan sampling train	EPA audit sample	---	± 50%
Parameter	**QC Type**	**Precision [a, b]**	**Accuracy [c]**
Stack Gas Samples (Continued)			
Modified Method 5 polynuclear aromatic hydrocarbon sampling train	PAH sampling surrogates	---	See Table 5-6[i]
Modified Method 5 polynuclear aromatic hydrocarbon sampling train	PAH isotope dilution internal standards	---	See Table 5-8[k]
Method 5 hydrogen chloride, chlorine, and particulate sampling train	Matrix spikes	≤ 35% RPD	± 30%
Method 5 hydrogen chloride, chlorine, and particulate sampling train	Standard reference material	---	90 to 110% of reference value
Method 0040 train	Field spikes	±30%	80 to 120%
Method 0040 train	Duplicates	±20%	---
Total chromatographicable organics	Surrogate spikes	≤ 35% RPD	70 to 130%
Gravimetric	Replicate weighings	±0.5 mg	---
Gravimetric	Audit Samples	---	75 to 125%
Mulit-metals sampling train	Matrix spike and post-digestion spikes	≤ 35% RPD	70 to 130%
Mulit-metals sampling train	EPA audit filter	---	±30%
Mulit-metals sampling train	Standard reference material	---	±30% of reference value
Hexavalent chromium train	Field spikes	≤ 35% RPD	70 to 130%
Hexavalent chromium train	Standard reference material	---	70 to 130% of reference value
Hexavalent chromium train	Matrix spikes	≤ 30% RPD	±25%
Aldehyde train	Field spikes	≤ 30% RPD	70 to 130%
Aldehyde train	Matrix spikes	≤ 30% RPD	70 to 130%
CEM carbon monoxide	Performance specification test	±3% of span	±5% of span
CEM oxygen	Performance specification test	0.5% oxygen	0.5% oxygen[l]
Oxygen by Orsat Method	Ambient air audit	---	20.8 ±0.5%[m]
Carbon dioxide by Orsat Method	Certified gas audit	---	0.2%

Notes:

ηg Nanograms
Btu British thermal unit

TABLE 5-1 (Continued)

SUMMARY OF TARGET DATA QUALITY OBJECTIVES FOR PRECISION AND ACCURACY

CEM	Continuous emission monitoring
EPA	U.S. Environmental Protection Agency
mg	Milligrams
PAH	Polynuclear aromatic hydrocarbons
POHC	Principal organic hazardous constituent
QC	Quality control
RPD	Relative percent difference
RSD	Relative standard deviation
TDS	Total dissolved solids
TS	Total solids
TSS	Total suspended solids

Notes (Continued):

a Precision data quality objectives are defined by RSD or RPD. See Section 13.0 for the equations used for calculating these precision indicators.

b The precision criteria do not apply when determinations are near the detection limit of the specific method being performed due to the inherent uncertainty of data determinations derived from trace level samples at or below the reporting limits. However, in all instances where the criteria have not been met, the data will be flagged, and the acceptance of the data for its intended objectives will be discussed in the final report.

c Accuracy is, in general, defined as percent recovery of spiked analytes or the bias associated with the measurements of standard reference materials and standards. When standard reference materials are analyzed as accuracy assessment samples, an acceptance range around the "true" value is used to evaluate accuracy.

d Elemental analysis will include the following: carbon, hydrogen, oxygen, nitrogen, sulfur, and chlorine.

e Surrogate spike compounds will be the same as those recommended for the EPA contract laboratory program (CLP). Surrogate spike compounds are identified in Tables 5-2 and 5-3.

f Metals analysis performed on the multi-metals train samples will include the following metallic analytes: antimony, arsenic, beryllium, cadmium, chromium, lead, mercury, nickel, thallium, and zinc.
Metals analysis performed on the feed samples will include the following elements: antimony, arsenic, barium, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, and thallium.

g The matrix spike compounds for volatiles and semivolatiles will be the same as those recommended for use in the EPA contract laboratory program. Matrix spike compounds are identified in Tables 5-4 and 5-5.

h The front two Tenax™ tubes and back volatile organic sampling train traps will be analyzed separately to determine the possible POHC breakthrough to the Anasorb™ 747 portion of the adsorbents. The analysis of the Anasorb™ 747 trap should show less than 30 percent of the POHC collected on the two front Tenax™ traps. Breakthrough of the POHC to the Anasorb™ 747 above this level may cause loss of desorption efficiency and would indicate a possible negative bias in the DRE calculations. This criterion does not apply when less than 75 ηg of POHC is detected on the back trap.

i The dioxin and furan, semivolatile, or PAH carbon-13-labeled or chlorine-37-labeled sampling surrogate spike compounds are identified in Table 5-6.

TABLE 5-1 (Continued)

SUMMARY OF TARGET DATA QUALITY OBJECTIVES FOR PRECISION AND ACCURACY

j The dioxin and furan isotope dilution internal standard spike compounds will be the labeled isomers identified in Table 5-7.

k The PAH isotope dilution internal standard spike compounds will be the labeled isomers identified in Table 5-8.

l For oxygen, analyses should agree within 0.3 percent oxygen when oxygen is less than 15 percent or by 0.2 percent when oxygen is greater than 15.0 percent.

m An ambient air audit should show 20.8 ±0.5 percent oxygen.

TABLE 5-2

VOLATILE SURROGATE COMPOUNDS WITH TARGET RECOVERY CRITERIA

Compound	Target Aqueous Surrogate Spike Recoveries	Target Solid and VOST Surrogate Spike Recoveries
Toluene-d_8	50 to 130%	50 to 130%
4-Bromofluorobenzene	50 to 130%	50 to 130%
1,2-Dichloroethane-d_4	50 to 130%	50 to 130%

Note:

VOST Volatile organic sampling train

TABLE 5-3

SEMIVOLATILE SURROGATE COMPOUNDS WITH TARGET RECOVERY CRITERIA

Compound	Target Aqueous Surrogate Spike Recoveries	Solid and MM5 Surrogate Spike Recoveries
d_5-Nitrobenzene	35 to 114%	23 to 120%
2-Fluorobiphenyl	43 to 116%	30 to 115%
d_{14}-Terphenyl	33 to 141%	18 to 137%
d_6-Phenol	10 to 110%	24 to 113%
2-Fluorophenol	21 to 110%	25 to 121%
2,4,6-Tribromophenol	10 to 123%	19 to 122%

Note:

MM5 Modified Method 5

TABLE 5-4

VOLATILE MATRIX SPIKE COMPOUNDS WITH TARGET RECOVERY CRITERIA

Compound	Target Aqueous Matrix Spike Recoveries	Target Solid and VOST Matrix Spike Recoveries
1,1-Dichloroethene	50 to 130%	50 to 130%
Trichloroethene	50 to 130%	50 to 130%
Benzene	50 to 130%	50 to 130%
Toluene	50 to 130%	50 to 130%
Chlorobenzene	50 to 130%	50 to 130%

Note:

VOST Volatile organic sampling train

TABLE 5-5

SEMIVOLATILE MATRIX SPIKE COMPOUNDS WITH TARGET RECOVERY CRITERIA

Compound	Target Aqueous Matrix Spike Recoveries	Target Solid and MM5 Front-Half Matrix Spike Recoveries
Phenol	12 to 150%	26 to 150%
2-Chlorophenol	27 to 150%	25 to 150%
1,4-Dinitrophenol	36 to 150%	28 to 150%
N-Nitroso-di-n-propylamine	41 to 150%	41 to 150%
1,2,4-Trichlorobenzene	39 to 150%	38 to 150%
4-Chloro-3-methylphenol	23 to 150%	26 to 150%
Acenaphthene	46 to 150%	31 to 150%
4-Nitrophenol	10 to 150%	11 to 150%
2,4-Dinitrotoluene	24 to 150%	28 to 150%
Pentachlorotoluene	9 to 150%	17 to 150%
Pyrene	26 to 150%	35 to 150%

Note:

MM5 Modified Method 5

TABLE 5-6

DIOXIN AND FURAN, SEMIVOLATILE, AND PAH SAMPLING SURROGATE SPIKE COMPOUNDS WITH TARGET RECOVERIES

Compound	MM5 Target QC % Recovery
Semivolatile Sampling Surrogate Compounds	
$^{13}C_3$-labeled Naphthalene	50 to 150%
Method 0023A Sampling Surrogate Compounds	
$^{37}Cl_4$-2,3,7,8-Tetrachlorodibenzodioxin	70 to 130%
$^{13}C_{12}$-1,2,3,4,7,8-Hexachlorodibenzodioxin	70 to 130%
$^{13}C_{12}$-2,3,4,7,8-Pentachlorodibenzofuran	70 to 130%
$^{13}C_{12}$-1,2,3,4,7,8-Hexachlorodibenzofuran	70 to 130%
$^{13}C_{12}$-1,2,3,4,7,8,9-Heptachlorodibenzofuran	70 to 130%
PAH Sampling Surrogate Compounds	
d_{10}-Methyl-naphthalene	50 to 150%
d_{12}-Perylene	50 to 150%
d_{14}-Terphenyl	50 to 150%

Notes:

MM5 Modified Method 5
PAH Polynuclear aromatic hydrocarbon
QC Quality control

TABLE 5-7

DIOXIN AND FURAN ISOTOPE DILUTION INTERNAL STANDARD SPIKE COMPOUNDS WITH TARGET RECOVERIES

Compound	MM5 Target QC % Recoveries
$^{13}C_{12}$-2,3,7,8-Tetrachlorodibenzodioxin	40 to 120%
$^{13}C_{12}$-2,3,7,8-Tetrachlorodibenzofuran	40 to 120%
$^{13}C_{12}$-1,2,3,7,8-Pentachlorodibenzodioxin	40 to 120%
$^{13}C_{12}$-1,2,3,7,8-Pentachlorodibenzofuran	40 to 120%
$^{13}C_{12}$-1,2,3,6,7,8-Hexachlorodibenzodioxin	40 to 120%
$^{13}C_{12}$-1,2,3,6,7,8-Hexachlorodibenzofuran	40 to 120%
$^{13}C_{12}$-1,2,3,4,6,7,8-Heptachlorodibenzodioxin	40 to 120%
$^{13}C_{12}$-1,2,3,4,6,7,8-Heptachlorodibenzofuran	40 to 120%
$^{13}C_{12}$-Octachlorodibenzodioxin	40 to 120%

Notes:

MM5 Modified Method 5
QC Quality control

TABLE 5-8

PAH ISOTOPE DILUTION INTERNAL STANDARD SPIKE COMPOUNDS WITH TARGET RECOVERIES

Compound	MM5 Target QC % Recoveries
Naphthalene-d_8	50 to 150%
Acenaphthylene-d_8	50 to 150%
Acenaphthene-d_{10}	50 to 150%
Fluorene-d_{10}	50 to 150%
Phenanthrene-d_{10}	50 to 150%
Anthracene-d_{10}	50 to 150%
Fluoranthene-d_{10}	50 to 150%
Pyrene-d_{10}	50 to 150%
Benzo(a)anthracene-d_{12}	50 to 150%
Chrysene-d_{12}	50 to 150%
Benzo(b)fluoranthene-d_{12}	50 to 150%
Benzo(k)fluoranthene-d_{12}	50 to 150%
Benzo(a)pyrene-d_{12}	50 to 150%
Benzo(g,h,i)perylene-d_{12}	50 to 150%
Indeno(1,2,3-c,d)pyrene-d_{12}	50 to 150%
Dibenzo(a,h)anthracene-d_{14}	50 to 150%

Notes:

MM5 Modified Method 5
PAH Polynuclear aromatic hydroacarbon
QC Quality Control

The following definitions of precision, accuracy, and completeness will be used for this project (calculation formulas may be found in Section 13.0):

Accuracy: Accuracy is a measurement of the bias in a system or the degree of agreement of a measurement X (or an average of measurements of the same parameter) with an accepted reference or "true" value T. Accuracy is typically expressed as a percent recovery calculated by the ratio of the measurement and the accepted value:

$$(X/T)100$$

Accuracy objectives are identified in Table 5-1.

Precision: Precision is a measurement of mutual agreement among individual measurements of the same property, usually under "prescribed similar conditions." Precision is expressed in terms of the relative percent difference (RPD) between duplicate determinations when the number of replicate determinations is less than four or in terms of the relative standard deviation (RSD) when four or more determinations are made. Various measurements of precision are used depending on the prescribed similar conditions. Precision objectives are shown in Table 5-1.

Completeness: Completeness is a measurement of the amount of valid data obtained from a measurement system as compared to the amount expected to be collected under optimal, normal conditions. Completeness is usually expressed as a percentage, and its calculation is based on the number of samples reaching the laboratory for analysis. Samples resulting from trial burn runs that are judged to be invalid on the basis of field performance indicators or aborted runs will not be submitted to the laboratory for analysis. The completeness objective for the trial burn will be to obtain acceptable results for all parameters, as described in Section 3.0, for three trial burn runs per test condition. The completeness DQO (100 percent completeness) will be met if these valid tests are obtained. With regard to the objective of obtaining valid runs, the impact of any sample losses will be assessed in the trial burn report. Analytical results will be reported in the trial burn report for all samples that receive analytical testing per regulatory reporting requirements.

Representativeness: Representativeness is the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Representative samples are those whose results are comparable to other data sets. Representativeness in stack sampling is achieved through the use of EPA’s 1990 standard stack sampling methodologies, which are found in the “Handbook - Quality

Assurance/Quality Control Procedures for Hazardous Waste Incineration" (EPA/625/6-89/012) (QA/QC Handbook).

Comparability: Comparability is the expression of confidence that one data set can be compared to another. Comparability of the trial burn data sets will be high due to the use of standardized methodology and the generation of data in common units.

Several procedures will be used for monitoring the precision and accuracy objectives of the analytical program. Sampling and analytical activities will follow standard referenced procedures whenever possible. Standard reference materials (SRM), calibration standards, internal standards, and surrogate compounds will be high-purity materials that are commercially available. Typically, these materials are greater than 99 percent pure and have a concentration that has been certified by the manufacturer. Analytical instruments used will be calibrated per the reference method requirements prior to sample analysis in order to demonstrate that accurate performance levels are being met. Data precision and accuracy will be assessed by evaluating the results from the analysis of internal standards, surrogate compounds, laboratory blanks, calibration check standards, reagent blanks, method blanks, field and trip blanks, duplicate samples, and matrix or surrogate spiked samples. Sections 6.0 and 10.0 describe the project-specific QC sample types that will be analyzed and list the sampling and analytical methods to which they will be applied.

When analytical QC procedures reveal that a measurement's error has exceeded the target criterion, the source of the deviation will be identified, and corrective action will be taken, as described in Section 14.0. If data fall outside the acceptable range of precision and accuracy, even after corrective action has been taken, those data points will be flagged and discussed specifically in the trial burn report. Whenever possible, alternative procedures (either sampling or analytical) will be considered and recommended to the analytical project manager. Any changes or additions will be submitted to the [*Enter Regulatory Agency*] for approval before final implementation.

5.1 EVALUATION OF PRECISION

The target precision estimates presented in Table 5-1 display acceptable target variability levels for replicate measurements of the same parameters and are expressed in terms of RPD for duplicate samples and as RSD when three or more data points are being compared. When analyses involve high levels of analytes, precision will be evaluated by conducting duplicate analyses of an unspiked sample and calculating the RPD. In this case, the result that will be used in trial burn calculations will be the average result of the original and the duplicate. If duplicate analyses indicate a possible precision concern, additional replicates will be performed to determine the value or to evaluate a potential cause of the measurement variability. Some analyses require the evaluation of a larger data set; in which case, precision will be reported as RSD. Examples of large data sets that will be used to evaluate precision include surrogate spikes for volatile and semivolatile determinations. When the analytical results approach the detection limit, precision often is affected adversely because of the enhanced uncertainty of determinations at the lower end of the method applicability. For those determinations near the method detection limit, the precision estimates that are outside the target DQOs will be flagged as estimated measurements. In cases in which duplicates are performed and one result is less than the practical quantitation limit, but greater than the method detection limit, the average will be reported and flagged as an estimated value. When duplicate analyses are performed with a combination of detected and nondetected results, data will be flagged to explain precision was not calculated. Precision data will be calculated and presented in the trial burn report.

For the analyses of density, British thermal unit (Btu), percent ash content, elemental analysis, moisture, viscosity, total chlorine, total dissolved solids (TDS), total solids (TS), total suspended solids (TSS), and stack gas particulate samples will be analyzed in duplicate. In the case of particulate analysis, duplicate measurements will entail replicate weight determinations to a constant final weight to demonstrate consistency. During the analysis of volatile and semivolatile organic compounds using gas chromatography and mass spectrometry (GC/MS), both the RPD from duplicate analysis and the RSD of surrogate recoveries from analytical determinations will be used to evaluate precision.

An evaluation of precision for the volatile organics sampling train (VOST) analyses requires an additional approach. Duplicate Tenax™ and Anasorb™ 747 traps will be spiked with the project-specific volatile surrogates and matrix spike compounds. These are spiked resin blanks and are analyzed prior to the collection of field samples. The RPD associated with each analyte should be less than or equal to 25 percent for these spiked resin blanks. Additional precision data for the actual samples will be obtained by calculating the RSD associated with surrogate spikes applied to each VOST sample.

The precision of CEM analyzers will be evaluated during the trial burn by using the following standard equation for these measurements:

$$\text{Precision } (as\ \%Drift) = \left(\frac{SR_f - SR_i}{Span} \right) x\ 100$$

where:

Sr_f	=	Final system response at end of a trial burn run
SR_i	=	Initial system response at start of a trial burn run
Span	=	Maximum gas concentration that an analyzer can detect

Precision estimates from matrix spikes and matrix spike duplicates will be conducted for Method 5 impinger samples that receive anion analysis by ion chromatography. Process samples of makeup water, caustic feed, scrubber purge water, incinerator ash, and waste feed samples will be evaluated with matrix spike and matrix spike duplicate determinations.

5.2 EVALUATION OF ACCURACY

Accuracy values presented in Table 5-1 represent components of both random error and bias, which are expressed as percent recovery of a "known" concentration of analyte spike, surrogate spike, standard reference material analysis, or audit sample analysis. Where direct analyses of a known standard material can be evaluated, accuracy may be assessed by analysis of a sample of the reference standard. SRMs will be used to evaluate the accuracy of stack gas hydrogen chloride samples, hexavalent

chromium samples, dioxins and furans, metals on filter media, and the various proximate analyses. SRMs available from the National Institute of Standards and Technology will be purchased for these parameters. In cases in which the matrix or sample preparation is to be evaluated for effects on accuracy, matrix spikes will be evaluated in the samples. In some cases, a combination of these accuracy evaluation procedures will be used. The accuracy of organic determinations by GC/MS analysis will include spiking each sample with surrogate compounds. Section 13.0 provides more discussion of accuracy calculations. All accuracy data will be presented in the trial burn report.

An assessment of accuracy on the VOST will include an evaluation of the analysis of the front and back VOST traps analyzed separately to determine possible POHC breakthrough to the Anasorb™ 747 portion of the sampling train. The analysis of an Anasorb™ 747 trap should indicate less than 30 percent of the POHC concentration that is collected by the front two Tenax™ traps. Breakthrough of the POHC to the Anasorb™ 747 above this level may cause loss of the desorption efficiency and result in a negative bias in the analytical result. This criterion does not apply when less than 75 nanograms (ηg) is detected on the back trap.

The accuracy of all CEM analyzers will be evaluated during the test by the measurement of percent accuracy as defined by the following equation:

$$\%\ Calibration\ Error\ (Accuracy) = \left(\frac{Value_a - Value_e}{Span} \right) x\ 100$$

where:

$Value_a$ = Analyzer indication of calibration gas concentration
$Value_e$ = Certified concentration of calibrated gas
Span = Maximum gas concentration that an analyzer can detect

The accuracy of oxygen and carbon monoxide CEM analyzers will be evaluated initially during a CEM performance specification test (PST) conducted prior to the trial burn. This CEM test will include tests for calibration drift, response time, calibration error, and relative accuracy per 40 CFR Part 266, Appendix IX, Section 2.1. Section 8.3 and Table 8-2 present additional CEM requirements for this test.

5.3 DETECTION AND REPORTING LIMIT DETERMINATIONS

Detection limits and reporting limits (described in Section 11.1.3) will be determined and proven, when necessary. The method of determining and proving limits is discussed in the following sections.

Volatiles POHCs in the VOST Samples

Results of nondetection for the volatile POHCs are not, in general, expected for VOST samples because of the relative concentrations of chlorobenzene typically expected to be present in the stack gas if present at relatively high concentrations in the feed. The 99.99 percent DRE performance of the [*boiler or incinerator*] is demonstrated if loading of the VOST tubes is below [*Enter Calculation in Nanograms*] ηg per [*Enter Calculation Reference*]. Therefore, performance of the unit is not based on the reporting limit of the analytical method. If a nondetection value must be demonstrated to be appropriate, then matrix spike samples will be performed by the laboratory, which will demonstrate the recovery and reproducibility of 200- to 250-ηg spikes of the POHCs applied to the resin material of each type of VOST cartridge. For optimum performance, the loading of VOST tubes at the 99.99 percent DRE should be at least one order of magnitude greater than the concentration of the lowest calibration standard applied for instrument calibration. Values of POHC concentration that are either greater than the highest calibration standard concentration, or below the lowest calibration standard concentration will be flagged as estimated values of the actual POHC concentration.

Chloride in the Stack Gas Samples

Results of nondetection are not, in general, expected for chloride samples from the Method 5 sampling trains because of the relative concentrations of hydrogen chloride and chlorine expected to be present in the stack gas. If nondetection values must be proven to be valid, matrix spike samples will be performed by the laboratory, which will demonstrate the recovery and reproducibility of spikes onto the stack gas samples at levels that are three to five times higher than the reporting limit used for this analytical method.

Metals in the Waste Feed Samples

In order to provide appropriate and defensible reporting limits for these samples, matrix spike and matrix spike duplicate portions of the waste feed samples will be analyzed. These samples will be spiked with the target metallic analytes at levels that are three to five times higher than the reporting limit of the method to demonstrate that the recovery and reproducibility of the analytical method are within the target DQOs.

Metals in the Stack Gas Samples

Results of nondetection are not, in general, expected for metallic analytes in stack gas samples because of the relative concentrations of metals expected to be present in the stack gas, and the low detectability of the inductively coupled argon plasma spectroscopy (ICP) or the ICP/MS methodology. If the validity of nondetection values must be proven, matrix spike samples will be performed by the laboratory, which will demonstrate the recovery and reproducibility of spikes onto full blank sampling trains spiked at levels that are three to five times higher than the reporting limit of the method. Two complete sets of blank train samples including spikes to filters and the impinger, will be prepared in the laboratory and spiked for the assessment of reporting limit values.

Semivolatile POHCs in the Stack Gas Samples

The level of naphthalene that demonstrates that a 99.99 percent DRE performance has been achieved by the incineration unit is [*Enter Calculation in Micrograms*] micrograms (µg) for Modified Method 5 (MM5) sampling train per [*Enter Calculation Reference*]. A reporting limit of approximately 50 µg per MM5 sampling train (sum of front half, back half, and impinger fractions) is a typical level that is demonstrable with matrix spikes and the level that should be detectable in these samples. Because the expected detectable level in these samples will be far below the performance DRE level, a reporting limit demonstration is not needed. The relative accuracy spikes of the spiked resin blanks and surrogate spikes will suffice to demonstrate the required performance. For optimum analytical performance, the

concentration of POHCs at the 99.99 percent DRE should be at least one order of magnitude greater than the concentration of the lowest calibration standard.

Formaldehyde in the Stack Gas Samples

Results of nondetection are not, in general, expected for stack gas samples of formaldehyde because of the relative concentrations of formaldehyde expected to be present in the stack gas. If the validity of nondetection values must be proven, then matrix spike samples will be performed by the laboratory, which will demonstrate the recovery and reproducibility of spikes onto the stack gas samples at levels that are three to five time higher than the reporting limit of the method.

Hexavalent Chromium in the Stack Gas Samples

Results of nondetection are not expected for stack gas samples because of the relative concentrations of hexavalent chromium expected to be present in the stack gas. If the validity of nondetection values must be proven, matrix spike samples will be performed by the laboratory, which will demonstrate the recovery and reproducibility of spikes onto the stack gas samples at levels that are three to five times higher than the reporting limit of the method.

Dioxins and Furans in the Stack Gas Samples

When a dioxin or furan analyte is not detected in isotope dilution internal standard methods, a sample-specific detection limit is calculated for each dioxin and furan analyte. This is done by (1) determining the GC/MS peak height of the noise or interferant in the expected region of the analyte signal, (2) multiplying this value by a safety factor of 2.5 to determine the detection limit (the 2.5 safety factor is disregarded if the noise or signal present in the analyte region is a result of chemical interferences), (3) using the resulting signal response values from interferants in the sample calculation as if they were detected dioxins or furans, and (4) flagging the result as the estimated sample detection limit (estimated maximum possible concentration).

Volatile and Semivolatile PICs in the Stack Gas Samples

The volatile and semivolatile PICs on VOST and MM5 train samples will be reported for analytes that give responses that are 10 percent of the relative area of the nearest internal standard. The 20 highest volatile and 20 highest semivolatile PICs will be identified by a library search using the National Bureau of Standards (NBS) library of organic compounds. Compounds that have an intensity that is greater than 10 percent of the nearest internal standard will be semiquantitated and reported. Peaks that have intensities that are less than 10 percent of the nearest internal standard will not be reported. The standard compounds list for Methods 8260 and 8270 represent the standard scan list of volatile and semivolatile PICs that will be quantitated for these samples. PICs will include compounds from the standard scan list and compounds identified by library search that are outside the scan list. Compounds on the standard scan list will be reported per the standard EPA Method SW-846 using laboratory-determined practical quantitation limits (PQL). PQLs are, in general, 2.5 times higher than the method detection limits (MDL).

5.4 EVALUATION OF COMPLETENESS

Data completeness represents the percentage of valid data collected from a measurement system as compared to the total amount expected to be obtained under optimal or normal conditions. The sampling completeness objective for the trial burn will be to obtain representative samples for all analytical parameters while operating the unit at the desired test specifications for a total of three test runs per test condition. The completeness objective for the trial burn will be to obtain acceptable results for all parameters for these trial burn runs. The completeness DQO (100 percent completeness) will be met if valid tests runs are obtained. Samples resulting from runs that are judged to be invalid based on field indicators of incinerator performance (or aborted runs) will not be submitted to the laboratory for analysis and are not considered to be a part of the sample completeness objective. When runs are invalid, sampling runs will be repeated until the appropriate number of runs for each trial burn test condition has been obtained. The impact of any occurrence of sample loss will be assessed against the objective of obtaining valid runs and will be discussed in the trial burn report.

6.0 SAMPLING AND MONITORING PROCEDURES

[*REQUIREMENT: In this section, the applicant shall describe the sampling and monitoring procedures that will be used in the collection of the trial burn samples. In addition, the applicant shall present a table giving all sampling points, sampling frequencies, total number of samples, and replicate and field duplicates.*]

The primary objective of this trial burn sampling and monitoring program is the collection of representative feed, process, and stack gas samples that will provide the analytical data necessary to evaluate the [*incinerator or boiler*]'s performance and demonstrate compliance with appropriate RCRA and BIF regulations. This objective will be met by reducing the risk of all known potential sources of fugitive contamination or bias that may be introduced to the samples by the sampling equipment, ambient conditions, handling, and sample preservation techniques. Tables 6-1A, 6-1B, and 6-1C summarize the planned sampling techniques, methodology, and containers that are to be used for each sample type collected during this test. The sampling techniques or methods listed in Tables 6-1A, 6-1B, and 6-1C are further described in standard operating procedures in Appendix D-5.7 of the TBP.

In developing the sampling procedures, the areas of waste and media, including physical state, composition, required sample volume, sample location accessibility, and time-dependent phenomena, were considered. Standard sampling methods, such as American Society for Testing and Materials (ASTM) methods, will be used for sampling the various feed and process streams. Stack gas samples will be collected using standard EPA methods from either SW-846 or CFR specifications. During the trial burn, all sampling and monitoring activities will be documented thoroughly. Regulatory agency approval will be requested if significant deviations from these procedures are expected during the sampling and monitoring procedures.

During the trial burn, the [*incineration or boiler*] system will be operated and tested under the operating conditions, as specified in the TBP. The following samples will be collected during the trial burn:

TABLE 6-1A

PLANNED SAMPLE COLLECTION METHODS, FREQUENCY, AND CONTAINERS HIGH-TEMPERATURE METALS EMISSIONS TEST—3 RUNS

Sample Name (Matrix)	Analysis	Type of Container(s)	Sampling Method	Sampling Frequency	Test Samples	Field QC Samples	Total Field Samples Collected
Feed and Process Samples							
Low-Btu Liquid Waste Feed (Water sample material with various organic compounds)	Btu, % ash, elemental analysis[a], density, viscosity, total chlorine	1-L Boston-round amber glass	S004[b], ASTM D-057[d]	Collect a grab aliquot every 15 minutes during each trial burn run[e].	3	--	3
	Metals	250-mL Boston-round amber glass	S004[b], ASTM D-4057[d]	Collect a grab aliquot every 15 minutes during each trial burn run[e].	3	--	3
High-Btu Liquid Waste Feed (Various organic compounds dissolved in organic solvents)	Btu, % ash, elemental analysis, density, viscosity, total chlorine	1-L Boston-round amber glass	S004[b], ASTM D-4057[d]	Collect a grab aliquot every 15 minutes during each trial burn run[e].	3	--	3
	Metals	1-L Boston-round amber glass	S007[c], ASTM D-4057[d]	Collect a grab aliquot every 15 minutes during each trial burn run[e].	3	--	3
Solid Waste Feed (Solid feed material with various organic compounds)	Btu, % ash, elemental analysis, density, total chlorine	1-L wide-mouth powder jar	S007[c], ASTM D-4057[d]	Collect a grab aliquot every 15 minutes during each trial burn run[e].	3	--	3
	Metals	1-L wide mouth powder jar	S007[c], ASTM D-4057[d]	Collect a grab aliquot every 15 minutes during each trial burn run[e].	3	--	3
Scrubber Purge Water (Aqueous and some solids)	TDS/TSS/TS	1-L Boston-round amber glass	S004[b], ASTM D-4057[d]	Collect a grab aliquot every 30 minutes during each trial burn run[e].	3	--	3
	Metals	250-mL Boston-round amber glass	S004[b], ASTM D-4057[d]	Collect a grab aliquot every 15 minutes during each trial burn run[e].	3	--	3

TABLE 6-1A (Continued)

PLANNED SAMPLE COLLECTION METHODS, FREQUENCY, AND CONTAINERS HIGH-TEMPERATURE METALS EMISSIONS TEST—3 RUNS

Sample Name (Matrix)	Analysis	Type of Container(s)	Sampling Method	Sampling Frequency	Test Samples	Field QC Samples	Total Field Samples Collected
Incinerator Ash	Metals	1-L wide mouth powder jar	S007[c], ASTM D-4057[d]	Collect a grab aliquot every 30 minutes during each trial burn run[e].	3	--	3
Stack Gas Samples							
M5 Train Particulate (Particulate filter and acetone probe rinse)	Particulate residue	Petri dish, 250-mL Boston-round amber glass	Method 5[f], Method 0050[g]	Collect 2 m^3 at a sampling rate of ≤ 0.75 m^3/hr.	3 filters, 3 acetone probe rinses	2 reagent blanks (1 filter, 1 acetone probe rinse)	7
M5 Train (0.1N sulfuric acid impinger composite)	Hydrogen chloride	1-L amber Boston-round glass	Method 5[f], Method 0050[g]	Collect 2 m^3 at a sampling rate of ≤ 0.75 m^3/hr.	3	1 reagent blank (0.1N sodium hydroxide impinger solution)	4
M5 Train (0.1N sodium hydroxide impinger composite)	Chlorine	1-L amber Boston-round glass	Method 5[f], Method 0050[g]	Collect 2 m^3 at a sampling rate of ≤ 0.75 m^3/hr.	3	1 reagent blank (0.1N NaOH impinger solution)	4
MMT Front Half Composite (Filter and nitric acid probe rinse)	Target metals and mercury[1]	Petri dish, 250-mL Boston-round amber glass	Method 0060[h]	Collect 2 m^3 at a sampling rate of ≤ 0.75 m^3/hr.	3	2 reagent blanks, 1 blank train	6
MMT Nitric Acid Impinger Composite (5% nitric acid and 10% hydrogen peroxide)	Metals and mercury[1]	1-L amber Boston-round amber glass	Method 0060[h]	Collect 2 m^3 at a sampling rate of ≤ 0.75 m^3/hr.	3	1 reagent blank, 1 blank train	5
MMT Empty Impinger (Empty at start of test)	Mercury	1-L amber Boston-round glass	Method 0060[h]	Collect 2 m^3 at a sampling rate of ≤ 0.75 m^3/hr.	3	1 blank train	4

TABLE 6-1A (Continued)

PLANNED SAMPLE COLLECTION METHODS, FREQUENCY, AND CONTAINERS HIGH-TEMPERATURE METALS EMISSIONS TEST—3 RUNS

Sample Name (Matrix)	Analysis	Type of Container(s)	Sampling Method	Sampling Frequency	Test Samples	Field QC Samples	Total Field Samples Collected
MMT Potassium Permanganate Impinger Composite (4% potassium permanganate and 10% sulfuric acid impinger composite and deionized water rinses)	Mercury	1-L amber Boston-round glass	Method 0060[h]	Collect 2 m^3 at a sampling rate of ≤ 0.75 m^3/hr.	3	1 reagent blank, 1 blank train	5
MMT 8N Hydrogen Chloride Rinse	Mercury	250-mL amber Boston-round glass	Method 0060[h]	Collect 2 m^3 at a sampling rate of ≤ 0.75 m^3/hr.	3	1 reagent blank, 1 blank train	5
Hexavalent Chromium Train Potassium Hydroxide Impinger Composite (1.0N potassium hydroxide impinger composite)	Hexavalent chromium	1-L amber Boston-round glass	Method 0061[i]	Collect 2 m^3 at a sampling rate of ≤ 0.75 m^3/hr.	3	2 field spikes per run, 1 reagent blank, 1 blank spike	11
Orsat	Oxygen and carbon dioxide	Tedlar™ bag	Method 3, Method 3A[j]	Collect 2 bags per run.	6	--	6

TABLE 6-1A (Continued)

PLANNED SAMPLE COLLECTION METHODS, FREQUENCY, AND CONTAINERS HIGH-TEMPERATURE METALS EMISSIONS TEST—3 RUNS

Notes:

--	Not applicable
≤	Less than or equal to
% ash	Percent ash
ASTM	American Society for Testing and Materials
Btu	British thermal unit
CFR	Code of Federal Regulations
L	Liter
m^3	Cubic meter
m^3/hr	Cubic meters per hour
M5	Method 5
mL	Milliliter
MMT	Multi-metals train
N	Normality
QC	Quality control
TDS	Total dissolved solids
TS	Total solids
TSS	Total suspended solids
a	Elemental analysis will include the following: carbon, hydrogen, oxygen, nitrogen, and sulfur.
b	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.
c	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.
d	ASTM D-4057-88, "Practice for Manual Sampling of Petroleum and Petroleum Products." Taken from *American Society for Testing and Materials*; *Annual Book of ASTM Standards*; ASTM: Philadelphia, PA, 1990.
e	An equal volume of each sample aliquot will be collected at the indicated time interval. All aliquots will be composited in the field to create a single test sample for each run, with the exception of samples receiving volatiles analysis. The sample portions designated for volatile analysis will be syringe or weight composited in the analytical laboratory to create a single test sample for each run.
f	Method 5 is appropriate for sampling stack gas isokinetically. Taken from "Method 5 Sampling Train," 40 CFR 60, Appendix A, July (1990).

TABLE 6-1A (Continued)

PLANNED SAMPLE COLLECTION METHODS, FREQUENCY, AND CONTAINERS HIGH-TEMPERATURE METALS EMISSIONS TEST—3 RUNS

Notes (Continued):

g Method 0050 is appropriate for sampling for hydrogen chloride and chlorine in stack gas isokinetically. Taken from "Isokinetic HCl/Cl_2 Emission Sampling Train," *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, (SW-846), 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.

h Method 0060 is appropriate for sampling for metals in stack gas. Taken from "Determination of Metals in Stack Emissions," *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, (SW-846), 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.

i Method 0061 is appropriate for sampling for hexavalent chromium in the stack gas. Taken from "Determination of Hexavalent Chromium Emissions from Stationary Sources," *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, (SW-846), 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.

j Methods 3 and 3A are appropriate for sampling stack gas in Tedlar™ bags for Orsat analysis. Taken from 40 CFR 60, July 1996.

TABLE 6-1B

PLANNED SAMPLE COLLECTION METHODS, FREQUENCY, AND CONTAINERS LOW-TEMPERATURE DRE PERFORMANCE DEMONSTRATION TEST—3 RUNS

Sample Name (Matrix)	Analysis	Type of Container(s)	Sampling Method	Sampling Frequency	Test Samples	Field QC Samples	Total Field Samples Collected
Feed and Process Samples							
Low-Btu Liquid Waste Feed (Water sample material with various organic compounds)	Btu, % ash, elemental analysis[a], density, viscosity, total chlorine	1-L Boston-round amber glass	S004[b], ASTM D-4057[d]	Collect a grab aliquot every 15 minutes during each trial burn run[e].	3	--	3
	Semivolatile POHCs	1-L Boston-round amber glass	S004[b], ASTM D-4057[d]	Collect a grab aliquot every 15 minutes during each trial burn run[e].	3	--	3
	Volatile POHCs	2 - 40-mL volatile organic analysis vials	S004[b], ASTM D-4057[d]	Collect a grab aliquot every 15 minutes during each trial burn run[e].	3	--	3
High-Btu Liquid Waste Feed (Various organic compounds dissolved in organic solvents)	Btu, % ash, elemental analysis, density, viscosity, total chlorine	1-L Boston-round amber glass	S004[b], ASTM D-4057[d]	Collect a grab aliquot every 15 minutes during each trial burn run[e].	3	--	3
	Volatile POHCs	2 - 40-mL volatile organic analysis vials	S004[b], ASTM D-4057[d]	Collect a grab aliquot every 15 minutes during each trial burn run[e].	3	--	3
	Semivolatile POHCs	1-L Boston-round Amber Glass	S004[b], ASTM D-4057[d]	Collect a grab aliquot every 15 minutes during each trial burn run[e].	3	--	3

TABLE 6-1B (Continued)

PLANNED SAMPLE COLLECTION METHODS, FREQUENCY, AND CONTAINERS LOW-TEMPERATURE DRE PERFORMANCE DEMONSTRATION TEST—3 RUNS

Sample Name (Matrix)	Analysis	Type of Container(s)	Sampling Method	Sampling Frequency	Test Samples	Field QC Samples	Total Field Samples Collected
Solid Waste Feed (Solid feed material with various organic compounds)	Btu, % ash, elemental analysis, density, total chlorine	1-L wide-mouth powder jar	S007[c], ASTM D-4057[d]	Collect a grab aliquot every 15 minutes during each trial burn run[e].	3	--	3
	Volatile POHCs	120-mL wide-mouth powder jars	S007[c], ASTM D-4057[d]	Collect a grab aliquot every 15 minutes during each trial burn run[e].	3	--	3
	Semivolatile POHCs	1-L wide-mouth powder jar	S007[c], ASTM D-4057[d]	Collect a grab aliquot every 15 minutes during each trial burn run[e].	3	--	3
Makeup Water (Tap water)	Volatile POHCs	2 - 40-mL volatile organic analysis vials	S004[b], ASTM D-4057[d]	Collect a grab aliquot every 30 minutes during each trial burn run[e].	3	--	3
	Semivolatile POHCs	1-L Boston-round amber glass	S004[b], ASTM D-4057[d]	Collect a grab aliquot every 30 minutes during each trial burn run[e].	3	--	3
Scrubber Purge Water (Aqueous and some solids)	TDS/TSS/TS	1-L Boston-round amber glass	S004[b], ASTM D-4057[d]	Collect a grab aliquot every 30 minutes during each trial burn run[e].	6	--	6
	Semivolatile POHCs	2 - 40-mL volatile organic analysis vials	S004b ,ASTM D-4057[d]	Collect a grab aliquot every 30 minutes during each trial burn run[e].	3	--	3

TABLE 6-1B (Continued)

PLANNED SAMPLE COLLECTION METHODS, FREQUENCY, AND CONTAINERS LOW-TEMPERATURE DRE PERFORMANCE DEMONSTRATION TEST—3 RUNS

Sample Name (Matrix)	Analysis	Type of Container(s)	Sampling Method	Sampling Frequency	Test Samples	Field QC Samples	Total Field Samples Collected
Scrubber Purge Water (Aqueous and some solids) (Continued)	Volatile POHCs	2 - 40-mL volatile organic analysis vials	S004[b], ASTM D-4057[d]	Collect a grab aliquot every 30 minutes during each trial burn run[e].	3	--	3
Caustic Feed (Sodium hydroxide in water)	Volatile POHCs	2 - 40-mL volatile organic analysis vials	S004[b], ASTM D-4057[d]	Collect a grab aliquot once during each trial burn run.	3	--	3
	Semivolatile POHCs	2 - 40-mL volatile organic analysis vials	S004[b], ASTM D-4057[d]	Collect a grab aliquot every 30 minutes during each trial burn run[e].	3	--	3
Incinerator Ash	Volatile POHCs	2 - 40-mL volatile organic analysis vials	S007[c], ASTM D-4057[d]	Collect a grab aliquot every 30 minutes during each trial burn run[e].	3	--	3
	Semivolatile POHCs	1-Liter wide-mouth powder jar	S007[c], ASTM D-4057[d]	Collect a grab aliquot every 30 minutes during each trial burn run[e].	3	--	3
Stack Gas Samples							
VOST Resin Tubes (Two Tenax™ resin tubes and an Anasorb™ 747 tube per set)	Volatile POHCs	VOST resin tubes	Method 0031[f]	Collect 4 resin tube sets[g], 40 minutes elapsed time at 0.5 L/min total 20 L per set).	12 sets	3 field blank sets, 1 trip blank set, 4 audit sets (if requested)	20 sets

TABLE 6-1B (Continued)

PLANNED SAMPLE COLLECTION METHODS, FREQUENCY, AND CONTAINERS LOW-TEMPERATURE DRE PERFORMANCE DEMONSTRATION TEST—3 RUNS

Sample Name (Matrix)	Analysis	Type of Container(s)	Sampling Method	Sampling Frequency	Test Samples	Field QC Samples	Total Field Samples Collected
VOST Condensate (Aqueous)	Volatile POHCs	2 - 40-mL volatile organic analysis vials	Method 0031[f]	Collect all condensate at the conclusion of each sampling run.	3	1 trip blank (deionized water)	4
MM5 Train A Front-Half Composite (Particulate filter and front-half filter holder and probe solvent rinses)	Semivolatile POHCs	Petri dishes, 250-mL Boston-round glass	Method 3542[h], Method 0010[i], Method 0023A[j]	Collect 3 m^3 at a sampling rate of ≤ 0.75 m^3/hr.	3	1 blank train front half composite, 2 field blanks	6
MM5 Train A Back-Half Composite (XAD-2 Resin Tube and back-half of the filter holder and coil condenser solvent rinses)	Semivolatile POHCs	XAD-2 resin tubes, 250-mL Boston-round glass	Method 3542[b] Method 0010[i], Method 0023A[j]	Collect 3 m^3 at a sampling rate of ≤ 0.75 m^3/hr.	3	3 XAD-2 field blanks, 1 XAD-2 trip blank, 1 blank train composite	8
MM5 Train A **(**Impinger composite and glassware solvent rinses)	Semivolatile POHCs	1 gallon amber Wheaton glass	Method 3542[h], Method 0010[i]	Collect 3 m^3 at a sampling rate of ≤ 0.75 m^3/hr.	3	1 blank train impinger composite, 1 field blank	5
M5 Train Particulate (Particulate filter and acetone probe rinse)	Particulate residue	Petri dish, 250-mL Boston-round amber glass	Method 5[k], Method 0050[l]	Collect 2 m^3 at a sampling rate of ≤ 0.75 m^3/hr.	3 filters, 3 acetone probe rinses	2 field blanks	8

TABLE 6-1B (Continued)

PLANNED SAMPLE COLLECTION METHODS, FREQUENCY, AND CONTAINERS LOW-TEMPERATURE DRE PERFORMANCE DEMONSTRATION TEST—3 RUNS

Sample Name (Matrix)	Analysis	Type of Container(s)	Sampling Method	Sampling Frequency	Test Samples	Field QC Samples	Total Field Samples Collected
M5 Train (0.1N sulfuric acid impinger composite)	Hydrogen chloride	1-L Boston-round amber glass	Method 5[k], Method 0050[l]	Collect 2 m^3 at a sampling rate of ≤ 0.75 m^3/hr.	3	1 reagent blank	4
M5 Train (0.1N sodium hydroxide impinger composite)	Chlorine	1-L Boston-round amber glass	Method 5[k], Method 0050[l]	Collect 2 m^3 at a sampling rate of ≤ 0.75 m^3/hr.	3	1 reagent blank	4
Orsat	Oxygen and carbon dioxide	Tedlar™ bag	Method 3, Method 3A[m]	2 Tedlar™ bags per run	6	--	6

Notes:

--	Not applicable
≤	Less than or equal to
% ash	Percent ash
ASTM	American Society for Testing and Materials
Btu	British thermal unit
CFR	Code of Federal Regulations
L	Liter
L/min	Liters per minute
m^3	Cubic meter
m^3/hr	Cubic meters per hour

TABLE 6-1B (Continued)

PLANNED SAMPLE COLLECTION METHODS, FREQUENCY, AND CONTAINERS LOW-TEMPERATURE DRE PERFORMANCE DEMONSTRATION TEST—3 RUNS

M5 Method 5

Notes (Continued):

mL Milliliter
MM5 Modified Method 5
N Normality
POHC Principal organic hazardous constituent
QC Quality control
TDS Total dissolved solids
TS Total solids
TSS Total suspended solids
VOST Volatile organic sampling train

a Elemental analysis will include the following: carbon, hydrogen, oxygen, nitrogen, and sulfur.

b 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.

c 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.

d ASTM D-4057-88, "Practice for Manual Sampling of Petroleum and Petroleum Products." Taken from *American Society for Testing and Materials*; *Annual Bood of ASTM Standards*; ASTM: Philadelphia, PA, 1990.

e An equal volume of each sample aliquot will be collected at the indicated time interval. All aliquots will be composited in the field to create a single test sample for each run, with the exception of samples receiving volatiles analysis. The sample portions designated for volatile analysis will be syringe or weight composited in the analytical laboratory to create a single test sample for each run.

f Method 0031 is appropriate for sampling for volatile organic compounds. Taken from "Sampling Method for Volatile Organic Compounds (SMVOC)," *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, (SW-846), 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

TABLE 6-1B (Continued)

PLANNED SAMPLE COLLECTION METHODS, FREQUENCY, AND CONTAINERS LOW-TEMPERATURE DRE PERFORMANCE DEMONSTRATION TEST—3 RUNS

and Emergency Response, Washington, D.C. 20460.

g Four resin tube sets will be collected during each run of the trial burn. Three of the sets will be analyzed at a minimum. The fourth set will be collected as a backup set and will be analyzed by the laboratory if sample loss or breakage occurs.

Notes (Continued):

h Method 3542 is appropriate for sampling for semivolatile analytes. Taken from "Extraction of Semivolatile Analytes Collected Using Method 0010 (Modified Method 5 Sampling Train," *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, (SW-846), Third Edition, September 1986. Contains 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.

i Method 0010 is appropriate for sampling stack gas for semivolatiles. Taken from "Modified Method 5 Sampling Train," *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, (SW-846), 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.

j Method 0023A is appropriate for sampling stack gas. Taken from "Sampling Method for Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofuran Emissions from Stationary Sources," *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, (SW-846), 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.

k Method 5 is appropriate for sampling stack gas isokinetically. Taken from "Method 5 Sampling Train." Taken from 40 CFR 60, Appendix A, July (1990).

l Method 0050 is appropriate for sampling stack gas for hydrogen chloride and chlorine isokinetically," Isokinetic HCl/Cl_2 Emission Sampling Train." Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, (SW-846), 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.

m Methods 3 and 3A are appropriate for sampling stack gas in Tedlar™ bags for Orsat analysis. Taken from 40 CFR 60, Appendix A July 1996.

TABLE 6-1C

PLANNED SAMPLE COLLECTION METHODS, FREQUENCY, AND CONTAINERS
STANDARD FACILITY OPERATING CONDITIONS RISK ASSESSMENT EMISSIONS TEST—3 RUNS

Sample Name (Matrix)	Analysis	Type of Container(s)	Sampling Method	Sampling Frequency	Test Samples	Field QC Samples	Total Field Samples Collected
Feed and Process Samples							
Low-Btu Liquid Waste Feed (Water sample material with various organic compounds)	Btu, % ash, elemental analysis[a], density, viscosity, total chlorine	1-L Boston-round amber glass	S004[b], ASTM D-4057[d]	Collect a grab aliquot every 15 minutes during each trial burn run[e].	3	--	3
	Semivolatile content	1-L Boston-round amber glass	S004[b], ASTM D-4057[d]	Collect a grab aliquot every 15 minutes during each trial burn run[e].	3	--	3
	Volatile content	2 - 40-mL volatile organic analysis vials	S004[b], ASTM D-4057[d]	Collect a grab aliquot every 15 minutes during each trial burn run[e].	3	--	3
	Metals	250-mL Boston-round amber glass	S004[b], ASTM D-4057[d]	Collect a grab aliquot every 15 minutes during each trial burn run[e].	3	--	3
High-Btu Liquid Waste Feed (Various organic compounds dissolved in organic solvents)	Btu, % ash, elemental analysis[a], density, viscosity, total chlorine	1-L Boston-round amber glass	S004[b], ASTM D-4057[d]	Collect a grab aliquot every 15 minutes during each trial burn run[e].	3	--	3

TABLE 6-1C (Continued)

PLANNED SAMPLE COLLECTION METHODS, FREQUENCY, AND CONTAINERS
STANDARD FACILITY OPERATING CONDITIONS RISK ASSESSMENT EMISSIONS TEST—3 RUNS

Sample Name (Matrix)	Analysis	Type of Container(s)	Sampling Method	Sampling Frequency	Test Samples	Field QC Samples	Total Field Samples Collected
High-Btu Liquid Waste Feed (Various organic compounds dissolved in organic solvents) (Continued)	Semivolatile content	1-L Boston-round amber glass	S004[b], ASTM D-4057[d]	Collect a grab aliquot every 15 minutes during each trial burn run[e].	3	--	3
	Volatile content	2 - 40-mL volatile organic analysis vials	S004[b], ASTM D-4057[d]	Collect a grab aliquot every 15 minutes during each trial burn run[e].	3	--	3
	Metals	1-L wide-mouth powder jar	S007[c], ASTM D-4057[d]	Collect a grab aliquot every 15 minutes during each trial burn run[e].	3	--	3
Solid Waste Feed (Solid feed material with various organic compounds)	Btu, % ash, elemental analysis[a], density, total chlorine	1-L wide-mouth powder jar	S007[c], ASTM D-4057[d]	Collect a grab aliquot every 15 minutes during each trial burn run[e].	3	--	3
	Volatile content	100-mL wide-mouth powder jar	S007[c], ASTM D-4057[d]	Collect a grab aliquot every 15 minutes during each trial burn run[e].	3	--	3
	Semivolatile content	1-L wide-mouth powder jar	S007[c], ASTM D-4057[d]	Collect a grab aliquot every 15 minutes during each trial burn run[e].	3	--	3

TABLE 6-1C (Continued)

PLANNED SAMPLE COLLECTION METHODS, FREQUENCY, AND CONTAINERS
STANDARD FACILITY OPERATING CONDITIONS RISK ASSESSMENT EMISSIONS TEST—3 RUNS

Sample Name (Matrix)	Analysis	Type of Container(s)	Sampling Method	Sampling Frequency	Test Samples	Field QC Samples	Total Field Samples Collected
Solid Waste Feed (Solid feed material with various organic compounds) (Continued)	Metals	1-L wide-mouth powder jar	S007[c], ASTM D-4057[d]	Collect a grab aliquot every 15 minutes during each trial burn run[e].	3	--	3
Scrubber Purge Water (Aqueous and some solids)	TDS/TSS/TS	1-L Boston-round amber glass	S004[b], ASTM D-4057[d]	Collect a grab aliquot every 30 minutes during each trial burn run[e].	3	--	3
Stack Gas Samples							
Volatile Unspeciated Mass (Tedlar™ Bags) C_1-C_7	Volatile unspeciated mass	Tedlar™ bags	Modified Method 0040[f]	1 Tedlar™ bag per run taking 2 to 3 hours per bag.	3	3 field blanks, 2 trip blanks, 3 field spikes, 1 train blank	12
Volatile Unspeciated Mass Condensate	Volatile unspeciated mass	2 - 40-mL volatile organic analysis vials	Modified Method 0040[f]	Collect the Method 0040 condensate at the end of each run.	3	1 train blank, 1 trip blank	5
VOST Resin Tubes (Two Tenax™ resin tubes and an Anasorb™ 747 tube per set)	Volatile PICs	VOST resin tubes	Method 0031[g]	Collect 4 resin tube sets[h] over 40 minutes elapsed time at 0.5 L/min (total 20 L per set).	12 sets	3 field blank sets, 1 trip blank set, 4 audit sets (if requested)	20 sets

TABLE 6-1C (Continued)

PLANNED SAMPLE COLLECTION METHODS, FREQUENCY, AND CONTAINERS
STANDARD FACILITY OPERATING CONDITIONS RISK ASSESSMENT EMISSIONS TEST—3 RUNS

Sample Name (Matrix)	Analysis	Type of Container(s)	Sampling Method	Sampling Frequency	Test Samples	Field QC Samples	Total Field Samples Collected
VOST Condensate (Aqueous)	Volatile PICs	2 - 40-mL volatile organic analysis vials	Method 0031[g]	Collect all condensate at the conclusion of each sampling run.	3	1 trip blank (deionized water)	4
MM5 Train A Front-Half Composite (Particulate filter and front-half filter holder and probe solvent rinses)	Semivolatile PICs, dioxins and furans	Petri dishes, 250-mL Boston-round glass	Method 3542[i], Method 0010[j], Method 0023A[k]	Collect 3 m^3 at a sampling rate of $\leq$ 0.75 m^3/hr.	3	1 blank train front-half composite, 2 field blanks	6
MM5 Train A Back-Half Composite (XAD-2 resin tube and back-half of the filter holder and coil condenser solvent rinses)	Semivolatile PICs, dioxins and furans	XAD-2 resin tubes, 250-mL Boston-round glass	Method 3542[i], Method 0010[j], Method 0023A[k]	Collect 3 m^3 at a sampling rate of $\leq$ 0.75 m^3/hr.	3	3 field blanks, 1 trip blank, 1 blank train back-half composite	8
MM5 Train A Impinger Composite (Impinger composite and glassware solvent rinses)	Semivolatile PICs only	1-gallon amber Wheaton glass	Method 3542[i], Method 0010[j]	Collect 3 m^3 at a sampling rate of $\leq$ 0.75 m^3/hr.	3	1 blank train impinger composite, 1 field blank	5

TABLE 6-1C (Continued)

PLANNED SAMPLE COLLECTION METHODS, FREQUENCY, AND CONTAINERS
STANDARD FACILITY OPERATING CONDITIONS RISK ASSESSMENT EMISSIONS TEST—3 RUNS

Sample Name (Matrix)	Analysis	Type of Container(s)	Sampling Method	Sampling Frequency	Test Samples	Field QC Samples	Total Field Samples Collected
MM5 Train B Front-Half Composite (Particulate filter and front-half of the filter holder and probe solvent rinse)	Semivolatile and nonvolatile unspeciated mass	Petri dishes, 250-mL Boston-round glass	Method 3542[i], Method 0010[j]	Collect 3 m^3 at a sampling rate of $\leq$ 0.75 m^3/hr.	3	2 field blanks, 1 blank train front-half composite	6
MM5 Train B Back-Half Composite (XAD-2 resin tube and back-half of the filter holder and coil condenser solvent rinses)	Semivolatile and nonvolatile unspeciated mass	XAD-2 resin tubes, 250-mL Boston-round glass	Method 3542[i], Method 0010[j]	Collect 3 m^3 at a sampling rate of $\leq$ 0.75 m^3/hr.	3	3 field blanks, 1 trip blank, 1 blank train back-half composite	8
MM5 Train B (Impinger composite and glassware solvent rinses)	Semivolatile and nonvolatile unspeciated mass	1-gallon amber Wheaton glass	Method 3542[i], Method 0010[j]	Collect 3 m^3 at a sampling rate of $\leq$ 0.75 m^3/hr.	3	1 field blank, 1 blank train back-half composite	5
MM5 Train C Front-Half Composite (Particulate filter and front-half filter holder and probe solvent rinses)	Polynuclear aromatic hydrocarbons	Petri dishes, 250-mL Boston-round glass	Method 3542[i], Method 0010[j]	Collect 3 m^3 at a sampling rate of $\leq$ 0.75 m^3/hr.	3	1 blank train front half composite, 2 field blanks	6

TABLE 6-1C (Continued)

PLANNED SAMPLE COLLECTION METHODS, FREQUENCY, AND CONTAINERS
STANDARD FACILITY OPERATING CONDITIONS RISK ASSESSMENT EMISSIONS TEST—3 RUNS

Sample Name (Matrix)	Analysis	Type of Container(s)	Sampling Method	Sampling Frequency	Test Samples	Field QC Samples	Total Field Samples Collected
MM5 Train C Back-Half Composite (XAD-2 resin tube and back-half of the filter holder and coil condenser solvent rinses)	Polynuclear aromatic hydrocarbons	XAD-2 resin tubes, 250-mL Boston-round glass	Method 3542[i], Method 0010[j], CARB 429[l]	Collect 3 m^3 at a sampling rate of $\leq$ 0.75 m^3/hr.	3	1 blank train back half composite, 3 field blanks, 1 trip blank	8
MM5 Train C (Impinger composite and glassware solvent rinses)	Polynuclear aromatic hydrocarbons	1-gallon amber Wheaton glass	Method 3542[i], Method 0010[j], CARB 429[l]	Collect 3 m^3 at a sampling rate of $\leq$ 0.75 m^3/hr.	3	1 blank train back half composite, 1 field blank	5
M5 Train Particulate (Particulate filter and acetone probe rinse)	Particulate residue	Petri dish, 250-mL Boston-round amber glass	Method 5[m], Method 0050[n]	Collect 2 m^3 at a sampling rate of $\leq$ 0.75 m^3/hr.	3 Particulate Filters, 3 Acetone Probe Rinses	2 reagent blanks (1 particulate filter, 1 acetone probe rinse)	8
M5 Train (0.1N sulfuric acid impinger composite)	Hydrogen chloride	1-L amber Boston-round glass	Method 5[m], Method 0050[n]	Collect 2 m^3 at a sampling rate of $\leq$ 0.75 m^3/hr.	3	1 reagent blank (0.1N sulfuric acid impinger composite)	4
M5 Train (0.1N sodium hydroxide impinger composite)	Chlorine	1-L amber Boston-round glass	Method 3542[i], Method 0010[j], CARB 429[l]	Collect 2 m^3 at a sampling rate of $\leq$ 0.75 m^3/hr.	3	1 reagent blank (0.1N sodium hydroxide impinger solution)	4

TABLE 6-1C (Continued)

PLANNED SAMPLE COLLECTION METHODS, FREQUENCY, AND CONTAINERS
STANDARD FACILITY OPERATING CONDITIONS RISK ASSESSMENT EMISSIONS TEST—3 RUNS

Sample Name (Matrix)	Analysis	Type of Container(s)	Sampling Method	Sampling Frequency	Test Samples	Field QC Samples	Total Field Samples Collected
MMT Front-Half Composite (Filter and 0.1N sodium hydroxide probe rinse	Target metals and mercury[l]	Petri dish, 250-mL Boston-round amber glass	Method 0060[o]	Collect 2 m^3 at a sampling rate of $\leq$ 0.75 m^3/hr.	3	2 reagent blanks, 1 blank train	6
MMT Nitric Acid Impinger Composite (5% nitric acid and 10% hydrogen peroxide impinger contents)	Metals and mercury[l]	1-L amber Boston-round amber glass	Method 0060[o]	Collect 2 m^3 at a sampling rate of $\leq$ 0.75 m^3/hr.	3	1 reagent blank, 1 blank train	5
MMT Empty Impinger (Empty at start of test)	Mercury	1-L amber Boston-round glass	Method 0060[o]	Collect 2 m^3 at a sampling rate of $\leq$ 0.75 m^3/hr.	3	1 blank train	4
MMT Potassium Permanganate Impinger Composite (4% potassium permanganate and 10% sulfuric acid impinger composite and deionized water rinses)	Mercury	1-L amber Boston-round glass	Method 0060[o]	Collect 2 m^3 at a sampling rate of $\leq$ 0.75 m^3/hr.	3	1 reagent blank, 1 blank train	5
MMT 8N Hydrogen Chloride Rinse	Mercury	250-mL amber Boston-round glass	Method 0060[o]	Collect 2 m^3 at a sampling rate of $\leq$ 0.75 m^3/hr.	3	1 reagent blank, 1 blank train	5

TABLE 6-1C (Continued)

PLANNED SAMPLE COLLECTION METHODS, FREQUENCY, AND CONTAINERS
STANDARD FACILITY OPERATING CONDITIONS RISK ASSESSMENT EMISSIONS TEST—3 RUNS

Sample Name (Matrix)	Analysis	Type of Container(s)	Sampling Method	Sampling Frequency	Test Samples	Field QC Samples	Total Field Samples Collected
Hexavalent Chromium Train Potassium Hydroxide Impinger Composite (1.0N potassium hydroxide impinger composite)	Hexavalent chromium	1-L amber Boston-round glass	Method 0061[p]	Collect 2 m^3 at a sampling rate of $\leq$ 0.75 m^3/hr.	3	2 field spikes per run, 1 reagent blank, 1 blank spike	11
Formaldehyde Train Impinger 1 (Aqueous acidic 2,4-dinitrophenyl-hydrazine)	Formaldehyde and aldehydes	1-L Boston-round amber glass	Method 0011[q]	Collect 1 m^3 at a sampling rate of $\leq$ 0.75 ft^3/hr.	3	3 reagent blanks, 1 blank train sample, 3 field spikes	10
Formaldehyde Train Impingers 2 and 3	Formaldehyde and aldehydes	1-L Boston-round amber glass	Method 0011[q]	Collect 1 m^3 at a sampling rate of $\leq$ 0.75 ft^3/hr.	3	1 blank train sample, 3 field spikes	7
Cascade Impactor	Particle size distribution	9-stage impactor in sealed polyethylene bag	--	Collect 2 m^3 at a sampling rate of $\leq$ 0.75 ft^3/hr.	3	--	3
Orsat	Oxygen and carbon dioxide	Tedlar™ bag	Method 3, Method 3A[r]	Collect 2 Tedlar™ bags per run.	6	--	6

TABLE 6-1C (Continued)

PLANNED SAMPLE COLLECTION METHODS, FREQUENCY, AND CONTAINERS
STANDARD FACILITY OPERATING CONDITIONS RISK ASSESSMENT EMISSIONS TEST—3 RUNS

Notes:

--	Not applicable
≤	Less than or equal to
% ash	Percent ash
ASTM	American Society for Testing and Materials
Btu	British thermal unit
CFR	Code of Federal Regulations
ft^3/hr	Cubic feet per hour
L	Liter
L/min	Liters per minute
m^3	Cubic meter
m^3/hr	Cubic meters per hour
M5	Method 5
mL	Milliliter
MM5	Modified Method 5
MMT	Multi-metals train
N	Normality
POHC	Principal organic hazardous constituent
QC	Quality control
TDS	Total dissolved solids
TS	Total solids
TSS	Total suspended solids
VOST	Volatile organic sampling train
a	Elemental analysis will include the following: carbon, hydrogen, oxygen, nitrogen, and sulfur.

TABLE 6-1C (Continued)

PLANNED SAMPLE COLLECTION METHODS, FREQUENCY, AND CONTAINERS
STANDARD FACILITY OPERATING CONDITIONS RISK ASSESSMENT EMISSIONS TEST—3 RUNS

Notes (Continued):

b 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.

c 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.

d ASTM D-4057-88, "Practice for Manual Sampling of Petroleum and Petroleum Products." Taken from *American Society for Testing and Materials*; *Annual Bood of ASTM Standards*; ASTM: Philadelphia, PA, 1990.

e An equal volume of each sample aliquot will be collected at the indicated time interval. All aliquots will be composited in the field to create a single test sample for each run, with the exception of samples receiving volatiles analysis. The sample portions designated for volatile analysis will be syringe or weight composited in the analytical laboratory to create a single test sample for each run.

f Method 0040 is appropriate for sampling stack gases for principal organic hazardous constituents. Taken from “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), 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. Also, see “Guidance for Total Organics - Final Report”, prepared by Radian Corporation, Research Triangle Park, North Carolina for National Exposure Research Laboratory, Air Measurements Research Division Methods Branch, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina, March 1996.

g Method 0031 is appropriate for sampling for volatile organic compounds. Taken from "Sampling Method for Volatile Organic Compounds (SMVOC),” *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, (SW-846), 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.

h Four resin tube sets will be collected during each run of the trial burn. Three of the sets will be analyzed at a minimum. The fourth set will be collected as a backup set and will be analyzed by the laboratory if sample loss or breakage occurs.

i Method 3542 is appropriate for sampling for semivolatile analytes. Taken from “Extraction of Semivolatile Analytes Collected Using Method 0010 (Modified Method 5 Sampling Train,” *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, (SW-846), Third Edition, September 1986. Contains 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.

TABLE 6-1C (Continued)

PLANNED SAMPLE COLLECTION METHODS, FREQUENCY, AND CONTAINERS
STANDARD FACILITY OPERATING CONDITIONS RISK ASSESSMENT EMISSIONS TEST—3 RUNS

Notes (Continued):

j Method 0010 is appropriate for sampling stack gas for semivolatiles. Taken from "Modified Method 5 Sampling Train," *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, (SW-846), 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.

k Method 0023A is appropriate for sampling stack gas. Taken from "Sampling Method for Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofuran Emissions from Stationary Sources," *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, (SW-846), 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.

l CARB 429 is appropriate for sampling stack gases for polynuclear aromatic hydrocarbons. Taken from “Determination of Polycyclic Aromatic Hydrocarbon (PAH) Emissions from Stationary Sources,” State of California Air Resources Board Method 429, Adopted September 12, 1989.

m Method 5 is appropriate for sampling stack gas isokinetically. Taken from "Method 5 Sampling Train." Taken from 40 CFR 60, Appendix A, July (1990).

n Method 0050 is appropriate for sampling stack gas for hydrogen chloride and chlorine isokinetically," Isokinetic HCl/Cl_2 Emission Sampling Train." Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, (SW-846), 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.

o Method 0060 is appropriate for sampling gases for metals. Taken from "Determination of Metals in Stack Emissions". Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, (SW-846), 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.

p Method 0061 is appropriate for sampling stack gases for hexavalent chromium emissions. Taken from "Determination of Hexavalent Chromium Emissions from Stationary Sources.” Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, (SW-846), 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.

TABLE 6-1C (Continued)

PLANNED SAMPLE COLLECTION METHODS, FREQUENCY, AND CONTAINERS
STANDARD FACILITY OPERATING CONDITIONS RISK ASSESSMENT EMISSIONS TEST—3 RUNS

Notes (Continued):

q Method 0011 is appropriate for sampling stack gases for formaldehyde emissions. Taken from "Sampling for Formaldehyde Emissions from Stationary Sources." Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, (SW-846), 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.

r Methods 3 and 3A are appropriate for sampling stack gas in Tedlar™ bags for Orsat analysis. Taken from 40 CFR 60, July 1996.

Feed Samples

- Low-Btu liquid waste feed
- Solid waste feed
- High-Btu liquid waste feed

Process Samples

- Makeup water
- Scrubber purge water
- Caustic solution
- Incinerator ash

Stack Samples

- VOST—volatile organics (POHCs and PICs)
- Unspeciated volatile organics
- MM5 train—speciated semivolatiles, PAHs, dioxins and furans, and unspeciated semivolatiles and nonvolatiles
- Multi-metals train (MMT)—boiler industrial furnace metals
- Method 5 (M5) train—particulate matter, hydrogen chloride, and chlorine
- Hexavalent chromium train
- Formaldehyde train—aldehydes and ketones
- Carbon dioxide and oxygen by Orsat (Tedlar™ bag samples)
- Oxygen and carbon monoxide by CEM

- Cascade impactor—particle-size distribution

Prior to the start of each sampling run, the stack sampling coordinator will be responsible for verifying that the sampling trains have been constructed properly and that calibrations have been performed properly. The stack sampling coordinator will also check to see that proper absorbing solutions have been used, required leak-check procedures are performed, and sample recovery is performed properly after completion of the run.

6.1 FIELD QUALITY CONTROL SAMPLES

QC samples will be collected during field sampling activities to provide a measured indication of QA for the test samples. The samples that will be collected include spiked resin blanks; field spiked samples for hexavalent chromium, formaldehyde, and volatile unspeciated mass; reagent blanks; field blanks; trip blanks; and blank train samples. Tables 6-2A, 6-2B, and 6-2C of this QAPP summarize the field QC sample requirements that will be applied during sampling activities.

6.1.1 Spiked Resin Blanks

Following sample resin tube preparation, but before the trial burn, two XAD-2 resin tubes and two VOST Tenax™ and Anasorb™ 747 sets will be assigned field sample numbers and submitted to the analytical laboratory as resin blanks. These samples will be spiked with the standard EPA contract laboratory program (CLP) surrogate and matrix spike compounds and analyzed to confirm that the resin materials are free of background contamination and to confirm that efficient surrogate and matrix spike recoveries are achievable. The XAD-2 resin tubes for the MM5A train also will be spiked with the Method 0023A and semivolatile sampling surrogates and isotope dilution internal standards. Split portions of the prepared extract will be analyzed for semivolatiles, dioxins, and furans. Two XAD-2 resin tubes for MM5C train will be spiked before the trial burn as spiked resin blanks. These tubes will be spiked with the sampling surrogates for PAHs and the isotope dilution internal standards for PAHs.

TABLE 6-2A

SUMMARY OF FIELD QUALITY CONTROL SAMPLE REQUIREMENTS HIGH-TEMPERATURE METALS EMISSIONS TEST—3 RUNS

Sample[a]	QC Sample Type	Frequency	QC Sample Total
MMT (Method 0060)	Reagent blanks	One each per test condition: 0.1 N nitric acid probe rinse solution, Particulate filter, 5% nitric acid and 10% hydrogen peroxide impinger solution, 4% potassium permanganate and 10% sulfuric acid impinger solution, 8N hydrogen chloride rinse solution	1 of each reagent solution and filter per test condition 2 complete sets blank train components (reagent blanks) spiked to assess train recovery and reporting limits
	Blank train	One complete blank train per test condition: 0.1 N nitric acid probe rinse solution, Particulate filter, 5% nitric acid and 10% hydrogen peroxide impinger solution, 4th impinger 0.1N nitric acid rinse, 4% potassium permanganate and 10% sulfuric acid impinger solution, 8N hydrogen chloride rinse solution	1 set of blank train samples per test condition
M5 train (Method 0050)	Reagent blanks	One each per test condition: 0.1N sulfuric acid impinger solution, 0.1N sodium hydroxide impinger solution	1 of each per test condition
		Acetone probe rinse solvent, Particulate filter	1 of each per test condition
Hexavalent chromium train (Method 0061)	Reagent blanks	One per test condition: 1.0N potassium hydroxide impinger solution	1
	Blank spikes	One blank spike per test condition	1
	Field spikes	Two field spikes per run	6

TABLE 6-2A

SUMMARY OF FIELD QUALITY CONTROL SAMPLE REQUIREMENTS HIGH-TEMPERATURE METALS EMISSIONS TEST—3 RUNS

Sample[a]	QC Sample Type	Frequency	QC Sample Total

Notes:

M5 Method 5
MMT Multi-metals train
N Normality
QAPP Quality assurance project plan
QC Quality control
[a] All field QC samples will be analyzed for the same analytical parameters as the actual trial burn samples. See Section 6.1 of the QAPP for a general discussion of these samples.

TABLE 6-2B

SUMMARY OF FIELD QUALITY CONTROL SAMPLE REQUIREMENTS LOW-TEMPERATURE DRE PERFORMANCE DEMONSTRATION TEST—3 RUNS

Sample[a]	QC Sample Type	Frequency	QC Sample Total
VOST tube sets	VOST audit	One complete set per trial burn	1 complete set
VOST tube sets (Method 0031)	Field blanks	One complete set per run	3 complete sets
	Trip blanks	One set per trial burn sample shipment	1 to 3 complete sets
VOST condensate	Deionized water trip blanks	One per trial burn sample shipment	1 to 3
MM5 XAD-2 resin tubes	Field blanks	One XAD-2 resin tube per test run, One particulate filter set per test condition, One front-half filter holder and probe rinse solvent set per test condition	3 XAD-2 resin tubes
	Trip blanks	One bland per trial burn sample shipment	1 to 3 XAD-2 resin tubes
	Spiked resin blanks	Two blanks per test condition	2
MM5A train Semivolatile POHCs	Reagent blanks	One blank each per trial burn: Acetone and methylene chloride solvent probe rinses, Particulate filter, Deionized water	1 of each reagent solution or filter per trial burn
	Spiked resin blanks	Two per trial burn	2
M5 train (Method 0050)	Reagent blanks	One each per test condition: 0.1N sulfuric acid impinger solution, 0.1N sodium hydroxide impinger solution	1 of each per test condition
		Acetone probe rinse solvent, Particulate filter	1 of each per test condition

Notes:

M5 Method 5
MM5 Modified Method 5
N Normality
POHC Principal organic hazardous constituents
QAPP Quality assurance project plan
QC Quality control
VOST Volatile organic sampling train

[a] All field QC samples will be analyzed for the same analytical parameters as the actual trial burn samples. See Section 6.1 of the QAPP for a general discussion of these samples.

TABLE 6-2B

SUMMARY OF FIELD QUALITY CONTROL SAMPLE REQUIREMENTS LOW-TEMPERATURE DRE PERFORMANCE DEMONSTRATION TEST—3 RUNS

TABLE 6-2C

SUMMARY OF FIELD QUALITY CONTROL SAMPLE REQUIREMENTS STANDARD FACILITY OPERATING CONDITIONS RISK ASSESSMENT EMISSIONS TEST—3 RUNS

Sample[a]	QC Sample Type	Frequency	QC Sample Total
VOST tube sets (Method 0031)	Field blanks	One complete set per run	3 complete sets
	Trip blanks	One set per trial burn sample shipment	1 to 3 sets
VOST condensate	Deionized water trip blanks	One per trial burn sample shipment	1 to 3
MM5A train Semivolatile PICs, dioxins and furans (Methods 3542, 0010, and 0023A combined)	Field blanks	One XAD-2 resin tube per test run, One particulate filter per test condition, One front-half of the filter holder and probe solvent rinse set per test condition	3 XAD-2 resin tubes
	Trip blanks	One per trial burn sample shipment	1 to 3 XAD-2 resin tubes
	Blank train	One blank train per trial burn: Particulate filter and front-half of the filter holder and probe solvent rinses, XAD-2 resin and solvent rinses of the back-half filter holder and coil condenser, Impinger condensate composite and solvent rinses	1 set of train samples per test
	Reagent blanks	One each per trial burn: Acetone, methylene chloride, and toluene solvent probe rinses, Particulate filter, Deionized water	1 of each reagent solution or filter per test condition
	Spiked resin blanks	Two per trial burn	2 XAD-2 resin tubes
MM5B train Semivolatile and nonvolatile unspeciated mass (Methods 3542 and 0010 combined)	Field blanks	One XAD-2 resin tube per test run, One particulate filter, One front-half of the filter holder and probe solvent rinse set per test condition	3 XAD-2 resin tubes
	Trip blanks	One per trial burn sample shipment	1 to 3 XAD-2 resin tubes

TABLE 6-2C (Continued)

SUMMARY OF FIELD QUALITY CONTROL SAMPLE REQUIREMENTS STANDARD FACILITY OPERATING CONDITIONS RISK ASSESSMENT EMISSIONS TEST—3 RUNS

Sample[a]	QC Sample Type	Frequency	QC Sample Total
	Blank train	One blank train per trial burn: Particulate filter and front-half of the filter holder and probe solvent rinses, XAD-2 resin and solvent rinses of the back-half filter holder and coil condenser, Impinger condensate composite and solvent rinses	1 set of train samples per test
MM5B train Semivolatile and nonvolatile unspeciated mass (Methods 3542 and 0010 combined) (Continued)	Reagent blanks	One each per trial burn: Acetone and methylene chloride solvent probe rinses, Particulate filter, Deionized water	1 of each reagent solution or filter per test condition
	Spiked resin blanks	Two per trial burn	2 XAD-2 resin tubes
MM5C train PAHs (Methods 3542, 0010, and CARB 429)	Field blanks	One XAD-2 resin tube per test run, One particulate filter, One front half of the filter holder and probe solvent rinse set per test condition	3 XAD-2 resin tubes
	Trip blanks	One per trial burn sample shipment	1 to 3 XAD-2 resin tubes
	Blank train	One blank train per trial burn: Particulate filter and front-half of the filter holder and probe solvent rinses, XAD-2 resin and solvent rinses of the back-half filter holder and coil condenser, Impinger condensate composite and solvent rinses	1 set of train samples per test
	Reagent blanks	One each per trial burn: Acetone and methylene chloride solvent probe rinses, Particulate filter, Deionized water	1 of each reagent solution or filter per test condition
	Spiked resin blanks	Two per trial burn	2 XAD-2 resin tubes

TABLE 6-2C (Continued)

SUMMARY OF FIELD QUALITY CONTROL SAMPLE REQUIREMENTS STANDARD FACILITY OPERATING CONDITIONS RISK ASSESSMENT EMISSIONS TEST—3 RUNS

Sample[a]	QC Sample Type	Frequency	QC Sample Total
Volatile unspeciated mass (Method 0040)	Field blanks	One per test run	3
	Trip blanks	Two per test condition	2
	Field spikes	One per test run	3
MMT (Method 0060)	Reagent blanks	One each per trial burn: 0.1N nitric acid probe rinse solution, Particulate filter, 5% nitric acid and 10% hydrogen peroxide impinger solution, 4% potassium permanganate and 10% sulfuric acid impinger solution, 8N hydrogen chloride rinse solution	1 of each reagent solution and filter per test condition
M5 train (Method 0050)	Reagent blanks	One each per trial burn: 0.1N sulfuric acid impinger solution, 0.1N sodium hydroxide impinger solution	1 of each per test condition
		Acetone probe rinse solvent, particulate filter	1 of each per test condition
Formaldehyde train (Method 0011)	Field spikes	One per test run in impinger 1, One per test run in impingers 2 and 3	6
	Reagent blanks	One each per test condition: Deionized water probe rinse solution, Methylene chloride train solution, DNPH impinger solution	1 of each reagent or solution per test condition
	Blank train	One train per test condition: DI water probe rinse solution, Methylene chloride train solution, DNPH impinger solution	1 set of train samples per test condition
Hexavalent chromium train (Method 0061)	Reagent blanks	One per test condition: 1.0N potassium hydroxide impinger solution	1
	Blank spikes	One sample spike per test condition	1
	Field spikes	Two sample spikes per run	6

TABLE 6-2C (Continued)

SUMMARY OF FIELD QUALITY CONTROL SAMPLE REQUIREMENTS STANDARD FACILITY OPERATING CONDITIONS RISK ASSESSMENT EMISSIONS TEST—3 RUNS

Sample[a]	QC Sample Type	Frequency	QC Sample Total

Notes:

DNPH	Dinitrophenylhydrazine
MM5	Modified Method 5
MMT	Multi-metals train
N	Normality
PAH	Polynuclear aromatic hydrocarbon
PIC	Products of incomplete combustion
QAPP	Quality assurance project plan
QC	Quality control
VOST	Volatile organic sampling train
[a]	All field QC samples will be analyzed for the same analytical parameters as the actual trial burn samples. See Section 6.1 of the QAPP for a general discussion of these samples.

6.1.2 Reagent Blanks

Reagent blanks are defined as samples of the reagent source water, solvents, solutions, and other media used for sample collection. Reagent blank samples of the 0.1 normality (N) sulfuric acid, 0.1N sodium hydroxide solution, acetone probe rinse solvent, and the particulate filter will be collected for the M5 train. The following reagent blank samples will be collected for the MMT: 0.1N nitric acid probe rinse solution, particulate filter, 5 percent nitric acid and 10 percent hydrogen peroxide impinger solution, 4 percent potassium permanganate and 10 percent sulfuric acid solution, and 8N hydrochloric acid solution.

Also, during the laboratory analysis of the trial burn samples, two complete sets of the abovementioned MMT blank trains (as reagent blanks) will be spiked with the appropriate metallic analytes and analyzed in order to assess the recovery efficiency of the actual sampling train components and to evaluate the appropriateness of the reporting limits used for the actual sampling matrix. One reagent blank sample of the 1.0N potassium hydroxide impinger solution used for the hexavalent chromium train will be collected. The following reagent blanks will be collected and analyzed for the formaldehyde train: methylene chloride and deionized water rinse solutions, and the dinitrophenylhydrazine (DNPH) impinger solution. The following reagent blanks will be collected for the MM5 trains: acetone, methylene chloride and toluene solvent rinses (toluene collected for the MM5A train only), particulate filter, and deionized impinger water. Each reagent blank will be analyzed for the same analytical parameters as the actual trial burn samples. The results from the analyses of these blanks will be used to demonstrate that these solvents, solutions, and filters are not potential sources of background contamination for samples requiring these sampling media during collection.

6.1.3 Field Blanks

Field blanks are defined as sampling media (such as VOST resin tube sets and XAD-2 tubes) that are handled at the sampling site in the same manner as the actual test samples except that no actual sample is collected on the media. The field blank samples will be collected and analyzed to demonstrate that sample handling procedures at each sampling location do not expose the samples to fugitive contaminants. Each

field blank tube will be opened in the field during the sampling run and will be subjected to the same handling procedures and laboratory analysis as the actual test samples. Field blanks will, in general, be considered to demonstrate good quality of background if the compound concentrations detected are less than the lowest standard as specified in the QA/QC Handbook, with the exception of low levels of the following common laboratory contaminants and products of resin degradation:

- Volatiles — Chloromethane, benzene, toluene, methylene chloride, acetone, and bromomethane
- Semivolatiles — Naphthalene, bis(2-ethylhexyl)phthalate, diethylphthalate, and di-n-octyl phthalate

Good laboratory practices and appropriate handling precautions will be taken to minimize these common laboratory contaminants and resin degradation products.

6.1.4 Trip Blanks

Trip blanks will consist of a set of clean, sealed VOST resin tubes, an XAD-2 tube, and a pair of volatile organic analysis (VOA) vials filled with ASTM type II deionized water. These tubes and vials are transported from the analytical laboratory to the field site and returned to the laboratory for storage and analysis along with the field test samples. The trip blank data will demonstrate that the samples are not exposed to fugitive contamination during storage and transport to their final laboratory destination. Trip blanks are analyzed for the same analytical parameters as the actual test samples. Trip blanks will generally be considered to demonstrate good quality of background if the compound concentrations detected are less than the lowest calibration standard, as specified in the QA/QC Handbook, with the exception of low levels of the following common laboratory contaminants and products of resin degradation:

- Volatiles — Chloromethane, benzene, toluene, methylene chloride, acetone, and bromomethane

- Semivolatiles — Naphthalene, bis(2-ethylhexyl)phthalate, diethylphthalate, and di-n-octyl phthalate

6.1.5 Hexavalent Chromium Train Stability Samples

Hexavalent chromium stability samples consists of field spikes that are analyzed to demonstrate that the native hexavalent chromium, when collected in the 1.0N potassium hydroxide impinger solution stack gas matrix and preserved according to the method, is stable over the time period between sample collection and subsequent sample analysis. Aliquots of the actual hexavalent chromium impinger samples will be spiked at the time of sample recovery at 10 parts per billion (ppb) and 25 ppb with a hexavalent chromium spiking standard of 1 µg per liter (L), which will be prepared in the field by the sampling team.

In addition to these spikes, one aliquot of the impinger samples will be analyzed without any spike added to determine the native concentration of hexavalent chromium in each train sample during each run. The spikes are being applied in lieu of applying the 24-hour holding time, as required by Method 218.6, to the hexavalent chromium samples associated with this project. One aliquot of the potassium hydroxide impinger reagent solution also will be collected and spiked in this way to assess the overall spike recovery and method accuracy as a blank spike sample. Field and blank spikes will be applied in the field after sample recovery, but prior to shipment of samples from the associated run. All spiked aliquots will be analyzed by the laboratory and the spike recoveries will be calculated. Good recovery of hexavalent chromium in the train spike samples (less than 70 percent) will indicate that the hexavalent chromium trapped in the 1.0N potassium hydroxide matrix remains in that oxidation state through analysis and verifies that the sample concentrations are representative of the "true" hexavalent chromium concentration in the stack gas. All samples submitted for analysis for hexavalent chromium will be analyzed within 30 days of collection. All data from the stability demonstration will be reported and discussed in detail in the trial burn report.

6.1.6 Formaldehyde Field Spikes

A Method 0011 field spike will be performed once during each trial burn run by introducing 200 microliters (µL) (or other appropriate spike volume) of the formaldehyde field spiking standard into a 200-milliliter portion of the DNPH solution. This spike standard will be made in the field by the sampling team. The spike sample will be analyzed as a quality check of the field handling and recovery procedures. A portion of the field spiking solution also will be submitted to the analytical laboratory for formaldehyde analysis.

6.1.7 Blank Trains

Blank trains are assembled and charged with all the required chemical reagents and sample collection media in the same manner as the actual test sample trains. They are leak-checked, heated to the appropriate temperature, placed near the stack, and sealed for the duration of one run. Upon completion of the run, the blank trains are disassembled, and the contents are collected using the same recovery procedures as used for the actual test sample trains. The results of the blank train samples are indicative of contamination introduced to the samples by contaminated reagents, glassware preparation, sampling environment, train handling, and sample recovery technique.

During the trial burn, one blank train will be collected for each of the following sampling trains:

- MM5A train (semivolatile POHCs, PICs, dioxins, and furans)
- MM5B train (semivolatile and nonvolatile unspeciated mass)
- MM5C train (PAHs)
- MMT (target metals, including mercury)
- Method 0011 (formaldehyde and aldehydes)

6.2 WASTE FEED AND PROCESS SAMPLING

Standard methods, procedures, and dedicated sampling equipment will be used for the collection of process samples associated with this trial burn. The process sampling coordinator will monitor all sampling activities during the trial burn to see that proper documentation is completed and that adherence to trial burn sampling procedures is observed. Sample traceability will be completed through the use of RFA and COC forms, sample collection sheets, the field logbook, and the unique alphanumeric sample number applied to each sample collected. Sample documentation procedures are discussed in detail in Section 7.0.

6.3 STACK GAS SAMPLING

The collection of stack gas samples will be completed by following the standard EPA methods taken from SW-846 and 40 CFR. The stack sampling coordinator is responsible for operation of the stack sampling equipment and collection of stack gas samples during each trial burn test run. The process sampling coordinator is responsible for proper recovery and preparation of the stack gas samples for shipment to the analytical laboratory. During the trial burn, the stack sampling coordinator and the analytical project manager will be responsible for monitoring the sampling team's adherence to the standard sampling procedures and for completing and performing final review of calibration documentation. QA calibration procedures are discussed in Section 8.0. The QC samples that will be collected are discussed in Section 6.1. Additional QA procedures that will be specifically applied to the stack sampling activities are discussed in the following sections.

6.3.1 Velocity and Traverse-Point Selection (EPA Methods 1 and 2)

Standard EPA Methods 1 and 2 will be used to determine the correct traverse point locations and to measure stack gas velocities at each of the traverses, respectively. The stack sampling coordinator will review all calibration and calculation documentation prior to the trial burn. The stack sampling coordinator will inspect the data for correct traverse point selection, absence of cyclonic flow in the stack, correct

number of sampling points, proper orientation of sampling ports, and verification that the traverse points are at least 0.5-inch from the stack walls. Documentation of the application and review of Methods 1 and 2 will be included in the trial burn report.

6.3.2 Orsat Determination of Oxygen and Carbon Dioxide (EPA Method 3)

During each test run, EPA Method 3 will be used for the collection and analysis of composite stack gas samples collected in Tedlar™ bags and analyzed for oxygen and carbon dioxide using the Orsat method. Multipoint integrated sampling from Method 3 for collecting the bag samples will be used. Tedlar™ bag samples will be taken from either the MMT or the M5 train. The stack sampling coordinator will monitor the analytical procedure used by members of the stack sampling team for adherence to procedures prescribed in the method. These determinations will be documented by the stack sampling technician and also will be reviewed by the stack sampling coordinator for completeness. Reference standards of oxygen and carbon dioxide will be analyzed during all runs of the trial burn.

6.3.3 Volatile Organic Sampling Train (Method 0031)

The VOST will be used to sample stack gas on Tenax™ and Anasorb™ 747 resin tubes for analysis of volatile POHC, chlorobenzene, and the volatile PICs. The VOST data will be used to assess the volatile PIC emissions and to determine if the DRE of the POHC meets the required 99.99 percent removal efficiency. The sampling apparatus will be inspected and calibrated prior to the trial burn. During each run, the stack sampling coordinator will verify adherence to the prescribed sampling procedure as described in EPA SW-846 Method 0031. Method 0031 requires that two Tenax™ tubes and one Anasorb™ 747 tube be used in a three-tube configuration of the VOST. Four sets of VOST tubes will be used during each sampling run to sample a nominal 20 liters of stack gas per tube set. Three of the four sets will be analyzed by combined Methods 5041 and 8260 and the remaining set will serve as an archive set. The archive set collected will provide a backup set of samples for each run in the event that any of the original sample sets of tubes are damaged. This procedure helps to ensure that the data completeness and final DQOs are achieved. During the analysis, the two Tenax™ tubes and one Anasorb™ 747 tube making up each set will be analyzed separately so that breakthrough and surrogate recovery from each

train type can be evaluated. For the three-tube configuration, the Tenax™ tubes will be coupled together as one sample, and the Anasorb™ 747 tube will be analyzed separately.
Table 6-3 summarizes the Method 8260 standard list of volatile compounds. To quantitate PICs, all samples receiving VOST analysis will be analyzed for this target compounds list (TCL). They also will receive an additional library search to identify and quantitate, as tentatively identified compounds (TIC), the 20 largest volatile non-TCL peaks greater than 10 percent the nearest internal standard.

Because of the low-level concentration of volatile compounds expected to be on the tubes, field blanks will be submitted for analysis. One set of field blanks will be collected during each run. The VOST field blank sample tubes will be handled in the field in a manner that is similar to that of the sample tubes. The samples will be taken to the VOST sampling location and uncapped during sample tube change-outs to simulate the actual sample exposure to ambient conditions. The field blanks will be placed into the VOST, leak-checked, and removed from the train using the same procedure as the actual samples. In addition, one trip blank pair will be packaged with each shipment of samples to the laboratory (typically, one per day). The aqueous VOST condensate from the VOST also will be analyzed for volatile POHCs and PICs. Each shipment of condensate samples will be accompanied by a deionized water trip blank. As part of Method 0031 requirements, the volatile content of the condensate is calculated by converting the concentration of the analytes in the condensate to total analyte mass. The volatile mass of each analyte is added to the analyte mass in the VOST resin tubes.

6.3.4 Modified Method 5 Train

Three variations of the MM5 train will be used, as described in the following sections.

6.3.4.1 MM5A Train Semivolatiles, Dioxins, and Furans (Combined Methods 0010 and 0023A)

The train A configuration of the MM5 sampling train will be used to collect stack gas for an assessment of naphthalene, which will be used as a semivolatile POHC during this testing program, and for the semivolatile PIC compounds listed in Table 6-4, using the procedures outlined in Methods 0010 and 3542.

This train also will be used to measure the dioxin and furan compound concentrations found in the stack gas using Method 0023A.

TABLE 6-3

SUMMARY OF VOLATILE PIC COMPOUNDS FOR ANALYSIS

SW-846 Method 8260A Compound List		
Acetone	1,3-Dichlorobenzene	4-Methyl-2-pentanone (MIBK)
Acetonitrile	1,4-Dichlorobenzene	Naphthalene
Acrolein (Propenal)	cis-1,4-Dichloro-2-butene	Nitrobenzene
Acrylonitrile	trans-1,4-Dichloro-2-butene	2-Nitropropane
Allyl alcohol	Dichlorodifluoromethane	Pentachloroethane
Allyl chloride	1,1-Dichloroethane	2-Picoline
Benzene	1,2-Dichloroethane	Propargyl alcohol
Benzyl chloride	1,1-Dichloroethene	β-Propiolactone
Bromoacetone	trans-1,2-Dichloroethene	Propionitrile (ethyl cyanide)
Bromochloromethane (I.S.)	1,2-Dichloropropane	n-Propylamine
Bromodichloromethane	1,3-Dichloro-2-propanol	Pyridine
4-Bromofluorobenzene (surr.)	cis-1,3-Dichloropropene	Styrene
Bromoform	trans-1,3-Dichloropropene	1,1,1,2-Tetrachloroethane
Bromomethane	1,2,3,4-Diepoxybutane	1,1,2,2-Tetrachloroethane
n-Butanol	Diethyl ether	Tetrachloroethane
2-Butanone (MEK)	1,4-Difluorobenzene (I.S.)	Toluene
Carbon disulfide	1,4-Dioxane	1,2,4-Trichlorobenzene
Carbon tetrachloride	Epichlorohydrin	1,1,1-Trichloroethane
Chloral hydrate	Ethanol	1,1,2-Trichloroethane
Chlorobenzene	Ethyl acetate	Trichloroethene
2-Chloro-1,3-butadiene	Ethylbenzene	Trichlorofluoromethane
Chlorodibromomethane	Ethylene oxide	1,2,3-Trichloropropane
Chloroethane	Ethyl methacrylate	Vinyl acetate
2-Chloroethanol	Hexachlorobutadiene	Vinyl chloride
bis-(2-Chloroethyl) sulfide	Hexachloroethane	o-Xylene
2-Chloroethyl vinyl ether	2-Hexanone	m-Xylene
Chloroform	2-Hydroxypropionitrile	p-Xylene
Chloromethane	Iodomethane	
Chloroprene	Isobutyl alcohol	
3-Chloropropene	Isopropylbenzene	
3-Chloropropionitrile	Malononitrile	
1,2-Dibromo-3-chloropropane	Methacrylonitrile	
1,2-Dibromoethane	Methanol	
Dibromomethane	Methylene chloride (DCM)	
1,2-Dichlorobenzene	Methyl methacrylate	

TABLE 6-3 (Continued)

SUMMARY OF VOLATILE PIC COMPOUNDS FOR ANALYSIS

Notes:

PIC Products of incomplete combustion
TCL Target compound list
VOST Volatile organic sampling train

This list consists of the SW-846 Method 8260A list of compounds. This list will be the TCL for analysis of volatile PICs during this trial burn project. The target compounds will be analyzed for by Method 8260A, and the 20 largest non-TCL peaks that are greater than 10 percent the nearest internal standard will be tentatively identified using a library search for all VOST samples analyzed.

TABLE 6-4

SUMMARY OF SEMIVOLATILE PIC COMPOUNDS FOR ANALYSIS

SW-846 Method 8270B Compound List		
Acenaphthene	Benzo(g,h,i)perylene	2-Chloronaphthalene
Acenaphthene-d_{10} (I.S.)	Benzo(a)pyrene	2-Chlorophenol
Acenaphthylene	p-Benzoquinone	4-Chloro-1,2-phenylenediamine
Acetophenone	Benzyl alcohol	4-Chloro-1,3-phenylenediamine
2-Acetylaminofluorene	α-BHC	4-Chlorophenyl phenyl ether
1-Acetyl-2-thiourea	β-BHC	Chrysene
Aldrin	δ-BHC	Chrysene-d_{12} (I.S.)
2-Aminoanthraquinone	λ-BHC (Lindane)	Coumaphos
Aminoazobenzene	Bis(2-chloroethoxy)methane	p-Cresidine
4-Aminobiphenyl	Bis(2-chloroethyl)ether	Crotoxyphol
3-Amino-9-ethylcarbazole	Bis(2-chloroisopropyl)ether	2-Cyclohexyl-4,6-dinitrophenol
Anilazine	Bis(2-ethylhexyl)phthalate	4,4'-DDD
Aniline	4-Bromophenyl phenyl ether	4,4'-DDE
o-Anisidine	Bromoxynil	4,4'-DDT
Anthracene	Butyl benzyl phthalate	Demeton-O
Armite	2-sec-Butyl-4,6-dinitrophenol	Demeton-S
Aroclor-1016	Captafol	Diallate (cis or trans)
Aroclor-1221	Captan	2,4-Diaminotoluene
Aroclor-1232	Carbaryl	Dibenz(a,j)acridine
Aroclor-1242	Carbofuran	Dibenz(a,h)anthracene
Aroclor-1248	Carbophenothion	Dibenzofuran
Aroclor-1254	Chlordane	Dibenzo(a,e)pyrene
Aroclor-1260	Chlorfenvinphos	Di-n-butyl phthalate
Azinphos-methyl	4-Chloroaniline	Dichlone
Barban	Chlorobenzilate	1,2-Dichlorobenzene
Benzidine	5-Chloro-2-methylaniline	1,3-Dichlorobenzene
Benzoic acid	4-Chloro-3-methylphenol	1,4-Dichlorobenzene
Benz(a)anthracene	3-(Chloromethyl)pyridine	1,4-Dichlorobenzene-d_4 (I.S.)
Benzo(b)fluoranthene	hydrochloride	3,3'-Dichlorobenzidine
Benzo(k)fluoranthene	1-Chloronaphthalene	2,4-Dichlorophenol

TABLE 6-4 (Continued)

SUMMARY OF SEMIVOLATILE PIC COMPOUNDS FOR ANALYSIS

SW-846 Method 8270B Compound List		
2,6-Dichlorophenol	Endosulfan I	Isophorone
Dichlorozos	Endosulfan II	Isosafrole
Dicrotophos	Endosulfan sulfate	Kepone
Dieldrin	Endrin	Leptophos
Diethyl phthalate	Endrin aldehyde	Malathion
Diethylstilbestrol	Endrin ketone	Maleic anhydride
Diethyl sulfate	EPN	Mestranol
Dimethoate	Ethion	Methapyrilene
3,3'-Dimethoxybenzidine	Ethyl carbamate	Methoxychlor
Dimethylaminoazobenzene	Ethyl methanesulfonate	3-Methylcholanthrene
7,12-Dimethylbenz(a)-anthracene	Famphur	4,4'-Methylenebis(2-chloroaniline)
3,3'-Dimethylbenzidine	Fensulfothion	4,4'-Methylenebis (N,N-dimethylaniline)
α,α-Dimethylphenethylmine	Fenthion	Methyl methanesulfonate
2,4-Dimethylphenol	Fluchloralin	2-Methylnaphthalene
Dimethyl phthalate	Fluoranthene	2-Methyl-5-nitroanaline
1,2-Dinitrobenzene	Fluorene	Methyl parathion
1,3-Dinitrobenzene	2-Fluorobiphenyl (surr.)	2-Methylphenol
1,4-Dinitrobenzene	2-Fluorophenol (surr.)	3-Methylphenol
4,6-Dinitro-2-methylphenol	Heptachlor	4-Methylphenol
2,4-Dinitropphenol	Heptachlor epoxide	2-Methylpyridine
2,4-Dinitrotoluene	Hexachlorobenzene	Mevinphos
2,6-Dinitrotoluene	Hexachlorobutadiene	Mexacarbate
Dinocap	Hexachlorocyclopentadiene	Mirex
Dinoseb	Hexachloroethane	Monocrotophos
Dioxathion	Hexachlorophene	Naled
Diphenylamine	Hexachloropropene	Naphthalene
5,5-Diphenylhydantoin	Hexamethylphosphoramide	Naphthalene-d_8 (I.S.)
1,2-Diphenylhydrazine	Hydroquinone	1,4-Naphthoquinone
Di-n-octyl phthalate	Indeno(1,2,3-cd)pyrene	1-Naphthylamine
Disulfoton	Isodrin	

TABLE 6-4 (Continued)

SUMMARY OF SEMIVOLATILE PIC COMPOUNDS FOR ANALYSIS

SW-846 Method 8270B Compound List		
2-Naphthylamine	Parathion	Sulfallate
Nicotine	Pentachlorobenzene	Terbufos
5-Nitroacenaphthene	Pentachloronitrobenzene	Terphenyl-d_{14} (surr.)
2-Nitroaniline	Pentachlorophenol Perylene-d_{12} (I.S.)	1,2,4,5-Tetrachlorobenzene
3-Nitroaniline	Phenacetin	2,3,4,6-Tetrachlorophenol
4-Nitroaniline	Phenanthrene	Tetrachlorvinphos
5-Nitro-o-anisidine	Phenanthrene-d_{10} (I.S.)	Tetraethyl dithiopyrophosphate
Nitrobenzene	Phenobarital	Tetraethyl pyrophosphate Thionazine
Nitrobenzene-d_5 (surr.)	Phenol	Thiophenol (Benzenethiol)
4-Nitrobiphenyl	Phenol-d_6 (surr.)	Toluene diisocyanate
Nitrofen	1,4-Phenylenediamine	o-Toluidine
2-Nitrophenol	Phorate	Toxaphene
4-Nitrophenol	Phosalone	2,4,6-Tribromophenol (surr.)
5-Nitro-o-toluidine	Phosmet	1,2,4-Trichlorobenzene
Nitroquinoline-1-oxide	Phosphamidon	2,4,5-Trichlorophenol
N-Nitrosodibutylamine	Phthalic anhydride	2,4,6-Trichlorophenol
N-Nitrosodiethylamine	2-Picoline	Trifluralin
N-Nitrosodimethylamine	Piperonyl sulfoxide	2,4,5-Trimethylaniline
N-Nitrosomethylethylamine	Pronamide	Trimethyl phosphate
N-Nitrosodiphenylamine	Propylthiouracil	1,3,5-Trinitrobenzene
N-Nitrosodi-n-propylamine	Pyrene	Tris(2,3-Dibromopropyl) phosphate
N-Nitrosomorpholine	Pyridine	Tri-p-tolyl phosphate
N-Nitrosopiperidine	Resorcinol	O,O,O-Triethyl phosphorothioate
Nitrosopyrolidine	Safrol	
Ocatmethyl pyrophosporamide	Strychnine	
4,4'-Oxydianinine		

Notes:

PIC Products of incomplete combustion
TCL Target compound list

This list is the SW-846 Method 8270B list of semivolatile compounds. This list comprises the TCL for semivolatile PIC analysis during this trial burn project. The analysis of target compounds will be done by Method 8270B, and the 20 largest non-TCL peaks greater than 10 percent the nearest internal standard will be tentatively identified using a library search.

During each trial burn run, the MM5 train will be assembled and leak-checked before sampling commences. A minimum of 3 dry standard cubic meters of stack gas will be sampled during each sampling run. At the end of each run, the sampling train will be disassembled, and all train samples will be collected.

Table 6-4 of this QAPP summarizes the Method 8270 standard list of semivolatile compounds, which will serve as the TCL for this project. All MM5 train samples will be analyzed for this list of compounds and will receive an additional library search to identify and quantitate as TICs the 20 largest non-TCL peaks that are greater than 10 percent the nearest internal standard by the GC/MS method (Method 8270).

During the laboratory sample preparation, the MM5 train samples will be grouped into the train's separate samples and extracted and combined to create three separate extracts for the analysis of semivolatile target analytes and PICs and two separate extracts for the analysis of dioxins and furans. The solvent rinse of the particulate filter and the front-half of the filter holder, and the probe will be collected by conducting three separate and thorough rinses each of acetone, methylene chloride, and toluene, in that order. Because the same MM5 train handles both the semivolatile analytes and the dioxins and furans, the toluene probe rinse should be collected in a sample bottle that is separate from those of the acetone and methylene chloride probe rinses. In the analytical scheme, toluene will be handled in such a way as to introduce the toluene only into the dioxin and furan fraction. Toluene blowdown for extract volume reduction will be significantly more difficult than the more volatile acetone and methylene chloride solvents. Semivolatile losses are likely to occur if toluene will be included in the semivolatile fraction preparation.

The particulate filter and front-half rinses (acetone and methylene chloride, only) will be Soxhlet-extracted using methylene chloride for 18 hours (Method 3540). Semivolatile surrogates and dioxin and furan isotope dilution internal standards will be added to the samples at this stage of the sample preparation. The dioxin and furan sampling surrogates also will be added to the particulate samples at this point. A subsequent Soxhlet extraction will be conducted using toluene, at which time the toluene probe rinse will be added to the sample. A 50 percent portion of the methylene chloride extract will be analyzed by

Method 8270 for semivolatile POHCs and PICs. The other 50 percent portion of methylene chloride will be combined with 50 percent of the toluene extract and analyzed by Method 8290 for dioxins and furans. Figure 6-1 depicts the sample handling and analysis scheme for these samples.

The XAD-2 resin tube samples and the solvent rinse of the back-half filter holder and coil condenser samples will be handled in the same way as will be the particulate filter samples, except that they will be prepared separately and analyzed as a separate sample. These samples will be extracted sequentially using methylene chloride, followed by toluene. Extractions will be conducted using Soxhlet extraction apparatus (Method 3540), and the extracts will be combined for analysis in the same way as will be the particulate filter fractions were combined. Figure 6-2 depicts the sample handling and extract splitting scheme for the XAD-2 resin tube portion of the MM5 train. Dioxin and furan sampling surrogates will not be added to these sample during preparation because these accuracy indicators will have been applied to the XAD-2 resin before the trial burn.

The impinger condensate composite includes the contents of MM5 impingers 1, 2, and 3. The impingers receive acetone and methylene chloride glassware solvent rinses. A 1-L portion of the impinger condensate composite will be combined with the solvent glassware rinse sample, and a liquid-liquid extraction will be done using Method 3510 and methylene chloride, only. Sequential, base-neutral, acid-extractable extractions will be conducted on the condensate composite. These extracts will be combined, reduced to a final extract volume of 5 milliliters and analyzed by Method 8270 for semivolatile POHC and PICs (see train schematic in Figure 6-3). Note that the total impinger condensate composite volume must be recorded before extraction commences. The reported analyte concentrations will be delivered from the analyst in micrograms per liter (μg/L), which will be multiplied by the total condensate composite volume to obtain the total analyte contribution from these samples.

The back-half samples will consist of a composite of the deionized water impinger condensate catches. The impinger catches will be combined in the field and measured volumetrically to within plus or minus 1 mL using a graduated cylinder and also will be weighed gravimetrically to within plus or minus 0.5 grams using an analytical balance.

FIGURE 6-1

MM5A TRAIN SAMPLE-HANDLING AND EXTRACT-SPLITTING SCHEME FOR THE PARTICULATE FILTER AND FRONT HALF OF THE FILTER HOLDER AND PROBE SOLVENT RINSES (SEMIVOLATILE POHC AND DIOXINS AND FURANS)

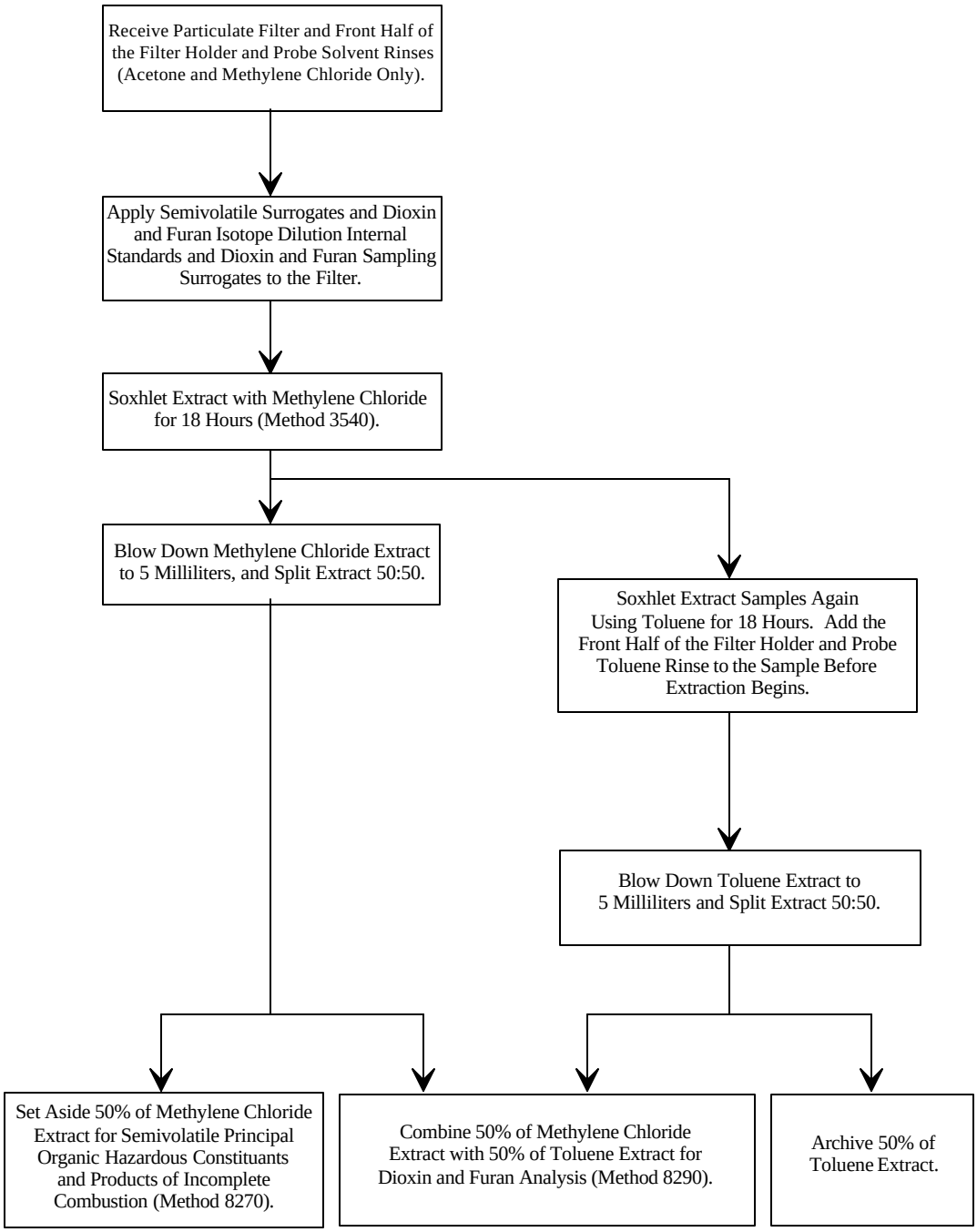


FIGURE 6-2

MM5A TRAIN SAMPLE-HANDLING AND EXTRACT-SPLITTING SCHEME FOR THE XAD-2 RESIN TUBE AND THE BACK HALF OF THE FILTER HOLDER AND COIL CONDENSER SOLVENT RINSES (SEMIVOLATILE POHCS, PICS, AND DIOXINS AND FURANS)

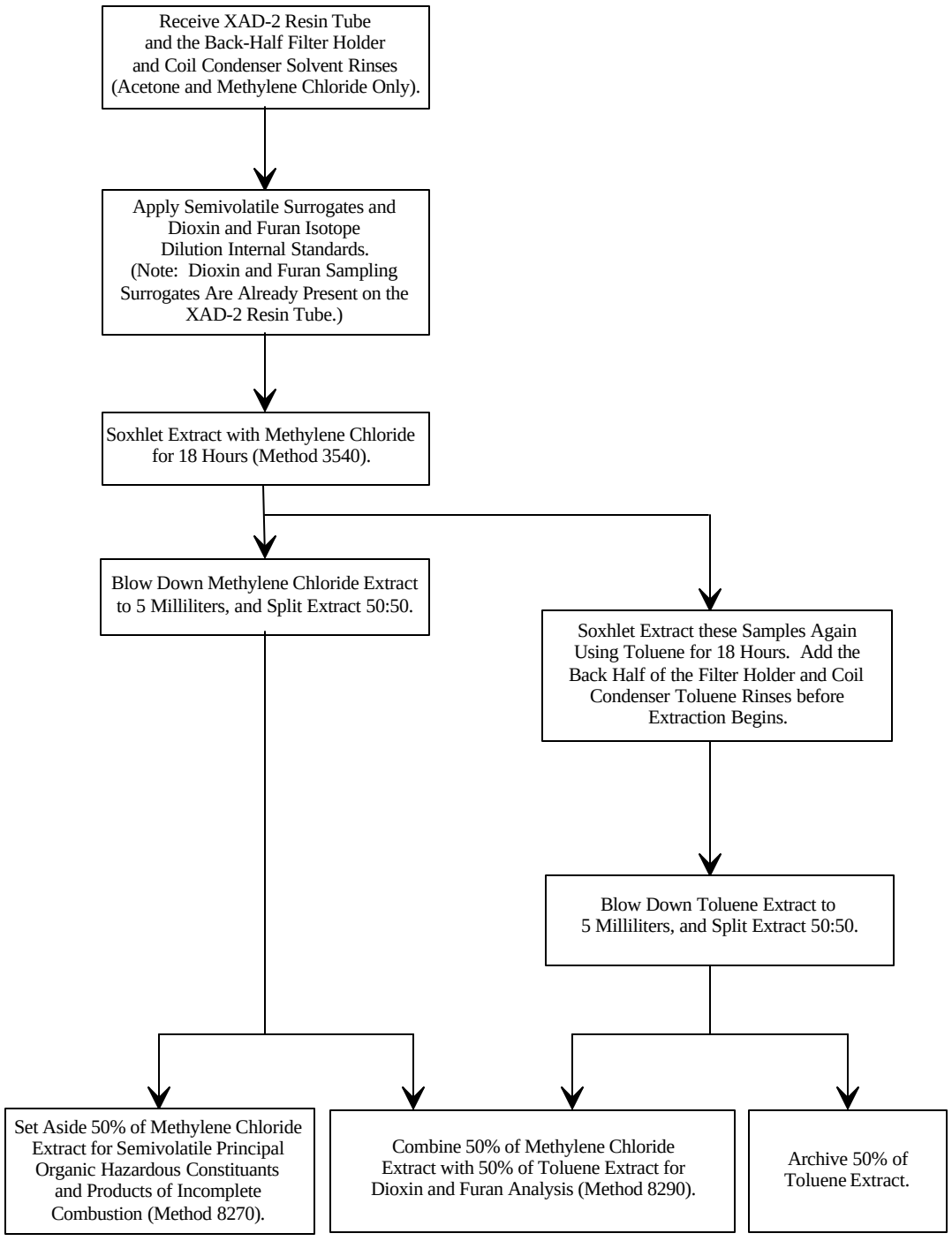
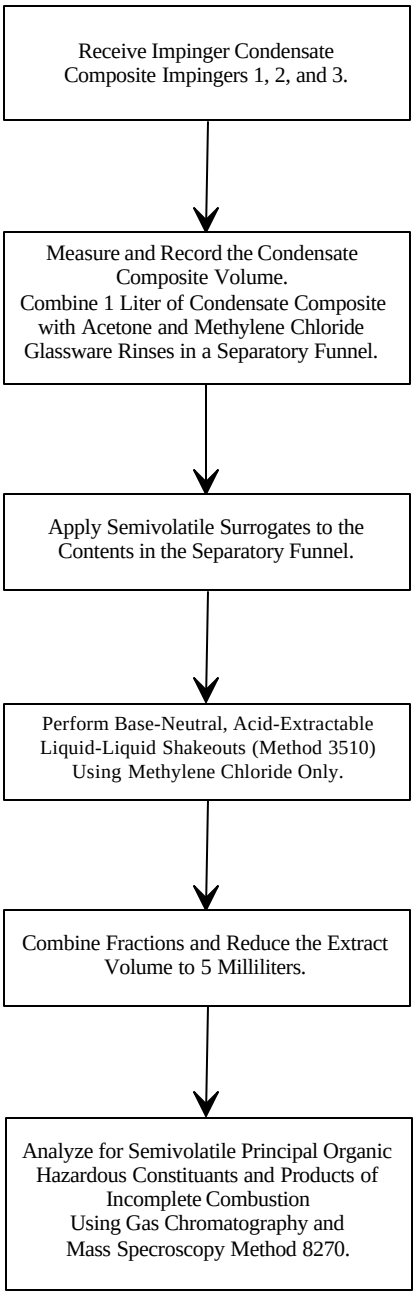


FIGURE 6-3

MM5A TRAIN SAMPLE-HANDLING SCHEME FOR IMPINGERS 1, 2, AND 3 CONDENSATE COMPOSITE AND GLASSWARE SOLVENT RINSES (SEMIVOLATILE POHCS AND PICS)



An elaborate spiking program will be applied to the MM5 trains that will allow for complete assessment of the sampling and analytical effort regarding the overall method accuracy. Spiked compounds will be placed on the components of the train at the different stages of the sampling and analytical program so that the efficiency of the method's performance can be measured quantitatively. By assuming that these compounds have chemical characteristics that are identical to the semivolatile and the dioxin and furan target compounds, the overall method efficiency can be assessed. Four types of spiking materials will be applied to the MM5 train samples. These types are defined as follows:

- Sampling Surrogate Spikes—These compounds are spiked directly onto the XAD-2 resin at the laboratory during resin tube preparation and prior to any field handling or sampling. The final recovery of these compounds gives the most comprehensive indication that the determination of native compounds using the MM5 methodology is accurate. Good recovery of these compounds will reflect the XAD-2 resin's ability to capture and retain semivolatiles and the various isomers of dioxins and furans.

- Semivolatile Surrogate and Isotope Dilution Internal Standard Spikes—These compounds are placed directly onto the sample just prior to the preparation and extraction steps. The final recovery efficiency of these compounds reflects the overall accuracy of the sample's laboratory handling and analysis. Accordingly, these compounds are used to generate data that indicate the relative accuracy of the analytical methods.

- Semivolatile Internal Standard Compounds and Dioxin and Furan Recovery Standards—These compounds are applied to the sample extracts just before the extracts are introduced onto the GC/MS instrument injection ports. These compounds are precisely applied at this step in the analytical scheme and provide the actual relative response factors that are used to calculate analyte concentrations.

- Matrix Spike Compounds (back-half and spiked resin blanks only)—These compounds are spiked onto a separately prepared aliquot of the MM5 train back half condensate sample or XAD-2 resin before analysis. The spiked aliquots are then analyzed, and the spike recovery is calculated. Recovery of these spikes provides an independent indicator of method accuracy relative to the sample matrix.

Table 6-5 lists the specific isomers that will be used to spike the MM5 train and the quantities that will be applied.

TABLE 6-5

MM5 TRAIN SPIKE COMPOUNDS AND QUANTITY SPIKED

Spike Type	Quantity Spiked
Sampling Surrogate Spikes (applied to XAD-2 before field sampling)	
Dioxin or Furan	
$^{37}Cl_4$-2,3,7,8-Tetrachlorodibenzodioxin	5 ηg
$^{13}C_{12}$-1,2,3,4,7,8-Hexachlorodibenzodioxin	5 ηg
$^{13}C_{12}$-2,3,4,7,8-Pentachlorodibenzofuran	5 ηg
$^{13}C_{12}$-1,2,3,4,7,8-Hexachlorodibenzofuran	5 ηg
$^{13}C_{12}$-1,2,3,4,7,8,9-Heptachlorodibenzofuran	5 ηg
Semivolatile POHC	
$^{13}C_3$-labeled Naphthalene	100 µg
PAH	
d_{10} - Methyl-naphthalene	500 ηg
d_{12} - Perylene	1,000 ηg
d_{12} - Terphenyl	500 ηg
Isotope Dilution Internal Standard Spikes and Surrogate Recovery Compounds (applied to each train half before sample preparation)	
Dioxin or Furan	
$^{13}C_{12}$ - 2,3,7,8-Tetrachlorodibenzodioxin	1 ηg
$^{13}C_{12}$ - 1,2,3,7,8-Pentachlorodibenzodioxin	1 ηg
$^{13}C_{12}$ - 1,2,3,6,7,8-Hexachlorodibenzodioxin	1 ηg
$^{13}C_{12}$ - 1,2,3,4,6,7,8-Heptachlorodibenzodioxin	1 ηg
$^{13}C_{12}$ - 1,2,3,4,6,7,8,9,-Octachlorodibenzodioxin	2 ηg
$^{13}C_{12}$ - 2,3,7,8-Tetrachlorodibenzofuran	1 ηg
$^{13}C_{12}$ - 1,2,3,7,8-Pentachlorodibenzofuran	1 ηg
$^{13}C_{12}$ - 1,2,3,6,7,8-Hexachlorodibenzofuran	1 ηg
$^{13}C_{12}$ - 1,2,3,4,6,7,8-Heptachlorodibenzofuran	1 ηg
Semivolatiles	
Nitrobenzene-d_5	50 µg
2-Fluorobiphenyl	50 µg
Terphenyl	50 µg
Phenol-d_5	100 µg
1-Fluorophenol	100 µg
2,4,6-Tribromophenol	100 µg

TABLE 6-5 (Continued)

MM5 TRAIN SPIKE COMPOUNDS AND QUANTITY SPIKED

Spike Type	Quantity Spiked
PAHs	
Naphthalene-d_8	200 ηg
Acenaphthylene-d_8	200 ηg
Acenaphthene-d_{10}	200 ηg
Fluorene-d_{10}	200 ηg
Phenanthrene-d_{10}	200 ηg
Fluoranthene-d_{10}	200 ηg
Pyrene-d_{10}	200 ηg
Benzo(a)anthracene-d_{12}	200 ηg
Chrysene-d_{12}	200 ηg
Benzo(b)fluoranthene-d_{12}	400 ηg
Benzo(k)fluoranthene-d_{12}	400 ηg
Benzo(a)pyrene-d_{12}	400 ηg
Benzo(g,h,i)perylene-d_{12}	400 ηg
Indeno(1,2,3-c,d)pyrene-d_{12}	400 ηg
Dibenzo(a,h)anthracene-d_{14}	400 ηg
Dioxin and Furan Recovery Standards and Semivolatile Internal Standards (applied to extracts prior to sample injection)	
Dioxin and Furan	
$^{13}C_{12}$ - 1,2,3,4-Tetrachlorodibenzodioxin	2 ηg
$^{13}C_{12}$ - 1,2,3,7,8,9-Hexachlorodibenzodioxin	2 ηg
Semivolatiles	
1,4 - Dichlorobenzene -d_4	20 µg/mL
Naphthalene - d_8	20 µg/mL
Acenaphthene - d_{10}	20 µg/mL
Phenanthrene - d_{10}	20 µg/mL
Chrysene - d_{12}	20 µg/mL
Perylene - d_{12}	20 µg/mL

TABLE 6-5 (Continued)

MM5 TRAIN SPIKE COMPOUNDS AND QUANTITY SPIKED

Spike Type	Quantity Spiked
Matrix Spike Compounds (applied to aliquot of sample matrix prior to extraction)	
Semivolatiles	
Phenol	75 µg/L
2-Chlorophenol	75 µg/L
1,4-Dinitrophenol	50 µg/L
N-nitroso-di-n-propylamine	50 µg/L
1,2,4-Trichlorobenzene	50 µg/L
4-Chloro-3-methylphenol	75 µg/L
Acenaphthalene	50 µg/L
4-Nitrophenol	75 µg/L
2,4-Dinitrotoluene	50 µg/L
Pentachlorophenol	75 µg/L
Pyrene	50 µg/L

Notes:

µg Microgram
µg/L Micrograms per liter
µg/mL Micrograms per milliliter
ηg Nanogram

Once during the trial burn, an MM5 blank train will be assembled and charged with all required reagents in a fashion that is identical to that of the actual sample train. This blank train will be heated and leak-checked in the same manner as the actual train, placed near the base of the stack, and sealed for the duration of one sampling run. Upon completion, the blank train samples will be recovered applying the same procedures used to collect actual trial burn train samples. These blank train samples will be analyzed for the semivolatile POHC, PICs, and dioxin and furan isomers using the same handling and analysis procedures performed on the actual sampling trains. The results of the blank train samples will indicate any possible contamination introduced to the samples by contaminated reagents, improper preparation or handling techniques, or contamination problems due to impure reagents. As well, field and trip blank XAD-2 resin tube samples will be collected to assess fugitive contamination reaching the samples during various sample handling stages, as described in Sections 6.1.3 and 6.1.4.

6.3.4.2 MM5B Train Semivolatile and Nonvolatile Unspeciated Mass

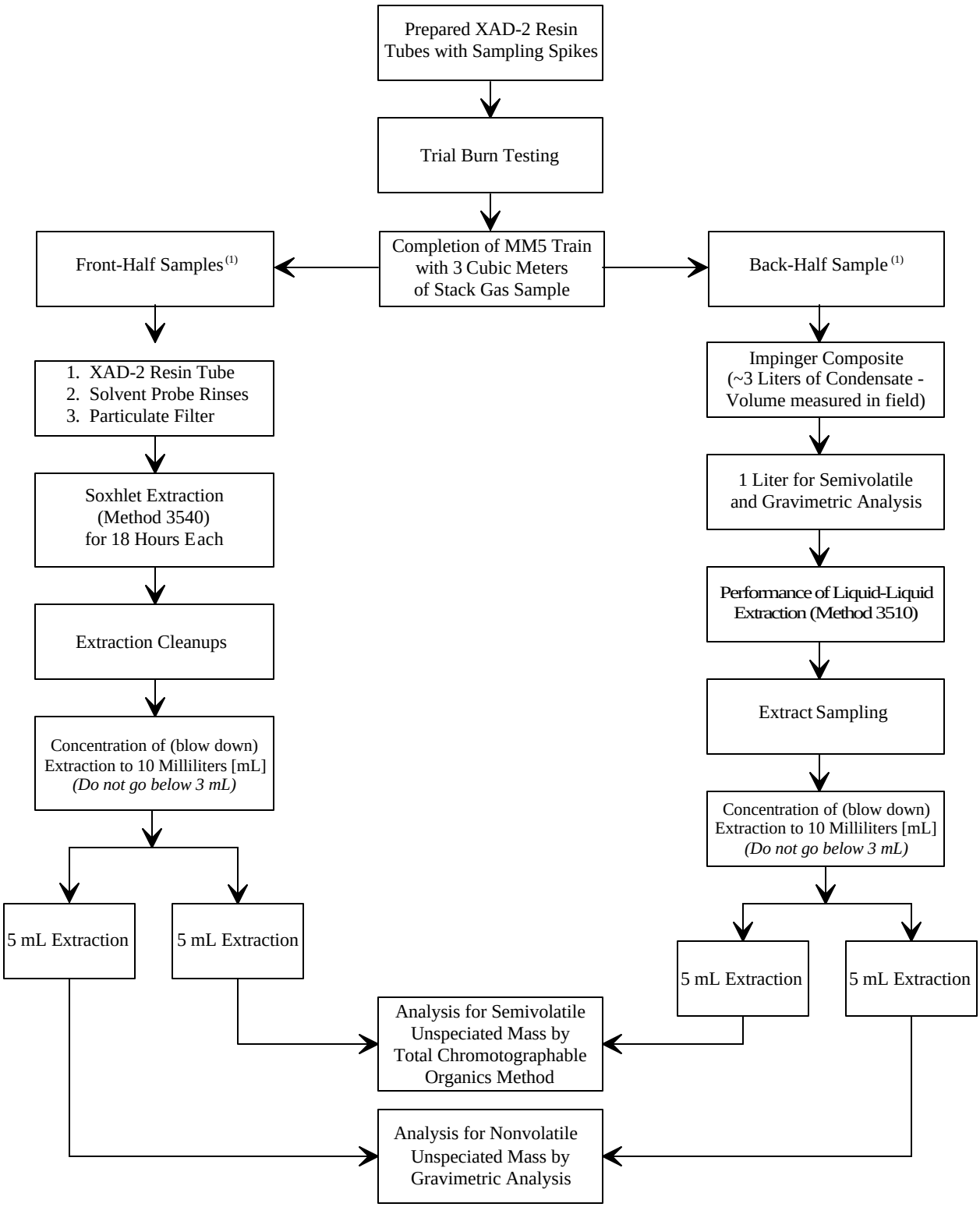
A separate MM5 train, the train B configuration, will be used to collect stack gas samples for semivolatile and nonvolatile unspeciated mass. The sampling methodology is, in general, the same as that presented for semivolatiles, with some exceptions:

- The semivolatile and nonvolatile unspeciated mass train will not be split to accommodate different classes of compounds.
- Semivolatile unspeciated mass surrogates will be applied to the train components at the appropriate preparation steps.
- Analysis of the extracts for semivolatile and nonvolatile unspeciated mass will be performed by GC and flame ionization detection (GC/FID) and by a gravimetric method, respectively.

Figure 6-4 depicts the MM5 train sample-handling and extract splitting scheme for the front half, the back half, and the impinger portions of the train.

FIGURE 6-4

MM5B TRAIN SAMPLE-HANDLING AND EXTRACT-SPLITTING SCHEME FOR SEMIVOLATILE AND NONVOLATILE UNSPECIATED MASS ANALYSIS



(1) Semivolatile unspeciated mass surrogates are added to the front-half and to the back-half samples immediately before solvent extraction is performed.

6.3.4.3 MM5C Train Polynuclear Aromatic Hydrocarbons

A separate MM5 train, the train C confirguration, will be used to collect stack gas samples for PAHs, in general, following the procedures described in California Air Resource Board (CARB) Method 429. The sampling methodology is the same as that presented for semivolatiles, with some exceptions:

- The PAH train will not be split to accommodate different classes of compounds. However, the same train components will be sampled and analyzed as defined for the MM5A train. Three separate train samples will be prepared for each train, and three separate analyses will be performed for each train.
- PAH-specific sampling surrogates, isotope dilution internal standards, and recovery standard will be applied to the PAH train components at the appropriate preparation steps.
- Analysis of the extracts for PAHs will be performed by high-resolution GC and high-resolution MS. The analytical method is a modified SW-846 Method 8290 using CARB 429 as guidance.

A list of TCL PAH compounds to be analyzed by high-resolution MS follows. Table 6-5 lists the specific compounds that will be used to spike the MM5 PAH train and the quantities that will be applied. Figures 6-5, 6-6, and 6-7 depict the MM5 PAH train sample-handling and extract-splitting scheme for both the front-half, the back-half, and the impinger portions of the train.

FIGURE 6-5

MM5C TRAIN SAMPLE-HANDLING AND EXTRACT-SPLITTING SCHEME FOR PARTICULATE FILTER AND FRONT HALF OF THE FILTER HOLDER AND PROBE SOLVENT RINSES (PAHS)

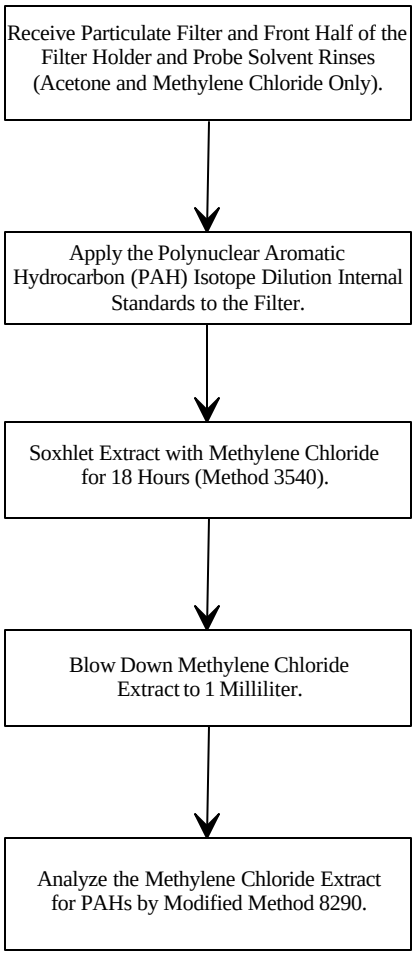


FIGURE 6-6

MM5 TRAIN SAMPLE-HANDLING AND EXTRACT-SPLITTING SCHEME FOR XAD-2 RESIN TUBE AND BACK HALF OF THE FILTER HOLDER AND COIL CONDENSER SOLVENT RINSES (PAHS)

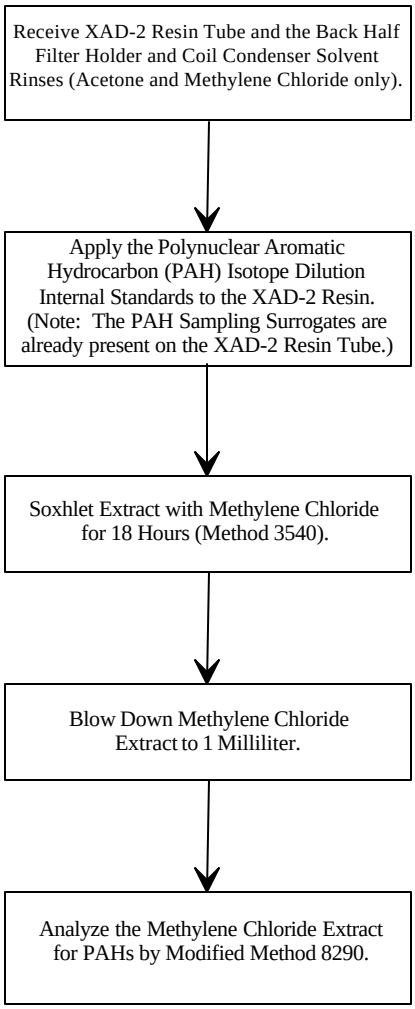
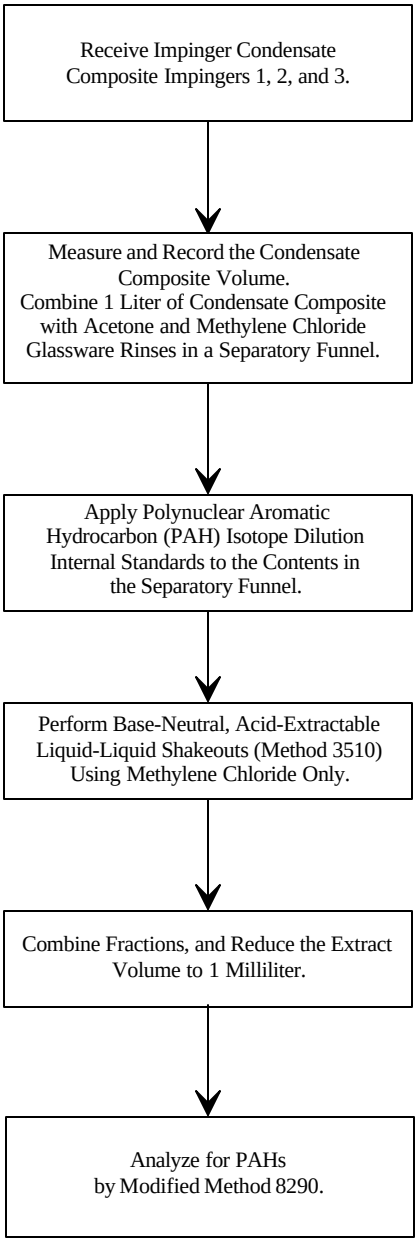


FIGURE 6-7

MM5 TRAIN SAMPLE-HANDLING SCHEME FOR IMPINGERS 1, 2, AND 3 CONDENSATE COMPOSITE AND GLASSWARE SOLVENT RINSES (PAHS)



TCL PAHs for High-Resolution Mass Spectroscopy Analysis

Naphthalene

Acenaphthalene

Acenaphthene

Fluorene

Phenanthrene

Anthracene

Fluoranthene

Pyrene

Benzo[a]anthracene

Chrysene

Benzo[k]anthracene

Benzo[b]fluoranthene

Benzo[g,h,i]perylene

Benzo[a]pyrene

Indeno[1,2,3-cd]pyrene

Dibenzo[a,h]anthracene

6.3.5 Multi-Metals and Mercury Train (Method 0060)

A standard SW-846 Method 0060 sampling train will be used to collect stack gas samples for an assessment of metals, mercury, and moisture during the trial burn. Stack gas moisture will be determined using this sampling train and incorporating the procedures found in EPA Method 4. EPA Method 4

requires measurement of the stack gas flow rate and a record of the temperature.

The target metals that will be analyzed in the train samples are found in the following list:

TCL Metallic Compounds for Analysis

Antimony

Arsenic

Barium

Beryllium

Cadmium

Total Chromium

Lead

Mercury

Nickel

Selenium

Silver

Thallium

The acetone probe rinse residue digestate, the nitric acid probe rinse digestate, and the particulate filter digestate will be combined in the laboratory as the front-half composite sample and analyzed for the target metals. The back-half of the train consists of the following three samples collected in separate containers: the 5 percent nitric acid and 10 percent hydrogen peroxide impinger catches from impingers 1 through 3, the empty impinger moisture gain (at position 4) and the 4 percent potassium permanganate and 10 percent sulfuric acid impinger catches from impingers 5 and 6, and a final rinse of impingers 5 and 6 with

8 N hydrogen chloride. The 5 percent nitric acid and 10 percent hydrogen peroxide impinger catches will be analyzed for the full target metals list, while the impinger 4 sample, the 4 percent potassium permanganate and 10 percent sulfuric acid impinger catches, and the 8 N hydrogen chloride rinse will be analyzed separately for mercury only.

The use of hydrofluoric acid is required in the preparation of the particulate filter and nitric acid probe rinse composite. The 5 percent nitric acid and 10 percent hydrogen peroxide impinger composite will be analyzed separately for the target metal analyte list. A separate portion of the impinger composite will be prepared by SW-846 Method 7470 for mercury. The fourth impinger (empty at the start of a test), the 4 percent potassium permanganate and 10 percent sulfuric acid impinger composite, and the 8N hydrogen chloride impinger rinse will be prepared and analyzed separately for mercury using Method 7470.

The analytical laboratory will analyze audit filter samples for metals and mercury if provided by the regulatory agency.

6.3.6 Hexavalent Chromium Train (Method 0061)

Stack gas samples for hexavalent chromium will be collected using a standard hexavalent chromium recirculatory train, as described in SW-846 Method 0061. The first impinger solution, aqueous 1.0N potassium hydroxide, is recirculated continuously through the train's probe to capture and stabilize stack gas hexavalent chromium. As well, the method requires that the hexavalent chromium train use all Teflon™ (or Teflon™-lined) impingers and connecting glassware. After completing each run, the impingers of the train will be connected to a purified nitrogen gas source and purged slowly, as specified in Method 0061. The impinger catches will be filtered under pressure on site and then collected for transport to the analytical laboratory. The purpose of the nitrogen gas purging and filtration steps is to purge the impinger solution and to preserve and stabilize the hexavalent chromium, if present, in the +6 oxidation state maintaining sample integrity.

To assess the stability of the trapped hexavalent chromium, the impinger sample composites for each hexavalent chromium train collected will be divided into aliquots and spiked as described in Section 6.1.5. The train aliquots will be analyzed by the laboratory to determine the native concentrations and spike concentration stability in the actual stack gas matrix. This procedure is being implemented in lieu of a 24-hour holding time requirement for hexavalent chromium samples.

An SRM containing a certified concentration of hexavalent chromium will be obtained and analyzed as an accuracy check for this method. The SRM will be prepared in an appropriate matrix at a concentration similar to the actual field samples and analyzed in conjunction with the field samples. Results of the SRM analyses will be included in the trial burn final report. Once during the trial burn the standard spiking material used to fortify the sample aliquots during each run at the various concentration levels will be submitted to the analytical laboratory for analysis. This sample will be analyzed to verify the concentration of hexavalent chromium in the solution.

6.3.7 M5 Hydrogen Chloride, Chlorine, and Particulate Train (Method 0050)

A standard EPA Method 5 isokinetic sampling train as described in EPA SW-846 Method 0050, will be used to collect stack gas samples for hydrogen chloride, chlorine, and particulate analysis during each test run. An integrated gas sample is extracted from the stack and passed through a 0.1N sulfuric acid solution. In this acidic solution, the hydrogen chloride gas is solubilized and forms chloride ions. The acidified solution prevents the chlorine gas from solubilizing and allows this gas to pass on through to the next set of impingers that contains a 0.1N sodium hydroxide solution. The chlorine gas hydrolyses in the basic solution following the chemical stoichiometry shown below:

$$\text{Chlorine} + \text{Water} \xrightarrow{\text{Sodium Hydroxide}} \text{Hydrochloric Acid} + \text{Hypochlorous Acid}$$

The chloride concentrations of the sulfuric acid impinger samples and the sodium hydroxide impinger samples will be reported separately. Analyses of these samples will be conducted using either SW-846 Method 9056 or SW-846 Method 9057.

The stack gas particulate emissions will be determined by weighing the solid residue collected from an acetone probe and filter housing rinse and by weighing the train particulate filter before and after sampling to determine total particulate by difference. The reported particulate determination will be the sum of the probe rinse residue and the particulate filter residue. Stack gas moisture content will be determined using this sampling train by following the procedures found in EPA Method 4. As shown in Table 6-2, reagent blank samples for the M5 train will be collected once during the trial burn. These reagent blanks will be collected to assess any possible sample contamination caused by handling or by contaminated reagents sources.

The stack sampling coordinator will be responsible for verifying before the test that the sampling train is constructed properly, and that calibrations have been performed properly. The stack sampling coordinator also will check to see that proper absorbing solutions have been used, required leak check procedures are performed, and sample recovery is properly performed after completion of the run.

6.3.8 Formaldehyde Train (Method 0011)

During the trial burn, the stack gas emissions will be sampled isokinetically and analyzed for the following aldehydes according to the procedures provided in SW-846 Methods 0011 and 8315: formaldehyde, acetaldehyde, benzaldehyde, propionaldehyde, and crotonaldehyde. The sampling train used will consist of a series of at least four impingers. The first and second impingers will contain from 100 to 200 mL each of a cleaned DNPH solution, while the third impinger will remain empty serving as a final moisture knockout during the test. The fourth impinger will contain a pre-weighed amount of silica gel to protect the sampling pump from moisture.

The DNPH impinger solution will be prepared and used in the field within 5 days of the date of preparation. The probe will be rinsed with methylene chloride three times followed by a deionized water rinse. These rinsates will be combined and analyzed for the aldehydes. Impinger 1 will be collected and analyzed separately from impingers 2 and 3 in order to evaluate analyte breakthrough. Impingers 2 and 3 will be collected and combined prior to analysis.

In order to assess analyte amounts contributed through the use of various chemicals, a reagent blank will be collected for each test run by placing equal amounts of DNPH reagent and methylene chloride into a sample container. This blank will be handled by the analytical laboratory in the same manner as the actual impinger samples.

One field spike will be collected during each run of the testing program by spiking 200 µL of formaldehyde standard into 200 mL of DNPH solution. Once during the trial burn, a blank train will be assembled, leak-checked, and placed near the stack for the duration of one sampling run. These spike and blank samples will be handled in the same manner as the actual stack gas samples. Additional laboratory QC, as described in the analytical method, will be performed as necessary.

6.4 PROCESS MONITORING EQUIPMENT

Process electronic data output will be monitored carefully by incinerator operators in order to maintain steady-state operating conditions during the trial burn. Process monitoring equipment will be inspected and calibrated periodically. Where duplicate monitors or methods of determination exist, the data generated will be compared for consistency.

6.5 CONTINUOUS EMISSION MONITORING EQUIPMENT

During testing, the CEM equipment for carbon monoxide and oxygen will be monitored continuously during each test. The quality of data generated by these CEM systems and the other monitors in place will be evaluated by conducting system performance checks before testing begins (described in

Section 8.0) by conducting calibration checks during the trial burn and by reviewing all data records obtained during the initial instrument performance evaluation.

During the trial burn, the monitors will be checked against reference standards daily, at a minimum. The zero and span checks will be considered a verification of the quality of data received from the monitors. If the zero and span checks show how unacceptable results for accuracy and precision, then the monitor will be recalibrated according to the manufacturer's specifications. Data will be reported on 1-minute intervals and will be archived in the CEM's data acquisition system.

7.0 SAMPLE HANDLING, TRACEABILITY, AND HOLDING TIMES

[*REQUIREMENT: In this section, the applicant shall identify each sample to be collected during the trial burn, the sample's holding time, and sample preservation requirements. All sample-handling procedures and traceability requirements must be described in detail.*]

Sample custody will be the responsibility of the process sampling coordinator from the time of sample collection until the arrival of samples at the analytical laboratory. Thereafter, custody will be maintained by the analytical laboratory performing the analysis. Samples will be kept on ice (at a temperature of less than or equal to 4 ^{o}C) and shipped to the analytical laboratory in a secured ice chest. Sample custody procedures will comply with the general elements outlined for trial burn sample custody found in the following EPA reference document:

- *Handbook, Quality Assurance/Quality Control (QA/QC) Procedures for Hazardous Waste Incineration*. U.S. Environmental Protection Agency. U.S. Government Printing Office: Washington, D.C. January 1990. EPA-625/6-89-023.

Custody of samples will begin with the sampling team and be transferred to the analytical laboratory at the time of sample shipment. The custody procedures will include the following activities:

- Labeling of all samples with a unique sample number
- Individual preparation and maintenance of a sample collection sheet with complete sampling data for each sample
- Maintenance of a list of all samples collected using a sample logbook that will serve as a master sample checklist
- Shipment of the samples to the analytical laboratory performing sample analysis accompanied by RFA and COC forms that will be inclusive of all samples in various coolers for that shipment.

The intent of these procedures is to document the samples' traceability, while providing a COC record for all samples collected. Possession and custody of the samples will be maintained in a competent fashion, and samples will be handled responsibly and stored at all times.

7.1 SAMPLE LABELING

Samples will be collected in containers labeled appropriately to give each sample a unique identification. The sample labels will be completed with sample type, date, run number, and sample number and placed on all sample containers prior to sample collection. To identify and track each sample and its corresponding analytical results, a unique alphanumeric sample number will be affixed in duplicate to the sample; one sample number will be affixed to the container label, and the other will be affixed to the container lid. A third sample number that is identical to the sample number on the container label will be placed in the field logbook in numerical order along with all pertinent sample description information. An example of the sample label that will be used on each sample container and the written information that identifies each sample, is shown in Figure 7-1. After all containers have been labeled, each will be staged in a sample cooler at its appropriate sampling location.

7.2 SAMPLE COLLECTION SHEETS

During the trial burn, a sample collection sheet will be completed for each sample collected. Each sample collection sheet will contain, at a minimum, the following information:

- Project name
- Run number
- Unique sample number
- Collection date and time

- Sampler's initials or name
- Sample location and type (e.g., metals spiking solutions and makeup water)

[*Insert Figure 7-1*]

FIGURE 7-1

SAMPLE LABELING AND NUMBERING SCHEME

Trial Burn Project Name
Trial Burn Location

SAMPLE TYPE: Scrubber Purge Water
1-L Composite Sample

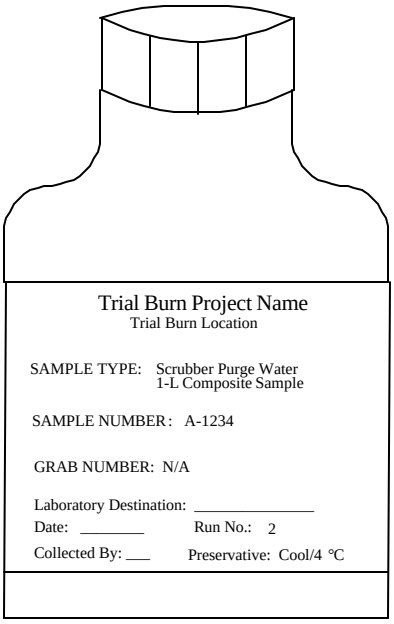
SAMPLE NUMBER: A-1234

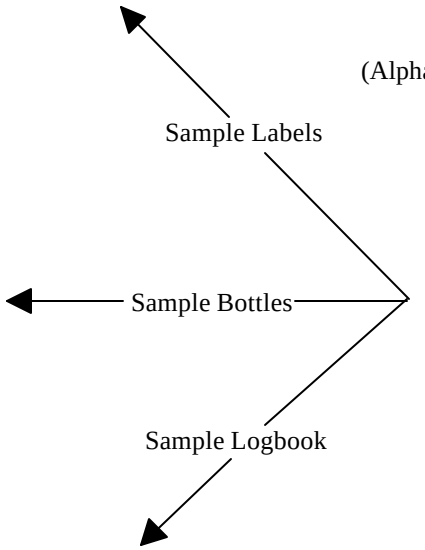
GRAB NUMBER: N/A

Laboratory Destination: _____

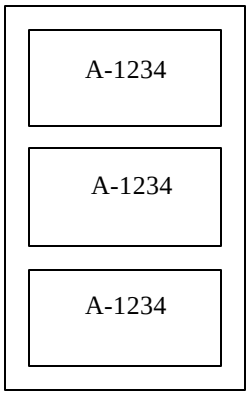
Date: _____ Run No.: 2

Collected By: _____ Preservative: Cool/4 °C





Sample Number Tape Roll
(Alphanumeric Numbers in Triplicate)



Trial Burn Project Name — Notebook No. 1

Run No. 2

Sample No.	Sample No.	Sample Description
A-1234	A-1234	Scrubber Purge Water
		1-L Composite - TDS and TSS, and Pesticides

- Container type
- Source
- Sampling technique, source, or special equipment required to obtain the sample (e.g., MM5 sampling train)
- Description of the compositing technique used to form the final test sample (specify in the comments section, if applicable)

An example of a sample collection sheet, shown in Figure 7-2, will provide an inventory and field sampling record of each sample collected during all field activities.

7.3 SAMPLE COLLECTION CHECKLIST

A sample collection checklist will be used in the field by the process sampling coordinator during each test run to verify that a complete and well-documented sampling program was implemented. This form of documentation will allow the process sampling coordinator to monitor the timeliness and completeness of all sampling activities in the field on a real-time basis. The sampling procedures, the types of samples collected, and the sample containers used will be monitored at each sample location during each sample interval. The sample collection times will be recorded on the sample collection checklist as a backup measure to verify sample completeness and accuracy. This checklist also will be used as an inventory checklist by which to verify the shipment of all trial burn samples to the analytical laboratory.

7.4 SAMPLE COLLECTION LOGBOOK

Each sample number also will be recorded sequentially in a bound field sampling logbook with a brief description of the sample type and volume. This logbook will be used to track all collected samples and to record trial burn sampling and analysis activities. The following information will be entered into the logbook:

FIGURE 7-2

PROCESS SAMPLE COLLECTION SHEET

Project Name: _____ **Run Number:** _____
Project Number: _____ **Sample Number:** _____
Project Description: _____ **Date:** _____
Sampler(s): _____ **Collection Time:** _____
_____ **Collection Frequency:** _____

Sample Type (circle one):	Composite				
	Aliquot				
	Grab (circle one):	Before Test	Start	During	End	After Test

Sample Description (circle one):	Purge Water	Incinerator Ash	POHC Spiking Materials
	Makeup Water	Ash Spiking Material	Low-Btu Liquid Waste Feed
	Caustic Feed	Other: _____	High-Btu Liquid Waste Feed
	Soil Feed	Other: _____	Other: _____

Composite Sampling Time Log:

(1) _____	(6) _____	(11) _____	(16) _____	(21) _____	(26) _____
(2) _____	(7) _____	(12) _____	(17) _____	(22) _____	(27) _____
(3) _____	(8) _____	(13) _____	(18) _____	(23) _____	(28) _____
(4) _____	(9) _____	(14) _____	(19) _____	(24) _____	(29) _____
(5) _____	(10) _____	(15) _____	(20) _____	(25) _____	(30) _____

Volume of Each Grab: _____ Total Number of Grabs: _____

Final pH of Sample: _____ Approximate Final Volume of Composite: _____

Sample Source: (circle one)	Pipeline Tap	Ash Conveyor Belt	Other: _____
	Reagent Source	Soil Feed Conveyor Belt	Other: _____
	Tank Source		Other: _____

Container Type: (circle one)	1-L Boston-round	40-mL VOA Vial	120-mL Wide-mouth
	1-L Wide-mouth	120-mL VOA Vial	2.5-L Jug
	500-mL Wide-mouth	1-gallon Amber Wheaton Jug	Other: _____

Comments:

_____
_____
_____

Sampler’s Signature and Date: _____

- Sampling personnel
- Sample number
- Type of sample (e.g., metals spiking solutions or makeup water)
- Location of sampling point
- Date of collection
- Field observations

7.5 REQUEST FOR ANALYSIS AND CHAIN OF CUSTODY

Figure 7-3 is an example of an RFA, and Figure 7-4 is an example of a COC form. These forms will provide the formal custody record. These forms will be completed and distributed as follows:

- One copy will be retained by the sampling team.
- The original form will be sent to the analytical laboratory with the sample shipment.

The laboratory analysis coordinator will take an inventory of each shipment of samples and will sign and date the original COC form. Next, the laboratory analysis coordinator will note on the COC form of any discrepancy in the number of samples or breakage of samples. The trial burn manager will be notified immediately of any problems identified with shipped samples. The laboratory will maintain custody of the samples until notification for release or disposal is received from the trial burn manager.

7.6 SAMPLE PRESERVATION AND HOLDING TIMES

Prior to sample collection, the sample containers will be placed on ice and chilled to a temperature that is less than or equal to 4 °C. All samples will be placed on ice in coolers during and after sampling and will be stored at a temperature of less than or equal to 4 °C until analyzed. The VOST tube sample pairs will

be preserved before, during, and after trial burn testing by placing them in a dedicated sample

FIGURE 7-3

EXAMPLE REQUEST FOR ANALYSIS FORM

Request for Analysis No.: _____
Project Name - Run No.: _____
Project Number:_____

Project Identification: _____
Client Project Number: _____
Project Number: _____
Laboratory Work Order Number: _____
Project Manager: _____

Analytical Testing QC Requirements:
The descriptions for the Project-Specific Quality Control Requirements column are as follows:
MS (Matrix Spike), MSD (Matrix Spike Duplicate),
DUP (Duplicate), and PDS (Post-Digestion Spike)

Project Deliverables:
Report analytical results on Certificates of Analysis and data packages adhered to the Contact Laboratory program (CLP) style, when required. Include "Field Number," Sample Type," and "Run Number" on all Certificates of Analysis.

Laboratory Deliverable Turnaround Requirements:
Date Sample(s) Collected: _____
Date Sample(s) Shipped: _____
Date Certificate(s) are Due: _____
Date Data Package(s) are Due: _____

Holding Time Requirements: (Extract and Analyze Sample Before the Date Given:)
Dioxins and Furans: _____
Collection to Extraction: _____
Extraction to Analysis: _____
Extract Samples By: _____
Analyze Samples By: _____

Laboratory Destination: _____
Courier: _____

Field Sample Number	Lab Sample Number	Project-Specific QC Requirements	Sample Type/Analysis	Analytical Specifications
C-1000	D-1000		Method 0023A Train XAD-2 Resin Tube Dioxin and Furan Analysis	**Note: This XAD-2 tube was spiked with 4 grams of each of the Method 0023A sampling surrogates. Please include the quantitation of these isotopically labeled compounds on the Certificate of Analysis.** Combine the XAD-2 resin tube with sample C-1001 (particulate filter) and sample C-1003 (solvent probe rinse). Spike the resin with the required isotope dilution internal standards and Soxhlet extract for 16 hours (SW-846 Method 3540). Blow down the extract to final volume and analyze it for all 2,3,7,8-isomer and totals by chlorinated class (tetra-octas) using SW-846 combined Methods 8290 and 0023A. Report data on Certificates of Analysis and in a CLP-style data package. Dioxin and furan data should include toxicity equivalency factor calculations.
C-1001	D-1001		Method 0023A Train Particulate Filter Dioxin and Furan Analysis	Combine with Sample C-1000, (XAD-2 resin tube) and Sample C-1003 (solvent probe rinse). Follow the instructions for XAD-2 resin tube (Sample C-1000). Report data on certificates and in a CLP-style data package.
C-1002	D-1002		Method 0023A Train Back-half Impinger Composite Archive	Archive this sample.
C-1003	D-1003		Method 0023A Train Solvent Probe Rinse Dioxin and Furan Analysis	Combine with Sample C-1000 (the XAD-2 resin tube) and Sample C-1001 (the particulate filter). Follow the instructions for the XAD-2 resin tube (Sample C-1000). Report data on certificates and in a CLP-style data package.

C-1004	D-1004		Method 0023A Train Toluene Probe Rinse Dioxin and Furan Analysis	Prepare sample using solvent dilution (SW-846 Method 3580), and analyze for all 2,3,7,8-chlorinated isomers and totals by class (tetra-octas) of dioxins and furans using high-resolution gas chromatography and mass spectroscopy (SW-846 Method 8290). Report data on certificates and in a CLP-style data package.

FIGURE 7-4

EXAMPLE CHAIN-OF-CUSTODY FORM

Sample Receipt Log and Condition of the Samples Upon Receipt

Please fill in the following information:		Comments
		(Please write "NONE" if no comment is applicable.)
(1)	Record the identities of any samples that were listed on the Request for Analysis form but were not found in the sample shipment.	_____
(2)	Record the sample shipping cooler temperature of all coolers transporting samples listed on the Request for Analysis form**.**	_____
(3)	Record any apparent sample loss or breakage.	_____
(4)	Record any unidentified samples transported with this shipment of samples.	_____
(5)	Indicate if all samples were received according to the project's required specifications (i.e, no nonconformances).	_____

Custody Transfer

Relinquished by: _____

Name	Company	Date/Time

Accepted by: _____

Name	Company	Date/Time

Relinquished by: _____

Name	Company	Date/Time

Accepted by: _____

Name	Company	Date/Time

cooler containing dry ice (preservation on regular ice is acceptable). The VOST sample tubes will remain chilled while sublimation of dry ice continually purges the sample cooler with a blanket of carbon dioxide, preventing sample contamination by ambient volatile organic sources. In addition to cooling all samples, chemical preservatives will be used, as required, in samples for specific analyses according to EPA protocols. Aqueous samples of purgeable halocarbons will be preserved chemically with 0.008 percent sodium thiosulfate, and aqueous samples receiving metals analysis will be preserved chemically with nitric acid to a pH of less than 2. Table 7-1 summarizes the holding times criteria that will be followed for this project. The holding times and preservation techniques are either those recommended in Title 40 CFR Section 136.3, Table 11, "Required Containers, Preservation Techniques, and Holding Times," or those presented by EPA in Table 3-1 of the *Handbook - Quality Assurance/Quality Control (QA/QC) Procedures for Hazardous Waste Incineration* (EPA-625/6-89-023).

TABLE 7-1

SAMPLE HOLDING TIME AND PRESERVATION TECHNIQUES

Measurement	Matrix	Preservation[a]	Holding Time[b]
Volatiles (including unspeciated mass)	Tedlar™ bags	Do not chill	6 hours
	Tenax™ and Tenax™-charcoal	Chill on dry ice to about 0 °C[c]	14 days to analysis
	Solids and other nonaqueous	Chill with ice ≤ 4 °C,	14 days to analysis
	Aqueous and liquid	Chill with ice ≤ 4 °C, 0.008% sodium thiosulfate	14 days to analysis
Semivolatiles (including TCO and GRAV)	XAD-2 resin	Chill with ice ≤ 4 °C	14 days to extraction 40 days from extraction to analysis
	Solids and other nonaqueous	Chill with ice ≤ 4 °C	14 days to extraction 40 days from extraction to analysis
	Aqueous and liquid	Chill with ice ≤ 4 °C	14 days to extraction 40 days from extraction to analysis
Dioxin, furans, and PAHs	XAD-2 resin	Chill with ice ≤ 4 °C	30 days to extraction 45 days from extraction to analysis (Method 8290)
Metals	Solids and other nonaqueous	Chill with ice ≤ 4 °C	6 months to analysis
	Aqueous and liquid	Chill with ice ≤ 4 °C nitric acid (pH < 2)	6 months to analysis
Mercury	Aqueous and liquid	Chill with ice ≤ 4 °C, pH < 2 with nitric acid	28 days to analysis
	Solids and other nonaqueous	Chill with ice ≤ 4 °C	28 days to analysis
Hexavalent chromium	1.0N potassium hydroxide	Nitrogen gas purge, filter, chill with ice ≤ 4 °C, final pH ≥ 8.5	24 hours to analysis[d]
Formaldehyde	Aqueous and liquid	Chill with ice ≤ 4 °C	30 days to extraction 30 days from extraction to analysis

TABLE 7-1 (Continued)

SAMPLE HOLDING TIME AND PRESERVATION TECHNIQUES

Measurement	Matrix	Preservation[a]	Holding Time[b]
Hydrogen chloride and chlorine	0.1N sodium hydroxide	Chill with ice ≤ 4 °C	30 days to analysis
	0.1N sulfuric acid	Chill with ice ≤ 4 °C, pH < 2	30 days to analysis
	Particulate filter	Chill with ice ≤ 4 °C	30 days to analysis
Heat content, density, moisture, viscosity, elemental analysis[e], % ash	Aqueous and nonaqueous liquids	Chill with ice ≤ 4 °C	None[f]
Total chlorine	Aqueous and liquid	Chill with ice ≤ 4 °C	30 days to analysis
TSS, TDS, TS	Aqueous and liquids	Chill with ice ≤ 4 °C	7 days to analysis

Notes:

GRAV = Gravimetric
N = Normality
PAH = Polynuclear aromatic hydrocarbons
TCO = Total chromatographable organics
TDS = Total dissolved solids
TS = Total solids
TSS = Total suspended solids

a All trial burn samples will be preserved on ice from the time of collection through delivery to the analytical laboratory.
b Holding times are calculated from the date of collection.
c VOST resin tubes will be preserved on dry ice before and after sampling. The use of regular ice is acceptable.
d The sample holding time will be 24 hours unless low-level (in parts per billion) field spikes are applied to the train samples at the time of sampling recovery.
e Elemental analysis will include the following: carbon, hydrogen, oxygen, nitrogen, sulfur, phosphorus, and chlorine.
f No specific holding time requirement is cited in the methods. However, samples will be analyzed in a timely manner (generally within 30 days).

8.0 SPECIFIC CALIBRATION PROCEDURES AND FREQUENCY

[*REQUIREMENT: In this section, the applicant shall reference all calibration procedures to be followed during the trial burn. The applicant also shall state the source of all standard analytical reference materials used in the calibrations, including chemical standards, gas calibration cylinders, and reference thermometers.*]

Calibration procedures for sampling and analytical instruments used in this project are provided in the method procedure documents discussed in this section. The stack sampling components requiring calibration consist of dry gas meters, rotameters, pitot tubes, vacuum gauges, manometers, barometers, and temperature-indicating devices (see examples of calibration forms in Appendix B). The laboratory analytical instruments will be calibrated according to the reference method requirements. The analytical calibration procedures, frequencies, acceptance criteria, corrective actions, and other internal analytical QC checks are summarized in Section 10.0.

8.1 PROCESS MONITORING EQUIPMENT

Process monitoring equipment, used to collect trial burn data, will be calibrated prior to the test, as required by the manufacturer and as specified in the TBP. Inspection and maintenance procedures for process instruments important to the trial burn will be conducted in accordance with each manufacturer's requirements. These instruments will include flow meters, weigh scales, thermocouples, pressure-sensing devices, and pH instrumentation. The pH electrodes will be calibrated daily during the trial burn using a two-point reference calibration spanning the expected test pH. All calibration data for each instrument will be documented and will include the calibration procedures implemented, if different from the procedures recommended by manufacturers, as well as the following information:

- Device being calibrated
- Identification number (serial number or tag number)

- Reference device
- Date of reference device's last calibration
- Identification of reference device (such as serial number or lot number)
- Date of the performance of calibration
- Name of primary technician performing calibration

8.2 STACK SAMPLING EQUIPMENT

The VOST, MM5, MMT, hexavalent chromium, formaldehyde, Method 0040, and M5 sampling train components will be calibrated as indicated by the EPA's "Quality Assurance Handbook of Air Pollution Measurement Systems" (EPA-600/4-77-0276). The activity matrices for calibrating the equipment and apparatus are shown in Table 8-1.

8.3 CONTINUOUS EMISSION MONITORING SYSTEMS

The following CEM calibration procedures are associated with the trial burn:

- Periodic calibration checks
- Test burn measurement system performance check

An initial PST of the CEM systems will be conducted prior to the trial burn. This PST will be conducted as described in 40 CFR 266, Appendix IX. The potential PST criteria are summarized in Table 8-2. In conducting the CEM system performance test, the entire system must be evaluated in its normal operational state. Before the trial burn is conducted, the trial burn manager will verify with the stack sampling coordinator that an acceptable PST has been achieved.

TABLE 8-1

ACTIVITY MATRIX FOR CALIBRATION OF EQUIPMENT

Equipment	Acceptance Limits	Frequency and Method of Measurements	Action if Requirements Are Not Met
Wet test meter	Capacity > 3.4 m^3/hr (120 ft^3/hr) accuracy within ± 1.0 percent	Calibration prior to test	Adjust until specifications are met, or return to manufacturer
Dry gas meter (for all control boxes)	$Y_i = Y \pm 0.02\ Y$	Calibration versus wet test meter: Initially and when post-check exceeds Y ± 0.05	Repair or replace, and then calibrate
Thermometers (stack gas meters and final impinger)	Impinger thermometer ± 1 °C (2 °F); Dry gas thermometer ± 3 °C (5.4 °F) over range; Stack temperature sensor ± 1.5 percent of absolute temperature	Calibration prior to test against a mercury-in-glass thermometer	Adjust, determine a constant correction factor, or reject
Probe heating system (Isokinetic trains)	Capable of maintaining 120 °C ± 14 °C (248 ° ± 25 °F) at a flow of 21 L/min (0.71 ft^3/min)	Calibration of component initially by APTD-0576(11); If constructed calibration by APTD-0581(10) or using published calibration curves	Repair or replace, and then reverify the calibration
Probe heating system (VOST)	Maintained at a temperature >131 °C	Periodic checks during sampling	Immediately increase the VOST system to the proper temperature
Barometer	± 2.5 mm (0.1 in.) mercury of mercury-in-glass barometer	Calibration initially versus mercury-in-glass barometer: checks before and after field test	Adjust to agree with a certified barometer
Probe nozzle	Average of three ID measurements of nozzle; Difference between high and low < 0.1 mm (0.004 in.)	Measurement by micrometer to nearest 0.025 mm (0.001 in.): checks before and after field test	Recalibrate, reshape, and sharpen when nozzle becomes nicked, dented, or corroded
Analytical balance (moisture)	± 1 mg of Class-S weights	Checks with Class-S weights upon receipt and daily	Adjust or repair
Type-S pitot tube or probe assembly or both	All dimension specifications met	Calibration prior to test and visually inspection after each field test	Use pitot tubes that meet face opening specifications, repair or replace, as required

TABLE 8-1 (Continued)

ACTIVITY MATRIX FOR CALIBRATION OF EQUIPMENT

Equipment	Acceptance Limits	Frequency and Method of Measurements	Action if Requirements Are Not Met
Stack gas temperature measurement system	Capable of measuring within 1.5 percent of minimum stack temperature	Calibration prior to test and after each field use	Adjust to agree with mercury bulb thermometer, construct calibration curve, correct readings
Differential pressure gauge (excludes inclined manometer)	Agree within ± 5 percent of inclined manometers	Calibration prior to and after field use	Adjust to agree with mercury bulb thermometer, construct calibration curve, correct readings

Notes:

ft^3/hr = Cubic feet per hour
ft^3/min = Cubic feet per minute
ID = Identification
in. = Inch
L/min = Liter per minute
m^3/hr = Cubic meters per hour
mg = Milligram
mm = Millimeter
VOST = Volatile organic sampling train
> = Greater than
< = Less than
± = Plus or minus

TABLE 8-2

SUMMARY OF CEM SYSTEM PERFORMANCE CHECK REQUIREMENTS

Criteria	Acceptable Limits					
	Carbon Monoxide[a]	**Oxygen[b]**	**Carbon Dioxide[c]**	**Nitrogen Oxides[d]**	**Sulfur Dioxide[d]**	**Total Hydrocarbon Content[b]**
CEM system measurement location	Stack sampling port	Stack sampling port	Stack sampling port	Stack sampling port	Stack sampling port	Stack sampling port
Calibration drift (precision)	3% of span	0.5% oxygen	3% of span	5% of span	5% of span	3% of span
Calibration error (accuracy)	5% of span	0.5% oxygen	2% of span	2% of span	2% of span	< 5% of span
Response time	2.0 min	2.0 min	0.5 min	0.5 min	2.0 min	0.5 min
Bias	--	5% of span	5% of span	5% of span	5% of span	--
Interference	--	2% of span	2% of span	2% of span	2% of span	--

Notes:

-- = Not applicable
CEM = Continuous emission monitoring
min = Minutes
a 40 CFR 266 Appendix IX, Section 2.1
b 40 CFR 266 Appendix IX, Section 2.2
c 40 CFR 60 Appendix B, Performance Specification 3
d 40 CFR 60 Appendix B, Performance Specification 2

During the trial burn, the CEM systems will be calibrated as required by the systems' manufacturer and demonstrated to be performing as described in Method 3A of 40 CFR 266. These requirements are as follows:

- Calibration of instruments (as required by manufacturer)
- Interference response check, as necessary
- Analyzer error and sampling system bias
- Equipment inspections

The CEM systems currently present on the incinerator will undergo a thorough system calibration check prior to the trial burn. The system performance check will include an equipment inspection; calibration; calibration error check; a sampling bias check, as applicable; calibration drift check; and an analyzer interference check, where applicable. Response time also will be recorded.

The criteria for the CEM measurement system calibration check are summarized in Table 8-2. If the CEM system fails any portion of the calibration check, corrective action will be taken, and the failed portions of the test will be repeated.

CEM calibrations for carbon monoxide and oxygen will be conducted using a three-point calibration procedure with certified standard gases with different known concentrations spanning the expected values in the gas stream. Calibration gas will be certified by the manufacturer to an accuracy of plus or minus 2 percent. Documentation of all calibrations and calibration checks made in association with this trial burn will be maintained for further review. These calibration records will include the following information:

- Calibration values on the data logger

- Calibration standards (e.g., cylinder gas identification and manufacturer's certified value, gas filter cell identification, and certified value)
- Documentation of values obtained during calibration checks
- Calibration logbook (including a record of the date and time of any adjustment or changes to the instrument's calibration)

8.4 ORSAT METHOD 3

During the trial burn, multi-point integrated bag samples will be collected and analyzed for carbon dioxide and oxygen using an Orsat analyzer (EPA Method 3, 40 CFR 60, Appendix A). Prior to the analysis of standard gas and stack gas samples, the Orsat gas analyzer will be leak-checked and inspected carefully. An ambient air sample will be analyzed for carbon dioxide, and the dry molecular weight will be calculated. Certified standard gas containing various concentrations of carbon dioxide in nitrogen also may be used to verify method performance.

9.0 ANALYTICAL OBJECTIVES AND PROCEDURES

[*REQUIREMENT: In this section, the applicant shall present in tabular form all of the samples to be collected during the trial burn along with the analytical procedure to be used, according to the trial burn protocol.*]

The analytical objective for this trial burn is to provide a database that most accurately reflects the composition of the samples being analyzed. This objective will be met by successful implementation of the analytical methodologies and procedures selected for the analysis of trial burn samples. The process of selecting the analytical methods and procedures for this project took into consideration the sample matrix, composition, volume, and analytes of interest.

9.1 ANALYTICAL LABORATORY

All analyses will be performed by a laboratory qualified in the appropriate categories of sample analysis. The following section summarizes the sample types and the methods of analysis to be used for this project. Laboratory qualifications and certifications will be submitted upon request.

9.2 ANALYTICAL PROCEDURES

Standard analytical reference methods and procedures will be followed during analysis of all samples collected and associated with this trial burn. The methods and procedures are discussed in detail in the following documents:

- "Sampling and Analysis Methods for Hazardous Waste Incineration." EPA-600/8-84-002. EPA, Office of Research and Development. Industrial Environmental Research Laboratory, Research Triange Park, NC, February 1984.
- *Annual Book of ASTM Standards,* D-1989-93. ASTM. Philadelphia, PA, 1996.

- *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method SW-8260, Third Edition, September 1986 (and its updates). EPA, Office of Solid Waste and Emergency Response (OSWER). Washington, D.C. 20460.

- *Methods for Chemical Analysis of Water and Waste*. EPA-600/4-79-020. EPA, Environmental Monitoring and Support Laboratory. Cincinnati, OH, 1979.

- "Test Methods." 40 CFR 60 Appendix A, July 1, 1991.

- "Guidance on Metals and Hydrogen Chloride Controls for Hazardous Waste Incinerators." Draft. EPA, Office of Solid Waste. Washington D.C. 20460, March 1989.

- *EPA Methods Manual for Compliance with the BIF Regulations Burning Hazardous Waste in Boilers and Industrial Furnaces.* EPA-530-SW-91-010. EPA, December 1990, and 40 CFR 266 Appendix IX, July 1, 1991.

- "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*. EPA-530-SW-91-010, EPA, December 1990, and 40 CFR 266 Appendix IX, Part 2.1, July 1, 1994.

The type of analysis, samples to be collected, sample matrices, procedure descriptions, and associated reference methods are summarized in Table 9-1 of this QAPP.

TABLE 9-1

SUMMARY OF ANALYTICAL METHODS AND PROCEDURES

Analysis	Sample Name	Sample Matrix	Procedure Description	Reference Method
Density (specific gravity)	High-Btu liquid waste feed	Organic materials and solvents	Gravimetric and volumetric	ASTM D-70[a]/D-891[b]
	Low-Btu liquid waste feed	Aqueous and some organics	Gravimetric and volumetric	ASTM D-70[a]/D-1429[c]
	Solid waste feed	Solid feed material	Gravimetric and volumetric	ASTM D-70[a]/D-854[d]
Heat content (Btu)	High-Btu liquid waste feed	Organic materials and solvents	Isoperibol calorimeter	ASTM D-2015[e], D-2382[f], D-240[g]
	Solid waste feed	Solid feed material	Isoperibol calorimeter	ASTM D-2015[e], D-2382[f], D-240[g]
	Low-Btu liquid waste feed	Aqueous and some organics	Isoperibol calorimeter	ASTM D-2015[e], D-2382[f], D-240[g]
Viscosity	High-Btu liquid waste feed	Organic materials and solvents	Kinematic viscometer	ASTM D-445[h]
	Solid waste feed	Solid feed material	Gravimetric and volumetric	ASTM D-70[a]/D-854[d]
	Low-Btu liquid waste feed	Aqueous and some organics	Kinematic viscometer	ASTM D-445[h]
Total chlorine	High-Btu liquid waste feed	Organic materials and solvents	Ion chromatographic determination of combustion residue	ASTM D-808[i], E-442[j], ASTM D4327-88[k]
	Solid waste feed	Solid feed material	IC	ASTM D-808[i], E-442[j], ASTM D4327-88[k]
	Low-Btu liquid waste feed	Aqueous and some organics	Ion chromatographic determination of combustion residue	ASTM D-808[i], E-442[j], ASTM D4327-88[k]
Elemental analysis (carbon, hydrogen, nitrogen, oxygen, sulfur)	High-Btu liquid waste feed	Organic materials and solvents	Ultimate analysis for the individual elements	ASTM D-3176[l]
	Solid waste feed	Solid feed material	Ultimate analysis for the individual elements	ASTM D-3176[l]
	Low-Btu liquid waste feed	Aqueous and some organics	Ultimate analysis for the individual elements	ASTM D-3176[l]
Percent ash	Ash spiking solution	Calcium salts in water	Muffle furnace heating	ASTM D-482[m]

TABLE 9-1 (Continued)

SUMMARY OF ANALYTICAL METHODS AND PROCEDURES

Analysis	Sample Name	Sample Matrix	Procedure Description	Reference Method
TDS and TSS and TS (residues)	Scrubber purge water	Aqueous dissolved and suspended solids	Gravimetric and filtration	EPA 600 - Method 160[n]
Moisture	M5 train	Impinger water and silica gel	Volumetric and gravimetric	EPA Method 4[o]
	MM5 train	Impinger water and silica gel	Volumetric and gravimetric	EPA Method 4[o]
	MMT	Impinger water and silica gel	Volumetric and gravimetric	EPA Method 4[o]
Volatile POHCs and PICs	VOST condensate	Aqueous condensate	Purge and trap, GC and MS	SW-8260[p]
	VOST tubes	Tenax™ and Anasorb™ 747 resins	Thermal desorption, purge and trap, GC and MS	SW-0031[q], SW-8260[p], SW-5041[r]
Volatile POHCs	Incinerator ash	Ash material	Purge and trap, GC/MS	SW-8260[p]
	Solid waste feed	Solid feed material	Purge and trap, GC/MS	SW-8260[p]
	Low-Btu liquid waste feed	Aqueous and some organics	Purge and trap, GC/MS	SW-8260[p]
	High-Btu liquid waste feed	Aqueous and some organics	Purge and trap, GC/MS	SW-8260[p]
	Makeup water	Aqueous	Purge and trap, GC/MS	SW-8260[p]
	Scrubber purge water	Aqueous	Purge and trap, GC/MS	SW-8260[p]
	Caustic feed	Caustic slurry	Purge and trap, GC/MS	SW-8260[p]
Semivolatile POHCs	Incinerator ash	Ash material	Sonication extraction, GC/MS	SW-3550[s], SW-8270[t]
	Solid waste feed	Solid feed material	Sonication extraction, GC/MS	SW-3550[s], SW-8270[t]
	Low-Btu liquid waste feed	Aqueous and some organics	Liquid-liquid extraction, GC/MS	SW-3510[u], SW-8270[t]
	High-Btu liquid waste feed	Aqueous and some organics	Waste dilution, GC/MS	SW-3580[v], SW-8270[t]
	Makeup water	Aqueous	Liquid-liquid extraction, GC/MS	SW-3510[u], SW-8270[t]
	Scrubber purge water	Aqueous	Liquid-liquid extraction, GC/MS	SW-3510[u], SW-8270[t]
	Caustic feed	Caustic slurry	Liquid-liquid extraction, GC/MS	SW-3510[u], SW-8270[t]

TABLE 9-1 (Continued)

SUMMARY OF ANALYTICAL METHODS AND PROCEDURES

Analysis	Sample Name	Sample Matrix	Procedure Description	Reference Method
Semivolatile POHCs and PICs	MM5 train (particulate filter and front-half filter holder and solvent probe rinse)	Particulate, filter, and solvent probe rinses	Soxhlet extraction, GC/MS	SW-3542[w], SW-3540[x], SW-8270[t]
Semivolatile POHCs and PICs (Continued)	MM5 train (XAD-2 resin and back-half filter holder and coil condenser solvent rinses)	XAD-2 resin and solvent rinses	Soxhlet extraction, GC/MS	SW-3542[w], SW-3540[x], SW-8270[t]
	MM5 train (impinger composite)	Impinger condensate composite (aqueous)	Liquid-liquid extraction, GC/MS	SW-3542[w], SW-3510[u], SW-8270[t]
Dioxins and furans	MM5 train (particulate filter and front-half filter holder and solvent probe rinse)	XAD-2 resin, filter media, and probe rinses	Soxhlet extraction, high-resolution GC/MS	SW-8290[y], SW-0023A[z]
	MM5 train (XAD-2 resin and back-half filter holder and coil condenser solvent rinses)	XAD-2 resin and solvent rinses	Soxhlet extraction, high-resolution GC/MS	SW-8290[y], SW-0023A[z]
Polynuclear aromatic hydrocarbons (PAH)	MM5 train (particulate filter and front-half filter holder and solvent probe rinse)	Particulate, filter, and solvent probe rinses	Soxhlet extraction, GC/MS	CARB 429[aa], SW-8290[y]
	MM5 train (XAD-2 resin and back-half filter holder and coil condenser solvent rinses)	XAD-2 resin and solvent rinses	Soxhlet extraction, GC/MS	CARB 429[aa], SW-8290[y]
	MM5 train (impinger composite)	Impinger condensate composite (aqueous)	Liquid-liquid extraction, GC/MS	CARB 429[aa], SW-8290[y]
Volatile unspeciated mass	Tedlar™ bags	Whole air stack gas	GC/FID	Modified Method 0040[bb], SW-8015[cc]
	Condensate	Organic condensate	GC/FID	SW-5030[dd], SW-8015[cc]

TABLE 9-1 (Continued)

SUMMARY OF ANALYTICAL METHODS AND PROCEDURES

Analysis	Sample Name	Sample Matrix	Procedure Description	Reference Method
Semivolatile and nonvolatile Unspeciated Mass	MM5 train	XAD-2 resin, filter, solvent probe rinses, impinger condensate	Purge and trap, GC/FID	SW-3540[x], SW-3510[u], SW-8015[cc]
Hydrogen chloride and chlorine	M5 train	Impinger solutions	IC	SW-9056[ee] and SW-9057[ff]
Metals and mercury	MMT	Impinger solutions	Acid digestion, ICP and CVAA	SW-0060[gg], SW-6010[hh]/6020[ii]/SW-7470[jj]
		Particulate filters and residue	Acid digestion, ICP and CVAA	SW-0060[gg], SW-6010[hh]/6020[ii]/SW-7470[jj]
	Liquid waste feed	Aqueous and xylenes	Acid digestion, ICP, ICP and MS, CVAA	SW-3050[kk]/3051[ll], SW-0060[gg], SW-6010[hh]/6020[ii]/SW-7470[jj]
	Solid waste feed	Solid feed material	Acid digestion, ICP, ICP and MS, CVAA	SW-3050[kk]/3051[ll], SW-0060[gg], SW-6010[hh]/6020[ii]/SW-7470[jj]
	Process waste Caustic Scrubber purge water Incinerator ash	Aqueous and ash residue	Acid digestion, ICP and CVAA	SW-3050[kk]/3051[ll], SW-6010[gg]SW-7470[jj]
Formaldehyde and other various aldehydes and ketones	Formaldehyde train	DNPH impinger solution and train rinses	Extraction, HPLC	SW-0011[mm] and SW-8315[nn]
Hexavalent chromium	Hexavalent chromium train	Potassium hydroxide impinger solution	IC and PCR spectrophotometric detector	Method218.6[oo] and SW-0061[pp]
Particulate	M5 train	Particulate filter	Gravimetric, replicate weighings	Method 5 [qq]

Notes:

TABLE 9-1 (Continued)

SUMMARY OF ANALYTICAL METHODS AND PROCEDURES

ASTM	American Society of Testing and Materials
Btu	British thermal unit
CARB	California Air Resources Board
CVAA	Cold vapor atomic absorption
DNPH	Dinitrophenylhydrazine
EPA	U.S. Environmental Protection Agency

TABLE 9-1 (Continued)

SUMMARY OF ANALYTICAL METHODS AND PROCEDURES

Notes (Continued):

GC	Gas chromatography
HPLC	High-performance liquid chromatography
IC	Ion chromatography
ICP	Inductively coupled argon plasma spectroscopy
M5	Method 5
MM5	Modified Method 5
MMT	Multi-metals train
MS	Mass spectroscopy
OSWER	Office of Solid Waste and Emergency Response
PAH	Polynuclear aromatic hydrocarbon
PCR	Post-column reactor
PIC	Product of incomplete combustion
POHC	Principal organic hazardous constituent
TDS	Total dissolved solids
TS	Total solids
TSS	Totals suspended solids
VOST	Volatile organic sampling train

a "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. ASTM, ASTM: Philadelphia, PA, 1996.

b "Test Method for Specific Gravity of Liquid Industrial Chemicals." ASTM D-891-89. Taken from *Annual Book of ASTM Standards.* D-1989-93. ASTM, ASTM: Philadelphia, PA, 1996.

TABLE 9-1 (Continued)

SUMMARY OF ANALYTICAL METHODS AND PROCEDURES

c "Test Method for Specific Gravity of Water and Brine." ASTM D-1429-86. Taken from *Annual Book of ASTM Standards.* D-1989-93. ASTM, ASTM: Philadelphia, PA, 1996.

TABLE 9-1 (Continued)

SUMMARY OF ANALYTICAL METHODS AND PROCEDURES

Notes (Continued):

d "Standard Test Method for Specific Gravity of Soils." ASTM D-854. Taken from *Annual Book of ASTM Standards.* D-1989-93. ASTM, ASTM: Philadelphia, PA, 1996.

e "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. ASTM, ASTM: Philadelphia, PA, 1996.

f "Standard Test Method for Heat of Combustion of Hydrocarbon Fuels by Bomb Calorimeter (High Precision Method)." ASTM D-2382-88. Taken from *Annual Book of ASTM Standards*. D-1989-93. ASTM, ASTM: Philadelphia, PA, 1996.

g "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. ASTM, ASTM: Philadelphia, PA, 1996.

h "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*. ASTM, ASTM: Philadelphia, PA, 1990.

i "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. ASTM, ASTM: Philadelphia, PA, 1996.

j "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. ASTM, ASTM: Philadelphia, PA, 1996.

k "Standard Test Method for Anions in Water by Ion Chromatography." ASTM D-4327-88. Taken from *Annual Book of ASTM Standards.* D-1989-93. ASTM, ASTM: Philadelphia, PA, 1996.

TABLE 9-1 (Continued)

SUMMARY OF ANALYTICAL METHODS AND PROCEDURES

l "Practices of Elemental Analysis of Coal and Coke." ASTM D-3176. Taken from *Annual Book of ASTM Standards.* D-1989-93. ASTM, ASTM: Philadelphia, PA, 1996.

TABLE 9-1 (Continued)

SUMMARY OF ANALYTICAL METHODS AND PROCEDURES

Notes (Continued):

m "Test Method for Ash from Petroleum Products." ASTM D-482-87. Taken from *Annual Book of ASTM Standards.* D-1989-93. ASTM, ASTM: Philadelphia, PA, 1996.

n "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. EPA, Environmental Monitoring and Support Laboratory, Cincinnati, OH, 1979.

o "Determination of Moisture Content in Stack Gases." 40 CFR 60 Appendix A, Method 4, Revised July 1, 1996.

p "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.

q "Method 0031 - 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, OSWER, Washington, D.C. 20460.

r "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).EPA, OSWER, Washington, D.C. 20460.

s "Method 3550 - Ultrasonic Extraction." Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method SW-3550, 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.

TABLE 9-1 (Continued)

SUMMARY OF ANALYTICAL METHODS AND PROCEDURES

Notes (Continued):

t "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.

u "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). EPA, OSWER, Washington, D.C. 20460.

v "Method 3580 - Waste Dilution." Taken from *SW-846 Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method SW-3580, 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.

w "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 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.

x "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.

y "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.

TABLE 9-1 (Continued)

SUMMARY OF ANALYTICAL METHODS AND PROCEDURES

Notes (Continued):

z "Method 0023A - Sampling Method for Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofuran Emissions from Stationary Sources." 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.

aa "Method 429 - Determination of Polycyclic Aromatic Hydrocarbon Emissions from Stationary Sources." CARB 429. State of California, Air Resources Board. September 12, 1989.

bb "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, OSWER, Washington, D.C. 20460.

cc "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.

dd "Purge and Trap for Aqueous Samples." Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846, SW-5030, 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.

ee "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.

TABLE 9-1 (Continued)

SUMMARY OF ANALYTICAL METHODS AND PROCEDURES

Notes (Continued):

ff "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.

gg "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). EPA, OSWER, Washington, D.C. 20460.

hh "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.

ii "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.

jj "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.

kk "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). EPA, OSWER, Washington, D.C. 20460.

TABLE 9-1 (Continued)

SUMMARY OF ANALYTICAL METHODS AND PROCEDURES

Notes (Continued):

ll "Method 3051 - Microwave Assisted Acid Digestion of Sediments, Sludges, Soils, and Oils." Taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846 Method SW-3051, 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.

mm "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). EPA, OSWER, Washington, D.C. 20460.

nn "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.

oo "Method 218.6 - Determination of Dissolved Hexavalent chromium in Drinking Water, Ground Water, and Industrial Wastewater Effluent by Ion Chromatography." Taken from "600 Series Methods for Chemical Analysis of Water and Waste." EPA. 1990.

pp "Method 0061 - 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). EPA, OSWER, Washington, D.C. 20460.

qq "Method 5 - Determination of Particulate Emissions from Stationary Sources." 40 CFR 60 Appendix A, Method 5, July 1990.

10.0 SPECIFIC INTERNAL QUALITY CONTROL CHECKS

[*REQUIREMENT: In this section the applicant shall identify specific internal QC procedures for each analytical method to be used during the analysis of trial burn samples.*]

This section describes QC procedures that will be followed by the laboratories during the analysis of the samples from the trial burn. The laboratories will be required to monitor the precision and accuracy of their sample analyses. The laboratories will use the following high-purity, commercially available materials for their QC procedures: SRMs, calibration standards, internal standards, and surrogate compounds. Using these materials, data precision and accuracy will be assessed by evaluating the results from an analysis of method blanks, laboratory blanks, and reagent blanks; duplicate samples; calibration check and internal (where appropriate) standards; matrix or surrogate spiked samples; and surrogate compound spike samples. Sections 10.1 through 10.5 describe the specific internal QC sample types that will be analyzed and identify the sampling and analytical methods to which they will be applied. Tables 10-1A, 10-1B, and 10-1C summarize the laboratory QC sample requirements. Table 10-2 lists the analytical QC checks, frequencies, acceptance criteria, and corrective actions for each standard ASTM and SW-846 analytical method or parameter. These QC checks are described in greater detail in the appropriate analytical reference method.

10.1 METHOD BLANKS

Method blanks will be analyzed to define the level of fugitive contamination present. Method blanks for this project will consist of those required by the analytical methods (method blanks prepared in the laboratory) to demonstrate the absence of significant background fugitive contaminants in reagents, materials, and glassware used during sample preparation and laboratory handling.

TABLE 10-1A

SUMMARY OF LABORATORY AND PROJECT-SPECIFIC QUALITY CONTROL SAMPLE ANALYSIS REQUIREMENTS HIGH-TEMPERATURE METALS EMISSIONS TEST—3 RUNS

Analytical Parameter (Analysis)	Sample Name or Type	Total No. of Field Samples	Analytical Procedure Description (Method)	Laboratory QC Measurement Type	Frequency of Applied QC Measurement Type	Total No. of Laboratory QC Measurements	Field QC Measurement Type	Total No. of Field QC Samples	Total No. of Laboratory Analyses[a]
Density[b]	High-Btu liquid waste feed	3	Gravimetric/ volumetric (ASTM D-70/D-891)	Duplicate	One per test condition	1	None required	None required	4
	Solid waste feed	3	Gravimetric/ volumetric (ASTM D-70/D-854)	Duplicate	One per test condition	1	None required	None required	4
	Low-Btu liquid waste feed	3	Gravimetric/ volumetric (ASTM D-70/D-1429)	Duplicate	One per test condition	1	None required	None required	4
Heat content (Btu)[b]	High-Btu liquid waste feed	3	Isoperibol calorimeter (ASTM D-2015, D-2382, D-240)	Duplicate	One per test condition	1	None required	None required	4
	Solid waste feed	3	Isoperibol calorimeter (ASTM D-2015, D-2382, D-240)	Duplicate	One per test condition	1	None required	None required	4

TABLE 10-1A (Continued)

SUMMARY OF LABORATORY AND PROJECT-SPECIFIC QUALITY CONTROL SAMPLE ANALYSIS REQUIREMENTS HIGH-TEMPERATURE METALS EMISSIONS TEST—3 RUNS

Analytical Parameter (Analysis)	Sample Name or Type	Total No. of Field Samples	Analytical Procedure Description (Method)	Laboratory QC Measurement Type	Frequency of Applied QC Measurement Type	Total No. of Laboratory QC Measurements	Field QC Measurement Type	Total No. of Field QC Samples	Total No. of Laboratory Analyses[a]
Heat content (Btu)[b] (Continued)	Low-Btu liquid waste feed	3	Isoperibol calorimeter (ASTM D-2015, D-2382, D-240)	Duplicate	One per test condition	1	None required	None required	4
Viscosity	High-Btu liquid waste feed	3	Kinematic viscometer (ASTM D-445)	Duplicate	One per test condition	1	None required	None required	4
	Low-Btu liquid waste feed	3	Kinematic viscometer (ASTM D-445)	Duplicate	One per test condition	1	None required	None required	4
Total chlorine[b]	High-Btu liquid waste feed	3	Bomb combustion, ion chromatography (ASTM D-404, E-441, D-4317-44)	Duplicate	One per test condition	1	None required	None required	4
	Solid waste feed	3	Bomb combustion, ion chromatography (ASTM D-404, E-441, D-4317-44)	Duplicate	One per test condition	1	None required	None required	4

TABLE 10-1A (Continued)

SUMMARY OF LABORATORY AND PROJECT-SPECIFIC QUALITY CONTROL SAMPLE ANALYSIS REQUIREMENTS HIGH-TEMPERATURE METALS EMISSIONS TEST—3 RUNS

Analytical Parameter (Analysis)	Sample Name or Type	Total No. of Field Samples	Analytical Procedure Description (Method)	Laboratory QC Measurement Type	Frequency of Applied QC Measurement Type	Total No. of Laboratory QC Measurements	Field QC Measurement Type	Total No. of Field QC Samples	Total No. of Laboratory Analyses[a]
Total chlorine[b] (Continued)	Low-Btu liquid waste feed	3	Bomb combustion, ion chromatography (ASTM D-404, E-441, D-4317-44)	Duplicate	One per test condition	1	None required	None required	4
Elemental analysis[c]	High-Btu liquid waste feed	3	Ultimate analysis (ASTM D-3173)	Duplicate	One per test condition	1	None required	None required	4
	Solid waste feed	3	Ultimate analysis (ASTM D-3173)	Duplicate	One per test condition	1	None required	None required	4
	Low-Btu liquid waste feed	3	Ultimate analysis (ASTM D-3173)	Duplicate	One per test condition	1	None required	None required	4
Percent ash content	Low-Btu liquid waste feed	3	Residue after combustion (ASTM D-441)	Duplicate	One per test condition	1	None required	None required	4
	Solid waste feed	3	Residue after combustion (ASTM D-441)	Duplicate	One per test condition	1	None required	None required	4

TABLE 10-1A (Continued)

SUMMARY OF LABORATORY AND PROJECT-SPECIFIC QUALITY CONTROL SAMPLE ANALYSIS REQUIREMENTS HIGH-TEMPERATURE METALS EMISSIONS TEST—3 RUNS

Analytical Parameter (Analysis)	Sample Name or Type	Total No. of Field Samples	Analytical Procedure Description (Method)	Laboratory QC Measurement Type	Frequency of Applied QC Measurement Type	Total No. of Laboratory QC Measurements	Field QC Measurement Type	Total No. of Field QC Samples	Total No. of Laboratory Analyses[a]
Percent ash content (Continued)	High-Btu liquid waste feed	3	Residue after combustion (ASTM D-441)	Duplicate	One per test condition	1	None required	None required	4
TDS/TSS/ TS (residues)	Scrubber purge water	3	Gravimetric (EPA 600-Method 160	Duplicate	One per test condition	1	None required	None required	4
Particulate	M5 train (particulate filter and acetone probe rinse)	3 Filters, 3 Acetone Probe Rinses	Gravimetric (EPA Method 5)	Replicate weighing to constant weigh	Every particulate sample	3 filters, 3 acetone probe rinses	Reagent blank (1 filter, 1 acetone probe rinse)	2	14
Hydrogen chloride	M5 train (0.1N sulfuric acid impinger composite)	3	Ion chromatography (SW-9056/SW-9057)	MS/MSD	One set per test condition	2	Reagent blank (0.1N sulfuric acid impinger solution)	1	6
Chlorine	M5 train (0.1N sodium hydroxide impinger composite)	3	Ion chromatography (SW-9056/SW-9057)	MS/MSD	One set per test condition	2	Reagent blank (0.1N sodium hydroxide impinger solution)	1	6

TABLE 10-1A (Continued)

SUMMARY OF LABORATORY AND PROJECT-SPECIFIC QUALITY CONTROL SAMPLE ANALYSIS REQUIREMENTS HIGH-TEMPERATURE METALS EMISSIONS TEST—3 RUNS

Analytical Parameter (Analysis)	Sample Name or Type	Total No. of Field Samples	Analytical Procedure Description (Method)	Laboratory QC Measurement Type	Frequency of Applied QC Measurement Type	Total No. of Laboratory QC Measurements	Field QC Measurement Type	Total No. of Field QC Samples	Total No. of Laboratory Analyses[a]
Metals	Low-Btu liquid waste feed	3	Digestion, ICP (SW-3050/ 3051, SW-6010/6020)	MS/MSD	One set of MS/MSDs per test condition	2	None required	None required	5
	Solid waste feed	3	Digestion, ICP (SW-3050/ 3051, SW-6010/6020)	MS/MSD	One set of MS/MSDs per test condition	2	None required	None required	5
	High-Btu liquid waste feed	3	Digestion, ICP (SW-3050/ 3051, SW-6010/6020)	MS/MSD	One set of MS/MSDs per test condition	2	None required	None required	5
	Incinerator ash	3	Digestion, ICP (SW-3050/ 3051, SW-6010/6020)	MS/MSD	One set of MS/MSDs per test condition	2	None required	None required	5
	Scrubber purge water	3	Digestion, ICP (SW-3050/ 3051, SW-6010/6020)	MS/MSD	One set of MS/MSDs per test condition	2	None required	None required	5

TABLE 10-1A (Continued)

SUMMARY OF LABORATORY AND PROJECT-SPECIFIC QUALITY CONTROL SAMPLE ANALYSIS REQUIREMENTS
HIGH-TEMPERATURE METALS EMISSIONS TEST—3 RUNS

Analytical Parameter (Analysis)	Sample Name or Type	Total No. of Field Samples	Analytical Procedure Description (Method)	Laboratory QC Measurement Type	Frequency of Applied QC Measurement Type	Total No. of Laboratory QC Measurements	Field QC Measurement Type	Total No. of Field QC Samples	Total No. of Laboratory Analyses[a]
Metals (Continued)	MMT front-half composite (filter, and 0.1N nitric acid probe rinse)	3	Digestion, ICP (SW-0060, SW-6010/6020)	PDS	Every front-half composite	3	Reagent blank (filter and 0.1N nitric acid probe rinse solution)	2	11
				Matrix spike at two times the reporting limit	Two MMT blank train front-half composites	2	Blank train	1	
	MMT back-half composite (5% nitric acid and 10% hydrogen peroxide)	3	Digestion, ICP (SW-0060, SW-6010/6020)	MS/MSD	One set per test condition	2	Reagent blank (5% nitric acid and 10% hydrogen peroxide impinger solution)	1	9
				Matrix spike at two times the reporting limit	Two MMT blank train back-half composites	2	Blank train	1	

TABLE 10-1A (Continued)

SUMMARY OF LABORATORY AND PROJECT-SPECIFIC QUALITY CONTROL SAMPLE ANALYSIS REQUIREMENTS
HIGH-TEMPERATURE METALS EMISSIONS TEST—3 RUNS

Analytical Parameter (Analysis)	Sample Name or Type	Total No. of Field Samples	Analytical Procedure Description (Method)	Laboratory QC Measurement Type	Frequency of Applied QC Measurement Type	Total No. of Laboratory QC Measurements	Field QC Measurement Type	Total No. of Field QC Samples	Total No. of Laboratory Analyses[a]
Metals (Continued)	EPA audit samples (metals on filters)	2[d]	Digestion, CVAA (SW-0060, SW-7470)	None required	None required	None Required	None required	None required	2[e]
Mercury	High-Btu liquid waste feed	3	Digestion, CVAA (SW-7470)	MS/MSD	One set of MS/MSDs per test condition	2	None required	None required	5
	Low-Btu liquid waste feed	3	Digestion, CVAA (SW-7471)	MS/MSD	One set of MS/MSDs per test condition	2	None required	None required	5
	Solid waste feed	3	Digestion, CVAA (SW-7470 or SW-7471)	MS/MSD	One set of MS/MSDs per test condition	2	None required	None required	5
	Incinerator ash	3	Digestion, CVAA (SW-7470 or SW-7471)	MS/MSD	One set of MS/MSDs per test condition	2	None required	None required	5
	Scrubber purge water	3	Digestion, CVAA (SW-7470 or SW-7471)	MS/MSD	One set of MS/MSDs per test condition	2	None required	None required	5

TABLE 10-1A (Continued)

SUMMARY OF LABORATORY AND PROJECT-SPECIFIC QUALITY CONTROL SAMPLE ANALYSIS REQUIREMENTS HIGH-TEMPERATURE METALS EMISSIONS TEST—3 RUNS

Analytical Parameter (Analysis)	Sample Name or Type	Total No. of Field Samples	Analytical Procedure Description (Method)	Laboratory QC Measurement Type	Frequency of Applied QC Measurement Type	Total No. of Laboratory QC Measurements	Field QC Measurement Type	Total No. of Field QC Samples	Total No. of Laboratory Analyses[a]
Mercury (Continued)	MMT front-half composite (filter and 0.1N nitric acid probe rinse)	3	Digestion, CVAA (SW-0060, SW-7470)	PDS[d]	Every front-half sample	3	Reagent blank (filter and 0.1N nitric acid probe rinse solution)	2	11
				Matrix spike at two times the reporting limit	Two MMT front blank train front-half composites	2	Blank train	1	
	MMT back-half composite (5% nitric acid 10% hydrogen peroxide)	3	Digestion, CVAA (SW-0060, SW-7470)	MS/MSD	One set per test condition	2	Reagent blank (5% nitric acid and 10% hydrogen peroxide impinger solution)	1	9
				Matrix spike at two times the reporting limit	Two MMT blank train back-half composites	2	Blank train	1	

TABLE 10-1A (Continued)

SUMMARY OF LABORATORY AND PROJECT-SPECIFIC QUALITY CONTROL SAMPLE ANALYSIS REQUIREMENTS
HIGH-TEMPERATURE METALS EMISSIONS TEST—3 RUNS

Analytical Parameter (Analysis)	Sample Name or Type	Total No. of Field Samples	Analytical Procedure Description (Method)	Laboratory QC Measurement Type	Frequency of Applied QC Measurement Type	Total No. of Laboratory QC Measurements	Field QC Measurement Type	Total No. of Field QC Samples	Total No. of Laboratory Analyses[a]
Mercury (Continued)	Impinger 4 (empty)	3	Digestion, CVAA (SW-0060, SW-7470)	MS/MSD	One set per test conditions	2	0.1N nitric acid impinger solution	1	9
				Matrix spike at two times the reporting limit	Two MMT blank train back-half composites	2	Blank train	1	
	4% potassium per-manganate and 10% sulfuric acid impinger composite	3	Digestion, CVAA (SW-0060, SW-7470)	MS/MSD	One set per test conditions	2	Reagent blank (4% potassium permanganate and 10% sulfuric acid impinger solution)	1	9
				Matrix spike at two times the reporting limit	Two MMT blank train back-half composites	2	Blank train	1	

TABLE 10-1A (Continued)

SUMMARY OF LABORATORY AND PROJECT-SPECIFIC QUALITY CONTROL SAMPLE ANALYSIS REQUIREMENTS HIGH-TEMPERATURE METALS EMISSIONS TEST—3 RUNS

Analytical Parameter (Analysis)	Sample Name or Type	Total No. of Field Samples	Analytical Procedure Description (Method)	Laboratory QC Measurement Type	Frequency of Applied QC Measurement Type	Total No. of Laboratory QC Measurements	Field QC Measurement Type	Total No. of Field QC Samples	Total No. of Laboratory Analyses[a]
Mercury (Continued)	8N hydrogen chloride impinger rinse samples	3	Digestion, CVAA (SW-0060, SW-7470)	MS/MSD	One set per test conditions	2	Reagent blank (8N hydrogen chloride impinger rinse solution)	1	9
				Matrix spike at two times the reporting limit	Two MMT 4% potassium permanganate and 10% sulfuric acid blank train composites	2	Blank train	1	
Hexavalent chromium	Hexavalent chromium recirculatory train impinger composite (1.0N potassium hydroxide)	3	IC/PCR spectrophoto-metric detector SW-7199, SW-0061)	MS/MSD	One set per test condition	2	Reagent blank (1.0N potassium hydroxide impinger solution)	1	12
				Field spike	Two per run	6			

TABLE 10-1A (Continued)

SUMMARY OF LABORATORY AND PROJECT-SPECIFIC QUALITY CONTROL SAMPLE ANALYSIS REQUIREMENTS HIGH-TEMPERATURE METALS EMISSIONS TEST—3 RUNS

Notes:

ASTM	American Society for Testing and Materials
Btu	British thermal unit
CVAA	Cold vapor atomic absorption
EPA	U.S. Environmental Protection Agency
ICP	Inductively coupled argon plasma spectroscopy
IC/PCR	Ion chromatography/post-column reactor
M5	Method 5
MS/MSD	Matrix spike/matrix spike duplicate
MMT	Multi-metals train
N	Normality
PDS	Post-digestion spike
QC	Quality control
SRM	Standard reference materials
TDS	Total dissolved solids
TS	Total solids
TSS	Total suspended solids

See Table 10-2 for additional method-specific required QC checks and frequencies.

a Total laboratory analyses include all field samples collected and all laboratory and field QC samples that are analyzed. This number may not be calculated easily by adding the totals from the columns above; however, the total number presented represents the required total analyses for the sample and quality assurance analytical program.

b An SRM will be submitted to the laboratory and analyzed for this parameter.

c Elemental analysis will include the following: carbon, hydrogen, oxygen, nitrogen, and sulfur.

d EPA audit filter samples will be analyzed by the analytical laboratory if supplied by the officiating regulatory agency.

e The total number of analyses is dependent on the total number of metals carboy mixtures required for spiking the metals for this test. Typically, one sample from each carboy will be collected per run.

TABLE 10-1B

SUMMARY OF LABORATORY AND PROJECT-SPECIFIC QUALITY CONTROL SAMPLE ANALYSIS REQUIREMENTS LOW-TEMPERATURE DRE DEMONSTRATION TEST—3 RUNS

Analytical Parameter (Analysis)	Sample Name or Type	Total No. of Field Samples	Analytical Procedure Description (Method)	Laboratory QC Measurement Type	Frequency of Applied QC Measurement Type	Total No. of Laboratory QC Measurements	Field QC Measurement Type	Total No. of Field QC Samples	Total No. of Laboratory Analyses[a]
Density[b]	High-Btu liquid waste feed	3	Gravimetric/ volumetric (ASTM D-70/D-891)	Duplicate	One per test condition	1	None required	None required	4
	Solid waste feed	3	Gravimetric/ volumetric (ASTM D-70/D-454)	Duplicate	One per test condition	1	None required	None required	4
	Low-Btu liquid waste feed	3	Gravimetric/ volumetric (ASTM D-70/D-1419)	Duplicate	One per test condition	1	None required	None required	4
Heat content (Btu)[b]	High-Btu liquid waste feed	3	Isoperibol calorimeter (ASTM D-1015, D-1341, D-140)	Duplicate	One per test condition	1	None required	None required	4
	Solid waste feed	3	Isoperibol calorimeter (ASTM D-1015, D-1341, D-140)	Duplicate	One per test condition	1	None required	None required	4

TABLE 10-1B (Continued)

SUMMARY OF LABORATORY AND PROJECT-SPECIFIC QUALITY CONTROL SAMPLE ANALYSIS REQUIREMENTS LOW-TEMPERATURE DRE DEMONSTRATION TEST—3 RUNS

Analytical Parameter (Analysis)	Sample Name or Type	Total No. of Field Samples	Analytical Procedure Description (Method)	Laboratory QC Measurement Type	Frequency of Applied QC Measurement Type	Total No. of Laboratory QC Measurements	Field QC Measurement Type	Total No. of Field QC Samples	Total No. of Laboratory Analyses[a]
Heat content (Btu)[b] (Continued)	Low-Btu liquid waste feed	3	Isoperibol calorimeter (ASTM D-1015, D-1341, D-140)	Duplicate	One per test condition	1	None required	None required	4
Viscosity	High-Btu liquid waste feed	3	Kinematic viscometer (ASTM D-445)	Duplicate	One per test condition	1	None required	None required	4
	Low-Btu liquid waste feed	3	Kinematic viscometer (ASTM D-445)	Duplicate	One per test condition	1	None required	None required	4
Total chlorine[b]	High-Btu liquid waste feed	3	Bomb combustion, ion chromatography (ASTM D-404, E-441, D-4317-44)	Duplicate	One per test condition	1	None required	None required	4
	Solid waste feed	3	Bomb combustion, ion chromatography (ASTM D-404, E-441, D-4317-44)	Duplicate	One per test condition	1	None required	None required	4

TABLE 10-1B (Continued)

SUMMARY OF LABORATORY AND PROJECT-SPECIFIC QUALITY CONTROL SAMPLE ANALYSIS REQUIREMENTS LOW-TEMPERATURE DRE DEMONSTRATION TEST—3 RUNS

Analytical Parameter (Analysis)	Sample Name or Type	Total No. of Field Samples	Analytical Procedure Description (Method)	Laboratory QC Measurement Type	Frequency of Applied QC Measurement Type	Total No. of Laboratory QC Measurements	Field QC Measurement Type	Total No. of Field QC Samples	Total No. of Laboratory Analyses[a]
Total chlorine[b] (Continued)	Low-Btu liquid waste feed	3	Bomb combustion, ion chromatography (ASTM D-404, E-441, D-4317-44)	Duplicate	One per test condition	1	None required	None required	4
Elemental analysis[c]	High-Btu liquid waste feed	3	Ultimate analysis (ASTM D-3173)	Duplicate	One per test condition	1	None required	None required	4
	Solid waste feed	3	Ultimate analysis (ASTM D-3173)	Duplicate	One per test condition	1	None required	None required	4
	Low-Btu liquid waste feed	3	Ultimate analysis (ASTM D-3173)	Duplicate	One per test condition	1	None required	None required	4
Percent ash content	Low-Btu liquid waste feed	3	Residue after combustion (ASTM D-441)	Duplicate	One per test condition	1	None required	None required	4
	Solid waste feed	3	Residue after combustion (ASTM D-441)	Duplicate	One per test condition	1	None required	None required	4

TABLE 10-1B (Continued)

SUMMARY OF LABORATORY AND PROJECT-SPECIFIC QUALITY CONTROL SAMPLE ANALYSIS REQUIREMENTS LOW-TEMPERATURE DRE DEMONSTRATION TEST—3 RUNS

Analytical Parameter (Analysis)	Sample Name or Type	Total No. of Field Samples	Analytical Procedure Description (Method)	Laboratory QC Measurement Type	Frequency of Applied QC Measurement Type	Total No. of Laboratory QC Measurements	Field QC Measurement Type	Total No. of Field QC Samples	Total No. of Laboratory Analyses[a]
Percent ash content (Continued)	High-Btu liquid waste feed	3	Residue after combustion (ASTM D-441)	Duplicate	One per test condition	1	None required	None required	4
TDS/TSS/ TS (residues)	Scrubber purge water	3	Gravimetric (EPA 600-Method 160	Duplicate	One per test condition	1	None required	None required	4
Volatile POHCs	Low-Btu liquid waste feed	3	Purge and trap, GC/MS (SW-8260)	Surrogate spike[d]	Every sample	4	None required	None required	4
				Duplicate	One per test condition	1			
	Solid waste feed	3	Purge and trap, GC/MS (SW-8260)	Surrogate spike[d]	Every sample	4	None required	None required	4
				Duplicate	One per test condition	1			
	High-Btu liquid waste feed	3	Purge and trap, GC/MS (SW-8260)	Surrogate spike[d]	Every sample	4	None required	None required	4
				Duplicate	One per test condition	1			

TABLE 10-1B (Continued)

SUMMARY OF LABORATORY AND PROJECT-SPECIFIC QUALITY CONTROL SAMPLE ANALYSIS REQUIREMENTS LOW-TEMPERATURE DRE DEMONSTRATION TEST—3 RUNS

Analytical Parameter (Analysis)	Sample Name or Type	Total No. of Field Samples	Analytical Procedure Description (Method)	Laboratory QC Measurement Type	Frequency of Applied QC Measurement Type	Total No. of Laboratory QC Measurements	Field QC Measurement Type	Total No. of Field QC Samples	Total No. of Laboratory Analyses[a]
Volatile POHCs (Continued)	Makeup water	3	Purge and trap, GC/MS (SW-8260)	Surrogate spike[d]	Every sample	5	None required	None required	5
				MS/MSD	One set per trial burn	2			
	Scrubber purge water	3	Purge and trap, GC/MS (SW-8260)	Surrogate spike[d]	Every sample	5	None required	None required	5
				MS/MSD	One set per trial burn	2			
	Caustic feed	3	Purge and trap, GC/MS (SW-8260)	Surrogate spike[d]	Every sample	5	None required	None required	5
				MS/MSD	One set per trial burn	2			
	Incinerator ash	3	Purge and trap, GC/MS (SW-8260)	Surrogate spike[d]	Every sample	5	None required	None required	5
				MS/MSD	One set per trial burn	2			

TABLE 10-1B (Continued)

SUMMARY OF LABORATORY AND PROJECT-SPECIFIC QUALITY CONTROL SAMPLE ANALYSIS REQUIREMENTS LOW-TEMPERATURE DRE DEMONSTRATION TEST—3 RUNS

Analytical Parameter (Analysis)	Sample Name or Type	Total No. of Field Samples	Analytical Procedure Description (Method)	Laboratory QC Measurement Type	Frequency of Applied QC Measurement Type	Total No. of Laboratory QC Measurements	Field QC Measurement Type	Total No. of Field QC Samples	Total No. of Laboratory Analyses[a]
Semivolatile POHCs	Low-Btu liquid waste feed	3	Liquid-liquid extraction, GC/MS (SW-3510, SW-8270)	Surrogate spike[d]	Every sample	4	None required	None required	4
				Duplicate	One per test condition	1			
	Solid waste feed	3	Sonication extraction, GC/MS (SW-3550, SW-8270)	Surrogate spike[d]	Every sample	4	None required	None required	4
				Duplicate	One per test condition	1			
	High-Btu liquid waste feed	3	Waste dilution, GC/MS (SW-3580, SW-8270)	Surrogate spike[d]	Every sample	4	None required	None required	4
				Duplicate	One per test condition	1			

TABLE 10-1B (Continued)

SUMMARY OF LABORATORY AND PROJECT-SPECIFIC QUALITY CONTROL SAMPLE ANALYSIS REQUIREMENTS LOW-TEMPERATURE DRE DEMONSTRATION TEST—3 RUNS

Analytical Parameter (Analysis)	Sample Name or Type	Total No. of Field Samples	Analytical Procedure Description (Method)	Laboratory QC Measurement Type	Frequency of Applied QC Measurement Type	Total No. of Laboratory QC Measurements	Field QC Measurement Type	Total No. of Field QC Samples	Total No. of Laboratory Analyses[a]
Semivolatile POHCs (Continued)	Makeup water	3	Liquid-liquid extraction, GC/MS (SW-3510, SW-8270)	Surrogate spike[d]	Every sample	5	None required	None required	5
				MS/MSD	One set per trial burn	2			
	Scrubber purge water	3	Liquid-liquid extraction, GC/MS (SW-3510, SW-8270)	Surrogate spike[d]	Every sample	5	None required	None required	5
				MS/MSD	One set per trial burn	2			
	Caustic feed	3	Liquid-liquid extraction, GC/MS (SW-3510, SW-8270)	Surrogate spike[d]	Every sample	5	None required	None required	5
				MS/MSD	One set per trial burn	2			

TABLE 10-1B (Continued)

SUMMARY OF LABORATORY AND PROJECT-SPECIFIC QUALITY CONTROL SAMPLE ANALYSIS REQUIREMENTS LOW-TEMPERATURE DRE DEMONSTRATION TEST—3 RUNS

Analytical Parameter (Analysis)	Sample Name or Type	Total No. of Field Samples	Analytical Procedure Description (Method)	Laboratory QC Measurement Type	Frequency of Applied QC Measurement Type	Total No. of Laboratory QC Measurements	Field QC Measurement Type	Total No. of Field QC Samples	Total No. of Laboratory Analyses[a]
Semivolatile POHCs (Continued)	Incinerator ash	3	Sonication extraction, GC/MS (SW-3550, SW-8270)	Surrogate spike[d]	Every sample	5	None required	None required	5
				MS/MSD	One set per trial burn	2			
Volatile POHCs	VOST condensate	3	Purge and trap, GC/MS (SW-0031, SW-8260)	Surrogate spike[d]	Every sample including blanks	4	Trip blank	1	8
	VOST tubes	18 (9 sets of VOST tubes)	Purge and trap, GC/MS (SW-0031, SW-8260/SW-5041)	Surrogate spike[d]	Every sample including blanks	30 samples	Trip blank	1 set	30
				Spiked resin blank	Two sets per trial burn	4 samples	Field blank	3 sets	
				VOST audit	Four sets per trial burn	4 sample sets			

TABLE 10-1B (Continued)

SUMMARY OF LABORATORY AND PROJECT-SPECIFIC QUALITY CONTROL SAMPLE ANALYSIS REQUIREMENTS LOW-TEMPERATURE DRE DEMONSTRATION TEST—3 RUNS

Analytical Parameter (Analysis)	Sample Name or Type	Total No. of Field Samples	Analytical Procedure Description (Method)	Laboratory QC Measurement Type	Frequency of Applied QC Measurement Type	Total No. of Laboratory QC Measurements	Field QC Measurement Type	Total No. of Field QC Samples	Total No. of Laboratory Analyses[a]
Semivolatile POHCs	MM5 train (particulate filter and the front-half filter holder and probe solvent rinses)	3	Soxhlet extraction, GC/MS (SW-3542, SW-3540, SW-8270)	Semivolatile surrogate spike	Every filter and combined solvent rinse sample	5	Field blank	1 particulate filter, 1 set of solvent probe rinses	5
							Blank train	1	
	MM5 train (XAD-2 resin and the back-half filter holder and coil condenser solvent rinses)	3	Soxhlet extraction, GC/MS (SW-3542, SW-3540, SW-8270)	Carbon-13-labeled sampling surrogate spike	Every XAD-2 resin tube including blanks	10	Trip blank	1 per sample shipment	10

TABLE 10-1B (Continued)

SUMMARY OF LABORATORY AND PROJECT-SPECIFIC QUALITY CONTROL SAMPLE ANALYSIS REQUIREMENTS LOW-TEMPERATURE DRE DEMONSTRATION TEST—3 RUNS

Analytical Parameter (Analysis)	Sample Name or Type	Total No. of Field Samples	Analytical Procedure Description (Method)	Laboratory QC Measurement Type	Frequency of Applied QC Measurement Type	Total No. of Laboratory QC Measurements	Field QC Measurement Type	Total No. of Field QC Samples	Total No. of Laboratory Analyses[a]
Semivolatile POHCs (Continued)				Semivolatile surrogate spike	Every XAD-2 resin tube including blanks	10	Field blank	3	
				Spiked resin blank	Two resin tubes per trial burn	2	Blank train	1	
	MM5 train (impinger condensate composite and the glassware solvent rinses)	3	Liquid-liquid extraction, GC/MS (SW-3542, SW-3510, SW-8270)	Surrogate spike[d]	Every back-half composite including blanks	6	Blank train	1	6
				MS/MSD	One set per trial burn	2	Field blank	1	
Particulate	M5 train (particulate filter and acetone probe rinse)	3 filters, 3 acetone probe rinses	Gravimetric (EPA Method 5)	Replicate weighing to constant weigh	Every particulate sample	3 filters, 3 acetone probe rinses	Field blank (1 particulate filter, 1 acetone probe rinse)	2	14

TABLE 10-1B (Continued)

SUMMARY OF LABORATORY AND PROJECT-SPECIFIC QUALITY CONTROL SAMPLE ANALYSIS REQUIREMENTS LOW-TEMPERATURE DRE DEMONSTRATION TEST—3 RUNS

Analytical Parameter (Analysis)	Sample Name or Type	Total No. of Field Samples	Analytical Procedure Description (Method)	Laboratory QC Measurement Type	Frequency of Applied QC Measurement Type	Total No. of Laboratory QC Measurements	Field QC Measurement Type	Total No. of Field QC Samples	Total No. of Laboratory Analyses[a]
Hydrogen chloride	M5 train (0.1N sulfuric acid impinger composite)	3	Ion chromatography (SW-9056/SW-9057)	MS/MSD[d]	One set per test condition	2	Reagent blank (0.1N sulfuric acid impinger solution)	1	6
Chlorine	M5 train (0.1N nitric acid impinger composite)	3	Ion chromatography (SW-9056/SW-9057)	MS/MSD[d]	One set per test condition	2	Reagent blank (0.1N sodium hydroxide impinger solution)	1	6

Notes:

ASTM American Society for Testing and Materials
Btu British thermal unit
DRE Destruction removal efficiency
EPA U.S. Environmental Protection Agency
GC/MS Gas chromatography and mass spectroscopy
IC/PCR Ion chromatography and post-column reactor
M5 Method 5
MM5 Modified Method 5
MS/MSD Matrix spike and matrix spike duplicate
N Normality
PDS Post-digestion spike

TABLE 10-1B (Continued)

SUMMARY OF LABORATORY AND PROJECT-SPECIFIC QUALITY CONTROL SAMPLE ANALYSIS REQUIREMENTS LOW-TEMPERATURE DRE DEMONSTRATION TEST—3 RUNS

Notes (Continued):

POHC Principal organic hazardous constituent
QC Quality control
SRM Standard reference materials
TDS Total dissolved solids
TS Total solids
TSS Total suspended solids
VOST Volatile organic sampling train

See Table 10-2 for additional method-specific required QC checks and frequencies.

a Total laboratory analyses includes all field samples collected and all laboratory and field QC samples that are analyzed. This number may not be calculated easily by adding the totals from the columns above; however, the total number presented represents the required total analyses for the sample and quality assurance analytical program.

b An SRM will be submitted to the laboratory and analyzed for this parameter.

c Elemental analysis will include the following: carbon, hydrogen, oxygen, nitrogen, and sulfur.

d Surrogate spikes will be applied to all samples including matrix spikes, duplicates, and blank analytical aliquots.

TABLE 10-1C

SUMMARY OF LABORATORY AND PROJECT-SPECIFIC QUALITY CONTROL SAMPLE ANALYSIS REQUIREMENTS STANDARD FACILITY OPERATING CONDITION RISK ASSESSMENT EMISSION TEST—3 RUNS

Analytical Parameter (Analysis)	Sample Name or Type	Total No. of Field Samples	Analytical Procedure Description (Method)	Laboratory QC Measurement Type	Frequency of Applied QC Measurement Type	Total No. of Laboratory QC Measurements	Field QC Measurement Type	Total No. of Field QC Samples	Total No. of Laboratory Analyses[a]
Density[b]	High-Btu liquid waste feed	3	Gravimetric/ volumetric (ASTM D-70/D-891)	Duplicate	One per test condition	1	None required	None required	4
	Solid waste feed	3	Gravimetric/ volumetric (ASTM D-70/D-454)	Duplicate	One per test condition	1	None required	None required	4
	Low-Btu liquid waste feed	3	Gravimetric/ volumetric (ASTM D-70/D-1419)	Duplicate	One per test condition	1	None required	None required	4
Heat content (Btu)[b]	High-Btu liquid waste feed	3	Isoperibol calorimeter (ASTM D-1015, D-1341, D-140)	Duplicate	One per test condition	1	None required	None required	4
	Solid waste feed	3	Isoperibol calorimeter (ASTM D-1015, D-1341, D-140)	Duplicate	One per test condition	1	None required	None required	4

TABLE 10-1C (Continued)

SUMMARY OF LABORATORY AND PROJECT-SPECIFIC QUALITY CONTROL SAMPLE ANALYSIS REQUIREMENTS STANDARD FACILITY OPERATING CONDITION RISK ASSESSMENT EMISSION TEST—3 RUNS

Analytical Parameter (Analysis)	Sample Name or Type	Total No. of Field Samples	Analytical Procedure Description (Method)	Laboratory QC Measurement Type	Frequency of Applied QC Measurement Type	Total No. of Laboratory QC Measurements	Field QC Measurement Type	Total No. of Field QC Samples	Total No. of Laboratory Analyses[a]
Heat content (Btu)[b] (Continued)	Low-Btu liquid waste feed	3	Isoperibol calorimeter (ASTM D-1015, D-1341, D-140)	Duplicate	One per test condition	1	None required	None required	4
Viscosity	High-Btu liquid waste feed	3	Kinematic viscometer (ASTM D-445)	Duplicate	One per test condition	1	None required	None required	4
	Low-Btu liquid waste feed	3	Kinematic viscometer (ASTM D-445)	Duplicate	One per test condition	1	None required	None required	4
Total chlorine[b]	High-Btu liquid waste feed	3	Bomb combustion/ion chromatography (ASTM D-404, E-441, D-4317-44)	Duplicate	One per test condition	1	None required	None required	4
	Solid waste feed	3	Bomb combustion/ion chromatography (ASTM D-404, E-441, D-4317-44)	Duplicate	One per test condition	1	None required	None required	4

TABLE 10-1C (Continued)

SUMMARY OF LABORATORY AND PROJECT-SPECIFIC QUALITY CONTROL SAMPLE ANALYSIS REQUIREMENTS STANDARD FACILITY OPERATING CONDITION RISK ASSESSMENT EMISSION TEST—3 RUNS

Analytical Parameter (Analysis)	Sample Name or Type	Total No. of Field Samples	Analytical Procedure Description (Method)	Laboratory QC Measurement Type	Frequency of Applied QC Measurement Type	Total No. of Laboratory QC Measurements	Field QC Measurement Type	Total No. of Field QC Samples	Total No. of Laboratory Analyses[a]
Total chlorine[b] (Continued)	Low-Btu liquid waste feed	3	Bomb combustion/ion chromatography (ASTM D-404, E-441, D-4317-44)	Duplicate	One per test condition	1	None required	None required	4
Elemental analysis[c]	High-Btu liquid waste feed	3	Ultimate analysis (ASTM D-3173)	Duplicate	One per test condition	1	None required	None required	4
	Solid waste feed	3	Ultimate analysis (ASTM D-3173)	Duplicate	One per test condition	1	None required	None required	4
	Low-Btu liquid waste feed	3	Ultimate analysis (ASTM D-3173)	Duplicate	One per test condition	1	None required	None required	4
Percent ash content	Low-Btu liquid waste feed	3	Residue after combustion (ASTM D-441)	Duplicate	One per test condition	1	None required	None required	4
	Solid waste feed	3	Residue after combustion (ASTM D-441)	Duplicate	One per test condition	1	None required	None required	4

TABLE 10-1C (Continued)

SUMMARY OF LABORATORY AND PROJECT-SPECIFIC QUALITY CONTROL SAMPLE ANALYSIS REQUIREMENTS STANDARD FACILITY OPERATING CONDITION RISK ASSESSMENT EMISSION TEST—3 RUNS

Analytical Parameter (Analysis)	Sample Name or Type	Total No. of Field Samples	Analytical Procedure Description (Method)	Laboratory QC Measurement Type	Frequency of Applied QC Measurement Type	Total No. of Laboratory QC Measurements	Field QC Measurement Type	Total No. of Field QC Samples	Total No. of Laboratory Analyses[a]
Percent ash content (Continued)	High-Btu liquid waste feed	3	Residue after combustion (ASTM D-441)	Duplicate	One per test condition	1	None required	None required	4
TDS/TSS/ TS (residues)	Scrubber purge water	3	Gravimetric (EPA 600-Method 160)	Duplicate	One per test condition	1	None required	None required	4
Volatile PICs	VOST condensate	3	Purge and trap, GC/MS (SW-0031, SW-8260)	Surrogate spike[d]	Every sample including blanks	4	Trip blank	1	8
	VOST tubes	18 (9 sets of VOST tubes)	Purge and trap, GC/MS (SW-0031, SW-8260/SW-5041)	Surrogate spike[d]	Every sample including blanks	30 samples	Trip blank	1 set	30
				Spiked resin blank	Two sets per trial burn	4 samples	Field blank	3 sets	
				VOST audit	Four sets per trial burn	4 sample sets			

TABLE 10-1C (Continued)

SUMMARY OF LABORATORY AND PROJECT-SPECIFIC QUALITY CONTROL SAMPLE ANALYSIS REQUIREMENTS STANDARD FACILITY OPERATING CONDITION RISK ASSESSMENT EMISSION TEST—3 RUNS

Analytical Parameter (Analysis)	Sample Name or Type	Total No. of Field Samples	Analytical Procedure Description (Method)	Laboratory QC Measurement Type	Frequency of Applied QC Measurement Type	Total No. of Laboratory QC Measurements	Field QC Measurement Type	Total No. of Field QC Samples	Total No. of Laboratory Analyses[a]
Volatile unspeciated mass (carbon-7 through carbon-17)	Method 0040 Tedlar™ bags	3	GC/FID (Modified SW-0040)	Field spike	One field spike per run	3 bags per test condition	Field blank	3 bags	17
				Duplicate	Every Tedlar™ bag	3	Train blank	3 bags	
							Trip blank	2 bags	
	Method 0040 condensate	3	Purge and trap GC/FID (SW-5030, SW-0040)	Matrix spike	One blank spike and blank spike duplicate per test condition	2	Field blank	3	11
							Train blank	3	
Semivolatile PICs	MM5 train (particulate filter and the front-half filter holder and probe solvent rinses)	3	Soxhlet extraction, GC/MS (SW-3542, SW-3540, SW-8270)	Semivolatile surrogate spike	Every filter and combined solvent rinse sample	5	Field blank	1 particulate filter, 1 set of solvent probe rinses	5
							Blank train	1	

TABLE 10-1C (Continued)

SUMMARY OF LABORATORY AND PROJECT-SPECIFIC QUALITY CONTROL SAMPLE ANALYSIS REQUIREMENTS STANDARD FACILITY OPERATING CONDITION RISK ASSESSMENT EMISSION TEST—3 RUNS

Analytical Parameter (Analysis)	Sample Name or Type	Total No. of Field Samples	Analytical Procedure Description (Method)	Laboratory QC Measurement Type	Frequency of Applied QC Measurement Type	Total No. of Laboratory QC Measurements	Field QC Measurement Type	Total No. of Field QC Samples	Total No. of Laboratory Analyses[a]
Semivolatile PICs (Continued)	MM5 train (XAD-2 resin and back-half filter holder and coil condenser solvent rinses)	3	Soxhlet extraction, GC/MS (SW-3542, SW-3540, SW-8270)	Carbon-13-labeled sampling surrogate spike	Every XAD-2 resin tube including blanks	10	Trip blank	1 per sample shipment	10
				Semivolatile surrogate spike	Every filter and combined solvent rinse sample	10	Field blank	3	
				Spiked resin blank	Two resin tubes per trial burn	2	Blank train	1	
	MM5 train (impinger condensate composite and glassware solvent rinses)	3	Liquid-liquid extraction, GC/MS (SW-3542, SW-3510, SW-8270)	Surrogate spike[d]	Every back-half composite including blanks	7	Blank train	1	7
				MS/MSD	One set per test condition	2	Field blank	1	

TABLE 10-1C (Continued)

SUMMARY OF LABORATORY AND PROJECT-SPECIFIC QUALITY CONTROL SAMPLE ANALYSIS REQUIREMENTS STANDARD FACILITY OPERATING CONDITION RISK ASSESSMENT EMISSION TEST—3 RUNS

Analytical Parameter (Analysis)	Sample Name or Type	Total No. of Field Samples	Analytical Procedure Description (Method)	Laboratory QC Measurement Type	Frequency of Applied QC Measurement Type	Total No. of Laboratory QC Measurements	Field QC Measurement Type	Total No. of Field QC Samples	Total No. of Laboratory Analyses[a]
Semivolatile unspeciated mass (carbon-7 through carbon-17)	MM5 train (particulate filter and front-half filter holder and probe solvent rinses)	3	Soxhlet extraction GC/FID (SW-3540, SW-8015)	Surrogate spike[d]	Every XAD-2 resin tube including blanks	8	Field blank	3	8
							Trip blank	1 per shipment	
							Blank train	1	
	MM5 train (XAD-2 resin and back-half filter holder and coil condenser solvent rinses)	3	Soxhlet extraction GC/FID (SW-3540, SW-8015)	Surrogate spike[d]	Every back-half composite	5	Deionized water reagent blank	1	5
							Blank train	1	
	MM5 train (impinger condensate composite and the glassware solvent rinses)	3	Liquid-liquid extraction, GC/MS (SW-3510, SW-8015)	Surrogate spike[d]	Every back-half composite including blanks	7	Blank train	1	7
				MS/MSD	One set per test condition	2	Field blank	1	

TABLE 10-1C (Continued)

SUMMARY OF LABORATORY AND PROJECT-SPECIFIC QUALITY CONTROL SAMPLE ANALYSIS REQUIREMENTS STANDARD FACILITY OPERATING CONDITION RISK ASSESSMENT EMISSION TEST—3 RUNS

Analytical Parameter (Analysis)	Sample Name or Type	Total No. of Field Samples	Analytical Procedure Description (Method)	Laboratory QC Measurement Type	Frequency of Applied QC Measurement Type	Total No. of Laboratory QC Measurements	Field QC Measurement Type	Total No. of Field QC Samples	Total No. of Laboratory Analyses[a]
Nonvolatile unspeciated mass (B.P. >300 °C)	MM5 train (particulate filter and the front-half filter holder and probe solvent rinses)	3	Soxhlet extraction/ gravimetric (SW-3540/EPA 160.3)	Replicate weighings to constant weight	Every nonvolatile unspeciated mass sample	8	Field blank	3	8
							Trip blank	1	
							Blank train	1	
	MM5 train (XAD-2 resin and the back-half filter holder and coil condenser solvent rinses)	3	Soxhlet extraction/ gravimetric (SW-3540/EPA 160.3)	Audit (Eicosane)	Two audit samples per test condition	2	Deionized water reagent blank	1	7
							Blank train	1	
	MM5 train (impinger condensate composite and the glassware solvent rinses)	3	Liquid-liquid extraction, GC/MS (SW-3510, SW-8015)	Audit (Eicosane)	Two audit samples per test condition	2	Deionized water reagent blank	1	7
							Blank train	1	

TABLE 10-1C (Continued)

SUMMARY OF LABORATORY AND PROJECT-SPECIFIC QUALITY CONTROL SAMPLE ANALYSIS REQUIREMENTS STANDARD FACILITY OPERATING CONDITION RISK ASSESSMENT EMISSION TEST—3 RUNS

Analytical Parameter (Analysis)	Sample Name or Type	Total No. of Field Samples	Analytical Procedure Description (Method)	Laboratory QC Measurement Type	Frequency of Applied QC Measurement Type	Total No. of Laboratory QC Measurements	Field QC Measurement Type	Total No. of Field QC Samples	Total No. of Laboratory Analyses[a]
PAHs	MM5 train (particulate filter and front- half filter holder and probe solvent rinses)	3	Soxhlet extraction, GC/MS (SW-3540, SW-3542, SW-8290, CARB 429)	PAH isotope dilution internal standard spike[d]	Every filter and solvent combined sample	6	Blank train	1	6
				Carbon-13-labeled sampling surrogate spike	Every filter and solvent combined sample	6	Field blank	1 particulate filter, 1 set of solvent rinses	
	MM5 train (XAD-2 resin and back half of the filter holder solvent rinses)	3	Soxhlet extraction, GC/MS (SW-3540, SW-3542, SW-8290, CARB 429)	Spiked resin blank	Two resin tubes per test condition	2	Field blank	3	10
				Carbon-13-labeled sampling surrogate spike	Every XAD-2 resin tube including blanks	10	Trip blank	1	
				PAH isotope dilution internal standard spike[d]	Every XAD-2 resin tube including blanks	10	Blank train	1	

TABLE 10-1C (Continued)

SUMMARY OF LABORATORY AND PROJECT-SPECIFIC QUALITY CONTROL SAMPLE ANALYSIS REQUIREMENTS STANDARD FACILITY OPERATING CONDITION RISK ASSESSMENT EMISSION TEST—3 RUNS

Analytical Parameter (Analysis)	Sample Name or Type	Total No. of Field Samples	Analytical Procedure Description (Method)	Laboratory QC Measurement Type	Frequency of Applied QC Measurement Type	Total No. of Laboratory QC Measurements	Field QC Measurement Type	Total No. of Field QC Samples	Total No. of Laboratory Analyses[a]
PAHs (Continued)	MM5 train (impinger condensate composite and the glassware solvent rinses)	3	Liquid-liquid extraction, GC/MS (SW-3510, SW-3542, SW-8290, CARB 429)	PAH isotope dilution internal standard spike[d]	Every back-half composite including blanks	7	Blank train	1	7
				MS/MSD	One set per test condition	2	Field blank	1	
Dioxins and furans[b]	MM5 train (particulate filter and the front-half filter holder and probe solvent rinses)	3	Soxhlet extraction, GC/MS (SW-8290, SW-0023A)	Isotope dilution internal standard spike	Every filter rinse and solvent combined sample	6	Blank train	1	6
				Carbon-13-labeled sampling surrogate spike	Every filter rinse and solvent combined sample	6	Field blank	1 particulate filter, 1 set of solvent rinses	

TABLE 10-1C (Continued)

SUMMARY OF LABORATORY AND PROJECT-SPECIFIC QUALITY CONTROL SAMPLE ANALYSIS REQUIREMENTS STANDARD FACILITY OPERATING CONDITION RISK ASSESSMENT EMISSION TEST—3 RUNS

Analytical Parameter (Analysis)	Sample Name or Type	Total No. of Field Samples	Analytical Procedure Description (Method)	Laboratory QC Measurement Type	Frequency of Applied QC Measurement Type	Total No. of Laboratory QC Measurements	Field QC Measurement Type	Total No. of Field QC Samples	Total No. of Laboratory Analyses[a]
Dioxins and furans[b] (Continued)	MM5 train (XAD-2 and back half of the filter holder and coil condenser solvent rinses)	3	Soxhlet extraction, GC/MS (SW-8290, SW-0023A)	Isotope dilution internal standard spike	Every XAD-2 resin tube including blanks	10	Blank train	1	10
				Internal standard recovery spike	Every front-half sample including blanks and rinses	10			
				Spiked resin blank	Two XAD-2 resin tubes	2	Field blank	3	
				Carbon-13-labeled sampling surrogate spike	Every XAD-2 resin tube including blanks	10	Trip blank	1	
Particulate	M5 train (particulate filter and acetone probe rinse)	3 particulate filters, 3 acetone probe rinses	Gravimetric (EPA Method 5)	Replicate weighing to constant weigh	Every particulate sample	3 particulate filters, 3 acetone probe rinses	Field blank	1 particulate filter, 1 acetone probe rinse	8
Hydrogen chloride	M5 train (0.1N sulfuric acid impinger composite)	3	Ion chromatography (SW-9056/SW-9057)	MS/MSD	One set per test condition	2	Reagent blank (0.1N sulfuric acid impinger solution)	1	6

TABLE 10-1C (Continued)

SUMMARY OF LABORATORY AND PROJECT-SPECIFIC QUALITY CONTROL SAMPLE ANALYSIS REQUIREMENTS STANDARD FACILITY OPERATING CONDITION RISK ASSESSMENT EMISSION TEST—3 RUNS

Analytical Parameter (Analysis)	Sample Name or Type	Total No. of Field Samples	Analytical Procedure Description (Method)	Laboratory QC Measurement Type	Frequency of Applied QC Measurement Type	Total No. of Laboratory QC Measurements	Field QC Measurement Type	Total No. of Field QC Samples	Total No. of Laboratory Analyses[a]
Chlorine	M5 train (0.1N sodium hydroxide impinger composite)	3	Ion chromatography (SW-9056/SW-9057)	MS/MSD	One set per test condition	2	Reagent blank (0.1N sodium hydroxide impinger solution)	1	6
Metals	MMT front-half composite (filter and 0.1N nitric acid probe rinse)	3	Digestion, ICP (SW-0060, SW-6010/6020)	PDS	Every front-half composite	3	Reagent blank (1 filter and 1 0.1N nitric acid probe rinse solution	2	12
				Matrix spike at two times the reporting limit	Two MMT blank train front-half composites	2			
				EPA audit metals on filter media[e]	Two filters per test condition	2			
	MMT back-half composite (5% nitric acid and 10% hydrogen peroxide)	3	Digestion, ICP (SW-0060, SW-6010/6020)	MS/MSD	One set per test condition	2	Reagent blank (5% nitric acid and 10% hydrogen peroxide solution)	1	8
				Matrix spike at two times the reporting limit	Two MMT blank train back-half composites	2			

TABLE 10-1C (Continued)

SUMMARY OF LABORATORY AND PROJECT-SPECIFIC QUALITY CONTROL SAMPLE ANALYSIS REQUIREMENTS STANDARD FACILITY OPERATING CONDITION RISK ASSESSMENT EMISSION TEST—3 RUNS

Analytical Parameter (Analysis)	Sample Name or Type	Total No. of Field Samples	Analytical Procedure Description (Method)	Laboratory QC Measurement Type	Frequency of Applied QC Measurement Type	Total No. of Laboratory QC Measurements	Field QC Measurement Type	Total No. of Field QC Samples	Total No. of Laboratory Analyses[a]
Mercury	MMT front-half composite (filter and 0.1N nitric acid probe rinse)	3	Digestion, CVAA (SW-0060, SW-7470)	PDS	Every front-half sample	3	Reagent blank (1 filter and 1 0.1N nitric acid probe rinse solution)	2	10
				Matrix spike at two times the reporting limit	Two MMT blank train front-half composites	2			
	MMT back-half composite (5% nitric acid and 10% hydrogen peroxide)	3	Digestion, CVAA (SW-0060, SW-7470)	MS/MSD	One set per test condition	2	Reagent blank (5% nitric acid and 10% hydrogen peroxide solution)	1	8
				Matrix spike at two times the reporting limit	Two MMT blank train back-half composite	2			
	Impinger 4 (empty)	3	Digestion, CVAA (SW-0060, SW-7470)	MS/MSD	One set per test conditions	2	Reagent blank (5% nitric acid and 10% hydrogen peroxide solution)	1	8
				Matrix spike at two times the	Two MMT blank train back-half	2			

TABLE 10-1C (Continued)

SUMMARY OF LABORATORY AND PROJECT-SPECIFIC QUALITY CONTROL SAMPLE ANALYSIS REQUIREMENTS STANDARD FACILITY OPERATING CONDITION RISK ASSESSMENT EMISSION TEST—3 RUNS

Analytical Parameter (Analysis)	Sample Name or Type	Total No. of Field Samples	Analytical Procedure Description (Method)	Laboratory QC Measurement Type	Frequency of Applied QC Measurement Type	Total No. of Laboratory QC Measurements	Field QC Measurement Type	Total No. of Field QC Samples	Total No. of Laboratory Analyses[a]
Mercury (Continued)	4% potassium permanganate and 10% sulfuric acid impinger composite	3	Digestion, CVAA (SW-0060, SW-7470)	MS/MSD	One set per test conditions	2	Reagent blank (4% potassium permanganate and 10% sulfuric acid impinger solution)	1	8
				Matrix spike at two times the reporting limit	Two MMT blank train back-half composites	2			
	8N hydrogen chloride impinger rinse samples	3	Digestion, CVAA (SW-0060, SW-7470)	MS/MSD	One set per test conditions	2	Reagent blank (8N hydrogen chloride impinger rinse solution)	1	8
				Matrix spike at two times the reporting limit	Two MMT 4% potassium permanganate and 10% sulfuric acid blank train composites	2			

TABLE 10-1C (Continued)

SUMMARY OF LABORATORY AND PROJECT-SPECIFIC QUALITY CONTROL SAMPLE ANALYSIS REQUIREMENTS STANDARD FACILITY OPERATING CONDITION RISK ASSESSMENT EMISSION TEST—3 RUNS

Analytical Parameter (Analysis)	Sample Name or Type	Total No. of Field Samples	Analytical Procedure Description (Method)	Laboratory QC Measurement Type	Frequency of Applied QC Measurement Type	Total No. of Laboratory QC Measurements	Field QC Measurement Type	Total No. of Field QC Samples	Total No. of Laboratory Analyses[a]
Formaldehyde and other aldehydes	Formaldehyde train front half (impinger 1)	3	HPLC (SW-0011 Method 8315)	Matrix spike	One per test condition	1	Reagent blank (DNPH impinger solution, methylene chloride and deionized water)	3	11
							Blank train	1	
							Field spike	3	
	Formaldehyde train back half (impingers 2 and 3)	3	HPLC (SW-0011 Method 8315)	Matrix spike	One per test condition	1	Blank train	1	5
Hexavalent chromium	Hexavalent chromium train (1.0N potassium hydroxide)	3	IC/PCR spectrophoto-metric detector (SW-0061 Method 218.6)	MS/MSD	One set per test condition	2	Reagent blank (1.0N potassium hydroxide impinger solution)	1	12
				Field spikes	Two per run	6			

TABLE 10-1C (Continued)

SUMMARY OF LABORATORY AND PROJECT-SPECIFIC QUALITY CONTROL SAMPLE ANALYSIS REQUIREMENTS STANDARD FACILITY OPERATING CONDITION RISK ASSESSMENT EMISSION TEST—3 RUNS

Notes:

ASTM	American Society for Testing and Materials
B.P.	Boiling point
Btu	British thermal unit
CARB	California Air Resources Board
CVAA	Cold vapor atomic absorption
DNPH	Dinitrophenylhydrazine
DRE	Destruction and removal efficiency
EPA	U.S. Environmental Protection Agency
GC/FID	Gas chromatography and flame ionization detector
GC/MS	Gas chromatography and mass spectroscopy
HPLC	High-performance liquid chromatography
IC/PCR	Ion chromatography and post-column reactor
ICP	Inductively coupled argon plasma spectroscopy
M5	Method 5
MM5	Modified Method 5
MMT	Multi-metals train
MS/MSD	Matrix spike and matrix spike duplicate
N	Normality
PAH	Polynuclear aromatic hydrocarbon
PDS	Post-digestion spike
PIC	Product of incomplete combustion
QC	Quality control
SRM	Standard reference materials
TDS	Total dissolved solids
TS	Total solids
TSS	Total suspended solids
VOST	Volatile organic sampling train

TABLE 10-1C (Continued)

SUMMARY OF LABORATORY AND PROJECT-SPECIFIC QUALITY CONTROL SAMPLE ANALYSIS REQUIREMENTS STANDARD FACILITY OPERATING CONDITION RISK ASSESSMENT EMISSION TEST—3 RUNS

Notes (Continued):

See Table 10-2 for additional method-specific required QC checks and frequencies.

a Total laboratory analyses includes all field samples collected and all laboratory and field QC samples that are analyzed. This number may not be calculated easily by adding the totals from the columns above; however, the total number presented represents the required total analyses for the sample and quality assurance analytical program.

b An SRM will be submitted to the laboratory and analyzed for this parameter.

c Elemental analysis will include the following: carbon, hydrogen, oxygen, nitrogen, and sulfur.

d Surrogate spikes will be applied to all samples including matrix spikes, duplicates, and blank analytical aliquots.

e EPA audit filter samples will be analyzed by the analytical laboratory if supplied by the officiating regulatory agency.

TABLE 10-2

SUMMARY OF ANALYTICAL QUALITY CONTROL CHECKS, FREQUENCIES, TARGET ACCEPTANCE CRITERIA, AND CORRECTIVE ACTION

Parameter/Method	QC Check	Frequency	Target Criteria	Corrective Action
Volatile POHCs and PICs and semivolatile PICs by GC/MS (Method 5041, Method 8260 for volatiles, and Method 8270 for semivolatiles)	Mass scale calibration using Bromofluorobenzene and DFTPP	Daily or every 12-hour shift	Daily or every 12-hour shift	Repeat calibration
	Ion abundance and intensity check	Beginning of 12-hour shift	Relative response factor - 0.05 Minimum response factor VOA SPCCs - 0.300 (0.250 for Bromoform) BNA SPCCs - 0.05	Repeat calibration
	Linearity check (multi-point calibration)	Each day, prior to sample analysis	± 30% for CCCs Minimum response factor for SPCCs	(1) Repeat linearity check (2) If still unacceptable make necessary adjustments (3) Repeat linearity check
	Single-point check	Daily (beginning of each 12-hour shift)	Initial calibration relative response factor agreement Within 30% (Method 8270) 25% (Method 8260)	(1) Repeat single-point check (2) If still unacceptable, perform multi-point calibration
	Resin blank spike recovery (VOST)	Prior to sample analysis (three per trial burn)	75% to 125% recovery, ± 25% RSD	(1) Repeat analysis (2) Flag data
	VOST audit	One audit set during the trial burn	50 to 150% of certified concentration	(1) Flag data (2) Discuss in final report

TABLE 10-2 (Continued)

SUMMARY OF ANALYTICAL QUALITY CONTROL CHECKS, FREQUENCIES, TARGET ACCEPTANCE CRITERIA, AND CORRECTIVE ACTION

Parameter/Method	QC Check	Frequency	Target Criteria	Corrective Action
Volatile POHCs and PICs and semivolatile PICs by GC/MS (Method 5041, Method 8260 for volatiles, and Method 8270 for semivolatiles) (Continued)	Surrogate spike analysis	Every sample	See Tables 5-2 and 5-3.	Flag data.
	Internal standard	All samples	Area counts 65 to 135% from standard calibration 30 seconds from standard calibration retention times	Flag data.
	Method blanks	Once per extraction lot ($\leq$20 samples)	No significant contamination in the method blanks	Data associated with method blanks are flagged[b].
	Matrix spike and matrix spike duplicate	See Tables 10-1A through 10-1C.	See Tables 5-4 and 5-5 < 35% RPD	Flag data.
Dioxin and furans by high-resolution GC/MS (Method 8290)	Initial calibration (linearity check at five concentration levels and retention time window verification)	As needed	Precision of relative response factors $\leq$ 20% RSD of 17 unlabeled standards Internal standards $\leq$ 30% of RSD S/N ratios 2.5 Isotopic ratios within control limits	(1) Repeat linearity check. (2) If still unacceptable make necessary adjustments. (3) Repeat linearity check.
	Continuing calibration check	Beginning and end of each 12-hour shift	Unlabeled standards $\leq$ 20% of ICAL Internal standards $\leq$ 30% of ICAL S/N ratios 2.5 Isotopic ratios within control limits	(1) Repeat single point check. (2) If still unacceptable, perform multi-point calibration.

TABLE 10-2 (Continued)

SUMMARY OF ANALYTICAL QUALITY CONTROL CHECKS, FREQUENCIES, TARGET ACCEPTANCE CRITERIA, AND CORRECTIVE ACTION

Parameter/Method	QC Check	Frequency	Target Criteria	Corrective Action
Dioxin and furans by high-resolution GC/MS (Method 8290) (Continued)	Retention time window verification and GC column performance	Start of each 12-hour shift	Compliance with Section 8.2.1 of Method 8290	Correct according to the method.
	Method blanks	Once per extraction batch (≤ 20 samples) Analyze after calibration standard and before the first sample	If less than the lower quantitation level, no action If greater than or equal to the lower quantitation level, consult with the client about the potential impact and resolution	Data associated with method blanks are flagged[b].
	Mass spectometer performance	Beginning and end of each 12-hour period of operation	Static resolving power of 10,000 (10% valley definition)	Comply with the method.
	Surrogate and alternate standard spike recovery	All samples	40 to 130%	(1) Flag data. (2) Correct procedures for remaining samples if possible. (3) Discuss in the final report.
	XAD-2 sampling surrogate spike recovery	Each XAD-2 sample tube	50 to 150% recovery See Table 5-6.	Flag data.
	Spiked resin blank	Three resin traps	± 30% RPD, 60 to 140% recovery	Flag data.
	Internal standard spikes	Every sample (including method blanks and all QC samples)	See Table 5-7.	Flag data.
Metals and mercury by ICP and CVAA (Method 6010 and combined Methods 7470/7471)	Method blanks	Once per digestion batch	Uncontaminated method blank	Flag data associated with method blanks.

TABLE 10-2 (Continued)

SUMMARY OF ANALYTICAL QUALITY CONTROL CHECKS, FREQUENCIES, TARGET ACCEPTANCE CRITERIA, AND CORRECTIVE ACTION

Parameter/Method	QC Check	Frequency	Target Criteria	Corrective Action
Metals and mercury by ICP and CVAA (Method 6010 and combined Methods 7470/7471) (Continued)	Multi-level initial calibration	Daily, before sample analysis	Linear correlation coefficient ≥0.995	Repeat calibration.
	Mid-range calibration check standard	Before and after sample analysis batch	80 to 120% recovery (ICP)	(1) Repeat analyses. (2) Upon second failure, recalibrate instrument. (3) Re-analyze sample.
	Calibration check standard	After each initial calibration	90 to 110% of theoretical	(1) Correct the problem. (2) Rerun the check standard until criteria are met to proceed with sample analysis.
	SRM audit sample (NIST or equivalent)(filters and aqueous media)	One per extraction lot (≤ 20 samples)	75 to 150% of reference value	(1) Flag associated data. (2) Repeat analysis.
	Spike sample analysis	One per 20 samples per matrix (excluding filters)	70 to 130% recovery	(1) Run check. (2) Correct problem. (3) Flag data.
	Post-digestion spikes	See Tables 10-1A through 10-1C.	70 to 130% recovery	(1) Run check. (2) Correct problem. (3) Flag data.

TABLE 10-2 (Continued)

SUMMARY OF ANALYTICAL QUALITY CONTROL CHECKS, FREQUENCIES, TARGET ACCEPTANCE CRITERIA, AND CORRECTIVE ACTION

Parameter/Method	QC Check	Frequency	Target Criteria	Corrective Action
Hexavalent chromium by IC and PCR spectrophotometric detector (Method 218.6)	Linearity check (four-point calibration)	Daily	Correlation coefficient ≥ 0.9950	(1) Repeat linearity check. (2) Prepare new standard. (3) Service instrument.
	Mid-point check standard	1 per 10 analyses	0 to 110% recovery	Repeat calibration.
	Method blanks	1 per batch	Less than reporting limit (0.5 g/L)	Flag data.
	Laboratory control samples (spiked blanks)	1 per batch	85 to 115%	Rerun LCS.
	Matrix spike and matrix spike duplicate	See Tables 10-1A through 10-1C.	± 25%	Flag data.
	Spike stability samples	See Tables 10-1A through 10-1C.	70 to 130% Recovery 35% RSD	(1) Flag data. (2) Discuss results in final report
	SRM audit samples from NIST or equivalent	Once during the trial burn	Within range established by the supplier	Repeat analysis.
Chloride by ion chromatography (Methods SW-9056 and BIF 9057)	Linearity check three-point calibration plus a blank (four points total)	Daily	Correlation coefficient ≥ 0.9950	(1) Repeat linearity check (2) Prepare new standard (3) Service instrument
	Standard reference material (SRM) from NIST or equivalent	Once during trial burn	90 to 110% of reference value	Flag data.
	Mid-point check standard	10%	± 10% recovery	Repeat calibration.
	Matrix spike and matrix spike duplicate	One front and one back impinger spiked at three times the native level	± 85 to 115% Recovery ± 35% RPD	Flag data.

TABLE 10-2 (Continued)

SUMMARY OF ANALYTICAL QUALITY CONTROL CHECKS, FREQUENCIES, TARGET ACCEPTANCE CRITERIA, AND CORRECTIVE ACTION

Parameter/Method	QC Check	Frequency	Target Criteria	Corrective Action
Formaldehyde determination of carbonyl compounds by high-performance liquid chromatography	Calibration verification	Verified each day before and after analyses are performed	Response factor ± 15% of original response factor of each analyte	Recalibrate system.
	Calibration standard response factors	Each day, prior to analysis	% RSD of the mean response factor of the calibration standard should be no greater than ± 20%	(1) Perform system check. (2) If calibration check does not meet criteria, recalibrate. (3) If recalibration does not meet criteria, make new calibration standard.
	Single-point calibration check	Following every tenth analysis or less	Verify that the response factor is within ± 15% of original calibration response factor	(1) Check additional calibration standards, as necessary, to verify response factor. (2) Flag data, as necessary.
	Solvent blank	Daily	Verify that the system is clean of interferences	Clean system by solvent flushing.
Total chlorine (ASTM D-808/E-442)	Duplicate analyses	See Tables 10-1A through 10-1C.	± 35% RPD	Conduct replicate analyses.
	SRM	Once during trial burn	90 to 110% of reference value 30% RPD	Repeat analysis.

TABLE 10-2 (Continued)

SUMMARY OF ANALYTICAL QUALITY CONTROL CHECKS, FREQUENCIES, TARGET ACCEPTANCE CRITERIA, AND CORRECTIVE ACTION

Parameter/Method	QC Check	Frequency	Target Criteria	Corrective Action
Heat content (Btu) (ASTM D-2015, D-2382, D-240)	Duplicate analyses	See Tables 10-1A through 10-C.	± 35% RPD	(1) Re-check. (2) Re-calibrate.
	SRM	Once during trial burn	90 to 110% of reference value 30% RPD	Repeat analysis.
Viscosity (ASTM D-445)	Duplicate analyses	See Tables 10-1A through 10-1C.	± 35% RPD	(1) Re-check. (2) Re-calibrate.
Elemental analysis (ASTM D-3176)	Duplicate analyses	See Tables 10-1A through 10-1C.	± 35% RPD	(1) Re-check. (2) Re-calibrate.
Percent ash (ASTM D-482)	Duplicate analyses	See Tables 10-1A through 10-1C.	± 35% RPD	(1) Re-check. (2) Re-calibrate.
TDS, TS, and TSS (EPA 600 - Method 160)	Duplicate analyses	See Tables 10-1A through 10-1C.	± 35% RPD	(1) Re-check. (2) Re-calibrate.
Density (ASTM D-70/D-891)	Duplicate analyses	See Tables 10-1A through 10-1C.	± 35% RPD	(1) Re-check. (2) Re-calibrate.
	SRM	Once during trial burn	90 to 100% of reference; 30% RPD	Repeat analysis.
Particulate matter (Calibration criteria are on Table 8-1)	Repeat filter weighing to a constant weight	Every filter, 30 minutes intervals	Agreement within ± 0.5 mg	Repeat weighing.
	Reagent blank (method blanks) Repeat filter weighing to constant weight	Every filter, 30 minutes intervals	Agreement within ± 0.5 mg	Repeat weighing.
Carbon monoxide and oxygen CEM	Zero gas Span gas	Before and after each run	See Table 5-1.	Perform full calibration.

TABLE 10-2 (Continued)

SUMMARY OF ANALYTICAL QUALITY CONTROL CHECKS, FREQUENCIES, TARGET ACCEPTANCE CRITERIA, AND CORRECTIVE ACTION

Notes:

ASME	American Society for Testing and Materials
BIF	Boiler or industrial furnace
BNA	Base neutral analysis
Btu	British thermal unit
CCC	Calibration check compound
CEM	Continuous emission monitoring
CVAA	Cold vapor atomic absorption
DFTPP	Decafluorotriphenyl phosphine
EPA	U.S. Environmental Protection Agency
g/L	Grams per liter
GC	Gas chromatograph
GC/MS	Gas chromatograph and mass spectrometry
IC	Ion chromatography
ICAL	Initial calibration
ICP	Inductively coupled argon plasma spectroscopy
LCS	Laboratory control sample
NIST	National Institute of Standards and Testing
PCR	Post-column reactor
PIC	Products of incomplete combustion
POHC	Principal organic hazardous constituents
QAPP	Quality assurance project plan
RPD	Relative percent difference
RSD	Relative standard deviation
S/N	Signal to noise
SPCC	System performance check compounds
SRM	Standard reference material
TDS	Total dissolved solids

TABLE 10-2 (Continued)

SUMMARY OF ANALYTICAL QUALITY CONTROL CHECKS, FREQUENCIES, TARGET ACCEPTANCE CRITERIA, AND CORRECTIVE ACTION

Notes (Continued):

TS	Total solids
TSS	Total suspended solids
VOA	Volatile organics analysis
VOST	Volatile organic sampling train

a All data outside the QAPP target criteria will be flagged and discussed in detail in the trial burn report.

b Blank corrections are not routinely applied to data.

10.2 DUPLICATE ANALYSES

Duplicate sample analysis will be requested for samples to evaluate the variance in a particular applied analytical method when other precision methods are not appropriate. For the trial burn, grab samples of equal volume will be collected at set time intervals and composited over the course of each run. The collection of a composite sample will compensate for any variability in the sample components while providing adequate volume for the analysis. All samples analyzed by cold vapor atomic absorption (CVAA) will receive duplicate analysis as specified in the method. Duplicate analyses will be requested on specified samples by the laboratory analysis coordinator on the RFA and COC forms submitted to the laboratory with the trial burn samples.

10.3 ANALYTICAL INSTRUMENT CALIBRATION

The analytical instrumentation used in the laboratory for analysis of project samples will undergo rigorous checks and re-checks of performance. Prior to sample analysis, initial and continuing calibrations will be performed according to the prescribed reference method to compare linearity of response to concentration of known amounts of the analytes of interest. If acceptance criteria, as specified in the appropriate analytical methods for initial or continuing calibrations, are not met, sample analysis will not proceed until the analytical problem has been rectified and the criteria have been met. Linearity checks will be used to verify that response has not shifted significantly from the most recent calibration. The instrument initial calibration procedures and acceptance criteria will be those established in the analytical method and those shown in Section 9.0 of the EPA QA/QC Handbook. As well, internal standards will be analyzed to evaluate instrument and method performance. Associated target QC percent recoveries are found in Section 5.0 (Tables 5-7 and 5-8).

10.4 MATRIX SPIKES

Matrix spike analysis will be conducted to evaluate accuracy and general matrix recovery. Matrix spikes will be prepared from the makeup water, scrubber purge water, and caustic feed process samples.

Matrix spikes also will be applied to the VOST, MM5, MMT, and acid gas train samples. Volatile and semivolatile target QC percent recoveries are shown in Section 5.0 (Tables 5-4 and 5-5). Additional spiking requirements for volatile, semivolatile, and dioxin and furan analyses are included in Section 6.0.

10.5 SURROGATE SPIKES

The GC/MS analytical procedures require that each sample be spiked with surrogate compounds used to calculate recovery as an indicator of the general accuracy of sample preparation and analysis. The following surrogate compounds will be used for an analysis of volatile POHCs and PICs: toluene-d_8, bromofluorobenzene, and 1,2-dichloroethane-d_4. The following surrogate compounds used for an analysis of semivolatile PICs: nitrobenzene-d_5, fluorobiphenyl, terphenyl-d_{14}, phenol-d_6, 2-fluorophenol, and 2,4,6-tribromophenol. Section 5.0 provides the target QC percent recoveries for volatiles and semivolatile surrogate compounds (Tables 5-2 and 5-3, respectively). These surrogate compounds are the recommended spiking materials used for the U.S. EPA CLP for application to samples being analyzed for semivolatiles and volatiles by Methods 8270 and 8260, respectively.

XAD-2 resin tubes will be spiked with carbon-13-labeled naphthalene during sample tube preparation. The carbon-13-labeled spiking standards used will be prepared from certified stock standards separate from the unlabeled standards used for calibration. Specific spiking requirements are specified in Table 10-2 and in Section 6.0. Target QC percent recoveries are shown in Section 5.0 (Table 5-6).

11.0 DATA REDUCTION, DATA VERIFICATION, AND DATA REPORTING

[*REQUIREMENT: In this section, the applicant shall provide a brief description of the data reduction scheme for nonroutine methods, a listing of all final experimental data, and a listing of all QC data*.]

This section of the QAPP describes the approach used to report, review, and reduce the field and laboratory data into an appropriate presentation format in the trial burn report. The presentation format will present the data to demonstrate compliance with the trial burn objectives. The raw data will be generated as field sampling documentation, sample traceability documentation, laboratory processing documentation, and raw data from analytical instruments. The most significant aspect of data reporting will be the compilation of the analytical results from the laboratory. Analytical results will be compiled in two main report deliverables from the laboratory. They are the analytical data package and the Certificate of Analysis. Following the delivery of the analytical results to the laboratory analysis coordinator, a data verification effort will be undertaken to review the content of these deliverables for compliance with the TBP specifications required of the laboratory. The reported data also will be evaluated for compliance with the DQOs. If the data are determined to have met the analytical requirements, they will then be used to calculate the [*incinerator or boiler*] trial burn performance indicators. The calculation of these performance indicators incorporates the data reduction steps that will organize the trial burn data into a usable database.

11.1 DATA REPORTING

Data reporting is considered to be the compilation of the results from the analytical laboratory. The laboratory deliverables that constitute this compilation are the hard copy analytical data packages and the certificates of analysis. The style and format of the deliverables and the process for completing their compilation is discussed in this section.

11.1.1 Analytical Data Packages

Analytical data packages are formatted and organized using the methods, standards, and format of the EPA CLP. These data packages are stand-alone deliverables that include the instrument raw data, parameter-specific QC documentation, calibration and calibration check performance, and instrumentation performance information. These data are included so that an independent verification of the final analytical results can be conducted. In addition to the raw data, all analytical data packages will contain the following two elements:

- Case Narrative—This portion of the data package identifies project-specific information and any pertinent information from the performing laboratory concerning data quality. It will provide a cross-reference listing of the field sample and laboratory sample identities. The narrative also summarizes the QC data and any difficulties or analytical anomalies encountered during laboratory processing that are considered pertinent to achieving DQOs or project-specific objectives.
- Traffic Reports—This portion of the data package includes the RFA and COC documentation and traceability documentation for all samples.

The remaining analytical data package sections are specific to each type of analysis performed (the associated reference methods are summarized in Table 9-1). The information will be presented in either a CLP format, a CLP-like format, or a raw data format. A CLP format will be used to present the raw analytical data for the following types of analysis:

- Volatiles by GC/MS
- Semivolatiles by GC/MS
- Metals by inductively coupled argon plasma (ICP or ICP/MS) and CVAA

A CLP-like format will be used to present the raw analytical data for the following types of analysis:

- Dioxins and furans by high-resolution GC/MS

- Chloride by ion chromatography
- Hexavalent chromium by ion chromatography
- Formaldehyde by high-performance liquid chromatography (HPLC)

A raw data format used for analytical bench sheets will be used to present the raw analytical data for the following types of analysis:

- Particulate
- Moisture
- Density
- Heat content
- Ash content
- Total chlorine
- Viscosity
- TDS, TSS, and TS
- Elemental analysis
- pH

A CLP data package (or a CLP-like data package) will summarize the raw data on standard EPA forms (or on forms similar to the standard EPA forms). The summary forms are included to tabulate information that is relevant to the analysis in a more accessible fashion. The data packages for volatiles and semivolatiles will include the following summary forms and the supporting raw data:

- Form I - Analysis Data Summary Sheet—This form reports the analytical results of each sample for target analyte(s), as defined in this QAPP and in the TBP. Qualifiers or flags

assigned by the laboratory are reported on this form.

- Form II - Surrogate Recovery Summary—This form reports percent recoveries of surrogate compounds spiked into each sample, duplicate sample, matrix spike sample, laboratory blank sample, and other QC samples. Recoveries that are determined to be outside of the CLP target control limits are flagged on this summary form.

- Form III - Matrix Spike/Matrix Spike Duplicate Recovery Summary—This form summarizes the results of analyses of the MS/MSD samples. The percent recoveries of the spiked compounds and the RPD between the duplicate spiked samples are reported. Recoveries or RPDs that are outside of the CLP target control limits are flagged on this summary form.

- Form IV - Method Blank Summary—This form displays extraction protocol, date of analysis, and specific analytical instruments used to perform an analytical analysis of the laboratory method blank. This summary form also tabulates the samples associated with each method blank analysis.

- Form V - GC/MS Tuning and Mass Calibration Summary—This form reports the results of GC/MS tuning for semivolatiles and summarizes the date and time of analysis of calibration or calibration check standards, samples, blanks, and MS/MSDs associated with each GC/MS tuning.

- Form VIIID - Initial Calibration Data—This form summarizes analyte-specific response factors of the initial calibration for specific instruments with which project samples and all associated QC samples were analyzed.

- Form IX - Continuing Calibration Data—This form is used to demonstrate that a continuing calibration procedure was performed at the beginning of each 12-hour analysis period. As well, the percent difference between the response factors of the initial calibration and the continuing calibration for each compound is given.

The sections of the data packages for metals by ICP or ICP/MS and CVAA will include the following summary forms and the supporting raw data:

- Form I - Inorganic Data Analysis Sheet—This form reports the analytical results of each sample for the target element(s), as defined in this QAPP and in the TBP. Qualifiers or flags assigned by the laboratory are also reported on this form with the results.

- Form II - Initial and Continuing Calibration Verification—This form relates the results of an initial and continuing calibration verification samples processed during the period that sample analyses were conducted. It also presents the recoveries of the elements in the calibration standards.

- Form III - Blanks—This form reports the results obtained when initial, continuing, and method preparation blanks were analyzed.

- Form IV - ICP Interference Check Sample—The form reports the results of an ICP interference check sample, which verifies that the contract laboratory's interelement and background correction factors were effectively implemented and evaluated.

- Form V - Spike Sample Recovery—This form summarizes the results of an analysis of the MS and post-digestion spike samples. The recoveries of the spiked elements are reported, and an element is flagged if it recovers outside of the CLP target acceptance ranges.

- Form VI - Duplicates—This form summarizes the results from an analysis of duplicate samples. The RPDs of the analyses are reported and flagged if they fall outside the CLP target acceptance ranges.

- Form VII - Laboratory Control Sample—This form reports the results of an analysis of the laboratory control sample, which serves to monitor the overall performance of all steps in the analysis procedure.

- Form VIII - Standard Addition Methods—This form summarizes sample identity, element, amount of spike added, observed absorbency, final concentration, and correlation coefficient obtained in the analyses of any sample whose concentration was determined by the method of standard addition.

- Form IX - ICP Serial Dilution—This form summarizes the results of analyses of an original sample and its re-analysis with a five-fold dilution applied. If the percent difference between the two analyses is not acceptable when judged by the CLP target standards, the results are flagged. These results indicate whether any significant physical or chemical interference exists due to the sample matrix.

- Form X - Instrument Detection Limits—This form summarizes instrument detection limits and analytical wavelengths at which they are obtained for each element on a specific instrument.

- Form XI - ICP Interelement Correction Factors—This form presents correction factors that are programmed into the ICP. The correction factors are used to adjust the results

for any interference that occurs between elements. The factors are determined annually.

- Form XII - ICP Linear Ranges—This form summarizes the concentration range over which the ICP has a linear calibration for each element.

- Form XIII - Preparation Log—This form summarizes sample preparation information (sample identity, preparation date, and weight or volume of sample).

- Form XIV - Analysis Run Log—This form displays the identification of the instrument on which the samples were analyzed. It gives the order in which the calibration standards and blanks, the samples, and associated preparation blanks and LCS were analyzed. It also gives the date and time of analysis and the element(s) of analysis.

A CLP-like data package for the analysis of dioxins and furans, PAHs, chloride, hexavalent chromium, or aldehyde does not include all the summary forms included in a CLP data package because some of the summary forms include information that is not part of these analytical methods. However, some CLP-like forms are compiled from the raw data, and all of the available raw data are presented in the CLP-like data package. For dioxins and furans, the information summarized on forms in the data packages will be similar to the summarized information in the portions of the data packages associated with semivolatile compounds. Analytical sample data, method blank data, laboratory-assigned qualifiers, and surrogate and internal standard recoveries for the standard compounds in each sample will be summarized; however, the information usually will be presented on one form. Raw data for GC/MS tuning are typically not summarized in a CLP-like format; however, the initial and continuing calibration raw data usually are summarized on separate forms.

The information summarized on forms in the data packages for chloride by ion chromatography will be similar to the information summarized in the metals portions of the data packages. The analytical result and laboratory-assigned qualifier for each sample analysis will be reported on a form similar to CLP Form I. Results of the MS/MSD analyses, the recovery of the spike, and the RPD between the samples will be summarized on a form similar to CLP Form V. Results of spiked blank analyses will be reported on a form similar to CLP Form VII. Typically, the initial calibration data and the continuing calibration raw data will be summarized.

The data package deliverables that fall under the category of the raw data or bench sheet format are miscellaneous classic parameters whose analyses include little, if any, instrumentation. Because they lack instrumentation, they contain a limited amount of raw data to be presented. Copies of the laboratory sample preparation sheets and the analyst's bench sheets will be included to support the results reported and to document the procedures implemented for each applicable analytical method.

11.1.2 Certificates of Analysis

Certificates of analysis will be presented in a project-specific format that includes both sample collection information and analytical data. These certificates will (1) summarize the analytical results from the data packages and the QAPP target acceptance limits, and (2) present the data in a more formal manner. In general, raw data are not part of the certificate presentation. The basic format used with the certificates is as follows:

- Case Narrative—The case narrative included with the certificates is essentially the same as the case narrative generated for the data package. Raw data are not included with the certificates, so more detail is often provided in this narrative than in the narrative provided with the data package.

- Analytical Results—The data on the project-specific target analyte(s) and the assigned laboratory qualifiers are taken from each Form I (or its equivalent) and summarized. The certificates for dioxin and furan analysis are typically reported in the same format as their Form I equivalent presented in the data package. Definitions for assigned laboratory qualifiers are included on the certificate.

- Surrogate Recoveries—If surrogate compounds are used in the analysis, their recoveries are summarized in the certificate format. QAPP target acceptance limits will be tabulated on the certificate, and recoveries that do not meet the target criteria will be flagged. For the dioxin and furan analysis, the recoveries of the isotope dilution internal standards are reported on the certificates.

- Matrix Spike Information—For all matrix spike analyses performed, the results and the accuracy and precision determinations will be reported on certificates. QAPP target acceptance limits will be given, and any determinations that fall outside of the target limits will be flagged.

- Duplicate Information—For the duplicate analyses performed, the results and the precision determinations will be reported in the certificate format. QAPP target acceptance limits will be included, and any determinations that fall outside of the target limits will be flagged.

11.1.3 Analytical Data Results

Depending on the analytical parameter, the laboratory recognizes three different quantitation limits for presentation of analytical results. The limits are (1) MDL, (2) instrument detection limit (IDL), and (3) PQL. The three limits will be encountered when evaluating the analytical results of the trial burn samples.

The MDL is defined as the minimum concentration of a substance that can be measured and reported with a 99 percent confidence that the analyte concentration is greater than zero. It is a statistical limit that is matrix independent. The MDL is determined from an analysis of seven replicate samples with analyte present at three to five times the estimated MDL. The MDL is determined by using the following formula:

$$MDL = \sigma \times t$$

where:

σ = standard deviation
t = Student's t-test value

With a 99 percent confidence interval and with seven analytical determinations (n = 7), and n-1 degrees of freedom, the Student's t-test value is 3.14. Therefore, if a sample contains a target analyte at a concentration equal to or greater than the MDL, it can be said with 99 percent confidence that the analyte would be detected. The MDL, however, is an absolute measurement and, as such, does not factor in the accuracy of the quantitation. The MDL is used, in general, with organic analyses.

For inorganic analyses, often the IDL is used. The IDL is defined as the smallest signal above background noise that an instrument can detect reliably. The IDL is determined by multiplying by three, the average of a standard deviation obtained from a signal from the analyte in a series of seven replicate measurements of a reagent blank's signal at the same wavelength. The equation for the calculation of IDL is identical to the equation for calculating the MDL. It is, therefore, like the MDL, a statistical limit and is matrix independent.

The PQL is defined as the lowest level that can be achieved reliably within specified limits of precision and accuracy during routine laboratory operating conditions. It is matrix dependent and is simply calculated as a multiple of the MDL or the IDL. Each compound or element is assigned a multiplier that is contingent upon the behavior of the compound or element during analysis. Changes to extraction protocol, amount of sample used in preparation, or dilution applied to the sample can raise or lower the PQL.

Data that will be reported as "not detected" will use the reporting limit for the lower limit. The reporting limit will be defined as the quantitation level that corresponds to the lowest level at which the entire analytical system gives reliable signals and an acceptable calibration point or low-level matrix spike. The trial burn report will provide data for establishing reporting limits that are to be included in calculations.

The analytical results for dioxins and furans and for PAHs are quantitated differently. They are quantitated using an isotope dilution method. Each sample is spiked with an isotopically labeled surrogate for each target compound. On a sample-by-sample basis, the recovery of each surrogate is determined; then, the analytical result is normalized to the recovery of the corresponding surrogate compound. In this manner, the PQL for each sample and each compound can vary as the surrogate recovery varies. This isotope dilution method is considered to be the most accurate quantitation method available for these analyses.

The results of sample analyses will be reported in concentration units. Sample results will be reported for

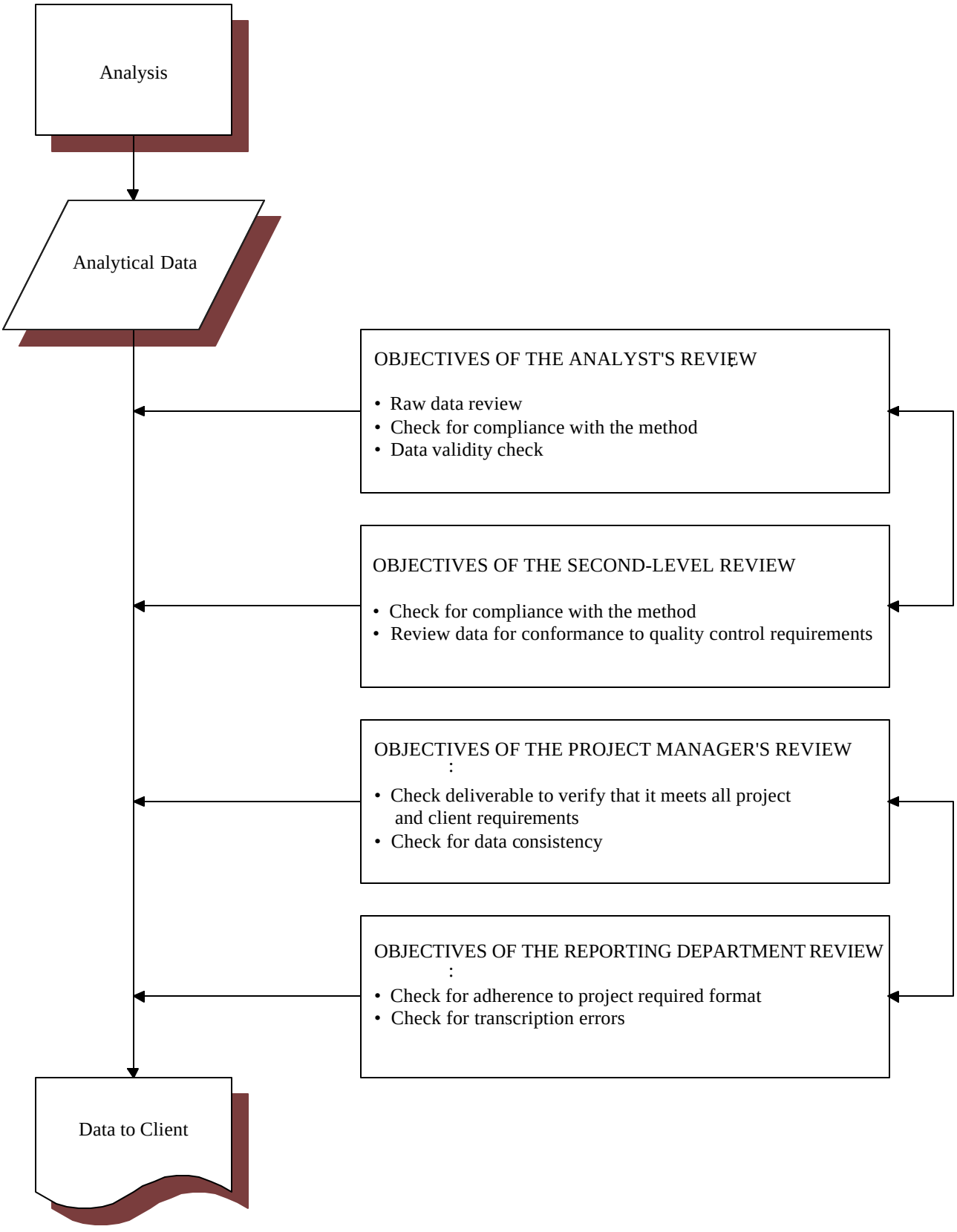
all samples and parameters required for the trial burn, as listed in Table 9-1 of this QAPP and in the TBP. Based on guidelines found in the analytical method, CLP, or in this QAPP, the laboratory will assign qualifiers to the results, when appropriate. Qualifiers appearing on a certificate of analysis are defined on that specific certificate. Data presented on tables in this report will carry all data qualifiers.

11.1.4 Report Preparation

For this trial burn report, the laboratories will follow standard operating procedures, applying the reporting process steps for the deliverables. The process to be used for the analytical laboratories is outlined in Figure 11-1.

FIGURE 11-1

INTERNAL DATA REVIEW PERFORMED BY THE LABORATORY



First, the analyst will review the calculations to confirm that the analytical results are correct. An analysis-specific data review checklist will be used to ensure that all preparation and analysis documentation for the test run and the QC samples is included in the data package. The analyst also will check the accuracy and completeness of the CLP and CLP-like summarization forms. Next, the data package will undergo peer review by the group leader or section head. This review will include an examination of at least 20 percent of all items listed in the checklist. If any deficiencies are found, they will be corrected after the analyst has been informed, and the deficiencies will be reviewed together. The laboratory project manager will perform the final review of the deliverables to check for completeness and to determine that the client's requirements for data quality were met.

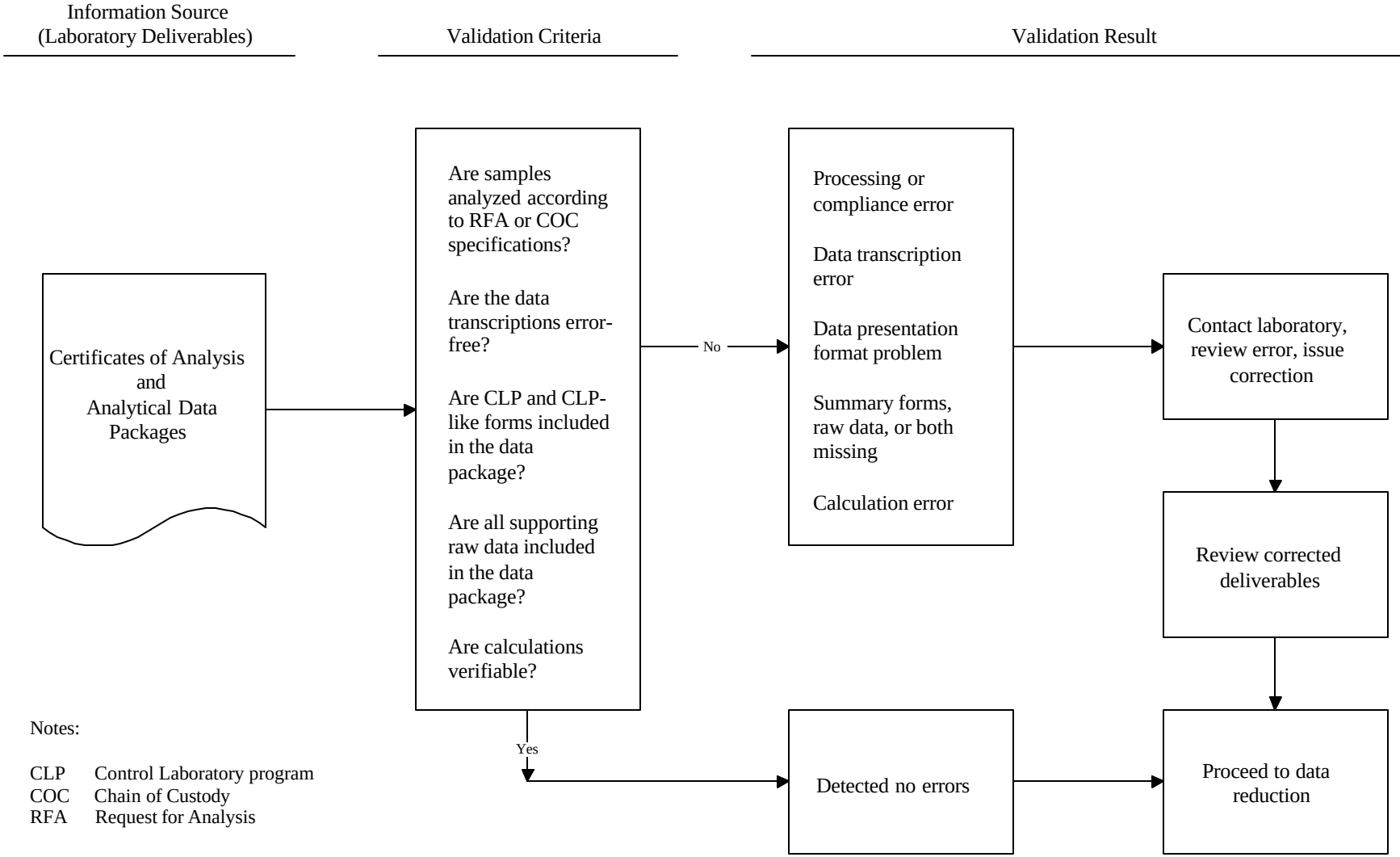
11.2 DATA REVIEW

The data review process is summarized in Figure 11-2. The data review process will be initiated when the laboratory analysis coordinator receives the certificates of analysis and analytical data packages from the laboratory and verifies that each sample was analyzed correctly for the parameter requested on the RFA and COC forms. This review of the deliverables will confirm that all laboratory QC (e.g., MS/MSD and duplicate analyses) requested on the RFA and COC forms was performed, and the results were reported. Table 10-1 of this QAPP shows the required QC samples and frequencies associated with this project. After this initial review, data reported on the certificates, each data package Form I, and raw data are compared to verify that no transcription errors occurred during reporting.

Next, the data for each analytical parameter will be reviewed thoroughly for each individual sample to ensure that all the pertinent information is included in the analytical data package. Table 10-2 of this QAPP identifies the QC checks and frequencies associated with each method of analysis for all trial burn samples. This review will confirm that the data are usable for an assessment of incinerator performance.

FIGURE 11-2

DATA VALIDATION AND REVIEW FLOW SCHEME



11.2.1 CLP Format Data Package Review

The CLP forms in data package sections for volatile and semivolatile will undergo a thorough review. Each Form II (surrogate recoveries) will be reviewed to identify samples with surrogate recoveries reported. The recoveries will be reviewed for compliance with the CLP target acceptance ranges. Second, the sample identities on each Form III (MS/MSD analysis) will be checked against the RFA and COC forms to confirm that an MS/MSD analysis has been performed for the requested sample(s). The recoveries and RPDs of the MS/MSD analyses will be reviewed for compliance with the CLP target acceptance ranges. Third, each Form IV (method blanks) will be checked to confirm that every sample analyzed will be associated with a method preparation blank. The data packages will be checked to verify the presence of all the supporting raw data for each method preparation blank. Fourth, from the information given on Form V (GC/MS tuning), the dates for the initial and continuing calibrations will be determined. Next, the data packages will be then checked for supporting raw data of each of the GC/MS tunings listed and for Form VIII information (initial and continuing calibrations) associated with each initial and continuing calibration and the supporting raw data. Fifth, for a minimum of one compound per project and QC sample, the tabulated result will be recalculated manually to validate that the analytical result has been calculated and transcribed correctly.

11.2.2 Inorganic Analyses Data Review

In reviews of data package sections for metals, the CLP forms will undergo a thorough review. First, the run logs will be inspected to determine the dates, instrument used, and element(s) of analyses. As well, the run logs will be checked to verify that the correct number of standards have been analyzed in the generation of the calibration curve. Second, each Form II (calibrations) and III (blanks) will be examined to determine that the number of initial calibration verifications and initial calibration blanks analyzed matches the number of dates of analysis listed in the run logs. Also from each Form III (blanks), a verification will be done to determine that each sample analyzed by each method is associated with a method preparation blank. Third, the sample identities on each Form V (MS/MSD analysis) and Form VI

(duplicate analysis) will be checked against the RFA to verify that each requested sample has had an MS/MSD or duplicate analysis performed. The recoveries and RPDs of the MS/MSD analyses and the RPDs of the duplicate analyses will be reviewed for compliance with the CLP target acceptance ranges. Fourth, for a minimum of one element per method on each trial burn run and QC sample, the calculated results will be re-calculated to validate that the analytical results have been calculated and transcribed correctly.

In reviews of data package sections for chloride, the sample identities listed as MS/MSD samples or as duplicate samples will be checked against the RFA to verify that each requested sample has had an MS/MSD or duplicate analysis performed. The recoveries and RPDs of the MS/MSD analyses and the RPDs of the duplicate analyses will be reviewed for compliance with the CLP target acceptance ranges.

11.2.3 CLP-Like Data Package Review

In reviews of data package sections for dioxins and furans, the case narrative, methodology used, and the QC sample program will be reviewed. Concentrations in standard solutions (e.g., natives, internal standards, and recovery standards) and spiking solutions will be examined. The percent RSD for each analyte on the initial calibration will be reviewed for compliance with target limits. The percent difference for each analyte in the continuing calibration summaries will be checked for compliance with the target limits. The sample tracking sheets will be reviewed to confirm that the sample weights, volumes, spike volumes, and final extract volumes have been included for each trial burn run sample and QC sample. Finally, the concentrations, flags, and qualifiers in the sample results summary will be reviewed for each trial burn run sample and each QC sample.

11.2.4 Classic Parameter Data Review

In reviews of data package sections for the classic parameters, the sample identities listed as duplicate samples will be checked against the RFA form to verify that a duplicate analysis has been performed for the requested sample(s). The RPDs of the duplicate analyses will be reviewed for compliance with the

CLP target acceptance ranges. The preparation and bench sheets will be examined to ensure that each date of analysis has the documentation needed to determine holding times and usability of the sample data.

If, during the review process, any errors or deficiencies are found in the certificates of analysis or in the analytical data packages, they will be noted by the reviewer, and the laboratory project manager will be notified so that corrected pages can be issued for inclusion into the trial burn report. The corrected pages are then reviewed upon submittal for accuracy before incorporation into the data package or certificate set.

11.3 DATA REDUCTION

When the data review process is complete, the certificates of analysis will be separated by type as either analytical or QC results. Both the analytical and the QC results will be summarized in tables for presentation in the final trial burn report and reduced into a form that is usable in the determination of the incinerator's performance. This process is shown in Figure 11-3.

11.3.1 Analytical Data Summary

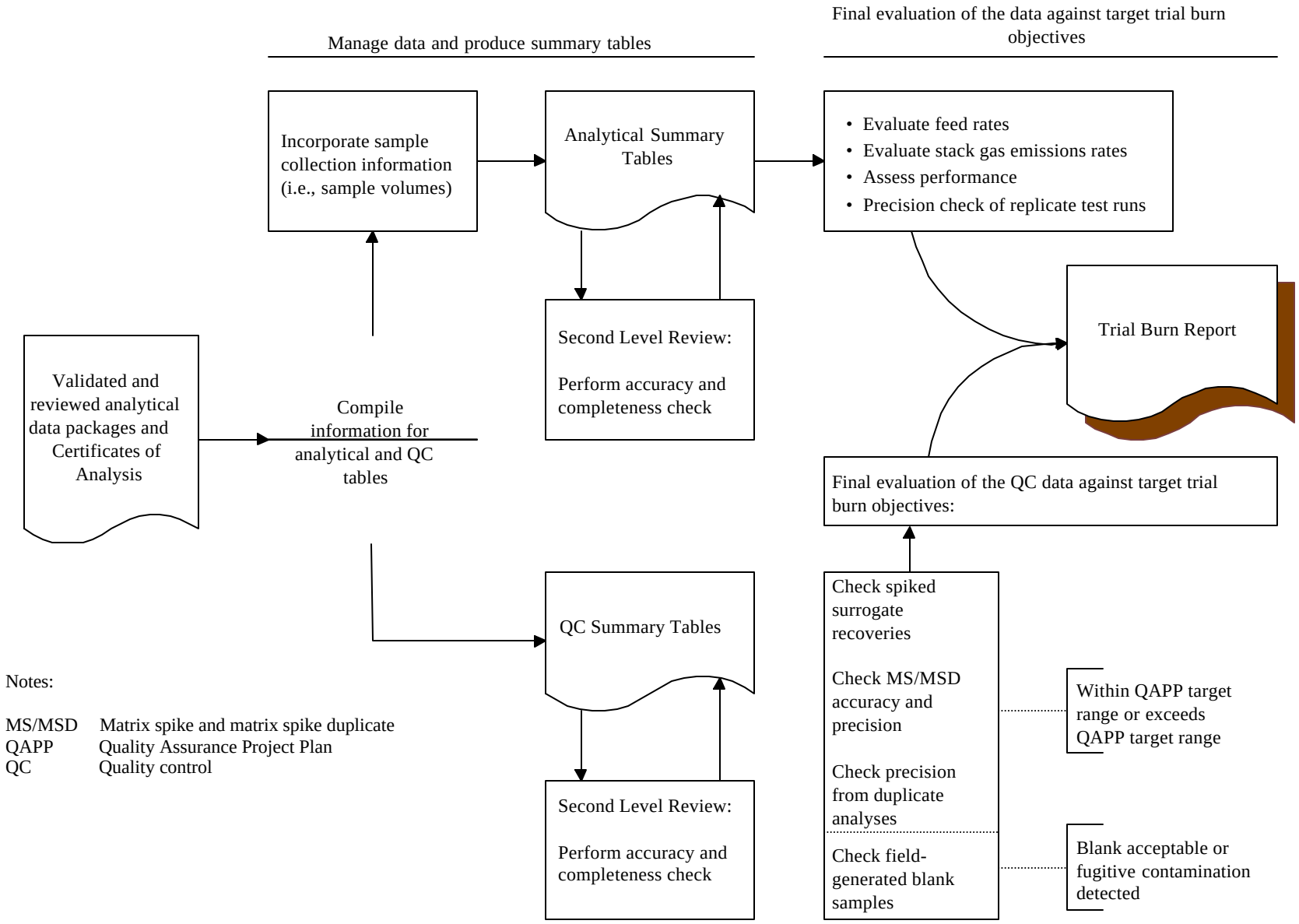
Analytical data summary tables will be included in the trial burn report and are categorized primarily by analytical parameter. Typically, these tables will summarize the following data:

- Waste feed samples volatiles analytical results
- Process samples volatiles analytical results
- MM5 train semivolatiles analytical results
- MM5 train dioxin and furan analytical results
- MM5 train PAH analytical results
- MM5 train TCO/GRAV analytical results

- M5 metals and mercury train analytical results
- M5 hydrogen chloride, chlorine, and particulate train analytical results
- Hexavalent chromium train analytical results
- Method 0040 train volatile unspeciated mass analytical results
- Method 0011 train formaldehyde analytical results

FIGURE 11-3

DATA REDUCTION FLOW SCHEME



Notes:

MS/MSD Matrix spike and matrix spike duplicate
QAPP Quality Assurance Project Plan
QC Quality control

In the summary tables, the data for waste feed, process, and stack gas train samples will be summarized for all runs or on a run-by-run basis and presented. The feed and process sample results will be presented, in general, in terms of mass per unit volume (for liquid matrix samples) or weight (for solid matrix samples). The data for stack gas samples will be presented on a per tube basis (for VOST samples) or on a front-half and back-half composite sample basis. Front-half and back-half results are, in general, reported from the laboratory in terms of mass per unit volume. These concentrations will be converted to total train mass collected by multiplying the recorded final volumes found on the field stack gas sample collection sheets by the concentration reported from the laboratory. Total mass of the front half and back half will be added together into a train total that can be incorporated into DRE or emission calculations. In instances in which the analyte concentration in an analyzed train sample is below the PQL, the PQL and a "less than" symbol will be the reported value in the table for the result, and the value will be used for any DRE and emission calculations. Any estimated quantitation reported from the laboratory will be flagged on the analytical summary tables.

The laboratory analysis coordinator will be assisted by the analytical project manager during the evaluation of the results to determine if the project objectives have been met by the reported data. All data collected during this project will be validated through the review process described in this section and will be reported. If anomalous results are obtained, every effort will be made to identify the reason for the anomaly in the sample collection, sample preparation, or analysis. If any anomalies have occurred, the trial burn report will include the results of the affected sample data, a thorough discussion of occurrence, and its impact on overall data usability.

11.3.2 Quality Control Data Summary

The QC data summary tables are found in the QA/QC report appendix of the trial burn report and are organized by parameter. Types of QC data summary tables that will be included in the trial burn report are as follows:

- Sample holding times
- Sample surrogate recovery results
- Matrix spike results
- Duplicate results
- Field blank results
- Trip blank background results
- Blank train background results
- Reagent blank background results
- CEM calibration checks

Within each parameter, the tables will be categorized as accuracy determinations (e.g., surrogate recoveries and MS/MSD analysis), precision determinations (MS/MSD analysis and duplicate analysis), and contamination evaluation results (information on field-generated blanks). The surrogate recoveries, the recoveries and RPDs from the MS/MSD analyses, and the RPDs from the duplicate analyses and any other accuracy or precision estimates will be checked against the QAPP target acceptance limits found in Section 5.0. Any data that fall outside of the QAPP target acceptance limits will be flagged or footnoted on the QC data summary tables. The data from the field-generated blanks will be sorted into categories such as field blanks, trip blanks, reagent blanks, and blank trains. The data from the field blanks and trip blanks will be interpreted in the QA/QC report to show that the samples could be handled in the field and transported to the laboratory without contamination problems. The reagent blank and blank train results will be interpreted to represent the amount of contamination from reagents or handling that will be present in a train before sampling has begun. In instances in which the analyte concentration in an analyzed train sample is below the PQL, the PQL and a "less than" symbol will be the reported value in the table for the result, and the value will be used for any DRE and emissions calculations.

The laboratory analysis coordinator will be assisted by the analytical project manager during an evaluation of the results to determine if the QC target acceptance criteria have been met by the reported data. Any data that do not meet the target criteria will be flagged, footnoted, and discussed in the final report. All data collected during this project will be validated through the review process described in this section and will be reported. If anomalous results are obtained, every effort will be made to identify the reason for the anomaly in the sample collection, sample preparation, or analysis. If any anomalies have occurred, the trial burn report will include the results of the affected sample data, thorough discussion of the occurrence, and its impact on the data.

11.4 TRAIN TOTAL CALCULATIONS

The calculation of the train total of an analyte is the sum of two or more fractions of train components. When a measurable amount of an analyte is found in one or more fractions, but the amount in the remaining fraction is below the reporting limit of the method, then the following strategy will be recommended, but is subject to an overruling by regulatory authorities. When a "nondetect" value is reported that is less than 10 percent of the total amount from fractions that have detected quantities, the values not detected will be counted as zero. In cases in which the detection limit reported is greater than 10 percent of the total detected amount in the other fractions, then the detection limit will be added to the total detected analyte and a "<" flag will be reported with the reported total.

Calculations will be carried out to at least one decimal place beyond that of the acquired data and should be rounded after final calculations to two significant figures for each analyte for each train total. Rounding of numbers should conform to procedures found in ASTM 380-76.

12.0 ROUTINE MAINTENANCE PROCEDURES AND SCHEDULES

[*REQUIREMENT: In this section, the applicant shall list all critical equipment necessary to maintain permit operating conditions and shall demonstrate continuing compliance to the permit.*]

Routine maintenance of sampling and analytical equipment used during the project will be performed in accordance with the procedures and schedules set forth in manufacturers' maintenance manuals and as described in appropriate sections of standard methods. Routine maintenance of all analytical instruments will follow the procedures and schedules as prescribed in the analytical laboratory's QA manual and the standard operating procedures written for each instrument.

A record of all routine maintenance performed will be made in a service record logbook for each instrument. If the performance of the instrument could have been affected by the maintenance procedure calibration, check samples, where appropriate, will be analyzed, and the results will be recorded in the maintenance record logbook before any samples are analyzed. Whenever parts are replaced, the serial number of the new part (if available) or an assigned serial number will be logged into the maintenance record logbook. When parts are replaced, check standards will be analyzed to demonstrate correct operation of the system.

13.0 ASSESSMENT PROCEDURES FOR ACCURACY, PRECISION, AND COMPLETENESS

[*REQUIREMENT: In this section, the applicant shall provide the formulae that will be used to determine the accuracy, precision, and completeness of the analytical measurements.*]

The QA activities implemented in this study will provide a basis for assessing the accuracy and precision of the analytical measurements. Section 5.0 of this QAPP discusses the QA activity that will generate the accuracy and precision data for each sample type. A generalized form of the equations that will be used to calculate accuracy, precision, and completeness follows.

13.1 ACCURACY

Percent accuracy will be determined using the following equation:

$$Percent\ Recovery = \frac{(X - S)}{T} \times 100$$

where:

X = Experimentally determined concentration of the spiked sample
T = True concentration of the spike
S = Sample concentration before spiking

13.2 PRECISION

Precision will be determined using the following equation:

$$Relative\ Percent\ Difference\ (RPD) = \left[\frac{(D_1 - D_2)}{\left(\frac{D_1 + D_2}{2}\right)}\right] \times 100$$

where:

D_1 and D_2 = Results of duplicate measurements or standard deviation relative to the average value expressed as relative standard deviation:

Relative standard deviation will be expressed as follows:

$$Relative\ Standard\ Deviation\ (\%RSD) = \left(\frac{\sigma_{(n-1)}}{\bar{x}\ (x_1 \ldots x_n)}\right) \times 100$$

where:

$\sigma_{(n-1)}$ = Standard deviation of the sample data
n = Number of replicates
$\bar{x}\ (x_1..x_n)$ = Arithmetic mean of the sample data

13.3 COMPLETENESS

Data completeness is a measure of the extent to which the database resulting from a measurement effort fulfills objectives for the amount of data required. For this program, completeness will be defined as the percentage of valid data for the total valid tests. Completeness is assessed using the following equation:

$$Completeness\ (\%) = \left(\frac{D_r}{D_c}\right) \times 100$$

where:

D_r = Number of samples for which valid results are reported
D_c = Number of valid samples that are collected and reach the laboratory for analysis

The completeness objective will help to evaluate the accuracy and precision of the analytical measurements.

14.0 AUDIT PROCEDURES, CORRECTIVE ACTION, AND QUALITY ASSURANCE REPORTING

[*REQUIREMENT: In this section, the applicant shall describe in detail all QA activities for both the trial burn activities and the routine incinerator operation. The applicant shall include all audits and QA reports that will be generated.*]

14.1 AUDIT PROCEDURES

Sampling performance audits will be accomplished through observation of the sampling operations by the regulatory agency representative and the laboratory analysis coordinator.

Analytical performance audits will consist of the replicate analysis and spiked sample procedures outlined in Section 9.0 of this document. If deemed necessary by the trial burn manager and laboratory analysis coordinator, SRMs will be submitted for analysis as blind QC samples.

14.2 CORRECTIVE ACTION

The need for corrective action will occur when a circumstance arises that adversely affects the quality of the data output. In order for corrective action to be initiated, an awareness of a problem must exist. In most instances, the personnel conducting the field work and the laboratory analysis will be in the best position to recognize problems that will affect data quality. Frequently, keen awareness on their part can detect minor instrument changes, drifts, or malfunctions that can then be corrected, thus preventing a major breakdown of the system. If major problems arise, they will be in the best position to decide upon the proper corrective action and initiate it immediately, thus minimizing data loss. Therefore, the field sampling and laboratory analysis personnel will have a prime responsibility for recognizing the need for a nonconformance report. Each nonconformance will be documented by the personnel identifying or originating it. For this purpose, a variance log (see Figure 14-1), a testing procedure record, a notice of equipment calibration failure, results of laboratory analysis QC tests, an audit report, an internal

memorandum, or a letter will be used, as appropriate.

FIGURE 14-1

EXAMPLE VARIANCE LOG

Variance No: _____
Project No.: _____
Project Name: _____

Page No. _____ of _____
Date: _____

Variance (include justification):

Applicable Document:

cc: Requested by: _____ Date: _____

Approved by: _____ Date: _____

Project Manager: _____ Date: _____

Quality Assurance Officer: _____ Date: _____

The following documentation will be included:

- Identification of the individual(s) identifying or originating the nonconformance report
- Description of the nonconformance
- Any required approval signatures
- Method(s) for correcting the nonconformance (corrective action) or description of the variance granted
- Schedule for completing corrective action

Documentation in the form of a nonconformance report (see Figure 14-2) will be made available to project and laboratory management. The trial burn manager and the laboratory analysis coordinator will be responsible for notifying appropriate personnel of the nonconformance. Samples affected will be listed on the nonconformance report.

Decisions on whether to take corrective action and which action(s) to take will be made by the trial burn manager if the nonconforming situation occurs in the field or by the laboratory analysis coordinator if the nonconforming situation occurs in the laboratory. When a corrective action is taken by any of the operations or analytical laboratory personnel, they will be responsible for notifying the trial burn manager so that, if deemed necessary, QA surveillance of the affected sampling or analysis system can be intensified. Nonconformance and corrective action reports will become part of the trial burn report or the supporting data files. A second recognition level of the need for corrective action will be determined by the laboratory analysis coordinator who will determine the need for corrective action from the results of audits described in Section 14.0 and from review of the QA data generated during the study. The laboratory analysis coordinator will be responsible for initiating corrective action by immediately notifying the trial burn manager during the sample analysis phase. The appropriate management will then be responsible for instituting corrective action and verifying that the corrective actions produce the desired results. Ultimately, the personnel performing and checking the sampling and analysis procedures and results must participate in decisions to take corrective actions. To reach the appropriate decision, each individual must understand the program objectives and data quality required to meet these objectives.

FIGURE 14-2

EXAMPLE NONCONFORMANCE REPORT

Project No.: _____ Page No. _____ of _____
Project Name: _____ Date: _____

Nonconformance:

Identified by: _____ Date: _____

Corrective Action Required:

To be reported by: _____ Date: _____

Must Corrective Action be Verified? YES _____ NO _____

To be verified by: _____

Prepared by: _____ Date: _____

Corrective Action Taken:

Performed by: _____ Date: _____

Verified by: _____ Date: _____

Approved by: _____ Date: _____

_____ Date: _____

_____ Date: _____

DQOs for this program are presented in Section 5.0. Criteria for data acceptance are presented in Tables 5-1 and 10-2 of this QAPP. Personnel involved in the project will receive or have available to them an approved copy of this QAPP and will be informed of these objectives. Each individual will have a responsibility to notify the respective field sampling or laboratory operations supervisor whenever a measurement system is not yielding data within these objectives. If a situation arises requiring corrective action, the following closed-loop corrective action system will be used:

- Define the problem.
- Assign responsibility for investigating the problem.
- Investigate and determine the root cause of the problem.
- Determine the course of corrective action needed to eliminate the root cause of the problem.
- Assign responsibility for implementing the corrective action.
- Determine the effectiveness of the corrective action, and implement the correction.
- Verify that the corrective action has eliminated the root cause of the problem.
- If not completely successful, loop back to the first step.

14.3 QUALITY ASSURANCE REPORTING

The trial burn manager, stack sampling coordinator, and laboratory analysis coordinator will review the QAPP during the course of the trial burn execution. Immediately, the trial burn manager will give the project manager verbal notification of any event or occurrence that could have a significant effect on the validity of the trial burn results. Verbal notification will be followed by a written memorandum, which will include the proposed corrective action. QA will be assessed in the trial burn report for each analytical parameter.

14.4 THIRD-PARTY AUDIT

A QA auditor or audit team that is independent of the [*Enter Company Name*], the [*Enter Stack Sampling Company*], and [*Enter Laboratory Name*] will be assigned to this project and will have the following responsibilities:

- Performing inspections of process equipment, process controls, data acquisition and recording systems, process operations, and sampling activities for compliance with this QAPP and the TBP
- Performing audits of the analytical laboratories for compliance with this QAPP and the TBP
- Reviewing stack sampling and analytical reports for completeness and accuracy
- Documenting the results of these inspections and audits in a written report that will be furnished to [*Enter Company Name*], [*Enter State Regulatory Agency*], and EPA within [*Enter Number*] days of the completion of field activities

ATTACHMENT B

SUPPORTING INFORMATION FOR SECTION 2.0
HOW TO REVIEW ELEMENT 1—THE TITLE PAGE WITH APPROVALS

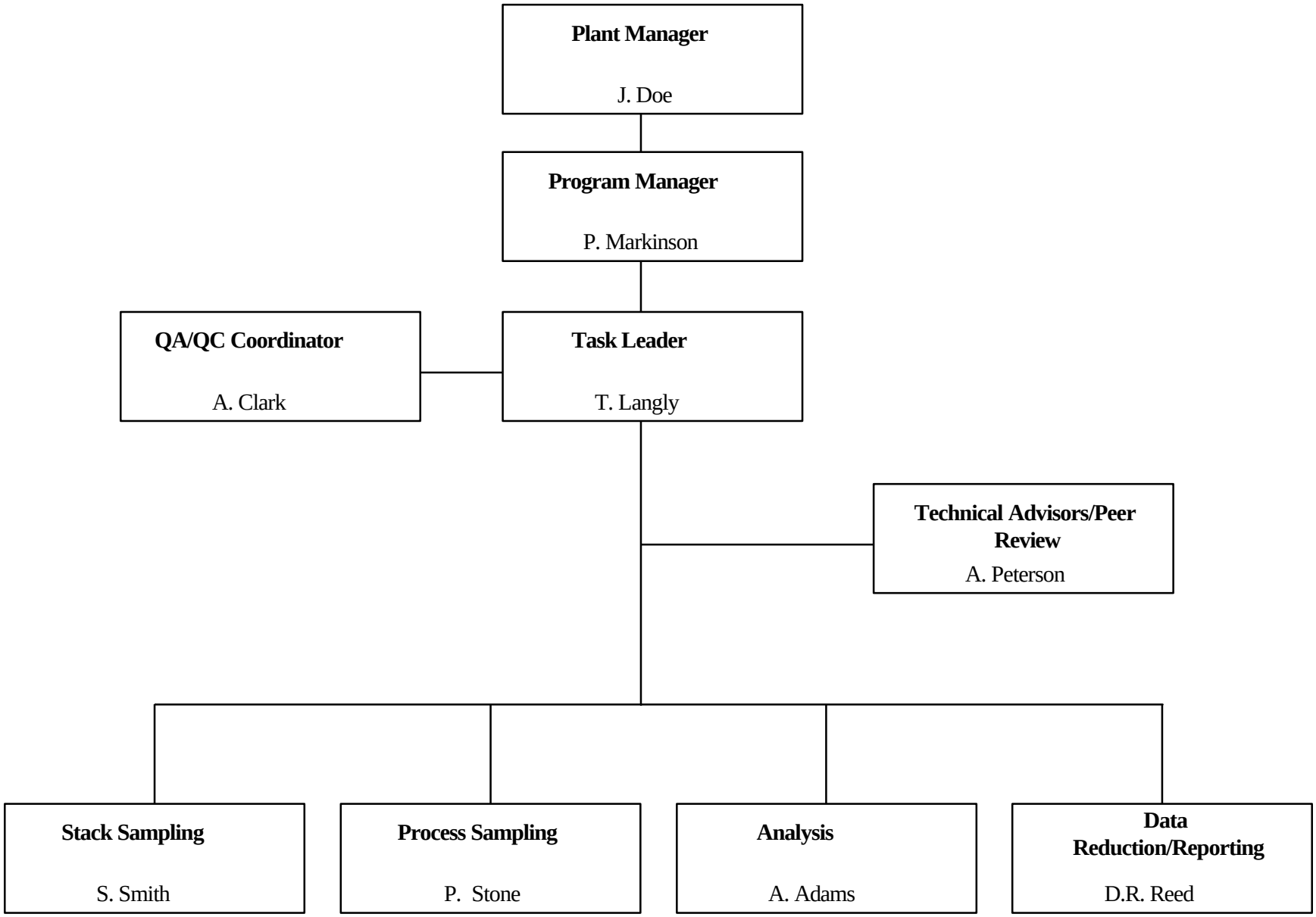
(6 Sheets)

ATTACHMENT B-1

XYZ Corporation
Quality Assurance Project Plan

APPROVALS:

Project Manager	Date
Task Leader	Date
Quality Assurance Coordinator	Date
Facility Project Manager	Date
Peer Reviewer	Date
Permit Writer	Date



Project Organization

Table 8-1

Sampling/Analytical Matrix for Trial Burn

Sample Location/ Description	Number of Runs			Sample Method or Type	Parameters	Analytical Method	Analytical Laboratory
	Test Condition 1	Test Condition 2	Test Condition 3				
Stack Emissions	4	4	3	SW-846 Method 0030	Volatile Organics	SW-846 5041/8240	Toxic Air, Inc.
	4	4	3	SW-846 Method 0010 (Modified Method 5)	Semivolatile Organics	SW-846 8270	123 Analytical Services
	3	3	3	40 CFR Part 60, Appendix A, Method 23/CARB Method 428	Dioxins/Furans	EPA Method 23/ CARB Method 428	Mesa Analytical
	3	3	3	40 CFR Part 60, Appendix A, Method 23/CARB Method 428	PCBs	EPA Method 23/ CARB Method 428	Mesa Analytical
	4	0	3	40 CFR 266, Appendix IX	Metals	SW-846 Methods	SAR
	4	0	0	40 CFR 266, Appendix IX, Method 0050	Particulate Matter	40 CFR 60 Method 5	SAR
	4	0	3	40 CFR 266, Appendix IX, Method 0050	HCl/Cl_2	SW-846 Method 9056	SAR

2-B-4

ATTACHMENT B-2

APPROVAL PAGE

QUALITY ASSURANCE PROJECT PLAN

PROJECT MANAGER

PROJECT MANAGER

QA MANAGER

QA MANAGER

U.S. EPA PROJECT COORDINATOR/RCRA PERMIT WRITER

U.S. EPA REGIONAL QUALITY ASSURANCE MANAGER

ATTACHMENT C

SUPPORTING INFORMATION FOR SECTION 3.0
HOW TO REVIEW ELEMENT 2—THE TABLE OF CONTENTS

(4 Sheets)

TABLE OF CONTENTS

TEXT

5.0 QUALITY ASSURANCE PROJECT PLAN
Title and Approval Page
Table of Contents

5.1 INTRODUCTION

5.2 PROJECT DESCRIPTION
5.2.1 Facility History/Background Information
5.2.2 Past Data Collection Activity/Current Status
5.2.3 Project Objectives and Scope
5.2.4 Sample Network Design and Rationale
5.2.5 Parameters to be Tested and Frequency
5.2.6 Data Quality Objectives
5.2.7 Project Schedule

5.3 PROJECT ORGANIZATION AND RESPONSIBILITY

5.4 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA
5.4.1 Level of Quality Control Effort
5.4.2 Accuracy, Precision, and Sensitivity of Analysis
5.4.3 Completeness, Representativeness and Comparability

5.5 SAMPLING PROCEDURES

5.6 SAMPLE CUSTODY
5.6.1 Field Chain of Custody Procedures
5.6.2 Laboratory Chain of Custody Procedures
5.6.3 Final Evidence Files Custody Procedures

5.7 CALIBRATION PROCEDURES AND FREQUENCY
5.7.1 Field Instruments/Equipment
5.7.2 Laboratory Instruments

5.8 ANALYTICAL PROCEDURES

5.9 INTERNAL QUALITY CONTROL CHECKS AND FREQUENCY

5.2 PROJECT DESCRIPTION

This plan has been prepared in support of an RFI Phase III work plan. The objective of this investigation is to determine if any release of hazardous constituents has occurred from SWMUs 1 and 2 at the XYZ facility.

The proposed field activities will consist of the collection of subsurface soil samples. The purpose of the RFI Phase III sampling is to provide additional information on both subsurface lithology and the existence of a release of hazardous constituents.

5.2.1 Facility History/Background Information

A detailed facility history, including background information, is provided in Section 2 of this work plan. XYZ has closed its RCRA Part B portion of the permit as of April 17, 1996 by the State Department of Environmental Management.

5.2.2 Past Data Collection Activity/Current Status

Details of past data collection activities are presented in Section 2.3 of this work plan.

5.2.3 Project Objectives and Scope

Project objectives and scope are described in Section 1 of this work plan.

5.2.4 Sample Network Design and Rationale

The sample network design and rationale for sample locations is described in detail in Section 3.2.2 of the Data Management Plan and Sections 4.2, 4.4, and 4.5 of the Sampling and Analysis Plan (SAP).

5.2.5 Parameters to be Tested and Frequency

Sample matrices, analytical parameters and frequencies of sample collection are presented in Table 5-1. Justification for parameter selection is provided in Section 4.6.3.

TABLE 5-1

SAMPLING & ANALYSIS SUMMARY

Sample Matrix	Analytical Parameters	Samples	Field Duplicate	MS/ MSD	Field, Trip & Equipment Blank	Matrix Total
Soil	Polynuclear Aromatic Hydrocarbons	36	4	4	4	48
	Volatile Organics	36	4	4	5	49
	Arsenic	36	4	4	4	48
	Barium	36	4	4	4	48
	Cadmium	36	4	4	4	48
	Chromium	36	4	4	4	48
	Lead	36	4	4	4	48
					4	48
					4	
Ground-water	Polynuclear Aromatic Hydrocarbons	32	4	4	8	48
	Volatile Organics	32	4	4	4	44
	Arsenic	32	4	4	4	44
	Barium	32	4	4	4	44
	Cadmium	32	4	4	4	44
	Chromiun	32	4	4	4	44
	Lead	32	4	4	4	44

5.2.6 Data Quality Objectives

Data Quality Objectives (DQOs) are qualitative and quantitative statements which specify the quality of the data required to support decisions made during RFI activities and are based on the end uses of the data to be collected. As such, different data used may require different levels of data quality. There are two analytical levels which address the data uses and QA/QC effort and methods required to achieve the desired level of quality needed for this investigation. These levels are:

Screening (DQO Level 1): This provides the lowest data quality but the most rapid results. It is only to be used for health and safety monitoring at the site. These types of data include those generated on-site through the use of the photoionization detection (PID) or flame ionization detection (FID) equipment.

Confirmational (DQO Level 4): This provides the highest level of data quality and is used for pusposes of risk assessment, evaluation of corrective measures, and release determination. These analyses shall be performed in accordance with SW-846 analytical and data validation procedures.

5.2.7 Project Schedule

The RFI shall begin upon approval of this work plan. A detailed schedule can be found in Section 3.4.

ATTACHMENT D

SUPPORTING INFORMATION FOR SECTION 4.0
HOW TO REVIEW ELEMENT 3—THE PROJECT DESCRIPTION

(16 Sheets)

1.0 PROJECT DESCRIPTION

XYZ Corporation will conduct a Trial Burn on Kiln 1 at its plant to demonstrate compliance with the performance specifications described in 40 Code of Federal Regulations (CFR) Parts 266.104 through 266.107 for the combustion of specific hazardous wastes, regulated under the Resource Conservation and Recovery Act (RCRA). Operating limits that will be demonstrated and/or included in the facility's RCRA permit will be developed from Trial Burn results. The two identical kilns at the facility are currently being operated under the interim status requirements specified in 40 CFR Parts 265 and 266, Subpart H.

The Trial Burn Plan, dated April 1996, which serves as a companion document to this QAPP is designed to demonstrate compliance with the performance standards of 40 CFR Parts 266.104 through 266.107, including:

- Destruction of organic constituents, in particular, 99.99% destruction and removal efficiency (DRE) of the selected principal organic hazardous constituents (POHCs);
- Limitation of stack total hydrocarbon concentration to less than 20 ppmv, adjusted to 7% oxygen, while establishing a maximum carbon monoxide (CO) stack concentration;
- Limitation of stack gas emission rates of the specified Tier III BIF etals (arsenic, beryllium, cadmium, chromium, and lead) to below the allowable levels determined by the EPA-generated RSDs or RACs and the site-specific air dispersion modeling;
- Limitation of stack gas emission rates of chlorine (Cl_2) and hydrogen chloride (HCl) to below the allowable levels determined by the EPA-generated RACs and the site-specific air dispersion modeling; and

- Limitation of stack gas particulate emissions to less than 0.08 grains per dry standard cubic foot, adjusted to 7% oxygen.

The Trial Burn Plan has been developed to ensure that the trial burn will also provide the information needed to establish adequate operating limits for Kiln 1 at the XYZ plant, as outlined in 40 CFR Part 266.102. Testing for the Trial Burn will be conducted under two operating conditions on Kiln 1. A third test condition, and additional testing during Conditions 1 and 2, will be conducted to acquire data for direct and indirect exposure risk assessment purposes. Table 1-1 describes the operating limits to be established and performance standards to be demonstrated under each condition.

This Quality Assurance Project Plan (QAPP) will serve as the detailed test plan for all sampling and analysis activities associated with the Trial Burn, and it provides specific quality assurance and quality control measures to be employed during the collection of all critical measurements. The sampling and analysis methods are detailed in Sections 5.0 and 8.0 of this QAPP, respectively. Additional information including a Trial Burn Schedule is presented in the Trial Burn Plan.

1.1 Process Description

The cement production process at the plant includes two identical kiln systems designed by Ron E. Smith . Each system consists of a 425-foot, inclined, steel rotary kiln, an air pollution control device (APCD), induced draft fan, and a common exhaust stack. A diagram of the kiln system is presented in Figure 1-1 (including approximate sampling locations). A more detailed description of the kiln process can be found in the Engineering Description, Section 3.0, of the Trial Burn Plan.

Table 1-1

Trial Burn Project Objectives

Operating Condition	Operating Limits to be Established	Performance Standards to be Demonstrated
1	Maximum Hazardous Waste Feed Rate Maximum Pumpable Hazardous Waste Feed Rate Maximum Production Rate (determined by measuring raw mix and recycled CKD feed rates) Maximum Combustion Zone Temperature (measured by optical pyrometer) Maximum Stack Gas Flow Rate[a] Maximum Secondary Air Temperature (as a measure of combustion zone temperature in the event of pyrometer failure) Minimum Baghouse Pressure Drop Maximum Total Chlorine Feed Rate Maximum Tier III Metal Feed Rate: in total feed streams in hazardous feed streams in pumpable hazardous waste Maximum Tier III Metal Emission Rate Maximum Cl_2 and HCl Emission Rate	Particulate Matter < 0.08 gr/dscf (40 CFR 266.105) Tier I Metals and Cl_2 and HCl below applicable RAC/RSD (40 CFR 266.106 and 107) Total Hydrocarbons < 20 ppm (40 CFR 266.104(c))
2	Maximum CO Stack Gas Concentration Minimum Combustion Zone Temperature (measured by optical pyrometer) Minimum Secondary Air Temperature (as a measure of combustion zone temperature in the event of pyrometer failure)	99.99 % DRE of selected POHCs[a,b] Total Hydrocarbons < 20 ppm (40 CFR 266.104(c)) CO (40 CFR 266.104(C))[c]
3[d]	N/A	N/A

[a]Flue gas flow rate limit will be based on Condition 1. DRE testing will be conducted during Condition 1 to acquire the data necessary for interpolating between Conditions 1 and 2.
[b]POHCs selected for this Trial Burn include: Tetrachloroethene and 1,2-Dichlorobenzene
[c]Limits to be established based on the average of the highest hourly rollling average of each run, corrected to 7% oxygen on a dry basis
[d]No limits or standards will be demonstrated. Data will be used to support a health-based risk assessment under normal operating conditions

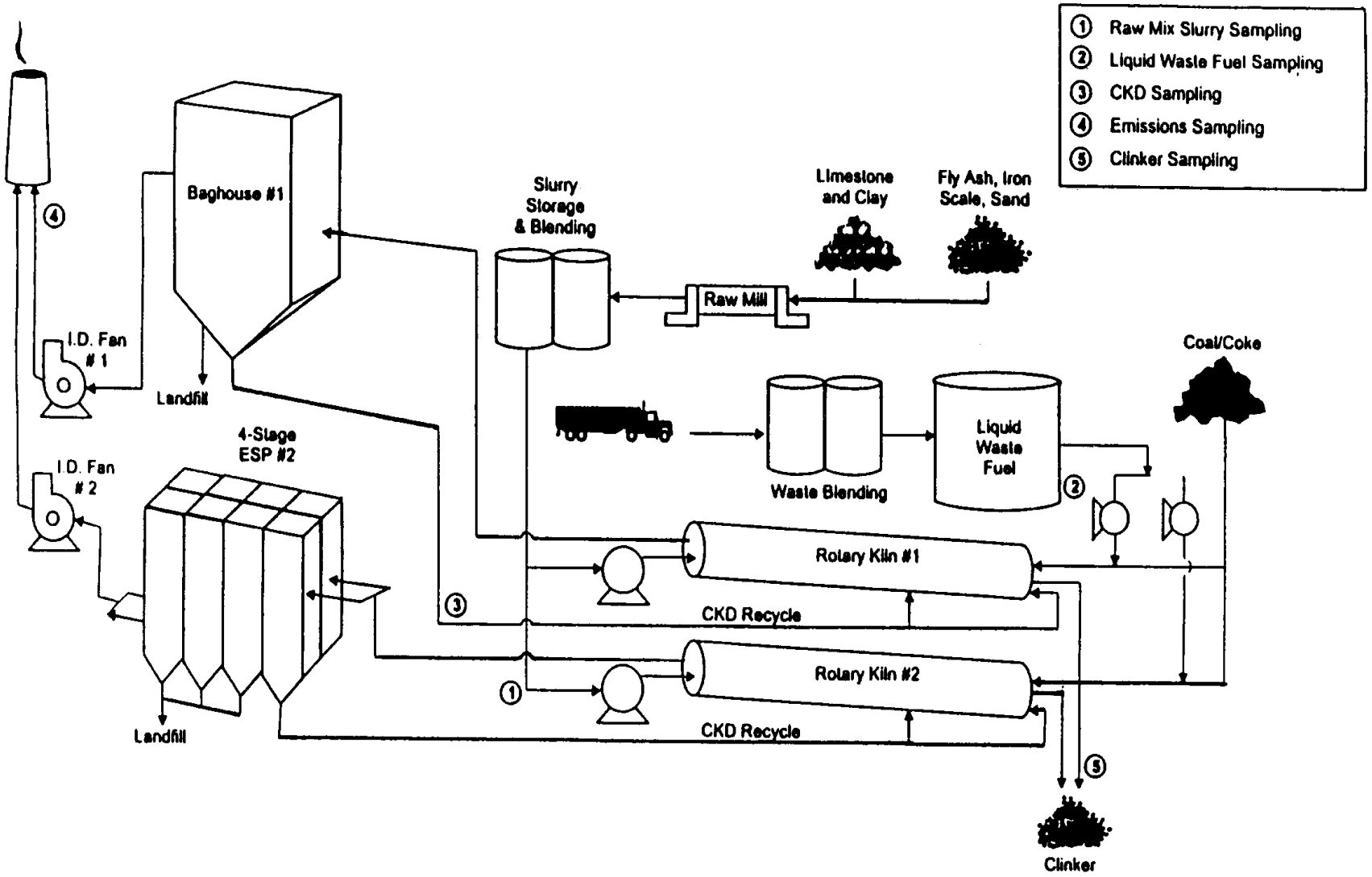


Figure 1-1. Schematic Diagram of Kiln #1 With Sampling Locations

Pulverized coal and/or petroleum coke (coal/coke), and supplemental hazardous waste-derived fuel (WDF) are burned in the kilns. A raw mix slurry containing limestone, clay, sand, iron ore, and fly ash as primary components is processed into a clinker product. The WDF provides up to 100% of the heat input required in the cement manufacturing process. Ignitable organic liquids, sludges, and solids are most frequently used in the preparation of the WDF (a detailed list of acceptable waste codes is presented in Appendix A of the Trial Burn Plan).

Currently, each kiln has an air pollution control system (APCS) that includes an electrostatic precipitator (ESP). XYZ is replacing the Kiln 1 ESP and associated ductwork with a baghouse. XYZ will replace the Kiln 2 ESP with an identical baghouse at a later date. During the trial burn, the Kiln 1 baghouse will be installed and fully operational; however, the existing Kiln 2 ESP will remain in operation until the Kiln 2 baghouse is installed. Exhaust gases from the two kilns will continue to be emitted from the existing common stack. This Trial Burn will demonstrate compliance for Kiln 1 and its new baghouse. Kiln 2 will continue to operate under interim status until its ESP is replaced, at which time data from this trial burn may be used as "data in lieu of" to demonstrate compliance for Kiln 2, per 40 CFR 270.22(a)6.

1.2 Feed Characterization

The raw materials for the cement manufacturing process include limestone and clay that are mined from the plant's quarry, sand, iron ore, and fly ash. Coal/coke is used as the primary fuel source for the process; however, WDR may be used to supplement or replace coal/coke as the fuel source.

Typical concentrations of organic constituents found in the WDF are provided in Table 1-2. Typical concentrations of BIF metals along with other physical characteristics of the WDR, coal/coke, and raw mix are presented in Table 1-3.

1.3 Trial Burn Conditions

Two Trial Burn test conditions, consisting of three runs for each desired sampling train (and an additional contingency run for trains that are necessary to establish BIF limits and/or operating parameters), will be conducted to demonstrate compliance with the requirements specified in 40 CFR Part 266 Subpart H. In addition to demonstrating compliance with the applicable regulations, the test conditions are designed to set operating limits on parameters that influence emissions of regulated constituents. As previously stated, additional testing will be conducted during Conditions 1 and 2, and at a third condition to acquire data for a health-based risk assessment. This testing will be independent of the Trial Burn. Conditions 1 and 2 are discussed in detail in Sections 4.0 and 7.0 of the Trial Burn Plan and Condition 3 is discussed in Appendix D of the Trial Burn Plan. The objectives of the test conditions are as follows:

- Test Condition 1 is designed to demonstrate the system's performance under maximum feed rates and temperatures. Under these conditions, emissions of BIF metals, chlorine/chloride, PM and potentially dioxins/furans are maximized.

- Test Condition 2 is designed to demonstrate the system's performance under maximum feed rates, and minimum combustion zone temperatures. Under these conditions, emissions of organic constituents and potentially dioxins/furnas are maximized.

- Test Condition 3 is designed to evaluate stack emissions of organic PICs (including dioxins/furans, PCBs, and other volatile and semi-volatile organic constituents), and BIF metals under normal operating conditions. The data acquired under Condition 3 will be used for a health-based risk assessment.

Table 1-2

Typical Organic Constituents in Liquid Waste-Derived Fuels (Dry Basis)

Constituent	Average 1995 Concentration (%)[a] (%)
Xylene	21.6
C_6-C_{16} Aliphatics	20.3
Toluene	16.6
C_9-C_{10} Alkyl Benzenes	10.1
Ethyl Benzene	4.6
Methyl Ethyl Ketone	4.1
2-Propanol	3.4
Butyl Acetate	3.0
Acetone	2.8
Methyl Isobutyl Ketone	2.6
Ethylene Glycol Monobutyl Ether (butyl cellosolve)	2.2
Methylene Chloride	1.5
Tetrahydrofuran	1.0
Ethyl Ether	0.9
Ethyl Acetate	0.8
Methyl Amyl Ketone	0.7
Methyl Isoamyl Ketone	0.4
Mesityl Oxide	0.4
Limonene	0.3
n-Propanol	0.3

Table 1-2

(Continued)

Constituent	Average 1995 Concentration (%)[a] (%)
2-Ethyl-1-hexanol	0.2
Terpenes	0.2
Ethylene Glycol Monobutyl Ether Acetate	0.2
Isophorone	0.2
N-Butanolzene	0.1
1,1,1-Trichloroethane	0.1
Dimethyl Adipate	0.1
2,6-Di-t-butyl-4-methyl Phenol	0.1
Diacetone Alcohol	0.1
Ethyl Acetate	0.1
Methyl Acetate	0.1
Diisobuytl Ketone	0.1
Propylene Glycol Methyl Ether Acetate	0.1
Benzene	0.1
Diethylene Glycol Monobutyl Ether (butyl carbitol)	0.1
Isobutyl Acetate	0.1
Carbitol Acetate	0.1

[a]Concentrations presented are the average values of daily 1995 sampling, based on percent of total organic constituents in WDF. All other constituents were present at a concentration less than 0.1%.

Table 1-3

Typical Metals Concentrations and Typical Physical/Chemical Characteristics of Feeds

Parameters	Raw Mix[a]	Coal/Coke[a]	Liquid Hazardous Waste-Derived Fuel[a,b]
Metals and Chlorine Concentrations (ppm)			
Ag	5.0	2.8	< 7.0
As	4.9	7.3	< 48
Ba	187	304	976
Be	0.9	0.7	< 8
Cd	0.6	0.5	18
Cr	26	8.4	175
Hg	0.5	0.5	0.20
Ni	30	153	NA
Pb	3.6	2.7	319
Se	0.9	1.3	NA
Sb	1.1	1/2	48
Tl	0.7	6.3	< 30
Chlorine	103	107	20,000
Physical Characteristics			
Reference Temperature, °F (± 25%)	....	....	70
Heat of Combustion, Btu/lb (HHV)	....	....	10,000 - 15,000 (blended to 13,000)
Solids, %	....	....	11
Density, lbs/ft^3	....	....	56.2 - 59.3
Moisture, %	....	....	10 - 15 (13 average)
Viscosity, cp	....	....	29

[a]Average of monthly average values from 1995.
[b]Values prefaced by "<" indicate average values were at detection limits.
NA - Not Available

A summary of the Trial Burn and risk assessment test conditions is shown in Table 1-4.

1.4 Summary of Sampling and Analysis

Both stack emissions and feed streams will be analyzed. Stack emissions will be analyzed for Appendix VIII organics including: volatile and semivolatile organic constituents, the spiked principal organic hazardous constituents (POHCs), dioxins and furans, and PCBs. Emissions will also be analyzed for particulate matter (PM), hydrogen chloride and free chlorine gas (HCl/Cl_2) and the BIF metals (antimony (Sb), arsenic (As), barium (Ba), beryllium (Be), cadmium (Cd), chromium (Cr), lead (Pb), mercury (Hg), silver (Ag), and thallium (Tl)). Emissions will also be analyzed for nickel (Ni) and selenium (Se) for risk assessment purposes.

The feed streams to be sampled include the raw mix slurry, and WDF. Samples of these feed streams will be analyzed for volatile and semivolatile POHCs (tetrachloroethene and 1,2-dichlorobenzene), the BIF metals, total chlorine, and physical and chemical characteristics (including: moisture, density, viscosity, and heat of combustion).

Cement kiln dust (CKD) recycled to Kiln 1 and clinker will also be sampled and analyzed for the aforementioned constituents and characteristics. CKD will also be analyzed on site for lead to demonstrate preconditioning of the kiln with respect to metal feed rates and emissions. Metal preconditioning is discussed in detail in Section 4.1.1.4 of the Trial Burn Plan.

Sampling procedures are discussed in detail in Section 5.0 and analytical method descriptions are presented in Section 8.0.

Table 1-4

Anticipated Trial Burn Test Conditions

	Parameter	Test Condition 1	Test Condition 2	Test Condition 3
1.0	**Production Rate** (measured by combining raw mix slurry and WDR feed rates, gal/hr)	235	235	195
2.0	**Feed Rate**			
	Total Hazardous Waste Feed Rate (grams/hr)	5.9×10^6	5.9×10^6	3.46×10^6
	Pumpable Hazardous Waste Feed Rate (grams/hr)	5.9×10^6	5.9×10^6	3.46×10^6
	POHC Feed Rate (lbs/hr):			
	Tetrachloroethene	N/A	12.7	N/A
	1,2-Dichlorobenzene	N/A	42	N/A
	Total Metals Feed Rates[a]:			
	Ag (grams/hr)	1.55×10^5	N/A	3.67×10^2
	As (grams/hr)	2.98×10^3	N/A	5.10×10^2
	Ba (grams/hr)	$2.59 \times 10_6$	N/A	1.65×10^4
	Be (grams/hr)	5.02×10^2	N/A	9.09×10^1
	Cd (grams/hr)	9.22×10^2	N/A	1.04×10^2
	Cr (grams/hr)	7.63×10^3	N/A	2.43×10^2
	Hg (grams/hr)	4.14×10^3	N/A	3.58×10^1
	Ni (grams/hr)[b]	N/A	N/A	TBD
	Pb (grams/hr)	1.07×10^4	N/A	1.36×10^3
	Sb (grams/hr)	1.55×10^4	N/A	2.43×10^2
	Se (grams/hr)[b]	N/A	N/A	TBD
	Tl (grams/hr)	2.59×10^3	N/A	1.53×10^2
	Total Chlorine Feed Rate (grams/hr)	1.2×10^5	N/A	7.64×10^4
3.0	**Operating Conditions**			
	Combustion Zone Temperature	3,000	2,000	2,800
	Secondary Air Temperature °F	1,800	1,200	1,600
	APCD Inlet Temperature °F	420	420	395
	Flue Gas Flow Rate, acfm	135,000	135,000	120,000
	Minimum Baghouse Presure Drop (inches water)	2 - 3	N/A	TBD
	Total Hydrocarbon (ppmv)	< 20	< 20	< 20
	Maximum CO concentration (ppmv, corrected to 7% oxygen)	N/A	300	TBD

[a]Metals mass feed rates will be set by establishing a total hazardous waste feed rate and adjusting the concentrations of As, Be, Cd, Cr, and Pb, via spiking into the liquid waste-derived fuel, accordingly (As will be used as a surrogate for Be).
[b]No limits will be established for Ni or Se. These metals will be analyed for risk assessment purposesonly.
N/A - Not Applicable
TBD - To be determined

Quality assurance objectives for accuracy and precision are not listed in Table 3-1 for PM in the stack gas, a critical measurement, because accuracy and precision for PM cannot be readily measured in a Trial Bur. Adherence to the EPA Method 5 PM measurement protocol, which includes performance-related activities such as sampling equipment calibration, isokinetic sampling, balance calibration, desiccation of filters to constant weight, etc., is the basis for achieving acceptable method accuracy and precision. For other critical measurement parameters, the performance objectives are expressed by conditions that can be appraised experimentally. If the QA objectives for accuracy and precision are not met, careful interpretation of the analytical data will be made to evaluate the associated impact on the performance demonstrations.

Completeness refers to the total amount of valid data collected, expressed as a percentage of the amount of data planned. Completeness objectives depend on measurement parameters. For a permit to be written, the completeness objective for all critical, non-continuously monitored emissions sampling and analysis parameters should be 100%, since three runs are conducted at each condition, and valid data for all three are used for the compliance demonstration. For continuously monitored parameters (THC, CO, O_2), the completeness objective is 90% of the one-minute average data points during a test run. For feed samples, the completeness objective will be 80% of the subsamples for each condition. Critical sampling and analysis parameters are defined as follows, for each condition:

Condition 1:

- Stack emissions of Tier III BIF metals (As, Be, Cd, Cr, and Pb);
- Stack emissions of HCl and Cl_2;
- Stack emissions of semivolatile POHC;
- Stack gas concentration of total hydrocarbons and oxygen;
- Stack gas concentration of particulate matter;

Table 4-3

Operating Limits to be Established Under Condition 2
(with 40 CFR 266.102(e) citation references)

Operating Parameter	Limit to be set	Particulate Standard	Metals Standard	HCl/Cl_2 Standard
Hazardous waste feed rate	Max		(4)(ii)(B)	(5)(ii)(B)
Feed rate of pumpable hazardous waste	Max		(4)(ii)(B)	
Device production rate	Max	(3)(B)	(4)(ii)(G)	(5)(ii)(G)
Combustion gas temperature	Max		(4)(ii)(E)	
Stack gas flow rate	Max[a]			
Baghouse Pressure Drop	Min	(3)(C)	(4)(ii)(H)	(5)(ii)(E)
Baghouse inlet temperature	Max		(4)(ii)(F)	
Feed rate of chlorine and chloride in total feed streams	Max		(4)(ii)(D)	(5)(ii)(C)
Feed rate of Tier III metals:				
in total feed streams	Max		(4)(ii)(C)(1)	
in hazardous feed streams	Max		(4)(ii)(C)(2)	
in pumpable hazardous waste feed streams	Max		(4)(ii)(C)(3)	
Emission rate of Tier III metals and HCl/Cl_2	Max		(4)(ii)(A)	(5)(ii)(A)
Concentration of HC in stack gases (from 40 CFR 266.102(e)(2)(ii)(B))	<20 ppmv			

[a]This limit is required per 40 CFR 266.102(e)(2)(I)(F). DRE testing will be conducted during this condition to provide data for interpolation of stack gas flow rate between Conditions 1 and 2, per EPA Guidance contained in EPA//625/6-89/019.

Table 4-6

Operating Limits to be Established Under Condition 2 (with 40 CFR 266.102(e) citation referenced)

Operating Parameter	Limit to be set	Particulate Standard	DRE Standard	CO and THC Standard
Production rate	Max[a]		(2)(i)(B)	
Hazardous waste feed rate	Max[a]		(2)(i)(A)	
Pumpable hazardous waste feed rate	Max[a]		(2)(i)(A)	
Combustion gas temperature	Min		(2)(i)(E)	
Flue gas flow rate	Max[b]		(2)(i)(F)	
Concentration of CO and THC in stack gasses	Max			(2)(ii)(B)

[a]Parameter will be monitored during Condition 2, but limit will be based on Condition 1 data only.

[b]Limit to be based on Condition 1 maximum flow rate. Condition 2 flow rate will be measured to acquire data for interpolation, per EPA Guidance contained in EPA/625/6-89/019.

Table 7-1

Trial Burn Schedule

Day	Task
1	**Arrival** • Metal spiking equipment set up • On-site chemists set up • Review of activities and schedule • Process stream sampling point walk-through
2	**Prep. For Condition 1** • Initiate metal spiking and CKD analysis (preconditioning) • Stack sampling set up
3	**Condition 1** • Emissions sampling and process stream sampling for Runs 1, 2, 3, and 4[a] - simultaneous metals and HCl/Cl^2/PM sampling • End metals spiking • Set up and initiate POHC spiking
4	**Condition 1 - Continued** • Emissions sampling and process stream sampling for Runs 5, 6, 7, and 8[a] - simultaneous dioxin/furan/PCB, VOST, and SVOST sampling • End POHC spiking • End Condition 1
5	**Acclimate kiln for Condition 2**
6	**Condition 2** • Re-initiate POHC spiking • Emissions sampling and process stream sampling for Runs 1, 2, 3, and 4[a] - simultaneous VOST and SVOST sampling • End POHC sampling
7	**Condition 2 - Continued** • Emissions sampling and process stream sampling for Runs 5, 6, and 7 - dioxin/furan/PCB sampling • End Condition 2 (this completes testing for the Trial Burn)
8	**Acclimate Kiln for Condition 3** (Risk Assessment Testing) **Condition 3** • Emissions sampling and process stream sampling for Runs 1, 2, and 3 - simultaneous VOST and SVOST sampling

Table 7-1

(Continued)

Day	Task
9	**Condition 3 - Continued** • Emissions sampling and process stream sampling for Runs 4, 5, and 6 - simultaneous metals and HCl/Cl^2 sampling
10	**Condition 3 - Continued** • Emissions sampling and process stream sampling for Runs 7, 8, and 9 - dioxin/furan/PCB sampling • Complete Condition 3 • Tear down sampling equipment • Wrap up meeting

[a]Contingency run. Samples will be collected, but will only be analyzed in the event of an unexpected loss of sample.

ATTACHMENT E

SUPPORTING INFORMATION FOR SECTION 5.0
HOW TO REVIEW ELEMENT 4—THE PROJECT ORGANIZATION OF PERSONNEL, RESPONSIBILITIES, AND QUALIFICATIONS

(14 Sheets)

ATTACHMENT E-1

2.0 PROJECT ORGANIZATION

The Trial Burn project organization is presented in Figure 2-1. The responsibilities of the key personnel are outlined in this section; resumes for 123 personnel are provided in Appendix A.

Mr. J. Doe, Plant Manager of the XYZ facility will assume overall responsibility for the Trial Burn. Mr. Doe administers all functions of the facility. He will certify the Trial Burn Report in accordance with 40 CFR 270.11(d).

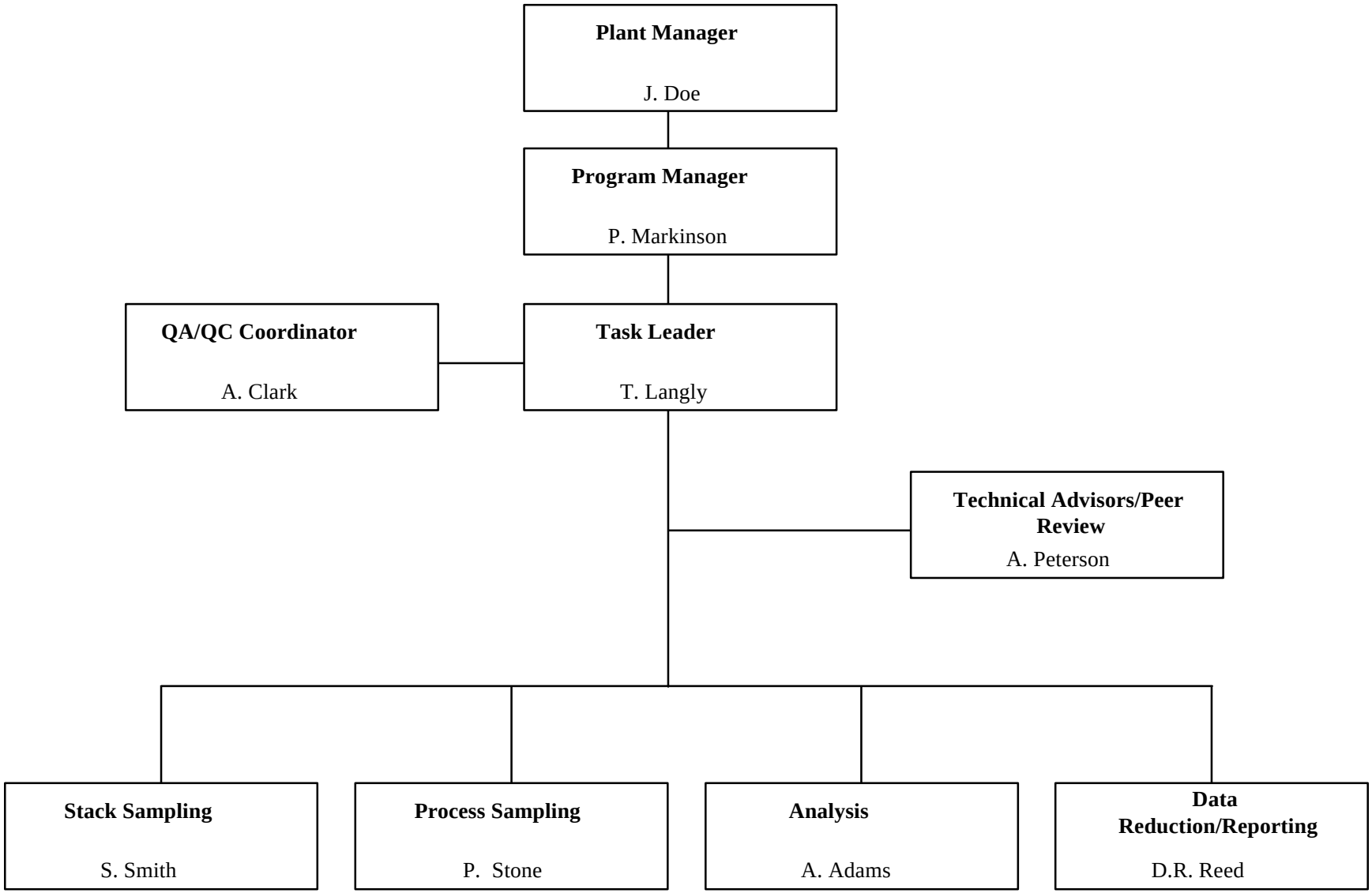
123 International LLC has been contracted to perform sampling and analysis for the Trial Burn. 123's primary responsibilities are to collect and analyze the samples and prepare the Trial Burn Report.

Mr.P. Markinson is the 123 Project Manager. As such, he has the overall responsibility for the success and quality of the 123 effort.

The 123 Task Leader, Mr. T. Langly, is responsible for the technical aspects of the project, and will be on site during the Trial Burn to coordinate 123's technical activities.

The 123 QA/QC coordinator, Ms. A. Clark, is responsible for the development of the QA/QC activities, as well as data validation.

The 123 Stack Sampling Leader, Mr. S. Smith is responsible for the coordination and supervision of the stack sampling, including the acquisition and calibration of all equipment and supplies. Mr. Smith is responsible for the completeness and accuracy of all stack sampling documentation.



Project Organization

Ms. A. Adams will serve as the 123 analytical coordinator and will ensure that the laboratory follows the specifications outlined in the QAPP.

Mr. A. Peterson will serve as the technical advisor and peer reviewer for this Trial Burn. Mr. Peterson will also review the Trial Burn Report prior to submission to the EPA.

Mr. D.R. Reed will be on site during the trial burn, will serve as the Process Sampling Leader, and will be responsible for ensuring the proper delivery of samples to the laboratory. Mr. Reed will also be responsible for data reduction activities including process data reduction and the generation of accurate graphic and tabular data summaries.

The Trial Burn Report will be prepared by the Task Leader, the Process Sampling Leader, and the Stack Sampling Leader. The Project Manager will retain overall responsibility for the final preparation of the report.

XYZ personnel will collect all kiln operating data, process feed stream samples, and associated quality control data.

Table 8-1

Sampling/Analytical Matrix for Trial Burn

Sample Location/ Description	Number of Runs			Sample Method or Type	Parameters	Analytical Method	Analytical Laboratory
	Test Condition 1	Test Condition 2	Test Condition 3				
Stack Emissions	4	4	3	SW-846 Method 0030[a]	Volatile Organics	SW-846 5041/8240	Toxic Air, Inc.
	4	4	3	SW-846 Method 0010 (Modified Method 5)	Semivolatile Organics	SW-846 8270	123 Anal. Services
	3	3	3	40 CFR Part 60, Appendix A, Method 23/CARB Method 428	Dioxins/Furans	EPA Method 23/ CARB Method 428	Mesa Analytical
	3	3	3	40 CFR Part 60, Appendix A, Method 23/CARB Method 428	PCBs	EPA Method 23/ CARB Method 428	Mesa Analytical
	4	0	3	40 CFR 266, Appendix IX	Metals	SW-846 Methods	SAR
	4	0	0	40 CFR 266, Appendix IX, Method 0050	Particulate Matter	40 CFR 60 Method 5	SAR
	4	0	3	40 CFR 266, Appendix IX, Method 0050	HCl/Cl_2	SW-846 Method 9056	SAR

Attachment E-2

4.0 PROJECT ORGANIZATION AND RESPONSIBILITY

At the direction of the U.S. EPA permit writer (or other designated responsible position), the site Project Manager has overall responsibility for all phases of the project. The activities described in this Quality Assurance Project Plan (QAPP) for the RCRA Groundwater Sampling/Analysis Plan at 123 Laboratories will be conducted by XYZ personnel utilizing the existing operational and administrative organization. XYZ personnel will coordinate the use of the outside laboratory. This section describes the various areas and their responsibilities.

4.1 Project Organizational Chart

A copy of the organizational chart for this project can be found in Figure 4A.

4.2 Management Responsibilities

4.2.1 U.S. EPA RCRA Project Officer/Permit Writer (or other responsible position)

This individual has the overall responsibility for all phases of the project described in this QAPP.

4.2.2 Site Project Manager

Overall site management of the sampling and analysis program will be the responsibility of the assigned Project Manager from XYZ's Environmental Services Department. The Project Manager will:

1) implement the project,
2) provide approval for the Quality Assurance Project Plan and procedures,
3) ensure that the written procedures are appropriate,
4) assist the Laboratory Chemist in Technician training,
5) provide guidance to the Chemist and/or Lab Technician regarding methods or statistical analysis,
6) review annual Appendix IX data,
7) record Corrective Actions in the Project Log,
8) coordinate the preparation, review, and submission of reporting documents to EPA,
9) appoint the Sample Custodian

4.3 Quality Assurance Responsibilities

4.3.1 U.S. EPA Region V Quality Assurance Manager (RQAM)

The RQAM has the responsibility to review and approve this Quality Assurance Project Plan. Additionally, the RQAM

1) conducts performance and system audits of the site laboratory and

2) reviews and evaluates analytical field and laboratory procedures

4.3.2 Site Project Quality Control Officer

The Site Project Quality Control Officer (SPQCO) works with the Project Manager to review the data after it is generated by the laboratory. The SPQCO is knowledgeable of laboratory operations but is independent of the laboratory. The Site Project Quality Control Officer for this project is responsible for:

1) reviewing the QA/QC procedures and ensuring that the procedures are being followed,

2) providing guidance for setting up the proper quality control procedures,

3) coordinate quality assurance activities,

4) summarizing, documenting, and reporting quality control activities and data generated in the laboratory,

5) developing and maintaining documentation of all QC procedures in the laboratory.

4.4 Laboratory Responsibilities

Environmental Analytical Services will provide primary analytical support for this plan.

4.4.1 Environmental Analytical Services

Environmental Analytical Services is responsible for preparation and analyses of samples for this plan.

a. Group Leader (used as a term for the departmental leader role) is responsible for:

1) ensuring that systems are in place for analyst training and training documentation,

2) coordinating contract laboratory services

3) coordinating inter- and intra-laboratory samples,

4) reviewing and approving laboratory procedures,

5) conducting internal performance and system audits,

6) coordinating, when appropriate, outside QA activities,

7) working with the designated Quality Control Officer to review the quality assurance activities and actions.

b. Chemist (used as a generic title for first level supervisory exempt personnel) is responsible for:

1) providing guidance to the Group Leader of Environmental Analytical Services or the Environmental Specialist of Environmental Controls when sampling instructions are prepared,

2) providing written laboratory procedures for the determination of the mentioned parameters and for the quality control activities in the Environmental Analytical Services laboratory,

3) reviewing data validation studies and data assessment activities,

4) ensuring the Laboratory Technicians are trained in the proper use of the written procedures,

5) ensuring the Laboratory Technicians follow the analysis and quality control procedures,

6) summarizing, documenting, and reporting quality control activities and data generated in the laboratory, and,

7) reviewing the analytical results and the QC data following the analyses. If questionable data exist, the Chemist provides guidance to the technician for appropriate action.

8) coordinating, along with the Group Leader, when appropriate, inter-laboratory samples and outside QA activities,

c. Laboratory Technicians (a generic title describing non-exempt level laboratory personnel) responsibilities include:

1) preparing samples for analysis,

2) calibrating the instruments and performing the analyses using approved procedures,

3) ensuring the instruments are working properly,

4) entering sample and QC data on the appropriate sample result forms, in the computer data base or control charts,

5) notifying the Chemist of any deviations from the standard operating procedures,

6) notifying the Chemist of any abnormalities or trends, and,

7) properly disposing of the samples after completion of the analyses.

d. Laboratory Sample Custodian responsibilities include:

1) receiving and inspecting sample containers and samples,

2) recording any abnormal conditions of the incoming sample containers,

3) verifying that the chain of custody was followed and filing the completed form,

4) notifying the technicians and chemist that samples have been received,

5) verifying unique sample identification on samples upon receipt,

6) maintaining the sample receiving log, and

7) transferring samples to appropriate location for technician access.

e. MIMS Coordinator (a responsibility assigned to one laboratory technician on each work shift)

1) records instrument identities and descriptions into MIMS (Maintenance Information Management System),

2) enters work order requests for repair or maintenance, and

3) monitors completion of work orders.

4.4.2 123 Laboratories, Inc.

Analytical work that cannot be completed in-house will be completed by the State office of 123 Laboratories, Inc. (123). Coordination of contract laboratory services will be provided by the Group Leader, Environmental Analytical Services, or the XYZ Project Manager. 123 Laboratories and responsibilities include:

1) First round analysis of metals and inorganics,

2) first round and annual Appendix IX analyses for five (5) wells and one (1) seep location,

3) provide sample containers to XYZ for the above analyses,

4) provide proper QA/QC for the above analyses,

5) maintain proper chain of custody documentation for all analyses,

6) report problems, corrective actions required, other issues to XYZ Project Manager, and

7) report results of analyses to XYZ Project Manager and provide data packages.

4.5 Field Responsibilities

4.5.1 Environmental Controls

The main role of the field personnel will be to conduct necessary sample collection and provide other required field support for operations and maintenance of the groundwater monitoring system.

a. Environmental Specialist has the following responsibilities:

1) overseeing development and maintenance of Standard Operating Procedures and training curriculum,

2) ensuring the sample operators follow the analysis and quality control procedures,

3) reviewing the scheduling and maintenance of the well sampling program,

4) reviewing the results of data on the control charts,

5) create and maintain documentation of the well performance,

6) maintain and create needed procedures, logs, and pertinent documents,

7) supervise day to day operations for the groundwater recovery and monitoring program,

8) coordinate program activities with maintenance, engineering, and well contractors,

9) identify and document non-conformance to procedures and corrective action taken.

b. Sampler has the following responsibilities:

1) overall responsibility for the operation of the groundwater program,

2) obtain scheduled groundwater samples,

3) label samples with unique numbers using sample date and location,

4) scheduling and maintenance of the monitoring well schedule,

5) trouble-shooting and maintenance of all monitoring and recovery well,

6) participate in special projects on an as needed basis,

7) maintain and help create needed procedures, logs and pertinent documents,

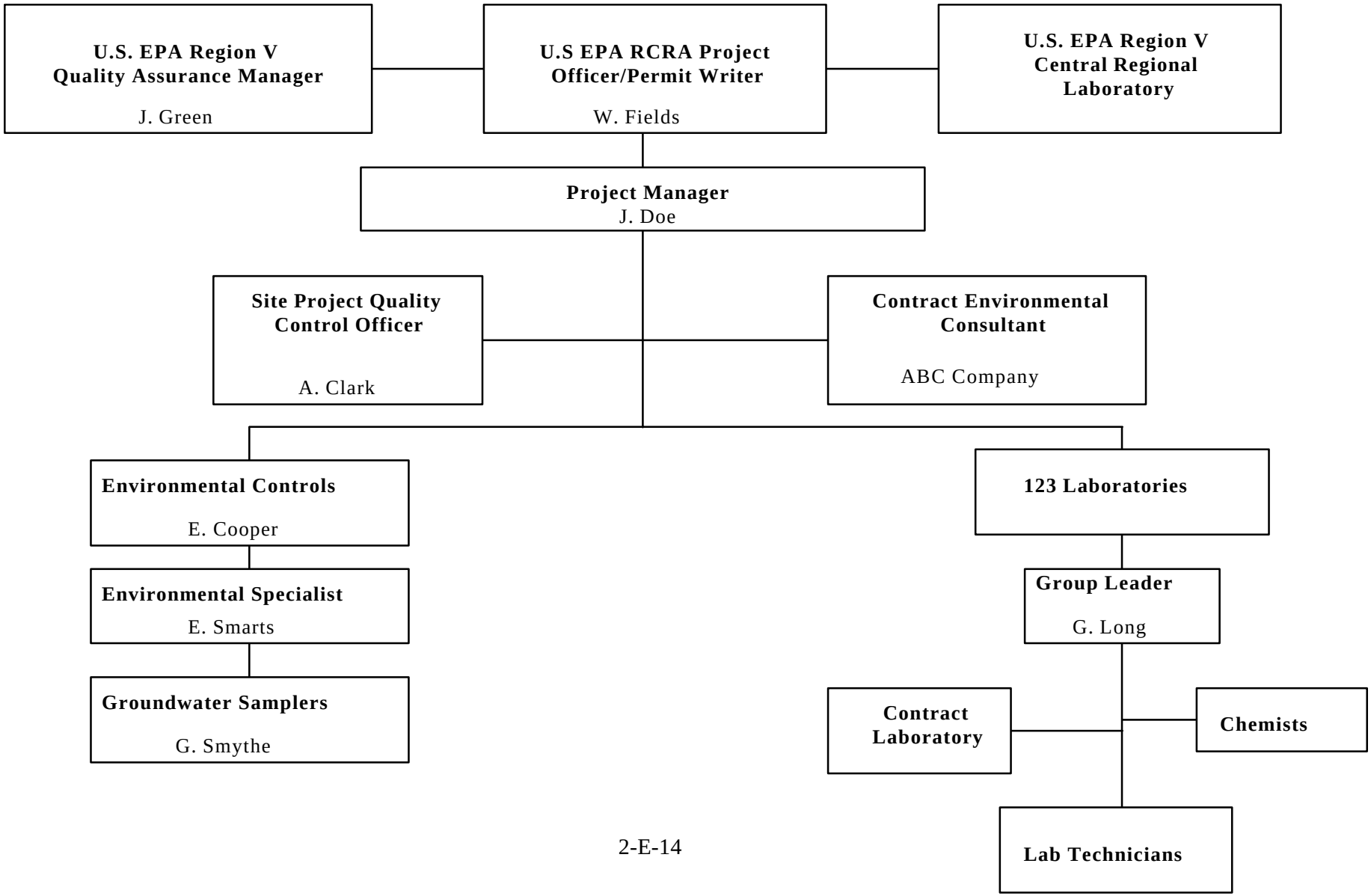
8) work directly with engineering support on technical issues,

9) maintain the routine stocking of necessary equipment in the well van,

10) create and maintain documentation of well performance,

11) interact with laboratory personnel on sampling projects

Figure 4A - Project Organizational Chart



12.0 PERFORMANCE AND SYSTEM AUDITS

Performance and system audits of both field and laboratory activities will be conducted to verify that sampling and analysis are performed in accordance with the procedures established in this plan.

12.1 Field Performance and System Audits

12.1.1 Internal Field Audits

Internal audits will be conducted annually by personnel, designated by Environmental Services Management, not directly associated with the project field or laboratory operations. System audits will include an examination of field documentation including examination of field sampling records, field instrument operating records, sample collection, handling and packaging in compliance with the established procedures, maintenance of QA procedures, chain of custody, etc.

12.1.2 External Field Audits

External audits of field activities may be conducted by the U.S. EPA Region V CRL at its discretion.

12.2 Laboratory Performance and System Audits

12.2.1 XYZ Internal Laboratory Audits

The internal audit will be conducted by personnel, designated by Environmental Services Management, not directly associated with the project field or laboratory operations. System audits will be done on an annual basis and will include an examination of laboratory documentation on sample receiving, sample log-in, sample storage, chain of custody procedure, sample preparation and analysis, instrument operating records, etc. Performance audits will also be conducted on an annual basis. Figure 12A is an internal audit checklist to be used during audits.

12.2.2 External Laboratory and Field Audits

External audits of laboratory activities will be conducted by the U.S. EPA Region V CRL at their discretion.

ATTACHMENT F

SUPPORTING INFORMATION FOR SECTION 6.0
HOW TO REVIEW ELEMENT 5—THE QUALITY ASSURANCE AND QUALITY CONTROL OBJECTIVES

(33 Sheets)

SECTION 3

QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

The overall QA objective for this project is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting that will provide results which are defensible. Specific procedures for sampling, chain-of-custody, laboratory instrument calibration, laboratory analysis, reporting of data, internal quality control, audits, preventive maintenance of field equipment, and corrective action are described in other sections of this QAPP.

3.1 PRECISION

3.1.1 Definition

Precision is defined in Guideline and Specifications for Preparing Quality Assurance Project Plans, U.S. EPA QAMS-005/80, as the measure of mutual agreement or variability among individual measurements of the same property, usually under prescribed similar conditions (e.g., under the same analytical protocols). The most commonly used estimates of precision are the relative percent difference (RPD) for when only two measurements are available, and the percent relative standard deviation (%RSD) for when three or more measurements are available. In both cases, the quantitative measure of the variability of the group of measurements is compared to their average value. This is especially useful in normalizing environmental measurements to determine acceptability ranges for precision, since it effectively corrects for the wide variability in analyte concentration indigenous to samples.

Precision for some analytical procedures is evaluated as the degree of agreement between a new set of results and a historical database and/or a table of acceptable criteria for a given parameter. This is measured as percent difference (% D) from the reference value, and is primarily used as a means for documenting acceptability of continuing calibration or standards traceability.

The RPD is calculated by expressing, as a percentage, the difference between results of the analysis of duplicate samples relative to the average of those results for a given analyte. This method for precision measurement can be expressed by the formula:

$$\% \ RPD = \frac{C_1 - C_2}{(C_1 + C_2)/2} \ x \ 100$$

Where:

% RPD	=	Relative percent difference.
C^1	=	Concentration of analyte in sample.
C^2	=	Concentration of analyte in replicate.

The % RSD is calculated by expressing, as a percentage, the standard deviation of the analytical results of the replicate determinations relative to the average of those results for a given analyte. This precision measurement, percent relative standard deviation (%RSD), has QA objectives identical to those for % RPD, as expressed by the formula:

$$\% \ RSD = \frac{[(\Sigma C^2)n - (\Sigma C)^2]/n(n-1)^{½}}{(C_1 + C_2 + C_3 \ ... \ C_n)/n} \ x \ 100$$

% RSD	=	Percent relative standard deviation
C	=	Concentration of analyte in the sample, and ($C_1 + C_2 + ...C_n$) represents the sum of the concentration of each replicate.
n	=	Number of replicate analyses.
$\sum$	=	"The summation of".

The % D is calculated by expressing as a percentage, the difference between the original value and new value relative to the original value. QA objectives for this precision measurement will be defined in the referenced Standard Operating Procedures. This method for precision measurement can be expressed by the formula:

$$Percent\ Difference\ (\%D)\ \frac{|original\ value\ -\ found\ value|}{original\ value}\ x\ 100\%$$

The precision involved in this project focuses on field sampling and laboratory analytical precision, which are discussed in the following sections.

3.1.2 Field Precision Objectives

Field precision is assessed through the collection and measurement of field duplicates. The total number of duplicates for this project are provided in Section 4 Table 4-1. The maximum allowable RPD control limit is based on the matrix of the sample and analysis parameter. If the criteria does not meet the assigned control limits, the homogeneity of the samples should be investigated and the discrepancy should be documented in the case narrative.

3.1.3 Laboratory Precision Objectives

Laboratory precision control limits are established and controlled by the laboratory matrix duplicate analysis, laboratory matrix spike duplicate analysis, and a set of two laboratory control samples (LCS). The LCS may be purchased commercially or prepared at a laboratory, and may also be identified as blank spike/blank spike duplicate (BS/BSD). The LCS pair or BS/BSD are subjected to all sample preparation. For some methods, such as metals, including the preparation methods, the

LCS and matrix spike duplicate may only contain a representative number of target analytes, rather than the full list. For organic analyses, the LCS pair (BS/BSD), and the matrix spike duplicate, may be surrogate compounds and/or a select number of target compounds.

Control limits are given in Table 3-1 and reflect the provided SOPs for each individual analysis and the Handbook "Quality Assurance/Quality Control Procedures for Hazardous Waste Incineration."

Table 3-2 provides a listing of target organic compounds and intended matrix spike compounds.

TABLE 3-1

PRECISION AND ACCURACY CRITERIA
STACK GAS SAMPLES

PARAMETER	PRECISION (RPD, RSD)			ACCURACY (%R)	
	DUP	MSD	LCSD	MS	LCS
Metals (ICPA)	≤20%	NA	≤20%	75-125%	80-125%
Metals (GFAA)	≤20%	NA	≤20%	85-115%	85-115%
Mercury	≤20%	NA	≤20%	85-115%	85-115%
Chloride/HCl	≤20%	≤20%	NA	90-110%	90-110%
Hexavalent Chromium	≤20%	NA	≤20%	75-125%	80-120%
Formaldehyde	≤20%	NA	≤20%	NA	(1)

(1) >80% for aldehydes
>50% for ketones

TABLE 3-1 (Continued)

PRECISION AND ACCURACY CRITERIA
STACK GAS SAMPLES

PARAMETER	ACCURACY, %R	
SVOC Surrogate Standards[1]	**Mean**	**95% CI**
Phenol - d_5	70	28.39-112.40
Nitrobenzene - d_5	68	30.52-105.65
1,3,5-Trichlorobenzene - d_3	55	22.19-87.75
1,4-Dibromobenzene - d_4	69	34.65-103.19
2-Fluorobiphenyl	77	37.70-115.87
2,4,6-Tribromophenol	78	32.43-123.81
Anthracene - d_{10}	77	37.45-116.75
Pyrene - d_{10}	80	33.65-126.15
Terphenyl - d_{14}	77	18.86-135.65
SVOC Internal Standards		
1,4-Dichlorobenzene - d_4 Naphthelene - d_8 Acenaphthene - d_{10} Phenanthrene - d_{10} Chrysene - d_{12} Perylene - d_{12}	50%-200% of the area of the internal standards from the most recent continuing calibration	
SVOC Matrix Spikes		
See listing in Table 3-2	Compound specific, maximum equals 50%-150%	

[1]QC limits based upon current laboratory 95% confidence interval.

TABLE 3-1 (Continued)

PRECISION AND ACCURACY CRITERIA
STACK GAS SAMPLES

PARAMETER	ACCURACY, % RECOVERY
PCDD/PCDF Internal Standards	
$^{13}C_{12}$-2,3,7,8-TCDF	40%-130%
$^{13}C_{12}$-2,3,7,8-TCDD	40%-130%
$^{13}C_{12}$-1,2,3,7,8-PeCDF	40%-130%
$^{13}C_{12}$-1,2,3,7,8-PeCDD	40%-130%
$^{13}C_{12}$-1,2,3,6,7,8-HxCDF	40%-130%
$^{13}C_{12}$-1,2,3,6,7,8-HxCDD	40%-130%
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDF	25%-130%
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDF	25%-130%
$^{13}C_{12}$-1,2,3,4,6,7,8,9-OCDD	25%-130%
PCDD/PCDF Surrogate Standards	
$^{13}C_{12}$-2,3,7,8-TCDD	70%-130%
$^{13}C_{12}$-2,3,4,7,8-PeCDF	70%-130%
$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	70%-130%
$^{13}C_{12}$-1,2,3,4,7,8-HxCDD	70%-130%
$^{13}C_{12}$-1,2,3,4,7,8,9-HpCDF	70%-130%
PCDD/PCDF Alternate Standards	
$^{13}C_{12}$-1,2,3,7,8,9-HxCDF	40%-130%
$^{13}C_{12}$-2,3,4,6,7,8-HxCDF	40%-130%

TABLE 3-1 (Continued)

PRECISION AND ACCURACY CRITERIA
STACK GAS SAMPLES

PARAMETER	ACCURACY, %R
VOST Surrogate Standards 1,2 Dichloroethane-d_4 Benzene-d_8 Toulene-d_8	50%-150%
VOST Internal Standards Bromochloromethane 1,4-Difluorobenzene Chlorobenzene-d_5	50%-200% of the area of the internal standards from the most recent continuing calibration
VOST Matrix Spikes See listing in Table 3-2	%Recoveries based on historical data

TABLE 3-1 (Continued)

PRECISION AND ACCURACY CRITERIA
STACK GAS SAMPLES

PARAMETER	ACCURACY, % RECOVERY
PCB internal Standards	
$^{13}C_{12}$-3,3,4,4-Tetrachlorobiphenyl $^{13}C_{12}$-2,2,3,3,4,4-Octachlorobiphenyl $^{13}C_{12}$-2,2,3,3,5,5,6,6-Octachlorobiphenyl	20%-130%
PCB Recovery Standards	
$^{13}C_{12}$-2,2,5,5-Tetrachlorobiphenyl $^{13}C_{12}$-3,3,4,4,5,5-Hexachlorobiphenyl	$\geq$10:1 Signal to noise ratio
PCB Alternate Standards	
$^{13}C_{12}$-2,2,4,4,5,5-Hexachlorobiphenyl	20%-130%
PCB Matrix Spikes	40%-50%
PCB Matrix Spikes	Precision, RPD
	$\leq$ 50%

TABLE 3-1 (Continued)

PRECISION AND ACCURACY CRITERIA
STACK GAS SAMPLES

PARAMETER	ACCURACY, % RECOVERY
Pesticide Surrogate Standards	
TCMX DCBF	50%-150% 50%-150%
Pesticide Matrix Spikes	
All target compounds	0-160%
Pesticide Matrix Spike Duplicate	
All target compounds	<50%

TABLE 3-1 (Continued)

PRECISION AND ACCURACY CRITERIA
FEED STREAM SAMPLES

PARAMETER	PRECISION (RPD, RSD)			ACCURACY (%R)	
	DUP	MSD	LSCSD	MS	LCS
Metals (ICPA)	≤20%	NA	≤20%	75-125%	80-120%
Metals (GFAA)	≤20%	NA	≤20%	85-115%	85-115%
Mercury (CVAA)	≤20%	NA	≤20%	85-115%	85-115%
Chloride	≤20%	≤20%	NA	75-125%	80-120%
Heating Value	≤20%	NA	≤20%	NA	80-120%
Ash Content	≤20%	NA	NA	NA	NA
Viscosity	≤20%	NA	NA	NA	NA
Specific Gravity	≤20%	NA	NA	NA	80-120%

TABLE 3-1 (Continued)

PRECISION AND ACCURACY CRITERIA
FEED STREAM SAMPLES

PARAMETER	ACCURACY, %R
SVOC Surrogate Standards	
2-Fluorophenol	43%-116%
Phenol - d_5	10%-84%
Nitrobenzene - d_5	35%-114%
2-Fluorobiphenyl	43%-116%
2,4,6-Tribromophenol	10%-123%
Terphenyl - d_{14}	33%-141%
SVOC Internal Standards	
1,4-Dichlorobenzene - d_4 Naphthelene - d_8 Acenaphthene - d_{10} Phenanthrene - d_{10} Chrysene - d_{12} Perylene - d_{12}	50%-200% of the area of the internal standards from the most recent continuing calibration
SVOC Matrix Spike Compounds	
1,2,4Trichlorobenzene	50% - 150%
SVOC Matrix Spike Compounds	**Precision, RPD**
1,2,4 Trichlorobenzene	$\leq$40%

TABLE 3-1 (Continued)

PRECISION AND ACCURACY CRITERIA
FEED STREAM SAMPLES

PARAMETER	ACCURACY, % RECOVERY
VOC Surrogate Standards	
1,2 Dichloroethane-d_4 Benzene-d_8 Toluene-d_8	50%-150%
VOC Internal Standards	
Bromochloromethane 1,4-Difluorobenzene Chlorobenzene-d_5	50%-200% of the area of the internal standards from the most recent continuing calibration
VOC Matrix Spike compounds	
Carbon Tetrachloride Chlorobenzene	50%-150% 50%-150%
VOC Matrix Spike Compounds	Precision, RPD
Carbon Tetrachloride Chlorobenzene	$\leq$25% $\leq$25%

TABLE 3-2

ORGANIC COMPOUND TARGET LIST, SAMPLING AND ANALYTICAL PROCEDURES, AND MATRIX SPIKES

Organic Compounds	Sampling/Analytical Methods	Matrix Spike Compound
Acetaldehyde	0011/0011A	
Acetone	0030/8240	*
Acrolein	0011/0011A	
Acrylonitrile	0030/8240	
Anthracene	0010/8270	*
Benzene	0030/8240	*
Benzidine	0010/8270	
Benzo(a)anthracene	0010/8270	*
Benzo(b)fluoranthene	0010/8270	*
Benzo(k)fluoranthene	0010/8270	*
Benzo(g,h,i)pervlene	0010/8270	*
Benzo(a)pyrene	0010/8270	*
Bis(2-ethylhexyl)phthalate	0010/8270	*
Bromodichloromethane	0030/8240	*
Bromoform	0030/8240	*
Bromomethane	0030/8240	*
tert-Butyl methyl ether	0030/8240	
Carbon disulfide	0030/8240	*
Carbon tetrachloride	0030/8010	*
Chlordane	0010/8080	*
Chlorobenzene	0030/8240	*
Chloroethane	0030/8240	*
Chloroform	0030/8240	*

TABLE 3-2 (Continued)

ORGANIC COMPOUND TARGET LIST, SAMPLING AND ANALYTICAL PROCEDURES, AND MATRIX SPIKES

Organic Compounds	Sampling/Analytical Methods	Matrix Spike Compound
Chloromethane	0030/8240	*
β-Chloronaphthalene	0010/8270	*
2-Chlorophenol	0010/8270	*
Chrysene	0010/8270	*
m-Cresol	0010/8270	
o-Cresol	0010/8270	
p-Cresol	0010/8270	
Cumene	0010/8270	
DDE	0010/8080	*
Dibenzo(a,h)anthracene	0010/8270	*
1,2-Dibromo-3-chloropropane	0010/8270	
Di(n)butyl phthalate	0010/8270	*
1,3-Dichlorobenzene	0010/8270	*
1,2-Dichlorobenzene	0010/8270	*
1,4-Dichlorobenzene	0010/8270	*
Dichlorodifluoromethane	0030/8240	
1,2-Dichloroethane	0030/8240	*
1,1-Dichloroethylene	0030/8240	*
(trans)1,2-dichloroethylene	0030/8240	*
2,.4-Dichlorophenol	0010/8270	*
1,2-Dichloropropane	0030/8240	*
(cis)1,3-Dichloropropene	0030/8240	*
(trans)1,3-Dichloropropene	0030/8240	*

TABLE 3-2 (Continued)

ORGANIC COMPOUND TARGET LIST, SAMPLING AND ANALYTICAL PROCEDURES, AND MATRIX SPIKES

Organic Compounds	Sampling/Analytical Methods	Matrix Spike Compound
Diethyl phthalate	0010/8270	*
2,4-Dimethylphenol	0010/8270	*
Dimethyl phthalate	0010/8270	*
1,3-Dinitrobenzene	0010/8270	
4,6-Dinitro-2-methlphenol	0010/8270	*
2,4-Dinitrophenol	0010/8270	*
2,4-Dinitrotoluene	0010/8270	*
2,6-Dinitrotoluene	0010/8270	*
Di(n)octyl phthalate	0010/8270	*
Ethylbenzene	0030/8240	*
Ethylene dibromide (Dibromoethane)	0030/8240	
Ethyl methacrylate	0030/8240	
Formaldehyde	0011/0011A	
Fluoranthene	0010/8270	*
Heptachlor	0010/8080	*
Hexachlorobenzene	0010/8270	*
Hexachlorobutadiene	0010/8270	*
α-Hexachlorocyclohexane (α-BHC)	0010/8080	*
β-Hexachlorocyclohexane (β-BHC)	0010/8080	*
γ-Hexachlorocyclohexane (γ-BHC)	0010/8080	*
Hexachlorocyclopentadiene	0010/8270	*
Hexachloroethane	0010/8270	*
Indeno(1,2,3-cd)pyrene	0010/8270	*

TABLE 3-2 (Continued)

ORGANIC COMPOUND TARGET LIST, SAMPLING AND ANALYTICAL PROCEDURES, AND MATRIX SPIKES

Organic Compounds	Sampling/Analytical Methods	Matrix Spike Compound
Methoxychlor	0010/8080	*
Methyl ethyl ketone (2-Butanone)	0030/8240	*
Methylene chloride	0030/8240	*
4-Methyl 2-pentanone	0030/8240	*
Naphthalene	0010/8270	*
Nitrobenzene	0010/8270	
N-Nitroso di-n-butylamine	0010/8270	
Pentachloronitrobenzene	0010/8270	
Pentachlorophenol	0010/8270	
Phenol	0010/8270	*
Polychlorinated biphenyls (10 homologue groups)	0010/680	*
Polychlorinated dibenzo-p-dioxins/furans	0023/0023	*
Pyrene	0010/8270	*
Styrene	0030/8240	*
1,1,1,2-Tetrachloroethane	0030/8240	
1,1,2,2-Tetrachloroethane	0030/8240	*
Tetrachloroethylene	0030/8240	*
Toluene	0030/8240	*
1,2,4-Trichlorobenzene	0010/8270	*
1,1,1-Trichloroethane	0030/8240	*
1,1,2-Trichloroethane	0030/8240	*
Trichloroethylene	0030/8240	*
Trichlorofluoromethane	0030/8240	*

TABLE 3-2 (Continued)

ORGANIC COMPOUND TARGET LIST, SAMPLING AND ANALYTICAL PROCEDURES, AND MATRIX SPIKES

Organic Compounds	Sampling/Analytical Methods	Matrix Spike Compound
2,4,5-Trichlorophenol	0010/8270	*
2,4,6-Trichlorophenol	0010/8270	*
Vinyl chloride	0030/8240	*
Vinylidine chloride (1,1-Dichloroethane)	0030/8240	*
m-Dimethyl benzene (m-xylene)	0030/8240	*
o-Dimethyl benzene (o-xylene)	0030/8240	*
p-Dimethyl benzene (p-xylene)	0030/8240	*

3.2 ACCURACY

3.2.1 Definition

Accuracy is defined as the degree of agreement of the analytical measurement with the true or expected concentration. When applied to a set of observed values, accuracy will be a combination of a random component and of a systematic error (or bias) component, which is caused by some artifact of the measurement system or deviation from protocol. Temperature effects, extraction inefficiencies, contamination, mechanical losses, and calibration errors are factors that effect the true measurement.

Analytical accuracy is expressed as the percent recovery (%R) of an analyte which has been used to fortify an investigative sample or a standard matrix (e.g., blank soil, analyte-free water, etc.) at a known concentration prior to analysis, and is expressed by the following formula:

$$\text{Accuracy} = \%\ \text{Recovery (\%R)} = \frac{A_T - A_O}{A_F} \times 100\%$$

Where:
A_T = Total amount found in fortified sample.
A_O = Amount found in unfortified sample.
A_F = Amount added to sample.

The fortified concentration will be specified by laboratory QC requirements specified in the respective laboratory standard operating procedure, or may be determined relative to background concentrations observed in the unfortified sample. In the latter case, the fortified concentration should be different (2 to 5 times higher) from the background concentration to permit a reliable recovery calculation. Standards of established accuracy, such as reference materials [e.g., National Institute for Standards and Technology (NIST) Standard Reference Material] will be used to calibrate instruments for this program.

The quality assurance objective for organic and inorganic analyses are tailored to the corresponding analytical technique. The accuracy for metals and inorganic analyses is obtained from the analyte recovery measured in a laboratory control sample (LCS), QC check sample (if applicable) and/or a field sample fortified with the element of interest (MS). The LCS and matrix spike recoveries criteria are provided in Table 3-1.

For organic analysis (GC & GC/MS), analytical accuracy is obtained from a select number of target compounds measured in a laboratory control sample, and/or a field sample fortified with the compound(s) of interest. These recovery measurements comprise both target compounds and surrogate compounds, and are representative of compound lists routinely analyzed.

Surrogates are compounds which may be similar in structure, composition and/or physical or chemical properties to the target compounds, but are not expected in the investigative sample. Often these compounds are fluorinated versions of the chlorinated target analyte. Since chlorine and fluorine are both in the halogen family, these compounds ideally will behave similarly during preparation and analysis. For GC/MS, radiolabeled versions of the target compounds (primarily deuterium, ^{13}C, or ^{37}Cl) are also used as surrogates to mimic the target compounds, as they can be distinguished during analysis from the unlabeled target compound. Since the surrogates are not expected in environmental samples, the surrogates can be added (spiked) as a market, or recovery check, in each sample prior to extraction and/or analysis to help evaluate the efficiency of the extraction and analysis, thus providing a QC indicator for 100% of the samples without having to analyze a second aliquot.

Fortification of the sample with target analytes prior to extraction provides recovery data for the actual target compound, and requires analysis of a second sample, unspiked, to allow correction for any of the compound indigenous to the sample when evaluating recoveries.

Refer to Table 3-1 for the accuracy control data. Also, refer to the individual organic standard operating procedures included in Appendix B.

The accuracy of the analyses data could be grouped as field and laboratory accuracy objectives.

3.2.2 Field Accuracy Objectives

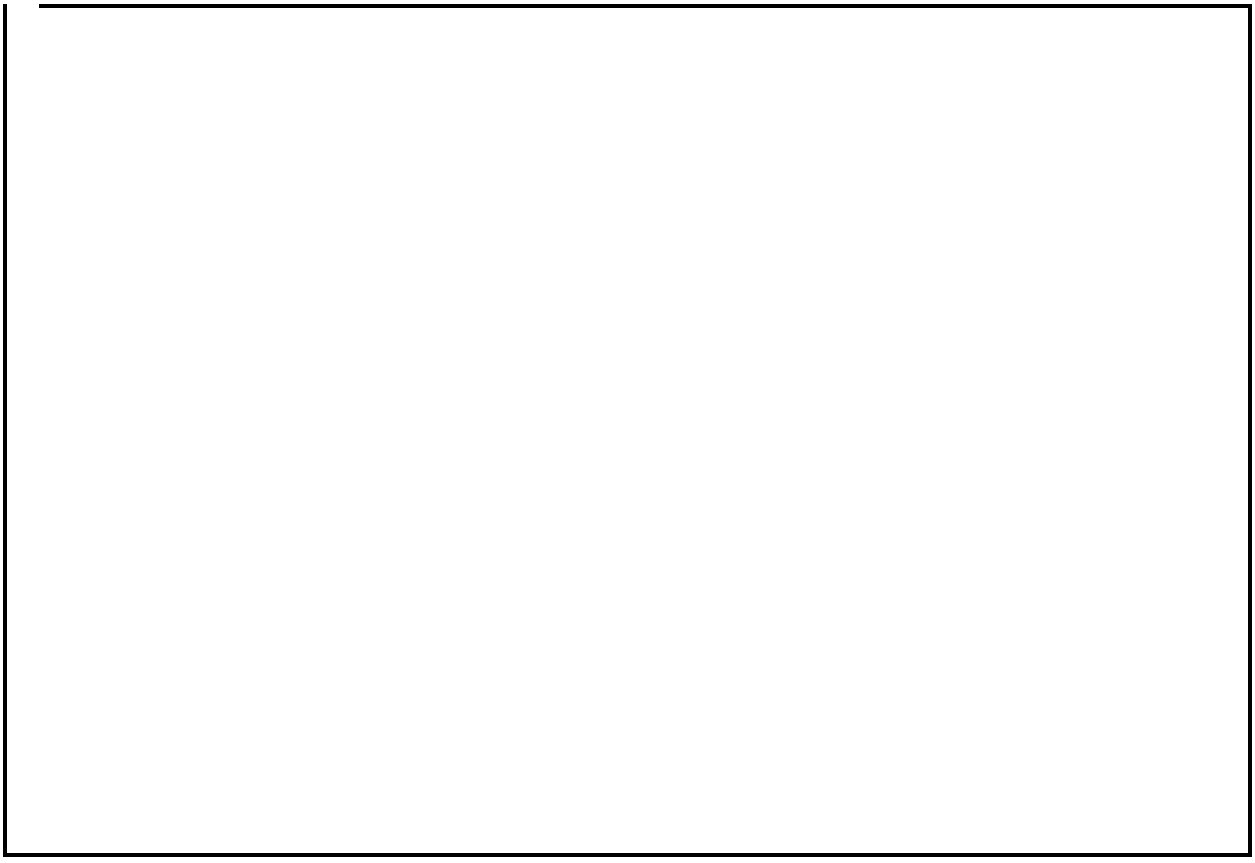
Accuracy in the field is assessed through the use of field and trip blanks and through the adherence to all sample handling, preservation and holding times. The trip blanks will be analyzed for each sampling event. The field blanks are also provided to the laboratory for specific analyses/parameters, along with each sampling event. The analysis of the blank is used to monitor potential contamination from the sample handling transportation (trip blank) and field sampling (field blank). These blanks should be free of target analytes at levels ≥ CRQL (Contract Required Quantitation Limit) in organic analysis and ≥ CRDL (Contract Required Detection Limit) and Method Detection Limits (MDL) in metal and inorganic analyses, respectively. All data associated with the out-of-control situation are evaluated with respect to project Data Quality Objectives (DQO's) for usability, sample availability for reanalysis, etc. If data are used without reanalysis, the case narrative will address the deviation. Table 4-1 in Section 4 lists field blank and trip blank sample frequency.

Precision and accuracy criteria for measurements performed in the field are presented in Table 3-3.

TABLE 3-3

QA OBJECTIVES FOR PRECISION, ACCURACY, AND COMPLETENESS FOR FIELD MEASUREMENTS

MEASUREMENT	PRECISION (RSD)	ACCURACY	COMPLETENESS
Carbon dioxide (EPA Method 3)	±0.3%	±0.5%	90%
Oxygen (EPA Method 3)	±0.3%	±0.5%	90%
Moisture (EPA Method 4)	Not determinable	Not determinable	90%
Particulate matter (EPA Method 5)	±12%	Not determinable	90%
Carbon Monoxide (NDIR)	±20%	±15%	90%
Gas temperature (Type K thermocouple)	Not determinable	±3%[a]	90%
Gas velocity (EPA Method 2)	Not determinable	Not determinable	90%



3.2.3 Laboratory Accuracy Objectives

Fortified standard matrices prepared in the laboratory are referenced as laboratory control samples (LCS) or blank spikes (BS) in inorganic and organic analyses, respectively, while fortified field samples are referenced as matrix spike (MS).

Laboratory accuracy is assessed through the analysis of matrix spikes (MS) of standard reference materials (SRM) and the determination of percent recoveries.

Accuracy control limits are given in Table 3-1. Table 3-4 identifies potential audit materials for this program. These audit materials will be analyzed only if provided by the U.S. EPA.

Also, the recoveries for each specific analysis/parameter are detailed in the laboratory Standard Operating Procedures (SOPs) included in Appendix B.

When the LCS recoveries exceeds the established acceptance limits, appropriate corrective action is taken (refer to the individual method operating practices). After the problem has been identified, corrected, and control has been re-established, sample analysis may continue. All data associated with the out-of-control situation are evaluated with respect to project DQO's for usability, sample availability for reanalysis, etc. For rejected results, the samples will be re-prepared and/or reanalyzed after control has been re-established. If data are used with reanalysis, the case narrative will address the deviation.

The % R for fortified (spiked) investigative sample analysis provides a tool for evaluating how well the method worked for the respective matrix. These values are used to assess the validity of a reported result within the context of the project DQO's. For results outside control limits, appropriate corrective action will be taken and the deviation will be noted in the case narrative accompanying the sample results.

The accuracy of the laboratory could also be assessed by the laboratory method blank (preparation blank). A method blank is a volume of deionized, distilled laboratory water for water samples, or a purified solid matrix for soil/sediment samples and other matrices, carried through the entire analytical scheme (extraction, concentration, and analysis). The blank analysis is performed once per preparation (extraction/digestion) batch of samples with similar matrix for all analytes, with the exception of GC/MS volatile analysis. The method blank for this parameter must be analyzed within 12 hours from the GC/MS tune analysis for each batch of samples/matrix.

TABLE 3-4

AUDIT MATERIALS AND ACCEPTANCE CRITERIA

MANUAL SAMPLING AND ANALYSIS AUDIT MATERIAL	ACCEPTANCE CRITERIA
Multimetal filter matrix	±10% of audit value
Mercury	±10% of audit value
PCDD/PCDF	Within 50% of the 90% CI
VOST	±50% of audit value
HCl	±10% of audit value
Critical Orifice	Dry gas meter ±5%

CI = Confidence Interval

The method blank must contain less than or equal to the detection limit value required to demonstrate compliance with emission rate limits and perform appropriate risk assessment calculation for any single target compound.

In the case of contamination, the appropriate corrective action is taken [refer to the individual method Operating Practice {OP}]. After the problem has been identified and corrected, sample analysis may continue.

3.3 COMPLETENESS

3.3.1 Definition

Completeness is a measure of the relative number of analytical data points that meet all of the acceptance criteria for accuracy, precision, and any other criteria required by the specific analytical methods used. The level of completeness can also be affected by loss or breakage of samples during transport, as well as external problems that prohibit collection of the sample.

For the purpose of this QAPP, completeness will be limited to a measure of valid QA results for precision and accuracy data obtained from LCS analysis. These data will be judged by objectives in Section 3, Tables 3-1 through 3-4 compared to the total amount of QA data collected. Completeness is calculated, with a 90% target objective for all parameters.

Completeness will be calculated as follows:

$$Completeness = \frac{Number\ of\ acceptable\ reported\ QC\ data}{Total\ number\ of\ planned\ QC\ data}\ x\ 100\%$$

However, even if data have not met this laboratory definition, the data are able to be reported without qualification. Project completion goals may still be met if the qualified data (i.e., data of unknown quality) even if not perfect, are suitable for specific project goals. Analytical and field data completeness will be addressed by applying quality checks and assessments described in these sections, internal QC checks, performance and systematic audits and quality assurance reports explained in the QAPP. If completeness is less than 90% for any parameter(s), the Project Manager will be notified immediately. The Project Manager is responsible for determining if resampling will be necessary to meet project objectives. Exceptions for accepting qualified data will be made by the U.S. EPA Region 5 QA Manager on a sample specific basis for approved reasons only.

The overall QA objective for field/sample transport/laboratory completeness is to have no less than 90% of the data usable without qualification. Tables 3-1 and 3-3 indicates the QA objectives for specific field-measured parameters for this program.

3.3.2 Field Completeness Objectives

Field completeness is a measure of the amount of valid measurements obtained form all the measurements taken in the project. Field completeness for this project will be greater than 90 percent.

3.3.3 Laboratory Completeness Objectives

Laboratory completeness is a measure of the amount of valid measurements obtained from all the measurements taken in the project. Laboratory completeness for this project will be greater than 90 percent.

3.4 REPRESENTATIVENESS

3.4.1 Definition

Representativeness is also a qualitative measure of data quality. Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition.

This concept involves collecting samples at proper process operating conditions, well-mixed areas of stacks or ducts, and at intervals that fully encompass the process description.

DQOs are quantitatively and qualitatively presented in the sections above in terms of the five QA objectives to clarify the data quality required from this testing project to support EPA's decision-making for this source category. The key elements of the DQOs include:

- Level of quality control/quality assurance.
- Sensitivity/minimum detection limits.
- Data review, validation, and reporting with statistical analysis.
- Sample management: sampling, sample recovery, sample preservation, and chain-of-custody procedures.
- Analytical methodology: documented analytical procedures, calibration, and data handling.
- Laboratory records: measurement data, maintenance records, and equipment manuals.
- Performance and system audits.
- Corrective action.

The DQOs address the entire project and provide an explanation of the interrelationships among the various groups involved in the project. When vendor supplied control limits are not available, limits may be determined using one of EPA supplied formulae to calculate limits based on statistical evaluation of plus/minus three times the standard deviation of replicate analysis of the sample in the laboratory.

Reference method sampling and analytical procedures will be employed in this project (where applicable) to help ensure the representativeness of the samples and the resulting data. All proposed field testing and measurement procedures are designed to attain the goal that the data represent the conditions found at the site. All sampling efforts will be representative of the matrix from which they were taken. All analytical activities are designed to produce data that is representative of the samples submitted for analysis. The primary tool for ensuring data representativeness is the QA/QC procedures followed by the laboratories.

The factors which affect the representativeness of samples and resulting data (sampling sites, sampling frequency, measurement system calibration status, sampling and analysis procedures, sampling equipment, and computation systems) are further addressed in the BIF Compliance/RCRA Trial Burn Test Plan.

3.4.2 Measures to Ensure Representativeness of Field Data

Representativeness is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the BIF Compliance/RCRA Trial Burn Test Plan is followed and that proper sampling techniques are used.

3.4.3 Measures to Ensure Representativeness of Laboratory Data

Representativeness in the laboratory is ensured by using the proper analytical procedures, meeting sample holding times and analyzing and assessing field duplicated samples. The sampling network was designed to provide data representative of facility conditions. During development of this network, consideration was given to applicable testing, monitoring, and analytical requirements. The rationale of the sampling network is discussed in detail in the BIF Compliance/RCRA Trial Burn Test Plan.

3.5 COMPARABILITY

3.5.1 Definition

The comparability is a qualitative, not quantitative, review of the measurement data. This QA objective determines the confidence with which data sets can be compared. The comparability will be ensured by the use of standardized test methods, QA planning, analytical planning, sample container preparation, sample handling procedures, analytical procedures, calculation procedures, and report preparation. In addition, these activities will be performed by properly trained personnel. The data from this program can be compared to those obtained from other planned or previous programs that meet the DQOS stated herein. This assumes the data are validated using the appropriate QA/QC criteria.

Any compromises of data or deviations from procedure will be highlighted in the reports to management.

All QA/QC assessments made during a project will be performed using a matrix representative of the sample matrix and conditions being measured, whenever possible. The data will be calculated and reported in units consistent with standard reporting conventions to enable comparability to existing data, standards, and/or regulatory action limits.

Generally, program analyte concentration and mass rate data will be reported in the following units:

- Mg, μg, ng, or lb or analyte per liter, cubic meter, and/or cubic foot of original sample.
- Kilograms, mg, and/or lb per hour.
- Parts per million by volume (ppm/v) or parts per billion by volume (ppb/v).
- Percent by weight or μg/kg.

Refer to Table D-21 of Section D-9d of the BIF Compliance/RCRA Trial Burn Test Plan for specific reporting units. Recovery information and the corrected concentration data will be provided as applicable.

3.5.2 Measures to Ensure Comparability of Field Data

Comparability is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the BIF Compliance/RCRA Trial Burn Test Plan is followed and that proper sampling techniques are used.

3.5.3 Measures to Ensure Comparability of Laboratory Data

Planned analytical data will be comparable when similar sampling and analytical methods are used and documented in the QAPP. Comparability is also dependent on similar QA objectives.

3.6 LEVEL OF QUALITY CONTROL EFFORT

Field blank, trip blank, method blank, duplicates, standard reference materials (SRM) and matrix spike samples will be analyzed to assess the quality of the data resulting from the field sampling and analytical programs.

Based on the method requirements specified in the individual SOP (Appendix B), the field blank, trip blank, method blank, duplicate, standard reference materials (SRM) and matrix spike samples will be analyzed to assess the quality of the data resulting from the field sampling and analytical programs.

The SOPs in Appendix B discuss method blanks, also referenced as preparation blanks or laboratory reagent blanks, as method performance indicators for monitoring the potential contamination that can be introduced during sample preparation and analysis.

Laboratory quality control is performed on the method blank, laboratory control sample (inorganic), or blank spike/spike duplicate (organic), matrix spike, matrix spike duplicate, and the laboratory matrix duplicate.

According to the standard operating procedures included in Appendix B, at least one method blank and one set of laboratory control sample analyses will be performed on each group of samples of a similar matrix type and concentration for each analysis batch of samples. These samples will be analyzed for all parameters specified in Table 3-1.

The matrix spike/spike duplicate will be analyzed for organic (VOA, BNA & PCDD/PCDF) analyses for sampling parameters and type of samples listed in Table 4-1.

The field blank, trip blank, and field duplicate will be analyzed to assess the quality of the data, resulting from the field sampling. The field blank samples are analyzed to check for procedural contamination at the facility, which may cause sample contamination. These blanks will be analyzed for metals and organics, including PCDD/PCDF parameters.

Trip blanks are used to assess the potential for contamination of samples due to contaminant migration during sample shipment and storage. One volatile organic analysis (VOA) trip blank consisting of distilled deionized ultra pure water will be included, along with each shipment of low Btu VOA samples.

Duplicate samples are collected from the same sampling location at the same time. At least one field duplicate will be analyzed from each group of samples of a similar matrix.

The laboratory and field quality control sample analyses are listed in Table 4-1.

ATTACHMENT G

SUPPORTING INFORMATION FOR SECTION 7.0
HOW TO REVIEW ELEMENT 6—SAMPLING AND MONITORING PROCEDURES

(2 Sheets)

Procedure	**Baghouse Ash and Spark Arrestor Ash Sampling Procedure**
Sample Name:	Baghouse Ash
Sampler:	Field Sampling Specialist
Process Locations:	55-gallon drums
Equipment:	120 mL glass VOA containers with Teflon®-lined lids and a grab sample collection scoop constructed of materials that are heat resistant and will not contribute contamination through its use. For baghouse and spark arrestor solids: Gloves (heat protective), eye protection, hard hat and other personal protective equipment as required.
Field Preservation Techniques:	Chill with ice $\leq$ 4 °C from time of collection
Collection Frequency:	Separate composite samples of both spark arrestor and baghouse solids will be collected at the end of each run of the trial burn.
Procedures:	Two 120 mL composite samples will be collected using a sampling thief (grain sampler). The thief will be inserted into the solid to be sampled, the inner tube rotated to open the sampler, and then agitated to encourage flow of the sample. The sampler will be closed, and the sample withdrawn. Samples from each drum will be composited in the field. Each composite sample will be placed in a separate 120 mL container. Pack as much ash into sample container as possible to remove void space. Store all samples collected during the run on ice in a clean and dedicated sample cooler. The resulting grab samples will be submitted to the analytical laboratory for analysis upon completion of the test as follows: Baghouse Ash Two mL samples for benzene analysis

Procedure (Continued)

Procedures (continued):

Two 120 mL samples for methanol analysis

Spark Arrestor Ash

Two 120 mL samples for benzene analysis

Two 120 mL samples for methanol analysis

Following the collection of each sample at the designated locations, the Field Sampling Specialist will update the sample collection documentation initiated for each sample. The sampling specialist will record on the sample collection sheet the time of collection for each grab sample and also record the total number of grab samples collected.

At the conclusion of each run, the sample coordinator will accept custody of all samples collected. The sample documentation will be reviewed for completeness and any discrepancies discussed/resolved with the Field Sampling Specialist. Samples will be placed on ice in dedicated shipping containers and stores in a sample storage area away from know potential contamination sources.

References:

Method S005, EPA-600/8-84-002

U.S. Environmental Protection Agency/Office of Solid Waste, Washington, D.C., "Test Methods for Evaluating Solid Waste - Physical/Chemical Methods," SW-846, 3rd. Ed., 1986 and updates.

ATTACHMENT H

SUPPORTING INFORMATION FOR SECTION 8.0
HOW TO REVIEW ELEMENT 7—SAMPLE HANDLING, TRACEABILITY, AND HOLDING TIMES

(9 Sheets)

6.0 SAMPLE HANDLING AND TRACEABILITY

Sample handling procedures, including compositing, labeling, preserving, storing, and transporting samples, will be conducted in a manner that protects the integrity of the samples and that provides an unambiguous link between analytical results and the conditions they represent. The following subsections describe general sample-handling procedures, sample-tracking procedures, and sample preservation and holding time requirements. A summary of sample handling, preservation, and holding times is presented in Table 6-1.

6.1 Sample Handling

Samples will be protected from evaporation, contamination, and degradation. Following collection, samples will be handled in clean, ventilated work areas and will be removed to dark, coll storage, as soon as possible. Feed samples will be segregated from emissions and other process samples to minimize any potential cross-contamination. Sample containers will be labeled at the time a sample is obtained using preprinted labels. Subsamples to be composited on site will be recorded on data sheets, and a single sample identification number will be assigned to the composite.

The samples will be packaged and labeled for shipment in compliance with current U.S. Department of Transportation (DOT) dangerous goods regulations. All sample containers will be wiped clean before packaging for shipping. Only metal or plastic ice chests will be used for shipping hazardous waste samples.

Each ice chest that contains liquid or solid samples will be lined with a 6-mil thick plastic bag. When possible, all samples from a single sampling run will be kept together as a set. Absorbent paper, vermiculite, or equivalent material will be used to absorb shock and spills.

Table 6-1

Summary of Sample Handling, Preservation, and Holding Times

Sample Type	Matrix	Container	Preservative	Max Holding Time Before Extraction (Days)	Max Holding Time from Extraction to Analysis (Days)	Max Holding Time from Sampling to Analysis
Volatile Organics	Tenax or charcoal	VOST cartridge	4 °C	N/A	N/A	14 days
	VOST Condensate	Amber glass VOA vial	4 °C, HCl to pH <2	N/A	N/A	14 days
	Feed streams[a], CKD	Glass bottle	4 °C	N/A	N/A	14 days
Semivolatile Organics	XAD-2	Foil covered, wrapped adsorbent module	4 °C	14	40	N/A
	Filter	Standard petri dish	4 °C	14	40	N/A
	Probe rinse, Transfer rinse, Condensate	Amber glass bottle	4 °C	7	40	N/A
	Feed streams[a], CKD	Glass bottle	4 °C	14	40	N/A
Dioxins/Furans and PCBs	XAD-II	Foil covered, wrapped adsorbent module	4 °C	14	N/A	45
	Filter	Standard petri dish	4 °C	14	N/A	45
	PNR and transfer rinse	Amber glass bottle	4 °C	7	N/A	45
	Impingers	Amber glass bottle	4 °C	14	N/A	45
	CKD	Glass bottle	4 °C	14	N/A	45

Table 6-1

(Continued)

Sample Type	Matrix	Container	Preservative	Max Holding Time Before Extraction (Days)	Max Holding Time from Extraction to Analysis (Days)	Max Holding Time from Sampling to Analysis
Metals	Filter	Polyethylene or glass container	None	N/A	N/A	6 months
	Acetone PNR; Acid PNR; HNO_3/H_2O_2 and Condensate; $KMnO_4$	Separate amber glass bottles	None	N/A	N/A	28 days - Hg; 6 months - other metals
	Feed streams[a], CKD	Glass bottle	None	N/A	N/A	28 days - Hg; 6 months - other metals
Particulate Matter, HCl/Cl_2	Filter	Petri dish	None	N/A	N/A	6 months
	PNR; Acid and knockout impingers; Alkaline impinger.	Separate amber glass bottles	Sodium thosulfate preservative for alkaline impinger contents	N/A	N/A	30 days
Total Chlorine/Chloride	Feed streams[a], CKD	Glass bottle	None	N/A	N/A	30 days
Physical/Chemical Characteristics[b]	Feed streams[a]	Glass bottle	None	N/A	N/A	

[a]Feed streams, include raw mix slurry and waste-derived fuel.
[B]includes moisture, heat of combustion, density, and viscosity analyses; however, raw mix will not be analyzed for viscosity.
N/A - Not Applicable

When more than one sample run can fit in a cooler, one of the sets will be placed in a separate bag to prevent cross-contamination if any of the samples break. Emissions samples will not be stored or shipped with process samples.

After the containers have been packaged, the plastic bag around the samples will be sealed by twisting the top and securely taping the bag closed to prevent leakage. When preservation requirements dictate, ice will be placed between the inner and outer plastic bags, and the outer bag will be taped shut.

Filters from stack sampling for organic species will be placed in glass containers, sealed with teflon tape, and placed in individual zip-lock plastic bags in coolers that have not been used for liquid or solid sample storage. Absorbent material or vermiculite will be packed between samples to absorb shock and spills incurred during shipment. Ice contained in double plastic bags will be added and the coolers taped shut. Filters from particulate and metals sample trains will be sealed in petri dishes with teflon tape and boxed for shipment.

Chain-of-custody records, and any other shipping and sample documentation will accompany the shipment. These documents will be enclosed in a waterproof plastic bag and taped to the underside of the ice chest lid.

Each ice chest prepared for shipment will be securely taped shut. Reinforced or other suitable tape will be wrapped at least twice around the ice chest near each end where the hinges are located. Chain-of-custody seals will be affixed across the joint between the top and bottom (in the front, and if unhinged, the back) of each ice chest prepared for shipment.

Sample shipping containers will be marked in accordance with DOT regulations for shipping hazardous materials (49 CFR 172) as appropriate.

When selecting sample shipment modes, field personnel will ensure that the sample will not exceed allowable holding times for individual analytes. Samples will be shipped as "Priority One/Overnight" through a reliable commercial carrier, such as Federal Express. Airbills will be completed and attached to the exterior lids of the containers.

A sample transfer form will be included in each shipping container, identifying each sample and its analytical requirements. Formal chain-of-custody procedures (i.e., signatures to release sample custody, controlled access, etc.) will be followed, and the samples will be tracked according to an unbroken documentation trail.

6.2 Traceability

Traceability refers to the link between the analytical results and the conditions they represent. This link includes not only sample custody, but also documentation of the preparation of reagents or supplies that become an integral part of the sample (e.g., filters and absorbing reagents), documentation of the exact location and specific considerations associated with sample acquisition, and documentation of sample preservation. This type of data will be recorded on the sample collection data sheets, prepared sample labels, and the standardized field tracking forms.

Accurate documentation of field sampling data, and sample collection and handling records, will be maintained throughout the program. The process and stack sampling task leaders will be responsible for ensuring that all data sheets, sample log book

entries, and transfer forms are completed correctly. Field personnel involved in the sample collection and recovery will assist in this effort.

All sampling data, including sampling times, locations, identification codes, and other pertinent and specific sample information, will be recorded on the sample collection data sheets contained in Appendix B. For individual samples, all pertinent information will be logged in the master sample logbook.

A master logbook will be kept for tracking and identifying all samples collected during the Trial Burn. Each sample will be assigned a unique log number identifying the project, the test stage, the run number, and a sequential identification number based upon the order of entry. Along with the log number, the master log will provide a section for comments, a description of the sample, and a sample description code. The sample description code is used to identify the sample type/matrix, test and run number, sample number (if more than one per test period) and duplicate designation (if applicable), sampling technique, and analytical requirements. The sample description code will be included along with the log number on all sample bottle labels. An example of the master logbook format, including the sample log format, is shown in Table 6-2.

Preprinted sample labels will be affixed to all sample bottles at the time of sample collection. The label will be marked to include sample log number, sample description code, date and time(s) of collection, the sampler's initials, and tare, net, and gross weights (as appropriate). Transfer forms will be completed by personnel involved in the sample handling before shipment or transfer for off-site analysis. Examples of the transfer forms and sample labels are contained in Appendix C.

Upon receipt of a sample shipment, the laboratory sample custodian will inspect the shipping container for warning labels and custody seals before opening. The sample

Table 6-2

Example of Master Logbook Format

Radian Field Number	Radian Sample Code	Description	Sampling Time (HHMM)	Sample Size	Storage Location or Shipping Destination	Comments	Recovery Person's Initials	Shipping Date	Cooler Number
PT-1	RM-1-1-SVOL	Raw Mix	1240	250 mL	ABC				
PT-2	WDF-1-2-PC	Waste-Derived Fuel	0830	250 mL	ABC				
PT-3	WDF-1-2-MET	Waste-Derived Fuel	1600	250 mL	ABC				

custodian will open the container and check the contents for evidence of breakage or leaking. The contents of the container will be inspected for chain-of-custody documents and other information or instructions. The presence or absence of ice will be noted on the chain-of-custody document or shipment condition report. The sample custodian will verify that all information on the sample bottle labels is correct and consistent with the chain-of-custody form and the airbill will be retained in the project file, and a copy will be returned to the Project Manager to verify receipt.

Any discrepancy between the samples and the chain-of-custody information, any broken or leaking sample bottles, or any other abnormal situations will be reported immediately to the QA/QC Coordinator, and corrective action options will be discussed and implemented. Notations of the problem and resolution will be made on the chain-of-custody form, initialed, and dated by the sample custodian.

The following information will be recorded on the chain-of-custody form:

- Date of receipt;
- Client name;
- Identifying number or description;
- Project number; and
- Analyses required.

Each sample is assigned a unique laboratory number, and a laboratory sample label is attached to each bottle. A work order is prepared and provided to the laboratory supervisor for scheduling tests in accordance with method-required maximum holding times. A bench sheet is printed and used to inform the analysts of the tests to be performed for each sample and to transmit information throughout the sample preparation, analysis, and report preparation sequence.

The pH of preserved liquid samples will be checked. Samples will be stored in designated refrigerated areas according to the analyses to be performed. Once the sample has been received by the laboratory, sample chain-of-custody forms are used only when samples are removed from secured areas in the laboratories and shipped to another location.

ATTACHMENT I

SUPPORTING INFORMATION FOR SECTION 9.0
HOW TO REVIEW ELEMENT 8—SPECIFIC CALIBRATION PROCEDURES AND FREQUENCY

(10 Sheets)

SECTION 6

CALIBRATION PROCEDURES AND FREQUENCY

This section describes the calibration procedures and the frequency at which those procedures will be performed for both field and laboratory instruments.

6.1 FIELD INSTRUMENT CALIBRATION

The following equipment items will be calibrated before and after field usage:

- Velocity measurement devices.
- Gas flow rate metering systems.
- Gas volume metering equipment.
- Gas composition measuring apparatus (Orsat).

The calibration records will include device numbers, calibration dates, methods, and data and results, and will be maintained on file at the XYZ/123 offices. Copies of applicable calibration records will also be available at the job site for review.

Acceptance limits are shown for each equipment item on Table 6-1.

TABLE 6-1

ACTIVITY MATRIX FOR CALIBRATION OF EQUIPMENT*

APPARATUS	ACCEPTANCE LIMITS	FREQUENCY AND METHOD OF MEASUREMENT	ACTION IF REQUIREMENTS ARE NOT MET
Wet test meter	Capacity 3.4 m^3/hr (120 ft/hr); accuracy within ±1.0%	Calibrate initially, and then yearly by liquid displacement	Adjust until specifications are met, or return to manufacturer
Dry gas meter	$Y_1 = T \pm 0.02\ Y$	Calibrate vs. wet test meter initially, and when post test check exceeds Y ±0.05 Y	Repair, or replace and then recalibrate
Thermometers	Impinger thermometer ±1 °C (2 °F); dry gas meter thermometer ±3 °C (5.4 °F) over range, stack temperature sensor ±1.5% of absolute temperature	Calibrate each initially as a separate component against a mercury-in-glass thermometer; then before each field trip compare each as part of the train with the mercury-in-glass thermometer	Adjust; determine a constant correction factor; or reject
Probe heating system	Capable of maintaining 120° ± 14 °C (248° ± 25 °F) at a flow rate of 20 1/min (0.72 ft^3/min)	Calibrate component initially by APTD-0576(11) if constructed by APTD-0581(10), or use published calibration curves	Repair, or replace and then reverify the calibration
Barometer	±2.5 mm (0.1 in.) Hg of mercury-in-glass barometer	Calibrate initially vs. mercury-in-glass barometer; check before and after each field test	Adjust to agree with a certified barometer
Probe nozzle	Average of three ID measurements of nozzle; difference between high and low 0.1 mm (0.004 in.)	Use a micrometer to measure to nearest 0.025 mm (0.001 in.), check before field test	Recalibrate, reshape, and sharpen when nozzle becomes nicked, dented, or corroded
Type S pitot tube and/or probe assembly	All dimension specifications met, or calibrate according to Section 3.1.2, and mount in an interference-free manner	When purchased, use method in Sections 3.1.1 and 3.1.2; visually inspect after each field test	Do not use pitot tubes that do not meet face opening specifications; repair or replace as required

Table 6-1

(Continued)

APPARATUS	ACCEPTANCE LIMITS	FREQUENCY AND METHOD OF MEASUREMENT	ACTION IF REQUIREMENTS ARE NOT MET
Stack gas temperature measurement system	Capable of measuring within 1.5% of minimum absolute stack temperature	When purchased and after each field test, calibrate against ASTM thermometer	Adjust to agree with Hg bulb thermometer, or construct a calibration curve to correct the readings
Analytical balance	±1 mg of Class-S weights	Check with Class-S weights upon receipt	Adjust or repair
Differential pressure gauge (does not include inclined manometers)	Agree within ±5% of incline manometers	Initially and after each field use	Adjust to agree with inclined manometer or construct calibration curve to correct the readings
Orsat analyzer	Average of three replicates should be 20.9 ± 0.5% (absolute) or known concentration ±0.5 (absolute)	Upon receipt and before any test in which the analyzer has not been checked during the previous 3 mo; determine % O_2 in ambient air, or use a calibration gas with known CO, CO_2, and O_w concentrations	Check Orsat analyzer for leaking valves, spent absorbing reagent, and/or operator techniques; repair or replace parts or absorbing solutions, modify operator techniques
Rotameter or rate meter	Smooth curve of rotameter actual flow rates with no evidence of error. ±5% of known flow rate	Check with wet test meter or volume meter at 6-month intervals or at indication of erratic behavior	Repeat calibration steps until limits are attained

*EPA-600/9-76-005, *Quality Assurance Handbook for Air Pollution Measurement Systems - Volume III*, U.S. EPA, Office of Research and Development, Environmental Monitoring and Support Laboratory, Research Triangle Park, NC, January 1976, as revised.

6.2 LABORATORY INSTRUMENT CALIBRATION

All instruments must be calibrated prior to use as a measurement device to establish the instrumental response to known reference materials. The manner in which various instruments are calibrated is dependent on the particular type of instrument and its intended use. All sample measurements are made within the calibrated range of the instrument. Preparation of all reference materials used for calibration will be documented in a standards preparation notebook.

Instrument calibration typically consists of two types: initial calibration and continuing calibration. Initial calibration procedures establish the calibration range of the instrument and determine instrument response over that range. Typically, three to five analytes concentrations are used to establish instrument response over a concentration range. The instrument response over the range is generally absorbance, peak height, etc., which can be expressed as a linear model with a correlation coefficient (e.g., for Atomic Absorption, Inductively Coupled Plasma, UV-Visible-Infrared Spectrophotometry) or as a response factor or amount vs. Response plot (e.g., for Ion Chromatography, Gas Chromatography, Gas Chromatography/Mass Spectrometry, High Performance Liquid Chromatography).

Continuing calibration usually includes measurement of the instrument response to fewer calibration standards and requires instrument response to compare with certain limits (e.g., ± 10%) of the initial measured instrument response. Continuing calibration may be used within an analytical sequence to verify stable calibration throughout the sequence, and/or to demonstrate that instrument response did not drift during a period of non-use of the instrument.

Specific instrument calibration procedures for various instruments are summarized further in this section and detailed in the respective analytical methods provided in the corresponding Standard Operating Practice (SOP).

All calibration standards will be prepared from ACS grade or better chemicals or reference materials, such as National Institute of Standards and Testing (NIST) Standard Reference Materials. The procurement of this material is the responsibility of the Laboratory QA Officer.

6.2.1 Analysis of Semivolatiles (Including PCDD and PCDF) and Volatiles by GC/MS Initial Calibration

Before any samples are analyzed, calibration standards of Standard Reference Materials (SRMs) will be prepared in the appropriate matrix in a concentration (or mas) series of blank, 0.5X, X, 2X, 5X, and 10X, where X is the detection limit concentration (or mass) of the analyte in the matrix being analyzed. These data will be plotted to define the linear response range of the GC/MS system (plot peak area on the ordinate and concentration on the abscissa). The majority of compounds analyzed for GC/MS comprise EPA's target compound list (TCL) or method specific compounds. The % RSD for all PCDD/PCDF conginers, volatile and semivolatile compounds in the Standard Reference Materials should be $\leq$ 30%. Once an acceptable calibration is obtained, samples may be analyzed until the expiration of the tune (12-hours from the tune analysis). After acceptable tuning, a continuing calibration standard may be analyzed in lieu of a full five point calibration.

Daily Calibration

During each operating shift, a midpoint calibration standard is analyzed to verify that the instrument responses are still within the initial calibration determinations. The calibration check compounds will be specified in the laboratory SOPs for each analysis. The response factors for each target compound in the continuing calibration standard is calculated, recorded and then compared to the average response factor from the initial calibration.

The percent difference (% D) between the initial and continuing calibrations should be $\leq$25% in volatile and semivolatile and 30% in tetra-to-hexa PCDD/PCDF and hepta-to-octa PCDD/PCDF, respectively.

These data will be treated as outlined for the calibration data obtained before the sample analyses are started.

The % RSDs and % Ds for all compounds in the Standard Reference Materials (SRMs) should meet the criteria specified in the reference method and the corresponding SOPs prior to the sample analysis. No analyses can be run until a successful initial calibration sequence has been demonstrated.

The response factor drift (% RSD) will be calculated and recorded. Any out-of-control situation will be reported to the Laboratory Manager and QA Officer who in turn will document the cause of the situation and initiate corrective action. A copy of this document will be given to the Laboratory QA Officer. If significant (% RSD > 30%) and/or (% Ds > 25%) percent difference are observed, appropriate corrective action will be taken to restore confidence in the instrument measurements and an additional five-point initial calibration must be re-established.

6.2.2 Analysis of Chloride and Hexavalent Chromium by Ion Chromatography

The ion chromatograph will be calibrated prior to each analytical run or minimally every 24 hours. Calibration standards will be prepared from appropriate reference materials, appropriately to the analysis being performed as described in the SOPs. The working standards will include a blank and a minimum of four concentrations to cover the anticipated range of measurements. The expected calibration standards are 0.5 ug/l, 1.0 ug/l, 3.0 ug/l, and 5.0 ug/l. At least one of the calibration standards will be at or below the desired instrument detection limit. The correlation coefficient of the plot of known versus found concentrations will be at least 0.995 in order to consider the responses linear over a range. If a correlation coefficient of 0.995 cannot be achieved, the instrument will be recalibrated prior to analysis of samples.

Calibration data, to include the correlation coefficient, will be entered in laboratory notebooks to maintain a permanent record of instrument calibrations.

6.2.3 Analysis of Metals by ICP and AAS - Calibration

Spectrophotometers will be calibrated prior to each day or period of use. Calibration standards will be prepared from the reference materials appropriate to analyses being performed, and working calibration standards will be prepared fresh daily. The working standards will include a blank and three concentrations to cover the anticipated range of measurement. At least one of the calibration standards will be at or below the desired instrument detection limit. The correlation coefficient of the plot of known versus found concentrations will be at least 0.995 in order to consider the responses linear over a range. If a correlation coefficient of 0.995 cannot be achieved, the instrument will be recalibrated prior to analysis of samples.

Calibration data, to include the correlation coefficient, will be entered into laboratory notebooks to maintain a permanent record of instrument calibrations.

One pont of calibration (high range calibration) should be analyzed after the instrument calibration. The continuing calibration analysis of mid range concentration should be performed within 2 hours or for each 10 sample analyses, whichever is more frequent. The % Ds for the initial and continuing calibrations should be ≤10% from the true values for each analyte analyzed by ICP and GAFF and 20% for mercury analyses. These criteria should be obtained prior to any sample analysis.

6.2.4 Analysis of Formaldehyde by High Performance Liquid Chromatography (HPLC)

High-performance liquid chromatographs will be calibrated on a 12 hour clock during the sample analysis. Calibration standard mixtures will be prepared from appropriate reference materials and will contain analytes appropriate for the method of analysis.

If a correlation of 0.996 cannot be obtained, additional standards must be analyzed to define the calibration curve. A midpoint check standard will be analyzed each 12 hours to confirm the validity of the initial calibration curve. The check standard must be within 10% of the initial response curve to demonstrate that the initial calibration curve is still valid.

Calibration data, to include the correlation coefficient, will be entered into laboratory notebooks to maintain a permanent record of instrument calibrations.

6.2.4 Analysis of CO_2 and O_2 by Orsat

The Orsat will be leak-checked prior to each sample using the procedure referenced in Section 5 of EPA Method 3. Ambient air will be analyzed to further leak-check the apparatus and to check the status of the O_2 absorbing solution and the calibration of the graduated portion of the burette relevant to O_2 (acceptability range = 20.8 ± 0.5%). Acceptable values can differ by no more than 0.3% by volume from each other in triplicate analyses of the same sample.

6.26. Gravimetric Analysis

The analytical balance will be checked daily with Class-S weights. The response will be within 1 mg of true before proceeding with sample determination.

6.2.7 Viscosity

All test apparatus will be equilibrated to room temperature. A certified thermometer will be used to measure the sample temperature.

6.2.8 High Heating Value

6.2.9 Ash

Calibration of the oven and balance will be checked daily. All weights will be recorded to the nearest 1 mg after the sample has cooled to balance temperature in a desiccator.

6.2.10 Specific Gravity

The balance will be calibrated and checked daily.

ATTACHMENT J

SUPPORTING INFORMATION FOR SECTION 10.0
HOW TO REVIEW ELEMENT 9—ANALYTICAL PROCEDURES

(24 Sheets)

ATTACHMENT J-1

SECTION 7

ANALYTICAL PROCEDURES

XYZ will utilize three laboratories for analysis of samples collected during the BIF Compliance/RCRA Trial Burn Test Program. Table 7-1 identifies the laboratories and analytical parameters.

7.1 FIELD ANALYTICAL PROCEDURES

Field sampling procedures have been provided in the BIF Compliance/RCRA Trial Burn Test Plan. CEM procedures are described in Appendix 2 of the BIF Compliance/RCRA Trial Burn Test Plan. All samples collected in the field will be shipped to the laboratories named in Table 7-1. Therefore, field analysis of samples is not anticipated.

7.2 LABORATORY ANALYTICAL PROCEDURES

The laboratories named in Table 7-1 will implement the project required Standard Operating Procedures (SOPs). The laboratory SOPs for sample preparation, cleanup and analysis are based on SW-846 Third Edition and other EPA and ASTM methods. These SOPs provide sufficient details and are specific to this BIF Compliance/RCRA Trial Burn Test Program.

TABLE 7-1
DESIGNATED LABORATORIES AND ANALYTICAL PARAMETERS

LABORATORY	ANALYTICAL PARAMETER
Octagon Laboratories, Inc. 1801 State Drive Mayberry, NC 27713 (919)555-5729	Semivolatiles Volatiles PCDD/PCDF Formaldehyde Metals (optional)
123-Gulf Coast Laboratories, Inc. 122471 James Street College Park, IL 60466 (708)555-5200 and 123-Lionville Laboratories 345208 Blackout Pool Road Lionville, PA 19341 (610)555-6100	Metals (excluding Cr^{+6} stack samples) Particulate HCl/Cl_w Ash Chloride Viscosity High Heating Value Specific Gravity
Developed Research Institute 3040 Walawala Road Park, NC 27709 (919)555-6897	Hexavalent Chromium (Cr^{+6}) (stack samples)
Rhine-Holtz, Inc. 20432 Detroit Street Hammock, IN 46320 (219)555-7651	Carbon Tetrachloride in VOST stack samples

Table 7-2 summarizes the analyte groups of interest, appropriate laboratory SOP numbers and EPA reference method for the organic and inorganic analytes, respectively, to be evaluated in this investigation. The laboratory SOPs to be used in this program have been included in Appendix B.

7.2.1 List of Project Target Compounds and Laboratory Detection Limits

A complete listing of project target compounds, laboratory detection limits, and equivalent emission rates are listed in Table 7-3.

7.2.2 List of Associated QC Samples

The laboratory SOPs include a QC section which addresses the minimum QC requirements for the analysis of specific analyte groups. Section 3 of this QAPP contains a complete listing of the associated QC samples for every analyte group and matrix.

TABLE 7-2
SUMMARY OF ANALYTICAL PROCEDURES,
METHODS NUMBERS AND DESIGNATED LABORATORIES

SAMPLE TYPE	ANALYTE GROUP	ANALYTICAL LABORATORY	LABORATORY SOP NO PREPARATION/ANALYSIS/REPORTING	EQUIVALENT METHOD NUMBER
Feed Stream Matrix of samples: Liquid & Solid	Chloride	1	21-15G-00220/21-15G-325.2	SW846-5050 (prep)/EPA 600/4/79-020 Method 325.2
	Ash	1	21-15G-2540G	Standard Method - Method 2540G
	Heating Value	1	21-15G-D240	ASTM D240-92
	Specific Gravity	1	21-15G-2710F	ASTM D5057-90
	Viscosity	1	21-15G-2196	ASTM D2196
	Semi Volatile POHC	2	OWL106/OMS155/OMS130	SW846-8270B
	Volatile POHC	2	OMS-100-90/OMS130	SW846-8240B
	ICP & GFAA Metals	1	21-15G-6010 & 21-15G-200.3	SW846-3010A & 3050A Prep SW846-6010B & 7000A Analysis
	Mercury (CVAA)	1	21-15G-245.1	SW846-7470A/7471A
	Cr^{+6}	1	21-15G-3500CrD	SW846-7196
Process Effluent Matrix of samples: Liquid	Chloride	1	21-15G-0022/21-15G-325.2	SW846-5050 (prep)/EPA 600/4-79-020 Method 325.2
	Specific Gravity	1	21-15G-2710F	ASTM D5057-90
	Viscosity	1	21-15G-2196	ASTM D2196
	Semi Volatile POHC	2	OWL106/OMS155/OMS130	SW846-8270B
	Volatile POHC	2	OMS-100-90/NA/OMS130	SW846-8240B
	ICP & GFAA Metals	1	21-15G-6010 & 21-15G-200.3	SW846-3010A Prep SW846-6010B & 7000A Analysis
	Mercury (CVAA)	1	21-15G-245.1	SW846-7470A

TABLE 7-2
(Continued)

SAMPLE TYPE	ANALYTE GROUP	ANALYTICAL LABORATORY	LABORATORY SOP NO PREPARATION/ANALYSIS/REPORTING	EQUIVALENT METHOD NUMBER
Stack Gas	Particulate	1	Not Provided	EPA Method 5 (Gravimetric)
	HCl, Cl_2	1	Not Provided	EPA Method 0050/Proposed SW846-9057
Matrix of samples: Liquids, filters and resins Process Effluent	Semi Volatile	2	OWL118/OMS155/OMS130	SW846-8270B
	Volatile Organic	2	OMS-108-90/OMS130	SW846-5040A/SW846-8240B
	Dioxin (PCDD/PCDF)	2	DSP 111-90/DHR 134-91/DHR 141-90	40 CFR 60 Appendix A Method 23
	ICP & GFAA Metals	1	21-15G-6010 & 21-15G-200.3	SW846-3050A SW846-6010B & 7000A
	Mercury (CVAA)	1	21-15G-245.1	SW846-7470A/7471A
	Cr^{+6}	3	ESE-800	40 CFR 60 Appendix A Method 306 Ion Chromatography with Post Reactor
	Formaldehyde	2	OLS 100	EPA Method 0011A
	Carbon Tetrachloride	4	RPI 0196-5040/8010	SW846-8010
	PCB	2	OWL 164/OMS 160/ORG 142, 140	EPA Method 680
	Pesticides	2	OWL 166/OGC 100, 128/OGC 137	EPA Method 8080

1. 123-Gulf Coast Laboratoriess, Inc.
   122471 James Street
   College Park, IL 60466
   (708)555-5200

2. Octagon Laboratories, Inc.
   1801 State Drive
   Mayberry, NC 27713
   (919)555-5729

3. Developed Research Institute
   3040 Walawala Road
   Park, NC 27709
   (919)555-6897

4. Rhine-Holtz, Inc.
   20432 Detroit St.
   Hammock, IN 46320
   (219)555-7651

TABLE 11-1
SUMMARY OF ANALYTICAL SOPs AND PREVENTIVE MAINTENANCE REFERENCES

SAMPLE TYPE	ANALYTE GROUP	ANALYTICAL LABORATORY	LABORATORY SOP NO	
			PREVENTIVE MAINTENANCE	INSTRUMENT CALIBRATION
Feed Stream Matrix of samples: Aqueous & Solid	Chloride	1	21-15G-325.2 (Sect. 7.0)/ 21-15G-0022 (Sect. 7.0)	21-15G-325.2 (Sect. 9.5)/ 21-15G-0022 (Sect. 9.6)
	Ash	1	21-15G-2540G (Sect. 7.0)	21-15G-2540G (Sect. 7.2)
	Heating Value	1	21-15G-D240 (Sect. 7.0)	21-15G-D240 (Sect. 9.3)
	Specific Gravity	1	21-15G-2710F (Sect. 7.0)	21-15G-2710F (Sect. 7.0)
	Viscosity	1	21-15G-2196 (Sect. 7.0)	21-15G-2196 (Sect. 7.0)
	Semi Volatile POHC	2	NS	OMS130 (OMS158)
	Volatile POHC	2	NS	OMS 100
	ICP or GFAA Metals	1	21-15G-6010A (Sect. 7.0) & 21-15G-200.3 (Sect. 7.0)	21-15G-6010A (Sect. 8.2) & 21-15G-200.3 (Sect. 9.4)
	Mercury (CVAA)	1	21-15G-245.1 (Sect. 6.0)	21-15G-245.1 (Sect. 9.9)
	Cr^{+6}	1	21-15G-3500 (Sect. 7.0)	21-15G-3500 (Sect. 9.7)
Process Effluent Matrix of samples: Aqueous	Chloride	1	21-15G-325.2 (Sect 7.0)/ 21-15G-0022 (Sect. 7.0)	21-15G-325.2 (Sect 7.0)/ 21-15G-0022 (Sect. 7.0)
	Specific Gravity	1	21-15G-2710 (Sect. 7.0)	21-15G-2710 (Sect. 7.0)
	Viscosity	1	21-15G-2196 (Sect. 7.0)	21-15G-2196 (Sect. 9.3.5)
	Semi Volatile POHC	2	NS	OMS130 (OMS158)
	Volatile POHC	2	NS	OMS 100
	ICP or GFAA Metals	1	21-15G-6010A (Sect. 7.0) & 21-15G-200.3 (Sect. 7.0)	21-15G-6010A (Sect. 7.0) & 21-15G-200.3 (Sect. 7.0)
	Mercury (CVAA)	1	21-15G-245.1 (Sect. 6.0)	21-15G-245.1 (Sect. 9.9)

TABLE 7-3
SUMMARY OF TARGET COMPOUNDS
AND LABORATORY DETECTION LIMITS

Volatile Compounds	Analytical Detection Limit	Emission Rate g/sec
Acetaldehyde		
Acetone		
Acrolein		
Acrylonitrile		
Benzene		
Bromodichloromethane		
Bromoform		
Bromomethane		
tert-Butyl methyl ether		
Carbon disulfide		
Carbon tetrachloride		
Chlorobenzene		
Chloroethane		
Chloroform		
Chloromethane		
Dichlorodifluoromethane		
1,2-Dichloroethane		
1,1-Dichloroethylene		
(trans)1,2-dichloroethylene		
1,2-Dichloropropane		
(cis)1,3-Dichloropropene		
(trans)1,3-Dichloropropene		
Ethylbenzene		
Ethylene dibromide (Dibromoethane)		
Ethyl methacrylate		

TABLE 7-3 (Continued)
SUMMARY OF TARGET COMPOUNDS
AND LABORATORY DETECTION LIMITS

Volatile Compounds	Analytical Detection Limit	Emission Rate g/sec
Formaldehyde		
Methyl ethyl ketone (2-Butanone)		
Methylene chloride		
4-Methyl 2-penatnone		
Styrene		
1,1,1,2-Tetrachloroethane		
p-Cresol		
Cumene		
DDE		
Dibenzo(a,h)anthracene		
1,2-Dibromo-3-chloropropane		
Di(n)butyl phthalate		
1,3-Dichlorobenzene		
1,2-Dichlorobenzene		
1,4-Dichlorobenzene		
Dichlorodifluoromethane		
1,2-Dichloroethane		
1,1-Dichloroethylene		
(trans)1,2-dichloroethylene		
2,.4-Dichlorophenol		
1,2-Dichloropropane		
(cis)1,3-Dichloropropene		

TABLE 7-3 (Continued)
SUMMARY OF TARGET COMPOUNDS
AND LABORATORY DETECTION LIMITS

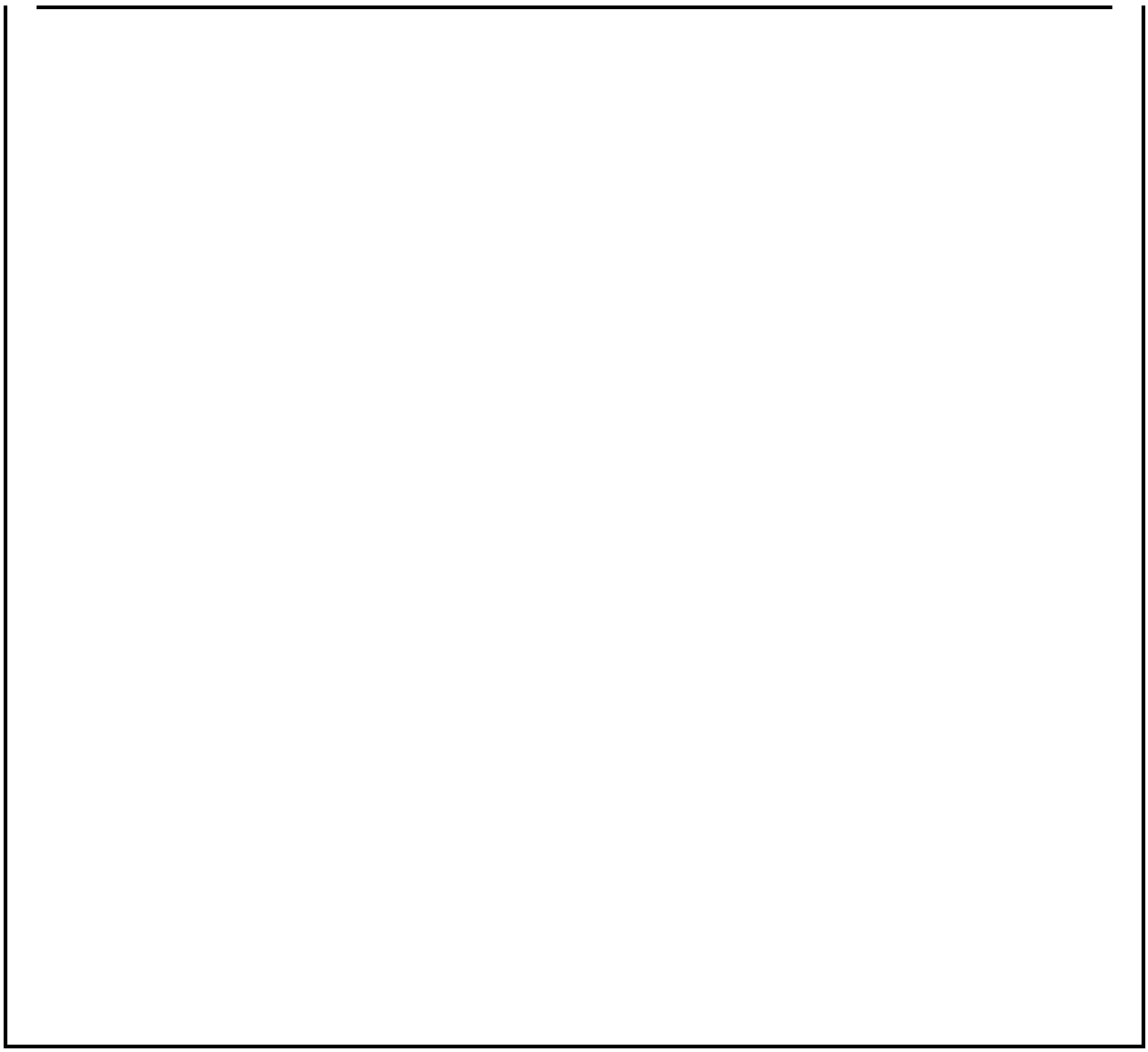
Volatile Compounds	Analytical Detection Limit	Emission Rate g/sec
Diethyl phthalate		
2,4-Dimethylphenol		
Dimethyl phthalate		
1,3-Dinitrobenzene		
4,6-Dinitro-2-methlphenol		
2,4-Dinitrophenol		
2,4-Dinitrotoluene		
2,6-Dinitrotoluene		
Di(n)octyl phthalate		
Ethylbenzene		
Ethylene dibromide (Dibromoethane)		
Ethyl methacrylate		
Formaldehyde		
Fluoranthene		
Heptachlor		
Hexachlorobenzene		
Hexachlorobutadiene		
α-Hexachlorocyclohexane (α-BHC)		
β-Hexachlorocyclohexane (β-BHC)		
γ-Hexachlorocyclohexane (γ-BHC)		
Hexachlorocyclopentadiene		
Hexachloroethane		
Indeno(1,2,3-cd)pyrene		

TABLE 7-3 (Continued)
SUMMARY OF TARGET COMPOUNDS
AND LABORATORY DETECTION LIMITS

Volatile Compounds	Analytical Detection Limit	Emission Rate g/sec
Methoxychlor		
Methyl ethyl ketone (2-Butanone)		
Methylene chloride		
4-Methyl 2-pentanone		
Naphthalene		
Nitrobenzene		
N-Nitroso di-n-butylamine		
Pentachloronitrobenzene		
Pentachlorophenol		
Phenol		
Polychlorinated biphenyls (10 homologue groups)		
Polychlorinated dibenzo-p-dioxins/furans		
Pyrene		
Styrene		
1,1,1,2-Tetrachloroethane		
1,1,2,2-Tetrachloroethane		
Tetrachloroethylene		
Toluene		
1,2,4-Trichlorobenzene		
1,1,1-Trichloroethane		
1,1,2-Trichloroethane		
Trichloroethylene		
Trichlorofluoromethane		

TABLE 7-3 (Continued)
SUMMARY OF TARGET COMPOUNDS
AND LABORATORY DETECTION LIMITS

Volatile Compounds	Analytical Detection Limit	Emission Rate g/sec
2,4,5-Trichlorophenol		
2,4,6-Trichlorophenol		
Vinyl chloride		
Vinylidine chloride (1,1-Dichloroethane)		
m-Dimethyl benzene (m-xylene)		
o-Dimethyl benzene (o-xylene)		
p-Dimethyl benzene (p-xylene)		



ATTACHMENT J-2

Procedure P-A-18. Procedure for Analysis of Volatile Total Chromatographable Organics in SW-0040 Samples

Sample name (matrices):	Method 0040 Bag Sample Method 9904 Condensate Sample
Sample holding time:	Field samples should 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.
Procedure:	The two portions (bag sample and condensate) of this stack gas sample are analyzed by separate methods and reported separately.

Bag Sample

This sample will be analyzed by field gas chromatography using a flame ionization detector 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 are sampled into Tedlar bags and require on-site gas chromatographic analysis of the collected sample. The range of applicable compounds is 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 must be made in order to achieve chromatographic resolution for methane at the same time as the total analysis time is limited to no more than 15-20 minutes.

The field GC may use two chromatographs, one with an appropriate column and conditions for C_1 - C_4, and the second with an appropriate column and conditions for the C_4 - C_6 range. A capillary column is 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 primarily be separating compounds on the basis of boiling points, but the separation will also 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 all have to be optimized for the best chromatographic results. A flame ionization detector is required to perform the analysis.

The gas chromatograph must be calibrated for quantitative analysis with a normal hydrocarbon curve. The curve is prepared using certified cylinders containing the n-alkanes from C_1 through C_6. A multipoint calibration of at least three points (in duplicate) is required. Calibration for methane must be performed carefully so that the quantity of methane can be determined accurately. Methane is often found in significant quantities when combustion stacks are sampled, and it is 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-C_6 standard gas mixture is used to calibrate the field gas chromatograph, and a point approximately in the middle of the calibration range should be analyzed at least once per day as a calibration check. The multipoint calibration is 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 will be required to set up calibration ranges, GC column, temperature programming, etc.

After full calibration, sample analysis is 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 is actuated and the contents of the loop are injected into the chromatograph. Simultaneously with the injection of the sample, the temperature programmer and integrator/data system data acquisition are started. Chromatograms and integrator/data system output are collected. Retention times and responses must agree to within 5 percent relative standard deviation with the calibration curve. Uniform flame ionization detector (FID) responses for varying compound classes is assumed in this methodology. The resulting quantitative results therefore tend to be biased low for compounds which are not n-alkanes. In many, if not most, cases, the species present are not 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.

Condensate Sample

This sample will be analyzed by field chromatography using a flame ionization detector 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 will be required to set up calibration ranges, GC column, temperature programming, etc.

Compounds with boiling points below 100 °C are sampled by SW-0040 into the condensate ahead 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-C_7 range is required. A capillary column with a length of 60 meters may be required to provide adequate resolution for smaller organic and hydrocarbon isomers. A flame ionization detector is required to perform this analysis.

The purge and trap GC must be calibrated for quantitative analysis with a normal hydrocarbon curve. The curve is prepared using liquid alkane standards containing the n-alkanes from C_5 through C_7. A multipoint calibration of at least three points (in duplicate) is required. The alkane mixture is used to calibrate the GC, and a point approximately in the middle of the calibration range should be analyzed at least once per day as a calibration check. The multipoint calibration is achieved through the use of serial dilutions of the primarily stock standard mixture in methanol solution.

After full calibration, sample analysis is initiated when an aliquot of the water sample in the VOA vial is transferred to the purge flask. The purge gas is activated, purging the vapor with an inert gas to the sorbent grab (VOCOL, VOCARB, or equivalent). When the sample is sufficiently purged from the vessel into the trap, the valve is actuated and the trap contents are desorbed by rapid heating onto the head of the GC column with the FID detector. The temperature programmer and integrator/data system acquisition are started. Chromatograms are integrator/data system output are collected.

Uniform flame ionization detector (FID) 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 reported as C_4 with the other organic results.

Referenced:

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, USEPA,

STANDARD OPERATING PROCEDURE	DEVELOPED RESEARCH INSTITUTE 3040 WALAWALA ROAD PARK, NC 27709-2194	SOP Number ESE-800 Page 1 of 5

TITLE: Analysis of Hexavalent Chromium in Aqueous Samples by Ion Chromatographic Separation Chromophoric Complexation Spectrophotometry

SOURCE: Environmental Chemistry Department

AUTHOR: Signed:

Date:

APPROVED BY: Signed:

Date:

EFFECTIVE DATE:

Revisions

No.	Section	Date	Pages	Initials/Dates

TABLE OF CONTENTS

Section		Page
1.0	Scope	3
2.0	Summary of Method	3
3.0	Limitations and Interferences.....	3
4.0	Apparatus.....	3
5.0	Reagents.....	3
6.0	Instrument Operation.....	4
7.0	Instrument Calibration.....	4
8.0	Sample Analysis.....	4
9.0	Maintenance.....	5

1.0 SCOPE

This document describes the determination of chromium (VI) in aqueous samples. The method is not expected to have significant interferences from other ions. The method has the potential for further significant improvements in sensitivity.

2.0 SUMMARY OF METHOD

The aqueous solution is analyzed using an ion chromatographic technique utilizing a mixed cation/anion separator column. Following chromatographic separation, the Cr^{+6} is reacted with a chromophoric reagent and measured spectrophotometrically at 520 nrn.

3.0 LIMITATIONS AND INTERFERENCES

No significant interferences are expected with this method. Trivalent chromium is separated during the chromatography step.

4.0 APPARATUS

4.1 Dionex single channel Ion Chromatograph. P/N 37029 or equivalent

4.2 Dionex NG1 Cation Guard Column, P/N 29567

4.3 Dionex AS7 Cation Separator Column, P/N 035393

4.4 Dionex Reagent Delivery Module (RDM), P/N 35354

4.5 Dionex Visible Detector (VSM), P/N 37044

4.6 Shimadzu C-R5a Chromatopac Integrator

4.7 Dionex Automated Sampler

5.0 REAGENTS

5.1 Ammonium Sulfate

5.2 Ammonium Hydroxide

5.3 1,5-diphenylcarbohydrazide (DPC)

5.4 methanol, HPLC Grade

5.5 sulfuric acid, 96%, spectrophotometric grade

5.6 deionized water, 18 M-ohm

5.7 Eluent: Prepare by dissolving 33 g of ammonium sulfate in 500 mL 18 M-ohm degassed deionized water containing 6.8 mL of concentrated ammonium hydroxide (29%). Dilute to 1 L with degassed deionized water.

5.8 Post Column Reagent: Prepare by dissolving 0.49 g of 1,5-diphenylcarbonhydrazide (DPC) in 100 mL of methanol. Add to about 500 mL of degassed deionized water containing 25 mL of concentrated sulfuric acid. Dilute to 1 L with degassed deionized water.

6.0 INSTRUMENT OPERATION

6.1 Assemble the accessories according to the manufacturer's instructions in the individual component manuals.

6.2 Install a 50 μL sample loop on the injection valve. (250-100 μL)

6.3 Conditions

Sample Size: 50 μL

Columns: NG1, Cation Guard Column

AS7, Cation Separator Column

Efluent Flow Rate: 1.0 mL/min

Post Column Reagent Flow Rate: 0.5 mL/min

Detection: VIA at 520 nrn - Filter #5 on wheel

6.4 Establish the recommended eluent and post column reactor flow rates: 1.0 mL/min for the eluent and 0.5 mL/min for the post column reactio reagent are suggested.

6.5 Turn pumps on

6.6 Set the detector range to the approximate sensitivity range.

7.0 INSTRUMENT CALIBRATION

7.1 Inject a series of Cr^{+6} standards diluted in deionized water in a range chosen to bracket the concentration of Cr^{+6} in the samples.

7.2 Determine the least squares fit. The calibration data should result in a correlation coefficient of 0.995 or better.

7.3 Run a check standard at least every tenth sample.

7.4 Blank dionized water samples should be analyzed to demonstrate that background hexavalent chromium is not present.

8.0 SAMPLE ANALYSIS

8.1 If the sample contains particulate matter, insert an Acrodisc prefilter in the injection port.

4.1.6 Deviations from Standard Methods

The following modifications or deviations from the Reference Methods or validated methods are to be made, and were reviewed and found to be acceptable to the external QA/QC team for the reasons stated. Any potential impacts on the data quality are addressed.

Deviations from CEM Reference Methods -

1. The CO monitor will not employ a drying tube (to remove moisture) or an ascarite tube (to remove CO_2). The sample conditioning system will be sufficient to reduce moisture in the gas stream such that interference by water vapor will be minimized. The cylinder gas PEAs will include a check of the CO/CO_2 discrimination by the CO monitor.

Deviations from Method 0010 and Method 23 for Trace Semivolatile Organics -

1. The filters, recovered from the Method 0010 trains and the Method 23 trains, will be combined with the methanol/methylene chloride rinse (Method 0010) or the acetone and methylene chloride rinse (Method 23) for each train. The methods state that the filter is kept separate from the solvent rinse, only to be combined later in the laboratory. The laboratory performing the semivolatile organic analyses, 123, has recommended that this variation be used. 123 was instrumental in the development of EPA Method 23. This variation should not affect the data quality, and may serve to improve the accuracy of the method. Triangle has reported in the past that they have encountered problems quantitatively recovering the filter and associated particulate matter for analysis. By placing the filter in a jar with the solvent rinses, loose particulate matter will be easier to transfer to the Soxhlet extractor used in these methods.

Deviations from Method 0012 for Metals -

1. Sampling for mercury with Method 0012 will not be performed for this test program. This will have no negative impact on the quality of the data, and will simplify sampling and sample recovery. The reagents required for mercury sampling and sample recovery are quite reactive and difficult to handle.

Deviations from Method 0013 for Hexavalent Chromium -

1. The strength of the potassium hydroxide impinger reagent will be increased from 0.1 N to 0.5 N. This step is being taken as a precaution to prevent the pH of the impinger reagent from dropping below 8.5 during sampling, and resulting in the sample being invalidated. This variation should not affect the quality of the data, provided the analysis of the sample is not affected. At worst the sample may require some dilution to reduce the ionic strength of the solution. This variation will help to ensure that a valid hexavalent chromium emission sample is collected.

Deviations from Method 0030 for Volatile Organic Compounds -

1. The VOST tube pairs from each sampling run will not be analyzed separately. Generally, it is recommended that VOST tube pairs collected from RCRA Part B Trial Burns be analyzed separately. Three tube pairs will be combined for analysis, the fourth VOST tube pair will be analyzed separately to assess breakthrough. This variation should have little impact on the quality of the data provided the DRE is demonstrated by a wide margin.

4.1.7 Pretest Survey of ESSROC Facility

APCC has conducted some preliminary tests at this facility, and have found that the emission sampling locations are acceptable. ESSROC is responsible for any modifications required for collection of process data and process samples, and will have all necessary modifications in place in time for the test program.

4.2 On-site Internal QA/QC Activities

Only one of the two identical process rotary kilns will be operated during the test program. The test program is divided into two phases, with both phases conducted at the one operating kiln. During Phase I, testing will be conducted to determine emissions of particulate matter, CO, THC, HCl, Cl_2, POHC/DRE, and O_2. For Phase 1, the kiln will be operated at the minimum practical temperature while the DRE for selected POHCs is determined. For Phase 2, the kiln will be operated at the maximum temperature while determining metals emissions and PCDD/PCDF emissions. In conjunction with the emission tests being conducted during Phase 1 and Phase 2, the input or output rates of various process streams will be determined and samples of these process streams will be collected for analyses of target compounds and certain other parameters.

This section discusses the internal QA/QC protocols for the following activities:

- Process sampling and emission measurement locations,
- Process operation and test conditions,
- Continuous emission monitoring,
- Manual sampling,
- Process and emission control system operational data recording, and
- Process sample collection.

4.2.1 Process Sampling and Emission Measurement Locations

Seven process sampling locations and two emission measurement locations will be used for this test program. These locations are summarized in Table 4.5, along with

ATTACHMENT K

SUPPORTING INFORMATION FOR SECTION 11.0
HOW TO REVIEW ELEMENT 10—SPECIFIC INTERNAL QUALITY CONTROL CHECKS

(22 Sheets)

9.0 INTERNAL QUALITY CONTROL CHECK PROCEDURES

Specific internal quality control (QC) procedures will be followed to ensure the collection of useful and valid data for the Trial Burn. Standard reference methods for sampling and analysis are detailed in Sections 5.0 and 8.0 of this document, respectively. QC procedures will be followed as described in these referenced methods. This section describes the procedures that are specific to this Trial Burn as well as procedures for the collection of QC samples used to assess data quality.

Table 9-1 presents a summary of the specific QC samples planned to assess overall measurement data quality. These samples include:

- Field and media blanks for stack samples;
- Field duplicate samples for process samples;
- Recovery solvent blanks;
- The separate analysis of the front and back traps from one VOST tube pair during each condition;
- One VOST condensate sample collected during each test condition;
- Analytical duplicate samples;
- Matrix or analytical spike duplicate samples; and
- Surrogate spikes.

Table 9-1

Summary of Matrix-Specific QC Sample Requirements[a]

	Blanks		Duplicates		MS/MSD[e]	Surrogate Spike
	Field	Media[c]	Field	Analytical[d]		
Volatile Organics						
Stack Gas	1[b]	1	-	-	1	All
Waste Derived Fuel	-	-	1	-	1	All
Raw Mix Slurry	-	-	1	-	1	All
Cement Kiln Dust	-	-	1	-	1	All
Semivolatile Organics						
Stack Gas	1	1	-	-	1	All
Waste Derived Fuel	-	-	1	-	1	All
Raw Mix Slurry	-	-	1	-	1	All
Cement Kiln Dust	-	-	1	-	1	All
Dioxin/Furan and PCBs						
Stack Gas	1	1	-	-	-	All
H.L./Cl_2						
Stack Gas	1	1	-	All	1	-
Metals						
Stack Gas	1	1	-	-	1[b]	-
Waste Derived Fuel	-	-	1	-	1	-
Raw Mix Slurry	-	-	1	-	1	-
Cement Kiln Dust	-	-	1	-	1	-
Cement Clinker	-	-	1	-	1	-
Particulate Matter						
Stack Gas	1	1	-	All	-	-
Composition						
Waste Feed	-	-	1	-	-	-

[a]Table indicates the number of QC samples to be collected during the entire Trial Burn unless otherwise noted.

[b] One field blank per run.

[c] Analytical spike

Field blanks for stack gas samples will be prepared by recovering assembled trains that have been treated as other trains except that no stack gas will be passed through the blank trains. The reagent blanks are samples of the solvents (i.e., 0.1 N HNO_3 or D.I. water) used to recover the sample trains. A blank of approximately the same sample volume used to rinse the sample trains will be collected for each recovery solvent and held for possible analysis. Media blanks consist of sampling media that are stored and shipped from the site, handled as ordinary samples, but not assembled in trains. Media blanks collected will not be analyzed unless needed to identify sources of contamination found in the field or trip blank samples.

One VOST tube pair during each test condition will be analyzed separately to assess any POHC breakthrough to the Tenax/charcoal absorbent tube (back trap). The results in the back trap should represent less than 30% of the POHC collected on the front tenax trap. Breakthrough of the POHC to the back trap above this level may indicate a loss of adsorbent efficiency, resulting in a positive bias in the DRE calculations. This criterion does not apply when less than 75 ng is detected on the back traps, as presented in Section 7.3.7 (pg. 45) of the EPA Handbook, "Quality Assurance/Quality Control (QA/QC) Procedures for Hazardous Waste Incineration," EPA/625/6-89/023, January 1990. During Condition 2, one VOST condensate sample will be analyzed for the volatile POHC.

All of the Method 0050 H.L./Cl_2 samples, including blanks, will be analyzed in duplicate according to Method 9056. The results of the two analyses will be compared to assess analytical variability and will be averaged for reporting purposes.

Matrix spike/matrix spike duplicate (MS/MSD) samples will be prepared by spiking sample splits with known concentrations of target analytes. Matrix spike results will provide a measure of the effectiveness of the method, in terms of analyte recovery (accuracy), in the actual sample

Matrix spike duplicate results provide a measure of precision at a predictable concentration.

Surrogate spiked samples are used to monitor method performance for GC/SM methods. The surrogate spike compounds routinely used with Methods 8240/8260, 8270, and Method 23 will be used for all liquid and stack gas samples from this Trial Burn.

A discussion of sampling and analytical QC procedures to be implemented during this program is presented below.

9.1 Materials Preparation Quality Control

The preparation of the POHC-spiked feed materials is described in Section 4.0 of this document. The materials will be prepared by weighing each material used, including the containers. The primary quality control procedures will be daily balance calibrations and established windows for periodic weight checks. [Systems audits will be conducted by the Lead Engineer during the preparation activities.]

9.2 Sampling Quality Control

A sampling matrix that shows the sampling method, frequency, compositing approach, and analytical parameters for each sample stream is presented in Section 5.0. QC procedures associated with stack gas, liquid, and solids sampling are described in the cited methods and summarized briefly below, along with specific procedures pertinent to this Trial Burn.

9.2.1 Stack Sampling

Before sampling, all of the applicable sampling equipment will be examined to ensure that each component is clean and operable. A file of the equipment calibration data forms will be compiled and reviewed by the stack sampling leader for completeness and accuracy to ensure the acceptability of the equipment. Sampling equipment calibration is described in Section 7.0. Upon arrival on site, the equipment will be unloaded, inspected for possible damage, and then assembled for use. Any damaged or faulty equipment will be tagged and removed from service until it can be repaired.

The following QC procedures are generally applicable to stack sampling. If any corrective actions are taken in response to these procedures or in response to supervisor review of QC procedures, the corrective action taken will be reported to the QA/QC Coordinator and documented in the field logbook.

The items shown below represent good sampling practice and are described in the methods:

1. Each sampling train will be inspected visually for proper assembly before every use.

2. Assembly and recovery of the sample trains will be performed in an environment free of uncontrolled dust.

3. All cleaned glassware, hardware, and prepared sorbent traps will be kept closed with caps (Teflon® or stainless steel), precleaned foil, or Teflon® film until assembly of the sample train in the field. The sorbent traps will be immediately re-capped when the train is disassembled and wrapped in foil to prevent possible degradation by exposure to light.

4. The numbers and locations of the sampling traverse points will be checked before taking any samples.

5. The manometer used to indicate the differential pressure (ΔP) across the Type S pitot tube will be leveled and zeroed.

6. The temperature measurement system will be checked visually for damage and operability by measuring the ambient temperature.

7. Prior to sampling, calculations will be made to determine the proper size nozzle required to attain isokinetic sampling.

8. The sampling nozzle will be inspected visually for damage before and after each run.

9. The Type S pitot tube will be inspected visually for damage before and after each run.

10. During sampling, the roll and pitch axis of the Type S pitot tube and the sampling nozzle will be properly maintained.

11. Handling of the filters will be performed in clean areas out of drafts. Teflon®-coated tweezers will be used at all times to transfer the filters.

12. The field balance will be checked daily against standard weights to read within ±0.5 percent of the standard, or a calibration curve will be prepared for the balance. This will be documented in the field logbook.

13. Any unusual conditions or occurrences will be noted on the appropriate data form during each run.

14. The VOST sampling train will be purged prior to sample collection. This will occur during the leak-checking operation and will be documented on the sampling data sheet.

15. The sampling probe will be sealed properly in the port to prevent air in-leakage.

The following activities relate to preparation of materials for sampling:

1. Prior to sampling, each particulate and metals filter will be equilibrated in a desiccator, weighed, using an analytical balance, to determine its initial mass and then packaged in a labeled Petri dish. This will be documented in a logbook showing the time and date of sequential weighings and the stabilization of the filter tare weight.

2. When weighing the filters, both before and after sampling, repeat weighings will be performed $\geq$ 6 hours after the initial weighings. Repeat weighings will be made until they agree within $\pm$0.5 mg. These activities will be recorded in a logbook.

The following activities will be documented on the pre-formatted data sheets:

1. All sampling data will be recorded on standard data forms which will serve as pre-test checklists.

2. Each leg of the Type S pitot tube will be leaked-checked before and after each run.

3. Dry gas meter readings, ΔP and ΔH readings, temperature readings, and pump vacuum readings will be made properly while sampling at each traverse point.

4. The entire sampling train will be leak-checked before and after each run. If the sampling train is moved from one sampling port to another during a run, the train will be leak-checked between ports.

5. Ice will be maintained in the ice bath throughout each run.

6. Filters and sorbent traps will be maintained at the proper temperature throughout the test run.

7. Impingers will be weighed to the nearest 0.1 g before and after sampling.

The following activities are specified in the respective methods:

1. A cyclonic flow check of the stack gas (both stack traverse diameters) will be performed prior to sampling to verify the absence or presence of cyclonic flow.

2. A field blank will be collected by assembling and recovering one complete sampling train. The blank sample train will be leak checked at the beginning and end of a run (or for the same number of times as the actual test train). No gaseous sample will be passed through the sampling train. A sampling data sheet will be filled out for the blank sample. It will be treated as an actual sample, except that no gas will be sampled.

3. Trip blanks for the VOST and aldehyde/ketone sampling trains consisting of sampling media that have been transported to the site, but not opened, will be collected and will be analyzed in the event of suspected contamination. These samples will be assigned log numbers, and will appear in the logbook and on the chain-of-custody forms.

4. Sorbent traps will be used within 4 weeks of preparation. Documentation of sorbent trap preparation will be available on-site.

5. Isokinetic sampling will be achieved within ±10 percent. Calculations of isokinetics will be performed on-site, as quickly as possible after sampling is concluded.

QC procedures specific to each sampling method are discussed in the following subsections.

9.2.1.1 Method 0030 Volatile Organics

SW-846 Method 0030 will be used for the collection of volatile organic samples. During sample collection, the gas stream temperature at the inlet to the first sorbent trap will be maintained at or below 20 °C. All sample traps will be stored on cold packs or shielded from

Exposure to moisture until ready for analysis. Each test run will consist of four pairs of traps. Three pairs will be analyzed; the fourth will serve as a backup in the event of sample loss. One field blank (one pair) will be collected during each run; and one trip blank will be collected for each test condition.

9.2.1.2 Method 0010 Semivolatile Organics

SW-846 Method 0010 will be used to collect samples of stack gases for the determination of semivolatile organics. The probe liner and filter holder temperatures will be maintained at 248 ±25 °F. The temperature of the gas entering the XAD-II resin module shall not exceed 68 °F. The system will be leak-checked before and after each run to ensure leakage rates of less than 0.02 cfm. If leakage rates exceed this limit, sample volumes will be adjusted accordingly, as described in Method 0010. Isokinetic sampling will be maintained within ± 10%. One field blank will be prepared by assembling and leak testing a sampling train, but without drawing any gas through the system.

9.2.1.3 Method 23/CARB Method 428 Dioxins and Furan and PCBs

No sealing greases will be used in the sampling train. The gas temperature exiting the condenser will be maintained at ≤20 °C. The sampling train is a modification of the Method 5 train and the system will be leak-checked according to Method 5 procedures.

9.2.1.4 Metals

The probe liner and filter holder temperatures will be maintained at 248 ±25 °F. The temperature of the gas exiting the condenser/entering the XAD trap shall not exceed 68 °F.

The system will be leak-checked before and after each run to ensure leakage rates of less than 0.02 cfm. If leakage rates exceed this limit, sample volumes will be adjusted accordingly, as described in Method 0010. Isokinetic sampling will be maintained within ±10%.

A field blank will be prepared by assembling and leak testing a sampling train, but without drawing any gas through the system.

9.2.1.5 Chlorine/Chloride and Particulate Matter

During the sampling run, the sampling rate will be maintained within 10% of true isokinetic. The temperature around the filter will be maintained at 248 ± 25°C. The system will be leak-checked both before and after the sampling run. If it becomes necessary to change a component during a run, a leak check will be conducted immediately after sampling is interrupted, before the change is made, and again after the component is changed but before sampling is resumed. A leak rate of less than 4% of the average sampling rate of ≤0.020 cfm is considered acceptable.

9.2.1.6 Continuous Emissions Monitors

Plant-owned CEMs will be used to monitor the concentration of various components in the stack gas. CEMs are described in detail in Section 3.0 of the Trial Burn Plan.

9.2.2 Process Sampling

WDF feed, raw mix slurry, clinker, and CKD samples will be collected using the tap-sampling procedures specified in EPA Method S-004 or scoop-sampling procedures specified in EPA Method S-007. All process samples will be composited according to the schedule indicated in

Section 5.0. The QC procedures will include the following:

1. Precleaned sample containers and sampling equipment will be used. Dedicated sampling equipment will be used for each sampling point to prevent cross-contamination of samples.

2. Samples will be composited per run in a 1-gallon or 2.5-gallon glass or plastic jar with a teflon-lined lid. The compositing jars will be kept on ice in coolers at each sampling point.

3. A small amount of material will be flushed from the sample tap for waste-derived fuel and raw mix samples before collection of each sample. This flushing will ensure that any stagnant accumulated solids or other contaminants that may be present in the tap do not affect the sample integrity. The purge material will be deposited in a bucket for disposal at the end of the run.

4. Following the purge of the line, the sampler will collect a subsample in a jar and transfer the subsample to the gallon jar for compositing. The gallon jar will be kept covered between subsamples.

5. Subsamples will be collected at the beginning of the appropriate sampling run and at 30-minute intervals for the duration of the run. Timing of sample collection will be coordinated by clock time and through communication with the Lead Engineer and Process Samplng Leader.

6. Process samplers will record the time, amount, and observations for each subsample on sample collection log sheets. An example of a log sheet is presented in Appendix B.

7. At the end of the run, the samples will be composited by mixing the collected material with a precleaned scoop or rod. Sample containers will then be filled, wiped clean, labeled, and packaged for shipping to the analytical laboratory.

8. Process samples will be kept separate from the stack samples and residual samples during all stages of the test (including collection, compositing, packaging, and shipping to the laboratory) to prevent cross-contamination.

9.3 Analytical Quality Control

A summary of analytical methods to be used with each parameter and sample stream is presented in Section 8.0 of this document. Analytical QC procedures will be followed as described in the referenced methods. This section presents a summary of QC procedures used to control method performance within acceptable limits and provides details or modifications specifically designed to assess precision and accuracy in the actual sample matrices.

9.3.1 Volatile Organics in Stack Samples

VOST cartridges will be thermally desorbed according to SW-846 Method 5041 and analyzed for volatile organics according to Method 8240. The contents of the cartridges will be spiked with internal standards and surrogates before desorption. Method 8240 QA protocol will be followed. A summary of the QA/QC procedures for the analysis is presented in Table 9-2.

9.3.2 Semivolatile Organics in Stack Samples

Samples of stack gas collected according to Method 0010 will be analyzed for semivolatile organics using gas chromatography with mass spectroscopy (GC/MS). Method accuracy and precision checks will be based on the analysis of duplicate virgin XAD-2 cartridges spiked with standard 8270 matrix spike compounds. A summary of method QA/QC procedures is presented in Table 9-3.

Table 9-2

Summary of QA/QC Procedures for Volatile Organics in Stack Samples

Quality Parameter	Method of Determination	Frequency	Target Criteria
Blanks--sample integrity and field contamination	Field blanks, 1 pair of traps	1 pair per run	Less than lowest standard
Blanks--verify no cross-contamination in storage and shipment	Trip blanks, 1 pair of traps	1 pair per test condition	Less than lowest standard
Blanks--verify no laboratory contamination and system control	Lab blanks, 1 pair of traps	Daily, before analysis of samples and in between high-level	Less than lowest standard
Initial calibration of GC/MS	3 to 5 standards	Prior to sample analysis	Variability of average RRF ≤ 20% RSD
Continuing calibration	Midlevel standard	Every day prior to sample analysis	RRF within ±25% of initial calibration (RRF)
Consistency in chromatography	Monitor internal standard; retention time and area	Every sample, standard, and blank	Retention time within ±30 sec. Of last calibration check Area is within 65% to 135% from last daily calibration check
Precision and accuracy	Duplicate analysis of traps spiked with a standard independent of alibration standards	5% of samples	70-130% recovery, <25% RPD
Continuing accuracy check	Spike each sample with surrogate	Every sample	70-130% recovery

RRF = Relative response factor.
RSD = Relative standard deviation.
RPD = Relative percent difference.

Table 9-3

Summary of QA/QC Procedures for Semivolatile Organics in Stack Samples

Quality Parameter	Method of Determination	Frequency	Target Criteria
Method performance - Accuracy	1. Historical data for surrogates, or 2. Blank SVOST[a] spiked with POHC	Before Trial Burn	50%-150% recovery
Calibration	Five-level calibration curve; DRE critical level at least 10 times higher than lowest standard; continuing calibration standard	At beginning of each day	<30% RSD[b] of average RRF[c] within 30% of average RRF from calibration
Accuracy - Calibration	Analysis of calibration check	After every initial calibration	70%-130% of theoretical value
Accuracy - Surrogates	Isotopically-labeled o-DCB spiked at not more than two times DRE critical level; and standard Method 8270 surrogates	Every sample	50%-150% recovery
Accuracy - Spikes	POHC and surrogate POHC spiked not more than two times the DRE level into samples of clean XAD resin	One per Trial Burn	50%-150% recovery, RPD <35%
Precision - Surrogates	Same as for accuracy	Every sample	50-150% recovery, <35% RSD
Blanks	Method blank for each SVOST component	One per batch of samples	Blank value <2 DL. If greater, DL is changed to 1.5 x blank level

[a]SVOST = Semivolatile organic sampling train.
[B]RSD = Relative standard deviation.
[C]RRF = Relative response factor.
[D]RPD = Relative percent difference.

9.3.3 Dioxins/Furans and PCBs in Stack Samples

Samples of stack gas collected according to EPA Method 23/CARB Method 428 also will be analyzed according to Method 23/428. Standard QA/QC procedures will be followed, as described in the methods, and summarized in Table 9-4.

9.3.4 Metals in Stack Samples

Samples of stack gas collected according to the Multiple Metals Procedure will be analyzed for toxic metals using ICP, GFAA, and CVAA according to SW-846 methods. A summary of the QC procedures is presented in Table 9-5.

9.3.5 Chlorine/Chloride in Stack Samples

Samples of stack gas collected according to EPA Method 0050 will be analyzed using Method 9056 (ion chromatography). A summary of the QC procedures is presented in Table 9-6.

9.3.6 QC for the Analysis of Waste Feeds and Residuals

Samples of all feed materials will be analyzed for semivolatile POHCs according to EPA Method 8270 (SW-846), volatile POHCs according to EPA Method 8260, metals (using SW-846 methods), and physical/chemical parameters using ASTM and SW-846 methods. The measurement parameters are given in Section 8.0 of this document. QC procedures are defined in the appropriate ASTM and SW-846 methods. A summary of the QA/QC

Table 9-4

Summary of QA/QC Procedures for Dioxins/Furans and PCBs in Stack Samples

Quality Parameter	Method of Determination	Frequency	Target Criteria
Blanks-verify no laboratory contamination and system control	Method blank	Daily, before analysis of samples and in between high-level samples	Less than lowest standard
Initial multipoint calibration of GC/MS	5 standards in triplicate	Annually	RSD <30%
Continuing Calibration	Mass scale calibration using PFTBA	Every day prior to sample analysis	
Precision and Accuracy	Spike each sample with surrogate	Every sample	40-130% (tetra-hepta isomers) 25-130% (hepta-octa isomers) RSD ≤50%

RRF = Relative response factor.
RSD = Relative standard deviation.
RPD = Relative percent difference.

Table 9-5

Summary of QA/QC Procedures for Metals Determination in Stack Gas Samples

Quality Parameter	Method of Determination	Frequency	Target Criteria
Calibration	Initial analysis of standards at multiple levels	At least once	Method-dependent. Suggest linear correlation coefficient of standard data: >0.995
	Continuing mid-range calibration standard	At least before and after sample analysis	80% to 120% of expected value for GFAA; 90% to 110% for ICP
	Continuing calibration blank	With continuing calibration standard	Subject to interpretation
Accuracy-Calibration	Analysis of calibration check standard	At every initial calibration	90% to 110% of theoretical value

Accuracy-Filters	Analysis of NIST standard reference filters	Once	75% to 125% of reference value
Accuracy-Metals	Analysis of spiked sampling media	Once	70% to 130% of reference value
Precision-Metals	Matrix spike or analytical spike duplicate analysis	Once	35% RPD
Blanks	Field blanks Method blanks	One each per Trial burn	Evaluated on a case-by-case basis

RPD = Relative Percent Difference.

Table 9-6

Summary of QA/QC Procedures for Chloride Determination

Quality Parameter	Method of Determination	Frequency	Target Criteria
Calibration-Qualitative	Relative retention time	Every calibration curve	±3 standard deviations of average
	Average retention time	Every calibration curve	Within retention time window of standards
Accuracy-Quantitative	Initial calibration with a minimum of four standards	At least once before sample analysis	Linear correlation coefficient <0.995
	Continuing calibration	Every 10 samples and at end of day	90%-110% of theoretical concentration

Accuracy-Calibration	Certified reference solution	After every initial calibration before sample analysis	90-110% of theoretical concentration
Accuracy-Spikes	One front and one back impinger spiked at no more than 3 times native level	Once per test	85%-115% recovery
Precision	One duplicate preparation of both a front and back impinger	Once per test	±25% range; if less than 5 times detection limit ±50% range
Blank	One method blank carried through sample preparation and analysis	Once per test	Method detection limit or less than 5% of sample levels

Table 9-7

Summary of QA/QC Procedures for Principle Organic Hazardous Constituent Determination in Waste Feed Samples

Quality Parameter	Method of Determination	Frequency	Target Criteria
Calibration	Initial analysis of five calibration standards Sample analysis must be bracketed by calibration standards	At least once All samples	NA
Accuracy-Calibration	Analysis of calibration check standard	After each preparation of standards and initial calibration	Must be within continuing calibration criteria

Accuracy-Surrogates	Isotopically labeled POHC spiked before sample preparation	Every sample	50%-130% recovery
Accuracy-Spikes	One sample from each matrix spiked with POHC	One per sample matrix	50%-130% recovery
Precision-Surrogates	Same as for surrogate accuracy-surrogates	One per test condition	<35% RSD of recovery
Precision-POHC	Duplicate preparation and analysis of one sample from each matrix	One per sample matrix	<35% RPD
Blanks	Method blank carried through all sample preparation steps	One per sample batch	<5% of sample concentrations of <MDL

MDL = Method Detection Limit
NA = Not Applicable
RSD = Relative Standard Deviation
RPD = Relative Percent Difference

A summary of the QA/QC procedures for metals is presented in Table 9-8. A summary of QA/QC procedures for the physical/chemical parameters is given in Table 9-9.

9.3.7 Continuous Emission Monitors

All plant-owned continuous emissions monitors will be calibrated daily as described in 40 CFR Part 266, Appendix IX, and the CO monitor will be calibrated before and after Condition II.

9.4 Analytical Documentation

The laboratories will prepare a data package containing the following information and records at a minimum:

- Completed chain-of-custody documentation showing sample receipt information including:
  - -- Data received;
  - -- Condition of samples;
  - -- Temperature;
  - -- pH (as appropriate);
  - -- Signature;
- Sample preparation log including batch QC samples;
- Initial calibration results;
- Continuing calibration results;
- Accuracy determinations;
- Precision determinations; and

Table 9-8

Summary of QA/QC Procedures for Metals Determination in WDF

Quality Parameter	Method of Determination	Frequency	Target Criteria
Calibration	Initial analysis of low-level and high-level standards	At least once before sample analysis	Method-dependent
	Continuing midrange calibration	Before and after sample analysis	80%-120% of expected value for GFAA and CVAA, 90%-110% of expected value for ICP
Accuracy-Calibration	Analysis of calibration check standard	After every initial calibration	90%-110% of theoretical value
Accuracy-Spikes	One sample from a run spiked with analytes at 3 times the detection limit	One per sample matrix	70%-130% recovery
Precision	One sample from a run analyzed in duplicate	One per sample matrix	Range <35% if sample result above lowest standard
Blank	Method blank carried through all sample preparation and analysis steps	One per sample batch	Below detection limit

Table 9-9

Summary of QA/QC Procedures for Heat of Combustion, Ash, Viscosity, and Chlorine Analysis

Quality Parameter	Method of Determination	Frequency	Target Criteria
Precision	Duplicate preparation and analysis of at least one run's samples	Once per test	≤25% RPD
Accuracy	Analysis of standard reference material	Once per test	90%-110% of stated reference value

RPD = Relative percent difference.

ATTACHMENT L

SUPPORTING INFORMATION FOR SECTION 12.0
HOW TO REVIEW ELEMENT 11—DATA REDUCTION, DATA VERIFICATION, AND DATA REPORTING

(16 Sheets)

ATTACHMENT L-1

11.0 DATA REDUCTION, VALIDATION, AND REPORTING

11.1 Data Reduction

11.1.1 Field Data Reduction Procedures

Raw data from field measurements and sample collection activities will be appropriately recorded in a field log. Generally, results are taken from direct reading instruments and no further reduction is required. Top of water depths are recorded from the top of casing. Water elevations are then calculated by ECIS utilizing known top of casing elevations to establish the top of water elevations. Figure 11A presents the units of measure for these field data. Calculations to establish the well volume and well purge volume are described in Section 6.1.4.1 and 6.1.4.2.

11.1.2 Lab Data Reduction Procedures

Figure 11A presents the references for the equations used in reducing raw data to calculated results. The actual calculation for each procedure is provided in the appropriate analytical method. Reporting units for each measurement parameter are also provided in this figure.

Calculations may be done by hand, by computing integrator, by computer, or by calculator. Data acquisition may be done by computer or computing integrator. Mass spectral data will be acquired and reduced by a VG system or equivalent. Data may be further reduced by personal computer systems with appropriate software.

11.2 Data Validation

11.2.1 Procedures used to Validate Field Data

Field activities and logbooks will be reviewed routinely by the Environmental Specialist to assure accuracy and adherence to procedures. The sampler's supervision does not participate in making any of the field measurements, or in adding notes, data or other information to the logbooks. Variations outside of acceptable limits or other significant discrepancies will be reported to the project manager and corrective actions instituted by the samplers' supervision.

11.2.2 Procedures used to Validate Lab Data

The data reduction will be performed by the analyst using one of the following methods: manually, computing integrator, or laboratory computer. Chromatograms will be reviewed by the analyst to ensure that the automatic peak picking and area determination functions have performed appropriately. Representative calculations will be reviewed by the chemist or another analyst. The analyst is responsible for notifying the chemist if control sample results are not within expected limits or if other significant

Figure 11A - Field and Laboratory Data Reduction Procedures

Title of SOP	XYZ Method Number	Units of Measure Reported
Field Measurements		
Well depths	GP-TL-2006	feet(ft)
Dissolved Oxygen	GP-TL-1029	mg/liter
Conductance	GP-TL-1030	μmhos
pH	GP-TL-1031	unitless
Temperature	GP-TL-1032	°F
Volatile Organic Compounds		
HSGC/FID	GP-TL-5011	mg/liter
PT/GC/MS	GP-TL-5070	mg/liter
DI/GC/FID	GP-TL-5014	mg/liter
Semi-volatile Organic Compounds		
HS/GC/FID	GP-TL-5011	mg/liter
GC/MS	GP-TL-5058	mg/liter
DI/GC/FID	GP-TL-5075	mg/liter
Anions by HPIC		
Nitrates, Chlorides, Sulfates	GP-TL-5003	mg/liter
Cations by HPIC		
Sodium, Potassium	GP-TL-5002	mg/liter
Cations by AA		
Magnesium	GP-TL-5004	mg/liter
Calcium	GP-TL-5005	mg/liter
Total Solids	GP-TL-5007	mg/liter
Total Dissolved Solids	GP-TL-5008	mg/liter
Chemical Oxygen Demand (COD)		
High	GP-TL-5009	mg/liter
Low	GP-TL-5010	mg/liter
Bicarbonates	GP-TL-5006	mg/liter

Figure 11A - Field and Laboratory Data Reduction Procedures
(Continued)

<u>123 Labs (Metals and Appendix IX)</u>	Method 3005A (Digestion)	
Antimony, Barium, Berrylium, Chromium, Cobalt, Copper, Nickel, Silver, Tin, Vanadium, Zinc	Method 6010A	mg/liter
	Method 3020A (Digestion)	
Arsenic	Method 7060	mg/liter
Cadmium	Method 7131	mg/liter
Lead	Method 7421	mg/liter
Selenium	Method 7740	mg/liter
Thallium	Method 7841	mg/liter
Mercury	Method 7470	mg/liter
	Method 3510A (Extraction)	
Appendix IX Volatile Organics	Method 8240A	mg/liter
Appendix IX Semivolatile Organics	Method 8270A	mg/liter
PCB/Pesticides	Method 8080	mg/liter
Chlorinated Herbicides	Method 8150A	mg/liter
	Method 9010A (Distillation)	
Cyanide, total	Method 9012	mg/liter
Sulfide	Method 9030A	mg/liter

References: SW846, Test Methods for Evaluating Solid Waste, Laboratory Manual Physical/Chemical Methods, Third Edition, 1992.

ATTACHMENT L-2

10.1.4.3 Stack Gas Volumetric Flow Rate--Dry Standard Conditions

The volumetric flow rate of the stack gas at dry standard conditions, based on EPA Reference Method 2, will be calculated as:

$$Q_{sd} = (1 - B_w)(Q_{ac})(528/T_s)(P_x/29.92)$$

where:

Q_{sd} = dry volumetric flow rate at standard conditions (dscfm);
Q_{ac} = actual volumetric flow rate (acfm);
B_w = moisture fraction;
528 = standard temperature (°R);
T_a = average gas temperature in stack (°R);
P_s = absolute stack pressure (in. Hg); and
29.92 = standard pressure (in. Hg).

10.2 Data Validation

All measurement data will be validated based upon the following qualities:

- Representative process conditions during sampling;
- Acceptable sample collection and testing procedures;
- Consistency with expected and/or other results; and
- Adherence to prescribed QC procedures.

This validation will be accomplished in several steps. For example, upon the completion of metals sampling run, the percent isokinetics will be determined. The results of three runs (within one test condition) will be compared for internal consistency. The results from the metals analysis will be reviewed by the laboratory personnel for analytical QA/QC, and the results will be converted into gas concentrations, and into mass emission rates. These results will be compared within a test condition for reproducibility, and between test conditions for

consistency with engineering principles. Any suspect data will be flagged and the nature of any problems explained.

10.3 Data Reporting

The results of the Trial Burn will be evaluated for completeness and representativeness. A Trial Burn Report will be submitted within 90 days of completion of sampling. Data and results interpretation will be presented as necessary in the report. Field and laboratory blank results will be reported in the appropriate units along with the associated samples. All values that are blank-corrected will be flagged. If blank-correction is performed, final results will be presented both with and without blank correction. A tentative Trial burn Report outline is presented in Table 10-1.

ATTACHMENT L-3

5.10 Internal Quality Control Checks and Frequency

5.10.1 Field Measurement and Sample Collection

Data Reduction

Field data reduction procedures will be minimal in scope. Only direct read instrumentation will be employed in the field. The use of pH meters, thermometers, and a probe to measure specific conductance will generate some measurements directly read from the meters following calibration per manufacturer's recommendations as outlined in Section 4.6.6 of the SAP. Such data will be written into field log books immediately after measurements are taken. Other field data consists of boring logs and other well installation and sample documentation. These data will be record into field log books as described in Section 6.3 of this work plan. If errors are made, results will be legibly crossed out, initialized and dated by the field member, and corrected in a space adjacent to the original (erroneous) entry. Later, when the forms required for this study are being filled out, the Project Manager, will proof the forms the forms to determine whether any transcription errors have been made by the field crew.

Data Validation

Procedures to evaluate field data for this project primarily include checking for transcription errors and review of field log books and boring logs, on the part of field crew members. This task will be the responsibility of the Project Manager, who will otherwise not participate in making any field measurements, or in adding notes, data or other information to the log book.

Data Reporting

Field data reporting shall be conducted principally through the transmission of report sheets containing tabulated results of all measurements in the field, documentation of sampling activities, creation of boring logs and documentation of all field calibration activities. These will be included in the RFI report.

3.6 PERSONNEL AND QUALIFICATIONS

ABC, with direction from XYZ, has responsibility for implementing the RFI Phase III Work Plan. ABC will perform the investigation and prepare the RFI report. Direct project management and QA will also be provided by ABC. All RFI Phase III implementation personnel will be qualified for the activities and tasks in which they will participate. A copy of personnel qualifications and appropriate resumes will be provided in the RFI report. An organizational chart is provided in Figure 3-3. The following are brief descriptions of the various positions.

XYZ PROJECT MANAGER

The Project Manager will be the company representative with overall project control. This individual will have direct contact with EPA V and the ABC management team.

US EPA RCRA PERMIT WRITER

The US EPA RCRA Permit Writer has the oversight responsibility for all phases of the RFI/CMS. This individual will be informed of project schedule, planning and modifications. Oversight and auditing will be at the agency's discretion.

ABC QA MANAGER

The ABC manager is responsible for auditing the QA program to assure it is being implemented according to the QAPP, satisfying both ABC and EPA requirements. The QA manager will be an independent auditor of the project. This individual will have direct communication with both the XYZ Project Manager and the ABC Project Manager. Specific duties include:

- QA audits of field operations.
- QA plan review and approval.
- QA technical assistance.

ABC PROJECT MANAGER

The ABC Project Manager is responsible to coordinate the implementation of the RFI and oversee the report preparation. These responsibilities include assurance that technical, financial, and scheduling objectives of the project are met. The Project Manager will have authority to commit the necessary resources for project completion. This individual will have direct contact with the XYZ Project Manager, the ABC QA Manager, the ABC Field Manager and the analytical laboratory.

ATTACHMENT L-4

provides a greater understanding of any immediate problems. The on-site data reduction and confirmation activities will be performed by an experienced data management specialist.

9.1.2 Office Calculations

All data averages will be "double-checked" to verify numerical accuracy by an experienced technician. Prior to utilization of the analytical data for calculation of test results, a reasonableness check will be applied to ascertain any obviously "out-of-line" results for reanalysis.

All results of calculations will be examined by another individual as assigned by the Field Team Leader. Depending on the complexity of the work, this person will either spot-check certain calculations or repeat the entire effort as assigned by the Field Team Leader. When all data are summarized, a check will be made for test result reasonableness by the Field Team Leader and by the XYZ Program Manager. The XYZ or 123 QA Manager will conduct routine audits to document that the checks are being performed and documented (with checker's initials and date).

The initial field test data and result calculations will be performed by portable PC following the completion of each test day. At the office, final results and result tables will be developed on a microcomputer. Standard EPA method programs have been developed and validated for the computational systems to ensure that correct equations are utilized to generate results. The programs will list all entry items (for proofing purposes) and produce calculated results in hard copy form. Reference method equations will be used to calculate the concentration and/or mass rate of each measured parameter.

The following stack sample blank corrections will be performed.

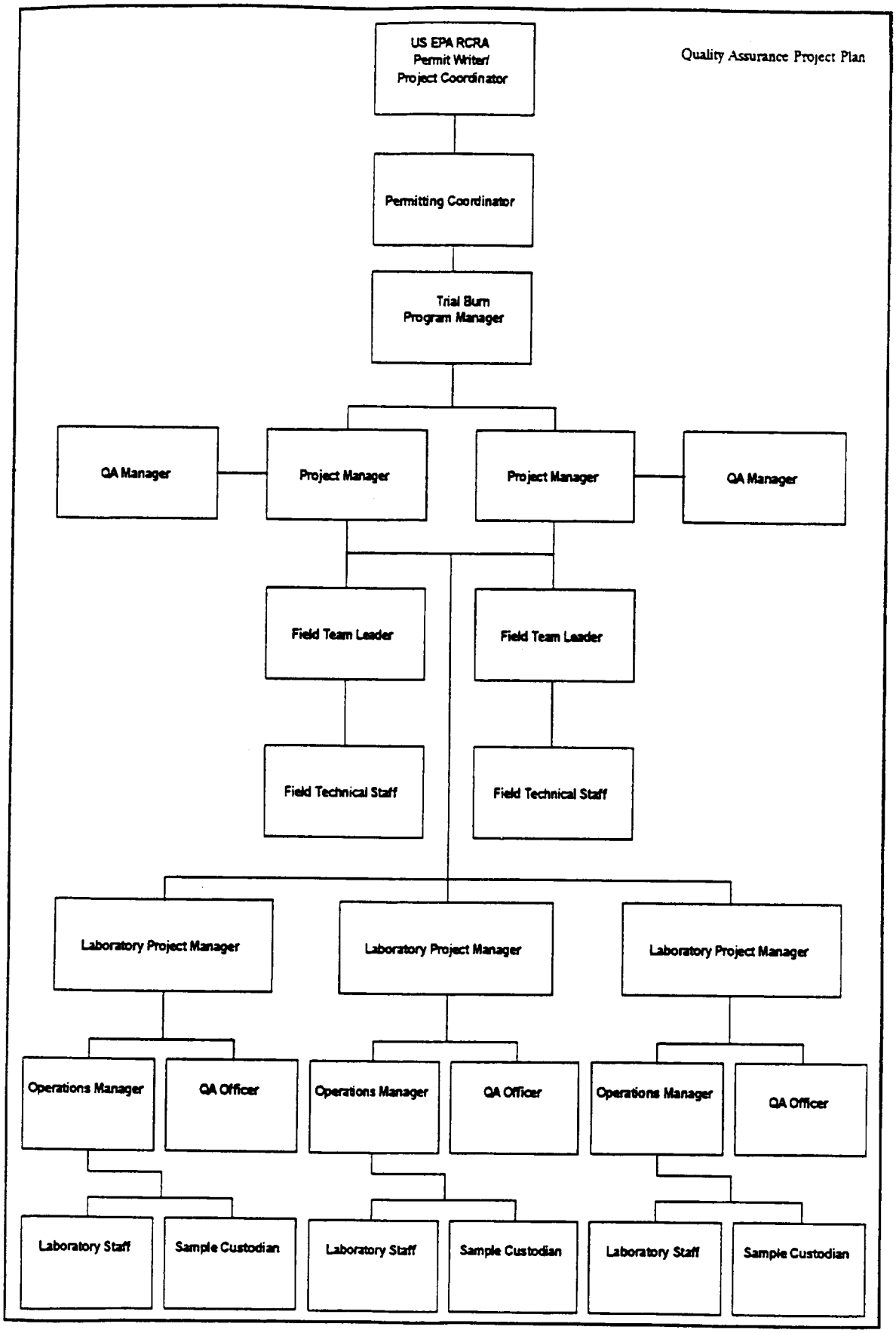


Figure 2-1
Project Organization Chart

- Analyze QC samples specified in the QAPP.

2.5 FIELD RESPONSIBILITIES

XYZ/123 Field Team Leader

The XYZ/123 project managers will be supported by the XYZ/123 field team leaders. He/she is responsible for leading and coordinating the day-to-day activities of the various resource specialists under his/her supervision. The XYZ/123 field team leaders are a highly experienced environmental professional and will report directly to the XYZ/123 project managers. Specific field team leader responsibilities include:

- Provide day-to-day coordination with the XYZ/123 project managers on technical issues in specific areas of expertise;
- Developing and implementing of field-related work plans, assurance of schedule compliance, and adherence to management-developed study requirements;
- Coordinating and managing of field staff including sampling, and supervising field laboratory staff;
- Implementing of QC for technical data provided by the field staff including field measurement data;
- Adhering to work schedules provided by the project manager;
- Authoring, writing, and approving of text and graphics required for field team efforts;
- Identifying problems at the field team level, resolving difficulties in consultation with the XYZ/123 project managers, implementing and documenting corrective action procedures, and provision of communication between team and upper management; and
- Participating in preparation of the final report.

ATTACHMENT L-5

Information System (ECIS) or a comparable system. Data from ECIS are used to generate reports as requested by various members of the project team, management, or other staff members or as required by the corrective action.

11.3.3 Laboratory Data Reporting

All analytical data will be reported in units of mg/L. Data which calculates to a value less than the estimated quantitation limit (EQL) will be reported as non-detect (ND) with a stated EQL for each compound reported. Quality control results will be included with the analytical results.

The reporting scheme for XYZ data is currently through ECIS. The data flow is centralized around that system with appropriate access levels to all involved personnel. The results are entered into ECIS by either the analyst, a responsible chemist, or a clerk.

ATTACHMENT M

SUPPORTING INFORMATION FOR SECTION 14.0
HOW TO REVIEW ELEMENT 13—ASSESSMENT PROCEDURES FOR ACCURACY, PRECISION, AND COMPLETENESS

(9 Sheets)

ATTACHMENT M-1

Table 3-1

Quality Assurance Objectives for the Trial Burn

Sample Type	Parameter	Accuracy (QC Procedure)	Precision (QC Procedure)
Stack Emissions	Volatile POHC: Tetrachloroethene	70-130% (Method Spike Recovery) 70-130% (Surrogate Recovery)	<25% RPD (Method Spike Duplicates) N/A
	Semivolatile POHCs: 1,2-Dichlorobenzene	50-150% (Resin Spike Recovery) 50-150% (Surrogate Recovery)	<35% RPD <35% RSD for surrogate recovery averaged over all runs for a given condition
	Dioxins/Furans	40-130% (tetra-hexa isomers) 25-130% (hepta-octa isomers) (Internal Standard Recovery) 70-130% (Surrogate Recovery)	<50% RSD for surrogate recovery averaged over all runs for a given condition
	PCBs	70-130% Surrogate Recovery	<50% RSD for surrogate recovery averaged over all runs for a given conditon
	Metals (As, Be, Cd, Cr, Pb, Sb, Ba, Hg, Ni, Se, Ag, Tl)	70-130% (Analytical Spike Recovery)	<35% RPD (Analytical Spike Duplicates)
	Particulate Matter	N/A	N/A
	HCl/Cl_2	75-125% (Matrix Spike Recovery)	<25% RPD (Matrix Spike Duplicates)

Table 3-1

(Continued)

Sample Type	Parameter	Accuracy (QC Procedure)	Precision (QC Procedure)
Stack Emissions (continued)	CEMs: CO THC O_2	 ±5% of span (CE) ±5 PPM THC (CE) ±0.5% O_2 (CE)	 ±3% of span (CD) ±3 PPM THC (CD) ±0.5% O_2 (CD)
Process Samples, as specified (see Section 8.)	Volatile POHCs	50-150% (Matrix Spike Recovery) 50-150% (Surrogate Recovery)	<30% RPD (Matrix Spike Duplicates) N/A
	Semivolatile POHCs	50-150% (Matrix Spike Recovery) 50-150% (Surrogate Recovery)	<30% RPD (Matrix Spike Duplicates) N/A
	Metals	70-130% (Matrix Spike Recovery)	<35% RPD (Matrix Spike Duplicates)
	Total Chlorine/Chloride, Physical/ Chemical Characteristics (Moisture, Heat of Combustion, Density, Viscosity)	75-125% (Reference Standards)	<25% RPD (Duplicate Samples)

CE = Calibration error
RPD = Relative Percent Difference
RSD = Relative Standard Deviation
CD = Calibration drift
N/A = Not Applicable

11.0 ASSESSMENT OF PRECISION, ACCURACY, AND COMPLETENESS

The QC analyses conducted during the plant Trial Burn are designed to provide a quantitative assessment of the measurement system data. The two aspects of data quality which are of primary concern are precision and accuracy. Precision is a measure of the variability associated with the measurement system. Accuracy reflects the degree to which the measured value represents the actual or "true" value for a given parameter and includes elements of both bias and precision. The completeness of the data will be evaluated based on the number of valid sample results compared with the number planned.

11.1 Precision

Precision is defined by EPA as "a measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions."[1] For this Trial Burn, precision estimates will be based on conditions that encompass as many components of variability as feasible, including variability in the sample matrix itself, as well as components of imprecision in sample collection, preparation, and analysis. Precision data will be reported for matrix spike duplicates, field duplicate samples, and surrogate spikes.

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[1] Quality Assurance Handbook for Air Pollution Measurement Systems, Volume I: Principles (EPA-600/976-005).

When estimated from duplicate results (X_1 and X_2), precision will be expressed in terms of relative percent difference (RPD) between results for field duplicates or matrix spike duplicates. RPD is calculated as follows:

$$RPD = \frac{|X_1 - X_2|}{Mean} \times 100$$

RPD is related to percent CV by ($RPD = CV \times \sqrt{2}$). These terms are independent of the error (bias) of the analyses and reflect only the degree to which the measurements agree with one another, not the degree to which they agree with the "true" value for the parameter measured.

For the CEM data, precision data will be expressed in terms of daily drift checks, calculated as follows:

$$\% \text{ Drift} = \frac{|X_1 - X_2|}{\text{Span Value}} \times 100$$

where: X_1 and X_2 are measured values for the beginning and end of the drift check period.

11.2 Data Accuracy

Accuracy, according to EPA's definition, is "the degree of agreement of a measurement (or an average of measurements of the same thing), X, with an accepted reference or true value, T." Accuracy includes components of both bias (systematic error) and imprecision (random error). Bias may be estimated from the average of a set of individual accuracy measurements.

For this Trial Burn, accuracy objectives will be expressed in terms of individual measurements. Individual measurements will be compared with the QA objectives presented in Section 3.0. In the final analysis, the average accuracy (i.e., bias), calculated as percent recovery, will be reported and used to assess the impact on project objectives. Percent recovery is calculated as follows:

$$\% \text{ Recovery} = \frac{\text{Measured Value}}{\text{Reference Value}} \times 100$$

In the case of matrix-spiked samples, the measured value in the above equation represents the difference between the spiked sample measurement result and the unspiked sample results. The reference value represents the amount of spike material added to the sample.

Consistent with reporting conventions for continuous monitor performance specifications, accuracy will be expressed in terms of percent error, which is directly related to the percent recovery calculation. Percent error is calculated as follows:

$$\% \text{ Error} = \frac{\text{Measured Value - Reference Value}}{\text{Reference Value}} \times 100$$

It follows that percent recovery and percent error are related by:

$$\% \text{ Error} = \% \text{ Recovery} - 100$$

11.3 Data Completeness

Completeness is a measure of the extent to which the database resulting from a measurement effort fulfills objectives for the amount of data required. For the Trial Burn program, completeness will be defined primarily in terms of the number of valid sample results collected compared with the number planned.

Equation for η_3 C ?

ATTACHMENT M-2

12. SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS

12.1. Accuracy Assessment

Specific routine procedures that will be used to assess the accuracy of laboratory data are discussed in Section 12.1 of the A_2I Laboratory QAPP, which is provided as **Appendix A.**

12.2. Precision Assessment

Specific routine procedures that will be used to assess the precision of laboratory data are discussed in Section 12.2 of the A_2I Laboratory QAPP, which is provided as **Appendix A.**

12.3. Completeness Assessment

Specific routine procedures that will be used to assess the completeness of laboratory data are discussed in Section 12.3 of the A_2I Laboratory QAPP, which is provided as **Appendix A.**

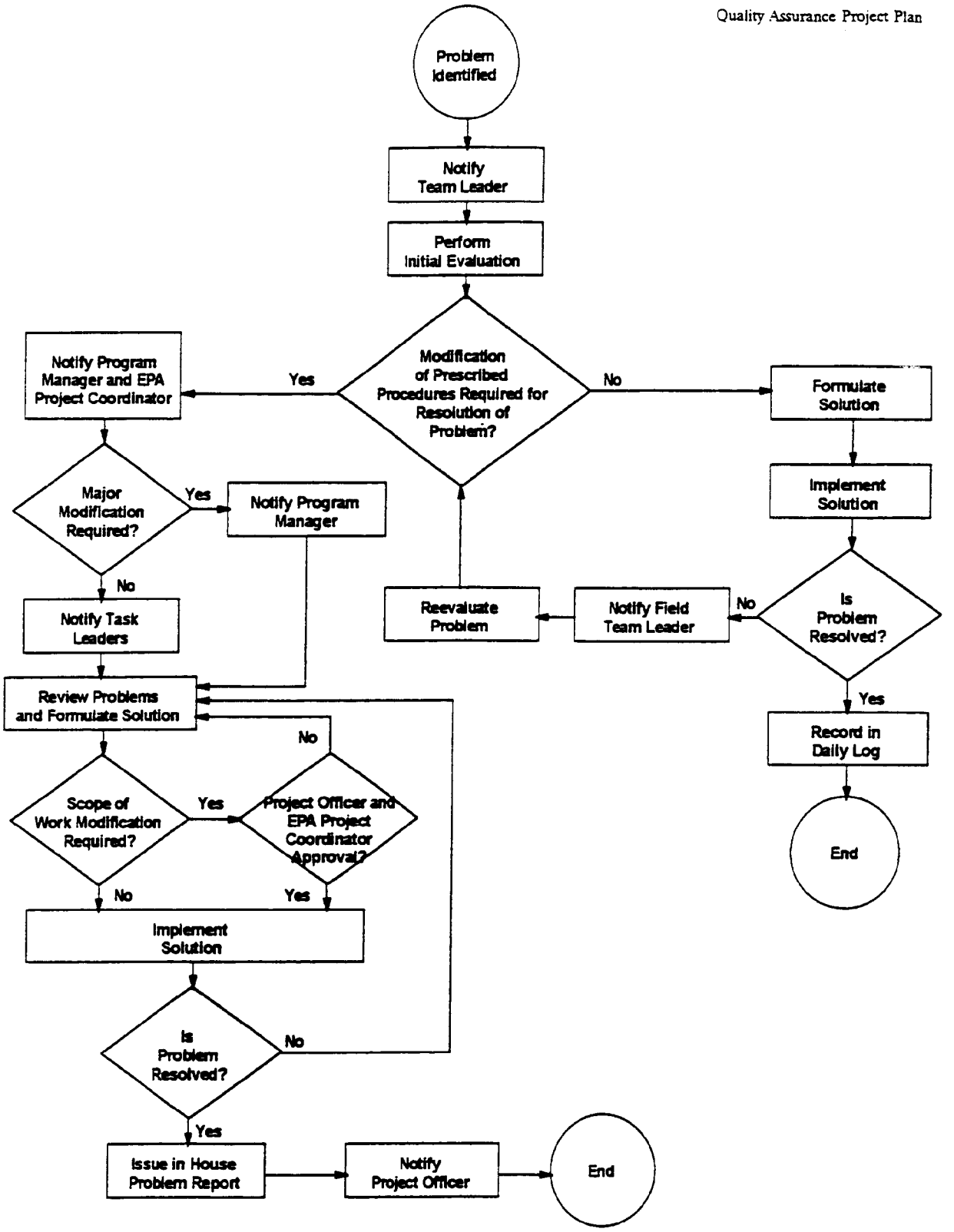
The number of samples to be taken in the field for each of the three SWMU is given in **Table 3B.** For each SWMU, it is this number that will be used to assess project completeness.

ATTACHMENT N

SUPPORTING INFORMATION FOR SECTION 15.0
HOW TO REVIEW ELEMENT 14—AUDIT PROCEDURES, CORRECTIVE ACTION, AND QUALITY ASSURANCE REPORTING

(18 Sheets)

ATTACHMENT N-1


Problem Identified
Notify Team Leader
Perform Initial Evaluation
Modification of Prescribed Procedures Required for Resolution of Problem?
Yes
No
Notify Program Manager and EPA Project Coordinator
Formulate Solution
Major Modification Required?
Yes
Notify Program Manager
Implement Solution
No
Notify Task Leaders
Reevaluate Problem
Notify Field Team Leader
No
Is Problem Resolved?
Review Problems and Formulate Solution
Yes
Record in Daily Log
No
Scope of Work Modification Required?
Yes
Project Officer and EPA Project Coordinator Approval?
End
No
Yes
Implement Solution
Is Problem Resolved?
No
Yes
Issue in House Problem Report
Notify Project Officer
End

15.0 CORRECTIVE ACTION

Corrective actions may be required for two classes of problems: analytical and equipment problems or noncompliance problems. Analytical and equipment problems may occur during sampling and sample handling, sample preparation, laboratory instrumental analysis, and data review.

For noncompliance problems, a formal corrective action program will be determined and implemented at the time the problem is identified. The individual who identifies the problem is responsible for notifying the Project Manager who will in turn arrange for appropriate contacts with U.S. EPA. If the problem is analytical in nature, information on these problems will be communicated to the Project Manager who will in turn coordinate any contact with the U.S. EPA, Quality Assurance Section. Implementation of corrective action will be confirmed in writing through the same channels.

Any nonconformance with the established quality control procedures in the QAPP will be identified and corrected in accordance with the QAPP.

15.1 Field Corrective Action

Technical staff and project personnel will be responsible for reporting all suspected technical or QA nonconformances or suspected deficiencies of any activity or issued document by reporting the situation to the Project Manager or designee. The project manager will be responsible for assessing the suspected problems and will make a decision based on the potential for the situation to impact the quality of the data. If it is determined that the situation warrants a reportable nonconformance requiring corrective action, then a nonconformance report will be initiated by the project manager.

Corrective actions will be implemented and documented in the field records. No staff member will initiate corrective action without prior communication of findings through the proper channels.

The project manager will be responsible for ensuring that corrective action for nonconformances are initiated by:

- evaluating all reported nonconformances;
- controlling additional work on nonconforming items;
- determining disposition or action to be taken;
- documenting the nonconformances;
- reviewing nonconformance reports and corrective actions taken;
- ensuring nonconformance reports are included in the Quarterly Reports to the U.S. EPA.

Corrective action for field measurements may include:

- repeat the measurement to check the error;
- check for all proper adjustments for ambient condition such as temperature;
- check the batteries;
- check the calibration;
- replace the instrument or measurement devices;
- stop work (if necessary).

15.2 Laboratory Corrective Action

The need for corrective action may be identified by any number of individuals involved in the Quality Assurance Project Plan. In all phases of the analytical operations, emphasis is placed on identifying the need for and initiating corrective action procedures. The decision to take corrective action may be made by the analyst or by any level of supervision or quality control.

The corrective actions taken will depend upon specific circumstances encountered. The approach to implementing corrective actions will initially involve determining which of four general areas the problem falls under: sampling, standards, instrumentation and data reduction. Often, the situation points directly to one or more of these areas for immediate attention. If it does not, a more generalized approach, based on experience with specific equipment and samples is pursued.

15.3 Corrective Action During Data Validation and Data Assessment

If during data validation and review, results are questionable, then an investigation of field and laboratory data will be initiated. These reviews may initiate a corrective action process in the field or the laboratory. The personnel responsible for data validation (environmental specialist and/or laboratory chemist) are responsible for initiating corrective action in the respective areas. The laboratory group leader, chemist, or Enviromental Specialist may request that sampling events be repeated. Records of corrective actions will be maintained by the respective area and reviewed by the project manager.

16.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

The Site Project Quality Control Officer will report to area management information detailing the on-going quality assurance evaluations as outlined in this project plan. This reporting will be done on a quarterly basis consistent with the reporting requirements of the permit. The information will include the results of any performance and systems audits, highlights of periodic data quality assessments, any significant problems encountered, and changes in sampling or analytical methodology developed since the last reporting period. This information may be provided either in an informal discussion, a written report, or an oral presentation. Area management includes the following management roles.

Manager; Environmental, Health, and Safety
Dept. Head; Environmental Controls
Dept. Head; Environmental Services
Dept. Head or Group Leader;

Other management personnel, as well as staff personnel, may also be included as appropriate.

SECTION 10
PERFORMANCE AND SYSTEM AUDITS AND FREQUENCY

Performance and system audits of both field and laboratory activities will be conducted to verify that sampling and analysis are performed in accordance with the procedures established in the BIF Compliance/RCRA Trial Burn Test Plan and QAPP. The audits of field and laboratory activities include two independent parts: internal and external audits.

10.1 FIELD PERFORMANCE AND SYSTEM AUDITS

10.1.1 Internal Field Audits

10.1.1.1 Internal Field Audit Responsibilities

Internal audits of field activities including sampling and field measurements will be conducted by the QA Manager.

10.1.1.2 Internal Field Audit Frequency

These audits will verify that all established procedures are being followed. Internal field audits will be conducted at least once at the beginning of the sampling program.

10.1.1.3 Internal Field Audit Procedures

The audits will include examination of field sampling records, field instrument operating records, sample collection, handling and packaging in compliance with the established procedures, maintenance of QA procedures, chain-of-custody, etc. Follow-up audits will be conducted (if needed) to correct deficiencies, and to verify that QA procedures are maintained throughout the remediation. The audits will involve review of field measurement records, instrumentation calibration records, and sample documentation. The field audit checklist (Technical Systems Audit) to be used for this project is included in Appendix C.

Audits will be conducted to verify that the process data being recorded by RPI Unit 4 DCS are accurate. The DCS audits will consist of a monthly demonstration of all AWFCO parameters and calibrations of process monitoring equipment.

10.1.2 External Field Audits

10.1.2.1 External Field Audit Responsibilities

External field audits may be conducted by the U.S. EPA at the request of the U.S. EPA Permit Writer/Project Coordinator.

10.1.2.2 External Field Audit Frequency

External field audits may be conducted any time during the field operations. These audits may or may not be announced and are at the discretion of the U.S. EPA.

10.1.2.3 Overview of the External Field Audit Process

External field audits will be conducted according to the field activity information presented in the QAPP.

10.2 LABORATORY PERFORMANCE AND SYSTEMS AUDITS

10.2.1 Internal Laboratory Audits

10.2.1.1. Internal Lab Audit Responsibilities

An internal laboratory audit may be conducted by the QA Manager.

10.2.1.2 Internal Lab Audit Frequency

An internal lab system audits may be done on an annual basis.

10.2.1.3 Internal Lab Audit Procedures

The internal lab system audits will include an examination of laboratory documentation on sample receiving, sample log-in, sample storage, chain-of-custody procedures, sample preparation and analysis, instrument operating records, etc. The RPI/WESTON QA Managers will evaluate the results of systems audits to ensure the laboratory maintains acceptable QC performance.

10.2.2 External Laboratory Audits

10.2.2.1 External Lab Audit Responsibilities

An external audit may be conducted by U.S. EPA Region 5 Central Regional Laboratory (CRL).

10.2.2.2 External Lab Audit Frequency

An external lab audit may be conducted at least once prior to the initiation of the sampling and analysis activities. These audits may or may not be announced and are at the discretion of the U.S. EPA.

10.2.2.3 Overview of the External Lab Audit Process

External lab audits will include (but not be limited to) review of laboratory analytical procedures, laboratory on-site audits, and/or submission of performance evaluation samples to the laboratory for analysis. A list of potential performance evaluation samples is presented in Table 10-01. Analysis of these samples will be performed only if provided by EPA.

TABLE 10-1

POTENTIAL AUDIT MATERIALS FOR THIS PROGRAM

TYPE OF AUDIT MATERIAL	NO. OF AUDITS	RANGE OF AUDIT	SOURCE OF AUDIT MATERIAL
General Meter Box Audits			
Critical orifice	1	NA	U.S. EPA
Analytical Systems Audits			
VOST	1	0-100 ppb multiple component cylinder	U.S. EPA
PCDD/PCDF	1	Blank	U.S. EPA
	1	0-500 ng	U.S. EPA
	1	0-500 ng	U.S. EPA
Metals	1	Multiple metals on filter	U.S. EPA
HCl	1	Low-range	U.S. EPA
	1	High-range	U.S. EPA
Hg	1	Low-range	U.S. EPA
	1	High-range	U.S. EPA

SECTION 13
CORRECTIVE ACTION

Corrective action is the process of identifying, recommending, approving and implementing measures to counter unacceptable procedures or out of quality control performance which can affect data quality. Corrective action can occur during field activities, laboratory analysis, data validation and data assessment. All corrective action proposed and implemented should be documented in the regular quality assurance reports to management. Corrective action should only be implemented after approval by the project manager, or his designee. If immediate corrective action is required, approvals secured from the project manager should be documented in an additional memorandum.

Depending on the nature of the problem, the corrective action may be formal or informal. In either case, occurrence of the problem, corrective action performed, and verification that the problem has been resolved shall be documented. Whenever a corrective action is required, documentation will be completed by the individual noting the problem and a copy filed with the Project Manager.

The shared effort for implementing the corrective action will be the responsibility of the Project Manager, the QA Manager, and the Field Team Leaders.

Corrective actions will be initiated when data quality problems are determined during the program. These data quality problems will be flagged "out of control" if they are outside of the predetermined limits specified above for internal, performance, system, and data audits. When discovered, prompt action toward a solution will be undertaken by the generator of the data. The corrective action will be conducted through the following six activities:

- Define the quality problem
- Notify the designated individuals listed in the QAPP.
- Determine the cause of the problem.
- Determine the corrective action.

- Implement the corrective action.
- Verify the solution to the problem.

Corrective action will be instituted immediately by the individual noting a problem in a measurement system. An unresolved will be reported to the employee's immediate supervisor for further action.

13.1 FIELD CORRECTIVE ACTION

Corrective action in the field can be needed when the sample network is changed (i.e. more/less samples, sampling locations other than those specified in the QAPP, etc.), sampling procedures and/or field analytical procedures require modification, etc. due to unexpected conditions. In general, the field staff (technician, field team leaders, project manager, and manager) may identify the need for corrective action. The field staff will recommend a corrective action. The project manager will approve the corrective measure which will be implemented by the field team. It will be the responsibility of the project manager to ensure the corrective action has been implemented.

If the corrective action will supplement the existing sampling plan (i.e., additional feed sampling) using existing and approved procedures in the QAPP, corrective action approved by the project manager will be documented. If corrective actions resulting in less samples (or analytical fractions), alternate locations, etc. which may cause project quality assurance objectives not to be achieved, it will be necessary that all levels of project management including the program manager, and the U.S. EPA RCRA Permit Writer/Project Coordinator concur with the proposed action prior to implementation.

Corrective action resulting from internal field audits will be implemented immediately if data may be adversely affected due to unapproved or improper use of approved methods. The quality assurance manager will identify deficiencies and recommended corrective action to the project manager. On-site EPA representatives (if available) will be notified immediately of any deficiencies and corrective actions. Implementation of corrective actions will be performed by the project manager and field team. Corrective action will be documented in quality assurance reports to the entire project management.

Corrective actions will be implemented and documented in the field record book. No staff member will initiate corrective action without prior communication of findings through the proper channels. If corrective actions are insufficient, work may be stopped by the U.S. EPA RCRA Permit Writer/Project Coordinator.

13.2 LABORATORY CORRECTIVE ACTION

Corrective action in the laboratory may occur prior to, during and after initial analyses. A number of conditions such as broken sample containers, multiple phases, potentially high concentration samples may be identified during sample log-in or just prior to analysis.

corrective action situation, it is the project manager who will be responsible for approving the implementation of corrective action, including resampling, during data assessment. All corrective actions of this type will be documented by the QA manager.

A corrective action flow diagram is provided in Figure 13-1.

ATTACHMENT N-2

SECTION 14

QUALITY ASSURANCE REPORTS TO MANAGEMENT

Good data quality is essential for the success of BIF Compliance/RCRA Trial Burn Test program and its associated quality assurance program. Documentation of periodic assessments of measurement data accuracy, precision, and completeness along with results of performance and technical systems audits and corrective action resolutions is necessary to define data quality. The individuals responsibility for documenting this information are: the Project Manager, the QA Manager, the Field Team Leaders, and the Laboratory QA Officer.

The quality of the data (i.e., its conformance/nonconformance to the established DQOs) will be assessed through internal and external audits. It is important to keep all individuals working on a project, especially management personnel, updated on results of audits. This allows effective management and review of sampling and analytical activities in a timely, consistent manner, while providing feedback to data generating personnel. This interaction will be accomplished through daily or periodic reports to management on the quality of the data. The content, distribution, and frequency of these reports and author responsibilities are described in the following subsections.

14.1 CONTENTS OF PROJECT QA REPORTS

This interaction and feedback will be accomplished in the form of the daily summary reports by the QA Manager to the Project Manager, and Field Team Leaders documenting the performance of critical measurement systems and corrective action efforts. The reports will provide or present:

- The previous day's testing results, describing the activities and assessing the data quality in terms of accuracy, precision, completeness, process conditions during sampling, CEM operation and acceptability of sample collection procedures
- Results of performance audits.
- Results of technical systems audits.
- Significant QA/QC problems observed.

- Corrective actions requested and initiated, and results.

Figure 14-1 provides a summary of the QA/QC report format and contents.

14.2 FREQUENCY OF QA REPORTS

Project personnel are required to report immediately to the Project Manager, QA Manager, and Field Team Leader any problems that would prevent the DQOs from being accomplished. Corrective action would then be considered toward resolution of the problem. The problem and all associated actions must be documented by the Field Team Leader in the field data record. The QA Manager will prepare daily reports summarizing the prior day's activities and results. This daily summary report will be included in the project file.

Effective management of the field sampling and sample recovery efforts requires timely assessment and review of field activities. This necessitates effective communication, interaction and feedback between the Project Manager, the Field Team Leaders, and the QA Manager.

FIGURE 14-1
QA/QC SUMMARY REPORT FORMAT AND CONTENT

1.0 Summary of Performance Evaluation Audits
- 1.1 Manual Sampling Methods
- 1.2 CEMs

2.0 Summary of Technical System Audits
- 2.1 CEMs
  - 2.1.1 Sampling
  - 2.1.2 Analysis
  - 2.1.3 Data Reduction (Acquisition)
  - 2.1.4 Completeness
- 2.2 Particulate and HC/Cl_2 (Methods 5 and 0050)
  - 2.2.1 Sampling
  - 2.2.2 Recovery
  - 2.2.3 Data Reduction
  - 2.2.4 Completeness
- 2.3 Semivolatile Organic and PCDD/PCDF Measurements (Method 0010 and Method 23)
  - 2.3.1 Sampling
  - 2.3.2 Recovery
  - 2.3.3 Data Reduction
  - 2.3.4 Completeness
- 2.4 Volatile Organic Measurements (Method 0030)
  - 2.4.1 Sampling
  - 2.4.2 Recovery
  - 2.4.3 Data Reduction
  - 2.4.4 Completeness
- 2.5 Trace Metals Measurements (Method 29)
  - 2.5.1 Sampling
  - 2.5.2 Recovery
  - 2.5.3 Data Reduction
  - 2.5.4 Completeness
- 2.6 Process Operational Data
  - 2.6.1 Collection
  - 2.6.2 Data Reduction
  - 2.6.3 Storage
  - 2.6.4 Completeness
- 2.7 Hexavalent Chromium
  - 2.7.1 Sampling
  - 2.7.2 Recovery
  - 2.7.3 Data Reduction
  - 2.7.4 Completeness
- 2.8 Formaldehyde (Method 0011)
  - 2.8.1 Sampling
  - 2.8.2 Recovery
  - 2.8.3 Data Reduction
  - 2.8.4 Completeness
- 2.9 Non-Air Stream Process Samples

3.0 Summary of Corrective Actions

4.0 Data Quality Indicators

5.0 Conclusions and Recommendations

Within 30-45 days following completion of the field test program, the QA Manager will prepare a letter report summarizing the field QA activities for the test program. The letter report will incorporate a compilation of the daily reports including any performance audit results, technical systems audit results, QA problems, corrective actions and a discussion of any changes or modifications to the QA/QC program.

The QA Manager will issue a field sampling Quality Assurance Report to the Project Manager within 60 days after returning from the field. This report will summarize all audit checks performed by the test team, including problems encountered in the field, corrective actions, and any changes, modifications to the BIF Compliance/RCRA Trial Burn Test Plan or QAPP. For this program, the report will include the information identified in Figure 14-1.

The Laboratory QA Officer will include a quality assurance section when the laboratory data report is issued. Similar to the post test field reporting, the laboratory report will summarize all audit checks by analytical personnel, including problems and corrective actions and any changes/modifications to the BIF Compliance/RCRA Trial Burn Test Plan or QAPP.

The field and laboratory quality assurance reports or a summary of the important results will be included in the final project report. This final report will discuss the quality of all data in terms of precision, accuracy, completeness, comparability, and representativeness. Results of all audits will be discussed, and any problems, corrective actions, and data impacts will be identified.

14.3 INDIVIDUALS RECEIVING/REVIEWING QA REPORTS

The Project Manager will receive daily summary reports for review as detailed above. The QA Manager will prepare and issue the field sampling QA Report to the Project Manager. The Laboratory QA Officer will prepare and issue the Laboratory QA report. The field sampling QA report and laboratory QA

reports will be combined and included in the final BIF Compliance/RCRA Trial Burn Test Report to be issued to the U.S. EPA Permit Writer.