APPENDIX D

QUALITY ASSURANCE PROJECT PLAN

QUALITY ASSURANCE PROJECT PLAN FOR THE COMPREHENSIVE PERFORMANCE TEST OF THE TRANE 1 AND TRANE 2 HAZARDOUS WASTE INCINERATORS EPA I.D. NO. PRD 090 613 357

PREPARED FOR:

TAPI PUERTO RICO, INC
GUAYAMA, PUERTO RICO

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1.0 QUALITY ASSURANCE PROJECT PLAN APPROVAL FORM AND DISTRIBUTION LIST

Project Title: TAPI Industries, Inc. (TAPI),
Compliance Performance Test (CPT) for the Trane 1 and Trane 2 Hazardous Waste Incinerators
Guayama, Puerto Rico

Expected CPT Date: Second Quarter 2012

Project Approvals:

Name/Function/Organization	Signature	Date
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Spiking Contractor	Scott Neal	
Laboratory Analysis Coordinator	William Anderson	
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QAPP Approval Statement: The individuals listed above:

1) Have received, read, and agreed to the appropriate information pertaining to assigned project responsibilities listed and provided in this QAPP, and

2) Agree that no testing methods will be modified. If modifications do occur to any sampling and analytical methods as specified in the associated CPT Plan, they are to be identified and explained in the sampling and analytical narratives, and discussed in the body of the test report. Approval for modifications to the test program specified sampling and analytical methods will be requested as appropriate from the Puerto Rico Environmental Quality Board (PREQB).

QAPP Distribution List

Project Organization Title	Organization/Name	No. of Copies
Environmental Manager	TAPI.	1
Test Coordinator	Focus Environmental, Inc.	1
Process Sampling Coordinator/Sample Custodian	Focus Environmental, Inc.	1
Stack Sampling Team Leader	Airtech Environmental, Inc.	1
Spiking Contractor	Engineered Spiking Solutions	1
Laboratory Analysis Coordinator	TestAmerica Laboratories	1
Quality Assurance Officer	Focus Environmental, Inc.	1
Puerto Rico Environmental Quality Board	PREQB	3
U.S. Environmental Protection Agency	EPA Region 2	2

The QAPP was distributed to these individuals, was read by the individuals, and they agree to the appropriate information pertaining to their project responsibilities as listed and provided in this QAPP.

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ATTACHMENTS

A Resumes of Key Individuals

ACRONYMS AND ABBREVIATIONS

AOC	Analytical Operational/Data Quality Center
ASTM	American Society for Testing Materials
CAR	corrective action request
CCB	continuing calibration blank
CCV	continuing calibration verification
CEM	continuous emissions monitor
CEMS	continuous emissions monitoring system
CF	calibration factor
cfm	cubic feet per minute
CFR	Code of Federal Regulations
Cl^-	chloride ion
Cl_2	molecular chlorine
CO	carbon monoxide
CMS	continuous monitoring system
CPT	Compliance Performance Test
COC	chain of custody
CVAA or CVAAS	cold vapor atomic adsorption spectroscopy
DL	minimum detectable limit
DOT	U.S. Department of Transportation
DQO	data quality objective
DRE	destruction and removal efficiency
dscf	dry standard cubic foot
dscm	dry standard cubic meter
DUP	duplicate
ECD	electron capture detector
EDL	estimated detection limit
EPA	U.S. Environmental Protection Agency
FB	field blank
FID	flame ionization detector
fpm	feet per minute
GC	gas chromatography
GC/MS	gas chromatography/mass spectrometry
H_2O_2	peroxide
H_2SO_4	sulfuric acid
HCl	hydrogen chloride (gas) or hydrochloric acid (aqueous)
HNO_3	nitric acid
HRGC/HRMS	high resolution gas chromatography/ high resolution mass spectrometry
HWC	Hazardous Waste Combustor
IATA	International Air Transport Association
ICB	initial calibration blank
ICP or ICAP	inductively coupled argon plasma spectroscopy
ICV	initial calibration verification

ID	internal diameter
IDL	instrument detection limit
L/min	liters per minute
lb or lbs	pounds
LCS	laboratory control standard
LVM	low volatility metal
m^3/min	cubic meters per minute
MACT	Maximum Achievable Control Technology
MDL	method detection limit
mg/m^3	milligrams per cubic meters
MS	matrix spike
MSD	matrix spike duplicate
NA	not applicable
$Na_2S_2O_3$	sodium thiosulfate
NaOH	sodium hydroxide
ND	not detect
Non-Hg	non-mercury
O_2	oxygen
OCl^-	hypochlorite
OSW	EPA Office of Solid Waste
PCDD	polychlorinated dibenzo-p-dioxin
PCDF	polychlorinated dibenzofuran
PDS	post-digestion spike
PDSD	post-digestion spike duplicate
PE	performance evaluation
PM	particulate matter
POHC	principal organic hazardous constituent
PREQB	Puerto Rico Environmental Quality Board
QA	quality assurance
QAO	quality Assurance Officer
QAPP	quality Assurance Project Plan
QC	quality control
RA	risk assessment
RATA	Relative Accuracy Test Audit
RCRA	Resource Conservation and Recovery Act
RDL	reliable detection limit
RF	response factor
RFA	request for analysis
RL	reporting limit
RPD	relative percent difference
RRF	relative response factor
RRT	relative retention time
RSD	relative standard deviation
SD	standard deviation

S/N	signal to noise ratio
SOP	standard operating procedure
SRE	system removal efficiency
SQL	sample quantitation limit
SVM	semivolatile metal
SW846	"Test Methods for Evaluating Solid Wastes Physical/Chemical Methods (SW-846)," Third Edition, 1986 and updates (December 1997).
TAPI	TAPI Puerto Rico, Inc.
TCDD or 2,3,7,8-TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
TEQ	toxicity equivalents
U.S. EPA	United State Environmental Protection Agency
VOA	volatile organic analysis

3.0 PROJECT DESCRIPTION

3.1 GENERAL

This Quality Assurance Project Plan (QAPP) is an integral part of the comprehensive performance test (CPT) plan for two hazardous waste incinerators operated by TAPI Puerto Rico, Inc. (TAPI), formerly API Industries, Inc. (API purchased the facility from Chemsource Corporation), at its pharmaceutical manufacturing facility in Guayama, Puerto Rico. This section provides a brief description of the test objectives, the unit operating protocol, the associated sampling and analytical protocol, and how they relate to establishing operating limits for the incinerator. Refer to the CPT plan for more detailed information on the scope of the testing.

3.2 QUALITY ASSURANCE PROJECT PLAN SCOPE

This QAPP presents the organization, objectives, functional activities, and specific Quality Assurance (QA) and Quality Control (QC) activities for the compliance performance testing of TAPI's two hazardous waste incinerators. This QAPP also describes the specific QA/QC protocols that will be followed for sampling, sample handling and storage, chain-of-custody, and laboratory analysis during the test program.

All QA/QC procedures will be in accordance with applicable professional technical standards, government regulations and guidelines, and specific project goals and requirements. The CPT plan and this associated QAPP have been prepared in accordance with EPA hazardous waste thermal treatment system testing and QAPP guidance documents, in particular the following:

- EPA Requirements for Quality Assurance Project Plans (EPA QA/R-5 EPA/240/B-01/003), March 2001
- Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans (QAMS-005/80)
- Quality Assurance/Quality Control (QA/QC) Procedures for Hazardous Waste Incineration, EPA/625/6-89/023, January 1990.
- National Emission Standards for Hazardous Air Pollutants from Hazardous Waste Combustors, 40 CFR 63 Subpart EEE, October 12, 2005.
- American Society for Testing and Materials, "Annual Book of ASTM Standards," latest annual edition.
- EPA, "New Source Performance Standards, Test Methods and Procedures," Appendix A, 40 CFR 60.
- EPA, "Test Methods for Evaluating Solid Wastes Physical/Chemical Methods (SW-846)," Third Edition, 1986 and updates.
- EPA, Region 6, "Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities", EPA 530D-98-001C, July, 1998.

3.3 FACILITY BACKGROUND INFORMATION

The incinerators are subject to the National Emission Standards for Hazardous Air Pollutants from Hazardous Waste Combustors. 40 CFR Part 63, Subpart EEE et al (also known as the Hazardous Waste Combustor Maximum Achievable Control Technology, or HWC MACT, standards). The incinerators are classified as existing hazardous waste combustors as defined at 40 CFR §63.1201.

TAPI's hazardous waste incinerators, referred to as the Trane 1 and Trane 2 units, are vertically fired liquid injection incinerators which treat hazardous process wastewater generated in the pharmaceutical manufacturing process. The incinerators do not treat waste from off-site sources. TAPI is permitted under RCRA Permit No. PRD090613357 to operate the incinerators.

Trial burn testing was conducted in 1988 in accordance with EPA-approved protocols to demonstrate compliance with applicable RCRA standards set forth at 40 CFR 264 Subpart O. The tests demonstrated that all standards were successfully achieved. A site-specific Preliminary Human Health Risk Assessment (ERM, 2003) was conducted which demonstrates that operation of the incinerators does not pose an unacceptable risk to human health and the environment. Subsequently, a CPT was conducted in 2006 to demonstrate compliance with the original HWC MACT standards at 40 CFR 63.1203. That test was successful in demonstrating compliance with all applicable HWC MACT standards.

The objectives of this Comprehensive Performance Test are to demonstrate that the two incinerators achieve compliance with the Permanent Replacement HWC MACT standards, set forth at 40 CFR 63.1219, to establish limits for operating parameters set forth at 40 CFR 63.1209, and to demonstrate compliance with performance specifications for continuous monitoring systems.

3.4 HWC MACT PERFORMANCE STANDARDS

HWC MACT standards applicable to TAPI's hazardous waste incinerators are summarized below (40 CFR 63.1219):

- Dioxins and furans less than 0.40 ng TEQ/dscm corrected to 7% oxygen. (This standard applies as per 40 CFR 63.1219(a)(ii) since the incinerators are not equipped with a waste heat boiler or a dry air pollution control system.)
- Mercury less than 130 ug/dscm corrected to 7% oxygen.
- Lead and cadmium less than 230 ug/dscm, combined emissions, corrected to 7% oxygen. Also referred to as semivolatile metals (SVM).

- Arsenic, beryllium and chromium less than 92 ug/dscm, combined emissions, corrected to 7% oxygen. Also referred to a low volatility metals (LVM).
- Carbon monoxide less than 100 parts per million by volume, on an hourly rolling average, (monitored continuously with a continuous emissions monitoring system), dry basis and corrected to 7% oxygen, and hydrocarbons less than 10 parts per million by volume, on an hourly rolling average, dry basis and corrected to 7% oxygen, and reported as propane, at any time during the destruction and removal efficiency test runs or their equivalent.
- Hydrochloric acid and chlorine gas (HCl/Cl_2) less than 32 parts per million by volume, combined emissions, expressed as chloride (Cl^-) equivalents, dry basis and corrected to 7% oxygen.
- Particulate matter less than 29 mg/dscm (0.013 gr/dscf) corrected to 7% oxygen.
- Destruction and removal efficiency of at least 99.99% for principal organic hazardous constituents (POHC), designated under paragraph (c)(3) of §63.1219.

The CPT will consist of a single test condition, comprised of three replicate runs. The objective of the test is to demonstrate that the Trane 1 and Trane 2 incinerators, operating simultaneously, will meet HWC MACT standards for Dioxin & Furans, CO, particulate matter, HCl/Cl_2, and metals. The results of previous testing are being submitted as data in-lieu of testing for DRE demonstration.

The sampling and analyses during this test condition are summarized in Table 3-1.

Table 3-1. Sampling and Analysis Summary

Sample Name	Sampling Location/ Access	Sampling Equipment	Sampling Reference Method [a]	Sample Size/Frequency-	Analytical Parameters	Analytical Reference Method [a]
Organic Waste Feed	1/Tap on line	250 mL grab sample bottle; 4 L glass bottle; 250 mL glass sample bottles;	ASTM E-300-86 EPA S004	Collect one 250 mL grab sample at each 15-minute interval during each test run. Grab samples will be combined in 4 L bottle to build run composite. Collect four 250 mL samples from the final composite.	Heating Value Viscosity Density Ash Content pH Total Chloride Moisture Metals: As, Be, Cd, total Cr, & Pb Hg	ASTM D-240 ASTM D-445 ASTM D-1963 ASTM D-482 EPA 9045D SW846 9056A ASTM D-4928 (Karl Fisher) SW846 6010C SW846 7470A/EPA 245.1 or SW846 7471B/EPA 245.5 CVAA
Aqueous Waste Feed	2/Tap on line	250 mL grab sample bottle; 4 L glass bottle; 250 mL glass sample bottles	ASTM E-300-86 EPA S004	Collect one 250 mL grab sample at each 15-minute interval during each test run. Grab samples will be combined in 4 L bottle to build run composite. Collect four 250 mL samples from the final composite.	Heating Value Viscosity Density Ash Content pH Total Chloride Moisture Metals: As, Be, Cd, total Cr, & Pb Hg	ASTM D-240 ASTM D-445 ASTM D-1963 ASTM D-482 EPA 9040C SW846 9056A ASTM D-4928 (Karl Fisher) SW846 6010C ICP SW846 7470A/EPA 245.1 or SW846 7471B/EPA 245.5 CVAA

Table 3-1. Sampling and Analysis Summary (Cont)

Sample Name	Sampling Location/ Access	Sampling Equipment	Sampling Reference Method [a]	Sample Size/Frequency-	Analytical Parameters	Analytical Reference Method [a]
Venturi Scrubber Blowdown	4/Tap on line	250 mL grab sample bottle; 4 L glass bottle; 250 mL glass sample bottle	ASTM E-300-86 EPA S004	Collect a 250 mL grab sample at each 15-minute interval during each test run. Grab samples will be combined in 4 L bottle to build run composite. Collect two 250 mL samples.	Total Solids Ash Content Total Chloride	EPA 160.3 ASTM D-482 SW846 9056A
Makeup Water	5/Tap on line	250 mL glass sample bottles	ASTM E-300-86 EPA S004	Collect two 250 mL sample bottles once during each test run	Total Solids Total Chloride	EPA 160.3 SW846 9056A
Auxiliary Fuel	6/Tap on line	250 mL glass sample bottles	ASTM E-300-86 EPA S004	Collect two 250 mL glass sample bottle once during test	Ash Content Total Chlorides Metals: As, Be, Cd, total Cr, & Pb Hg	ASTM D-482 SW846 9056A SW846 6010C ICP SW846 7470A/EPA 245.1 or SW846 7471B/EPA 245.5 CVAA
Sodium Chloride Spiking Solution	7/Tap on line	250 mL sample bottle	ASTM E-300-86 EPA S004	Collect one 250 mL sample bottles of the material once during each test run	Total Chloride (used for confirmation)	SW846 9056A
Methylene Chloride Spiking Solution	8/Tap on line	250 mL sample bottle	ASTM E-300-86 EPA S004	Collect one 250 mL sample bottles of the material once during each test run	Total Chloride (used for confirmation)	SW846 9056A
Lead Spiking Solution	9/Tap on line	250 mL sample bottle	ASTM E-300-86 EPA S004	Collect one 250 mL sample bottles of the material once during each test run	Lead (used for confirmation)	SW846 6010C

Table 3-1. Sampling and Analysis Summary (Cont)

Sample Name	Sampling Location/ Access	Sampling Equipment	Sampling Reference Method [a]	Sample Size/Frequency-	Analytical Parameters	Analytical Reference Method [a]
Chromium Spiking Solution	10/Tap on line	250 mL sample bottle	ASTM E-300-86 EPA S004	Collect one 250 mL sample bottles of the material once during each test run	Chromium (used for confirmation)	SW846 6010C
Stack Gas	11/Stack Isokinetic ports	Method 23 Sampling Train	EPA Method 23	Minimum of 180 minutes and 2.5 dry standard cubic meters[c,d]	PCDD/PDCFs	SW846 Method 8290A
Stack Gas	11/Stack Isokinetic ports	Method 29 Sampling Train	EPA Method 29	2 hours [c,d]	Metals: As, Be, Cd, total Cr, & Pb	Method 29; SW846 Method 6010C
Stack Gas	11/Stack Isokinetic ports	Method 5/26A	EPA Method 5/26A	2 hours [c,d]	Particulate HCl/Cl_2	EPA Method 5 SW846 Method 9057
Stack Gas	12/CEMS port	Installed CO & O_2 CEMS	40 CFR 60, Appendix B Specification 4B	Continuous	CO & O_2	40 CFR 60, Appendix B, Specification 4B

Notes:
[a] Refer to Figure 7-1 of the CPTP

[b] Reference Method Sources:
"ASTM" refers to American Society for Testing Materials, Annual Book of ASTM Standards, Annual Series
"SW846" refers to Test Methods for Evaluating Solid Waste, Third Edition, November 1986, and Updates.
"EPA Method" refers to New Source Performance Standards, Test Methods and Procedures, Appendix A, 40 CFR 60.

[c] The exact volume of gas sampled will depend on the isokinetic sampling rate.

[d] Sampling train operation includes measuring stack gas: velocity, pressure and temperature (EPA Method 2); moisture (EPA Method 4); and oxygen and carbon dioxide concentration (EPA Method 3A).

4.0 ORGANIZATION OF PERSONNEL, RESPONSIBILITIES, AND QUALIFICATIONS

4.1 GENERAL

The project organization for this test is summarized in Figure 4-1. The TAPI Technical Affairs Director is responsible for oversight of all activities performed at the TAPI site. The TAPI Environmental Manager and the TAPI Environmental Operations Engineer report to the TAPI Technical Affairs Director.

The TAPI Technical Affairs Director or his designee (i.e. Environmental Manager, Environmental Operations Engineer) is responsible for all day-to-day environmental compliance activities related to the operation of the incinerators. During the testing, the Environmental Manager (or his designee) and other Technical Affairs Department staff members will be available to lend support to the testing program where needed.

During the test, the TAPI Environmental Operations Engineer, on behalf of the TAPI Environmental Manager, will be responsible for ensuring that the processes run properly and that the unit achieves the desired test conditions on each test day. As such, the TAPI Environmental Operations Engineer, working through the TAPI Environmental Manager, will assign responsibilities the unit operations. He will be responsible for ensuring that all of the applicable process data are collected during each of the test runs. TAPI's Environmental Manager will be responsible for supervising all of the contractors associated with the program and will serve as the official communication link between TAPI and the respective contractors and regulatory observers.

The Test Coordinator and Quality Assurance Officer from the Test Management Contractor are experienced in the technical coordination and QA/QC associated with the testing of combustion systems similar to the incinerators. The Stack Sampling Contractor is experienced in conducting the stack sampling called for in the CPT and will conduct the stack sampling for this project. The analytical laboratory is experienced in the analysis of stack emissions and process samples, and will provide analytical services for this project.

Resumes of key individuals who will be implementing the test are presented in Attachment A.

4.2 TEST COORDINATOR

The Test Coordinator is responsible for the execution of the CPT, QAPP, preparation of the final test report, and interpretation of the test results. During the test, the Test Coordinator is responsible for the

overall implementation of the test program. The Test Coordinator will serve as the focal point between the TAPI Environmental Manager, TAPI Environmental Operations Engineer, and the sampling spiking contractors on testing related matters, and will coordinate activities among various project team members. Specific Test Coordinator responsibilities include:

- Ensuring compliance with the CPT and the QAPP by all project team members during the test
- Documenting testing activities in a field logbook
- Providing sample checklists, labels, and request for analysis (RFA) and chain of custody (COC) forms for use by the Stack Sampling Contractor, and the Process Sample Coordinator
- Assisting the TAPI Environmental Manager in interfacing with the regulatory observers and/or oversight contractors during the test
- Providing coordination between the TAPI Environmental Manager and the sampling and spiking teams during the test, especially regarding decisions to start, stop, hold or repeat sampling runs
- Performing inspections of the process equipment, process controls, process operations, data acquisition and recording systems, and sampling activities for compliance with this QAPP and the CPT
- Providing field review of process operating logs, and completed sample collection sheets, stack sampling logs, COC forms, and RFA forms
- Interfacing with the Laboratory Analysis Coordinator while samples are being analyzed
- Interfacing with the other testing contractors while the stack sampling, spiking, and other test data are being reduced
- Supervising production of the test reports
- Ensuring all test and calculations are certified by an engineer licensed to practice in Puerto Rico and that all chemical analyses are certified by a chemical engineer or chemist licensed to practice in Puerto Rico
- Preparing operating specifications for the system based on the results of the test.

4.3 QUALITY ASSURANCE OFFICER

The Quality Assurance Officer's (QAO's) responsibilities include the following:

- Assuring all individuals included in the QAPP Distribution List receive current copies of revisions as applicable
- Reviewing the stack sampling and analytical reports for completeness and accuracy
- Conducting or coordinating any required audits of the data reduction or laboratory procedures to ensure compliance with the QAPP
- Conducting validation of the analytical data generated for completeness of the reports including documentation of the required QA/QC analyses and corrective actions.
- Preparing a report of the QA/QC activities that summarizes the findings, including a statement for inclusion in the CPT report executive summary regarding if any of the test data are invalid or unusable.

4.4 PROCESS SAMPLING COORDINATOR/SAMPLE CUSTODIAN

A Process Sampling Coordinator/Sample Custodian will be appointed who will have overall responsibility for the collection and handling of all test samples. As Process Sampling Coordinator, this person has the following responsibilities:

- Coordinating the preparation and shipment of process sampling equipment to the test site
- Directing and/or participating in process sampling activities
- Recording field test data required by the process sampling methods
- Reviewing and approving process sample collection sheets and field data sheets prepared by others
- Overseeing recovery of process samples and preservation of process samples in the field
- Documenting all required process samples are collected
- Performing all QA activities required by the process sampling methods
- Preparing a draft and final report of process sampling activities.

As the Sample Custodian, this person has the following responsibilities:

- Controlling issuance of sample containers at the test site
- Packaging the process and stack gas samples, ensuring that the samples' preservation during shipment to the laboratory
- Preparing COC and RFA forms for all samples or reviewing the same test documentation prepared by other test team members
- Coordinating the shipping of all samples to the laboratory.
- Monitoring the shipment of samples to the laboratory to ensure that all samples are received on schedule and with all preservation requirements being met. Any discrepancies should be immediately reported to the QAO, Test Coordinator, and TAPI Environmental Manager.

The Process Sampling Coordinator/Sample Custodian will be an employee of the stack sampling contractor or test management contractor.

4.5 SPIKING CONTRACTOR

The Spiking Contractor will have responsibility for the spiking the sodium chloride solution, methylene chloride and, metals (lead and chromium) to the waste feeds during the CPT. The Spiking Contractor has the following responsibilities:

- Preparing and shipping the spiking equipment and materials to the test site
- Preparing and calibrating the spiking equipment
- Spiking the sodium chloride solution, methylene chloride and, metals (lead and chromium) to the waste feeds in accordance with the CPT plan

- Recording spiking system operating data
- Notifying the Test Coordinator immediately of any difficulties or interruption of the spiking system operations
- Reducing spiking data and performing all calculations and QA activities required by the CPT` and QAPP
- Preparing a draft and final report of spiking activities.

4.6 STACK SAMPLING TEAM LEADER

The Stack Sampling Team Leader will have overall responsibility for the collection and handling of all stack gas related samples. The Stack Sampling Team Leader has the following oversight responsibilities:

- Preparing and shipping stack sampling equipment to the test site
- Preparing and calibrating stack sampling equipment
- Directing and/or participating in stack sampling activities
- Recording field test data required by the stack sampling methods
- Reviewing and approving stack sample collection sheets and stack sampling field data sheets
- Overseeing recovery of stack sampling-related samples and preservation of those samples
- Notifying the Sample Custodian of all samples collected
- Reducing stack sampling data and performing all calculations and QA activities required by the stack sampling methods
- Preparing a draft and final report of stack sampling activities.

4.7 TAPI WASTE MGT. OPERATIONS

The TAPI Waste Mgt. Operations will be responsible for the operation of the incinerators. Their duties will include:

- Maintaining the incinerators within specified target limits
- Maintaining logs of process data as required
- Downloading and providing the incinerators one-minute operating data to the Test Coordinator in Microsoft Excel or ASCII format
- Assisting in the collection of waste feed samples
- Transferring to the Sample Custodian all waste feed samples collected.

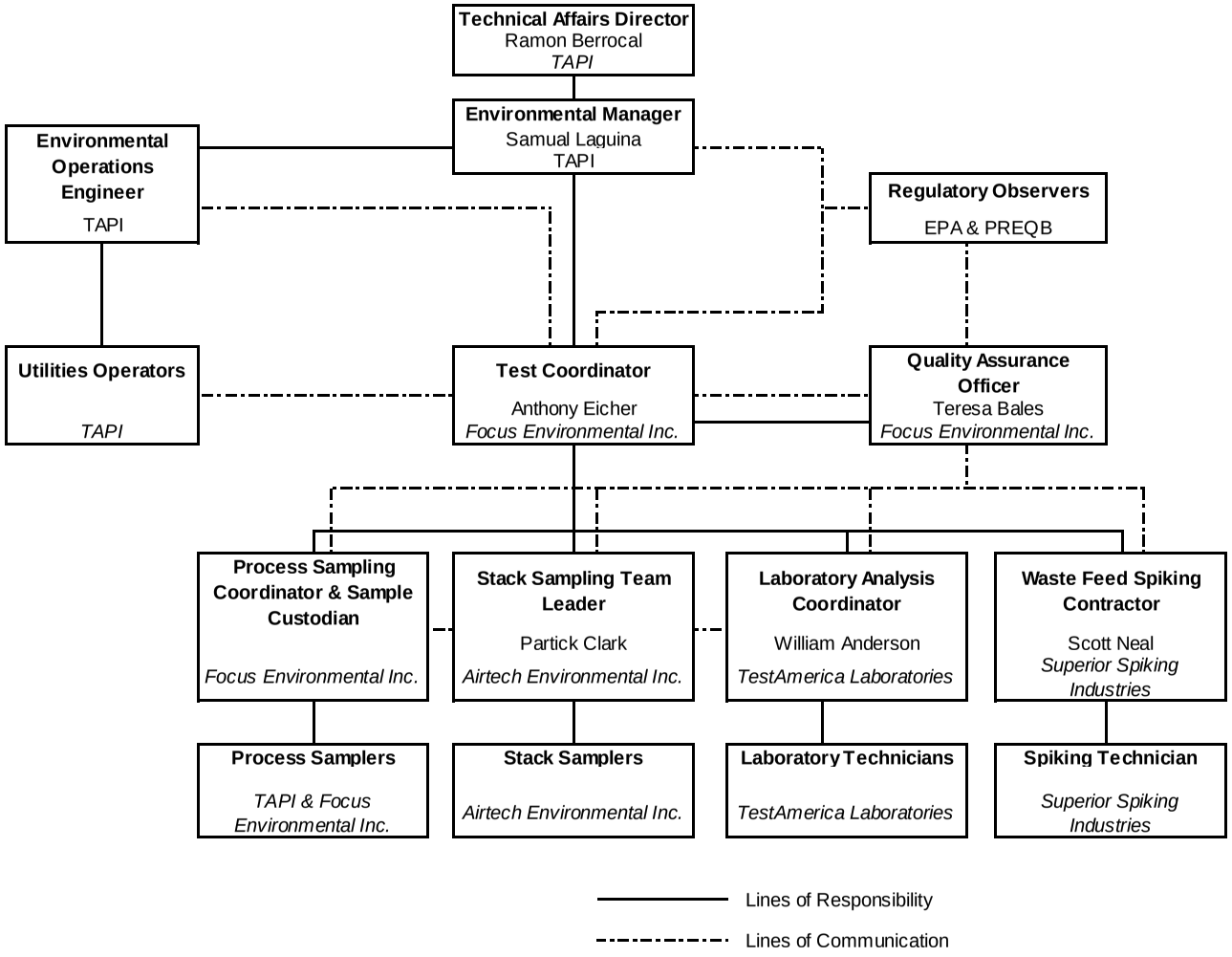
4.8 LABORATORY ANALYSIS COORDINATOR

The Laboratory Analysis Coordinator will have overall responsibility for the analysis of all process and stack gas related samples. The Laboratory Analysis Coordinator has the following responsibilities:

- Receiving, verifying, and documenting that incoming field samples correspond to the sample chain of custody information

- Notifying the Sample Custodian, QAO, Test Coordinator, and TAPI Environmental Manager of any discrepancies or problems in the COC and RFA information, preservation, or sample condition
- Maintaining records of incoming samples
- Tracking samples through processing, analysis, and disposal
- Designating QC samples for analysis during the project
- Verifying that laboratory personnel are trained and qualified in specified laboratory QC and analytical procedures
- Verifying that laboratory QC and analytical procedures are being followed as specified in this QAPP, the laboratory specific QA/QC Plan, and the laboratory specific analytical standard operating procedures (SOPs)
- Reviewing QC and sample data during analysis and determining if repeat analyses are needed
- Submitting certified QC and sample analysis results and data packages to the Test Coordinator
- Notifying the QAO and Test Coordinator of any QC excursions during the preparation and analysis of the field samples or associated QC samples
- Archiving analytical data
- Preparing a statement of the analysis activities for inclusion in the CPT report executive summary regarding if any of the test data are invalid or unusable.

Figure 4-1. TAPI Test Project Organization and Responsibility



5.0 QUALITY ASSURANCE OBJECTIVES AND QUALITY CONTROL OBJECTIVES

5.1 GENERAL

The project objectives are summarized in Section 3.0 of this QAPP. The selected stack sampling contractor and the contract laboratory are well experienced in the types of sampling and analyses represented by this test program. The analytical laboratory will provide method detection limits and reporting limits for each analysis. The laboratory will provide the best and lowest detection limits for all testing parameters. Blind audit samples will be included in the analysis scope as a third party check of the laboratory accuracy. These audit samples may be provided by the agency or may be obtained from the agency specified contractor.

The overall quality assurance objective is to produce a complete data set that can be used to fully assess and validate the operation of the incinerator relative to the HWC MACT emissions and performance standards. This includes a number of quality indicators necessary to assess the precision and accuracy of all the test data.

The field and laboratory data obtained during this test will be reviewed by the QAO. The data quality will be discussed with respect to meeting each of the data quality objectives (DQOs) and the overall project objective. Data that are outside of the target DQO limits will be evaluated relative to the impact(s) on the overall project objective of assessing the incinerator's performance. The data evaluation and validation will be included in the final test report.

Table 5-1 presents target DQOs for precision and accuracy for each type of analysis that will be performed during the test program. QA/QC objectives for precision, accuracy, representativeness, completeness and comparability are defined in this section. Procedures and formulas for determining accuracy and precision are presented in Section 13.0 of this document. The following definitions briefly describe the meaning of each QA/QC objective:

> **Precision:** A measure of mutual agreement among individual measurements of the same property, usually under "prescribed similar conditions." Various measures of precision exist depending on the prescribed similar conditions. If the number of samples is less than three, the precision is described as range percent or relative percent difference (RPD) from the average of replicate measured values for analysis of the same parameter. If the number of samples is three or greater, precision is best described in terms of relative standard deviation (RSD).

Accuracy: The degree of agreement of a measurement (or an average of measurements of the same parameter) X, with an accepted reference or true value, T. Accuracy is usually expressed as the difference between the two values, X - T, or the difference as a percentage of the reference or true value, 100 (X - T)/T, and sometimes expressed as a ratio, X/T. In some cases, accuracy is described as the percentage recovery of a known quantity of material added to a sample prior to analysis. Accuracy is a measure of the bias in a system.

Completeness: A measure of the amount of valid data obtained compared to the amount expected to be collected under normal conditions. Completeness is usually expressed as a percentage.

Representativeness: The degree to which data accurately and precisely represent a characteristic of a population, parameter variation at a sampling point, process condition, or an environmental condition. Representativeness is built into the sampling methods used to insure that samples collected represent the matrix (stack gas, waste, etc.) being sampled. To assess representativeness, sample collection data will be reviewed to determine if the sample methods specified in the QAPP were followed

Comparability: The confidence with which one set of data can be compared to another. Comparability of data will be assessed during the review of the final data by comparing the results from the three individual test runs to determine if they are sufficiently similar or if there are any outliers.

5.2 PRECISION AND ACCURACY

A number of procedures will be implemented to assess the precision and accuracy of the sampling and analytical data. All sampling and analytical activities will be conducted following referenced procedures. All reference materials used as calibration standards, surrogate compounds, or laboratory control samples will be of the highest purity commercially available. The calibration of instruments used during analysis will be verified each day that samples are analyzed as described in later sections of this QAPP. Assessment of data precision and accuracy will be accomplished by evaluating the results from multiple analyses of the same parameter, and analysis of standards, duplicates, and spiked samples. Field and laboratory contamination will be assessed through the analysis of reagent, instrument, method, and field and trip blanks.

Precision estimates presented in Table 5-1 represent variability for replicate measurements of the same parameters, expressed in terms of relative percent difference (RPD) for duplicate samples or relative standard deviation (RSD) for three or more measurements, as appropriate. For analyses of samples with detectable concentrations of the target analytes, precision is evaluated by conducting duplicate analyses of unspiked samples and assessing the RPD. In the evaluation of larger data sets (three or more data points), the RSD is assessed. When duplicate analyses are performed, the original analysis result will be

used in test calculations. If the variances in the duplicate analyses call into question the analytical precision, additional analyses, if allowed by the method, will be performed to better determine the actual value or to evaluate the potential reason(s) for the measurement variability.

For analytical results near the detection limit, precision can be impacted. For the cases where the original and duplicate results are a combination of detect and non-detect results at the method detection limit (MDL) where precision cannot be calculated, the data will be flagged as estimated.

Accuracy values in Table 5-1 include components of both random error and bias, expressed as a percentage of the "true" of "known" value (for reference materials) or percent analyte recovery (for spiked samples). The QA/QC program will focus upon controlling measurement error within the estimated limits of measurement uncertainty, as specified in Table 5-1. It should be noted that these limits are estimates that are, in most cases, described in the referenced analytical methods or in QA/QC guidance for hazardous waste thermal treatment. They represent the range of results that can be expected from these methods based on actual field sampling results and laboratory-based QA/QC studies. Therefore, it is reasonable to expect that the measurement errors associated with this project will be within the objectives shown in Table 5-1. QA/QC determinations which fall outside of the target range will be flagged and an assessment of the impact, if any, on the usefulness of the data on the overall results and conclusions of the test program will be provided in the final test report.

The analytical laboratory's standard operating procedures (SOPs) for each analysis will be followed. If during the course of test sample analyses, an analytical result exceeds the calibrated range for a target analyte, or any other analytical anomalies are noted with any test samples, the Test Project Coordinator and QAO are to be contacted immediately to discuss the results/issues and possible options before proceeding with the subject analyses. If ongoing QA/QC procedures reveal that a measurement's error has exceeded the estimated data quality limits, the source of the excessive error 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 in the final report. The precision and accuracy for those measurements will be reported as determined using the actual data. Also, alternative procedures (either sampling or analytical) may be considered and recommended if possible.

5.2.1 Process Sample Properties

To demonstrate the precision (reproducibility) and accuracy of the analyses of heat content, density, ash content, viscosity, moisture, pH, total solids and, total chlorine in waste feeds and process samples,

analyses will include a prescribed number of duplicate analyses. Where possible, laboratory standards will be used to demonstrate the accuracy of the analytical methods applied to the project samples.

5.2.2 Process Sample Metals

The waste feed metals analysis methods are inductively coupled argon plasma spectroscopy (ICP) for non-mercury (non-Hg) metals and cold vapor atomic adsorption spectroscopy (CVAA) for mercury (Hg). To demonstrate the precision (reproducibility) of metals analyses, a system matrix spike analyses are performed as part of waste feed metals analyses. Sample aliquots will be spiked with metal analytes at the greater of 2 times the sample's apparent native concentration or 10 times the MDL to demonstrate the recovery and reproducibility of the methods. The relative recoveries of the matrix spikes and analysis of laboratory standards will be used to demonstrate the accuracy of the analytical methods applied to the project samples.

5.2.3 Method 23 PCDD/PCDF Sampling

A Method 23 train will be used to sample the stack gas for emissions of PCDD/PCDFs. Prior to use in the field, all of the XAD-2 resin traps for use in the Method 23 sampling train are spiked with isotopically-labeled PCDD/PCDF sampling surrogate compounds as noted in Table 5-1. Two of the XAD-2 resin traps prepared for this project will also have PCDD/PCDF matrix spikes applied and are retained by the laboratory. These two XAD resin traps are then included with the field samples when they are returned to the laboratory for analysis. The recoveries of the PCDD/PCDF isotopically-labeled sampling surrogates and matrix spike compounds from these two retained XAD resin trap samples provide an accuracy assessment of the Method 23 analytical methodology. The recovery of the isotopically-labeled sampling surrogates spiked to every field-use XAD resin sample provides a field through analysis accuracy assessment of the Method 23 methodology.

The recoveries of the internal standard compounds applied during the preparation and analysis of the Method 23 sampling train components provide accuracy and precision measurements for the sample preparation and analysis steps. Recovery standard compounds applied immediately prior to analysis provide a benchmark for which internal standard recoveries are measured. Table 5-1 notes the RPD and RSD values for the Method 23 PCDD/PCDF analyses.

5.2.4 Method 29 Metals Sampling

Non-detect results are possible for Method 29 stack gas samples for metals due to the relatively low feed rates of metals and the corresponding low concentrations of metals expected in the stack gas. The test program includes collection of a blank Method 29 train to assess blank contamination levels. The analysis program includes matrix spike and post-digestion spikes of actual Method 29 samples. The

recovery and reproducibility of these spikes and analyses will be used to verify that any non-detect values for Method 29 stack gas samples are valid. The spiked samples will be spiked with metal analytes at 3X to 5X the MDL to demonstrate the recovery and reproducibility of the preparation and analysis methods.

An additional accuracy check of the Method 29 methodology is metals audit samples. Metals audit samples are usually provided in the form of a spiked filter and an aqueous solution for non-mercury metals, and an aqueous solution for mercury. These samples serve as blind audit samples. Metals audit samples will be submitted for analysis along with the balance of the Method 29 test samples.

5.2.5 Method 5/Method 26A Particulate Sampling

The gravimetric analysis of the Method 5/26A samples for particulate analyses includes replicate weighings to assess analysis precision. The analytical balance accuracy is verified using Class S weights. Method 5/26A particulate matter samples are evaporated, and dried and desiccated to constant weight.

5.2.6 Method 26A Chloride Sampling

The analysis of the Method 26A samples for chloride includes a system MS/MSD analyses to evaluate the precision and accuracy of the ion chromatography analytical methodology. An additional accuracy check of the Method 26A methodology is chloride audit samples. Chloride audit samples in the form of spiked aqueous solutions are analyzed as blind audit samples. Chloride audit samples will be submitted for analysis along with the balance of the Method 26A test samples.

Matrix spikes to Method 26A field samples and reagent blanks will be performed at the greater of 2 times the sample's apparent native concentration or 10 times the MDL used for the ion chromatography method to demonstrate the recovery and reproducibility of the method. The relative recoveries of the matrix spikes provide a measure of the accuracy of the chloride ion analysis methodology. Additionally, precision is accessed via duplicate analyses of field, reagent blank, calibration standard, and QC samples.

5.2.7 Waste Feed Spiking

The delivered feed rates of various spiking materials are determined via the concentrations of the species in the spiking materials, and the rates that the spiking materials are transferred to the waste feed line. The spiking contractor must provide documentation of the spiking material compositions. Acceptable forms of documentation include the chemical manufacturer's certified assay and/or the preparer's certified composition or assay. This information must be brought to the site at the time of testing so the spiking

rates can be verified against the test targets. The spiking material composition data shall also be included in the spiking report.

If the scales and differential weights methodology is utilized in measuring the feed rates of the spiking materials, the scales used shall be accurate to ± 0.1 pound (lb). The precision of individual scale readings/measurements shall also be to ± 0.1 lb. If continuous mass flow metering systems connected to a personal computer methodology is utilized, the mass flow instruments must be accurate to ± 0.1 lb with corresponding precision of individual readings/measurements of ± 0.1 lb.

5.2.8 Installed CO and O_2 CEMS

The precision of the installed carbon monoxide and oxygen continuous emissions monitoring system (CEMS) analyzers will be assessed using the recommended calibration gases in accordance with 40 CFR 60, Appendix B Performance Specification 4B. Refer to Appendix E-16 of the CPT Plan for the procedures to be implemented during the CPT. Precision will be assessed using the following equation:

$$\text{Precision}(\%drift) = \left(\frac{R_f - R_i}{Span}\right)x100$$

where:

R_f = Final monitor response at end of the test run

R_i = Initial monitor response at start of the test run

Span = Maximum range of the analyzer.

The accuracy of all CEMS analyzers will be evaluated by the measurement of percent accuracy as defined by the equation below:

$$\text{Accuracy}(\%) = \left(\frac{R_a - R_c}{Span}\right)x100$$

where:

R_a = Analyzer indicated concentration of the calibration gas

R_c = Certified concentration of the calibration gas

Span = Maximum range of the analyzer.

The accuracy of oxygen and carbon monoxide CEMS analyzers will be evaluated via a Relative Accuracy Test Audit (RATA) conducted prior to the CPT. The RATA will include calibration drift tests, response time tests, calibration error tests, and relative accuracy tests per the 40 CFR 60, Appendix B Performance Specification 4B. During the CPT, the oxygen and carbon monoxide CEMS analyzers will be calibrated daily before the start of testing. Refer to Appendix E-16 of the CPT Plan for the procedures to be implemented during the CPT.

5.3 DETECTION LIMITS AND REPORTING

How the detection limits will be used in data reduction and reporting is described in Section 11.0.

For inorganic analyses and non-isotope dilution method organic analyses, the laboratory report will provide both the Method Detection Limit (MDL), and either the Reliable Detection Limit (RDL) or the laboratory specified reporting limit (RL). The laboratory will maintain on records documenting the MDL, and the RDL or RL determinations. Generally, all non-detects for target analytes will be reported and assessed at the laboratory-determined MDL. Laboratory-determined MDLs, are determined in accordance with the guidelines established in 40 CFR Part 136, Appendix B. If an analyte is detectable at some value between the MDL and the RDL or RL, the detected value will be reported and flagged as estimated. If matrix interference(s) occurs or sample dilutions are necessary, a sample specific MDL or sample quantitation limit (SQL) may be reported. If a sample specific MDL or SQL is applicable, the documentation of the serial dilutions or other measures taken to arrive at the SQL will be documented in the analytical report.

For isotope dilution organic analysis methods, the non-detects for the isotope dilution methods will be determined using the Method 23 definition of a minimum detectable limit (DL) which may be referred to by the laboratory as either a DL or as an estimated detection limit (EDL) without the use of empirical factors or other mathematical manipulations specific to the laboratory.

The analytical report of any target analyte that is non-detect shall include the MDL or Dl (EDL), and the RDL or RL, as appropriate.

5.4 COMPLETENESS

Data completeness represents the valid data collected from the total number of valid tests conducted. Samples resulting from test runs that are judged invalid based on field performance indicators or aborted runs will not be submitted to the laboratory for analysis. Because the possibility exists that a sample may be lost or broken, the data from each individual analytical parameter may not be complete for all test runs.

The impact of any occurrence of sample loss will be assessed with regard to the objective of obtaining valid runs and will be discussed in the final test report. The results of a test run will only be replaced upon receiving approval from the Administrator as allowed by 40 CFR 63.7(e)(3). There will be two types of completeness objectives used while evaluating this test program. The primary completeness objective is to generate sufficient data for the regulatory agencies to judge the performance of the system. A secondary completeness objective is that ninety percent of all of the data quality objectives for all of the samples collected meeting the requirements specified in the QAPP.

5.5 REPRESENTATIVENESS AND COMPARABILITY

The sampling procedures chosen for the test program are, wherever possible, approved EPA or American Society for Testing Materials (ASTM) sampling methods that are typically employed on thermal treatment system tests. The use of standard sampling methods affirms sample consistency and representativeness.

Use of standard, approved sampling and analysis methods, standardized data reduction procedures, and QC samples will provide data that are technically defensible and are comparable from test run to test run, test condition to test condition.

Table 5-1. Test Analytical Data Quality Objectives

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Parameter	QC Type	Precision	Accuracy
Process Samples and Liquid Waste Feeds			
Heating value, ash content, moisture, density, viscosity, pH	Duplicates	≤ 10% RPD	---
Heating value, ash, density	Reference Sample	---	± 10%
Total Chlorine	Reference Sample		± 20%
	Matrix Spike/Matrix Spike Duplicates	≤ 15% RPD	± 20%
Metals	Duplicates	≤ 20% RPD	---
	Matrix Spikes	≤ 20% RPD	± 25%
Method 23 Sampling Train (PCDD/PCDFs)			
Method 23 PCDD/PCDFs	Spiked Resin Blanks	≤ 25% RPD	75-125%
	PCDD/PCDF C^{13} Labeled Sampling Surrogate Spike	≤ 35% RSD	Note a
	PCDD/PCDF C^{13} Isotope Dilution Internal Standard Spikes	---	Note b
	PCDD/PCDF C^{13} Labeled Recovery Surrogate Spike	---	Note c
	EPA Audit Sample	---	50-150%
Method 29 Sampling Train			
Method 29 Metals	Post-Digestion Spikes	≤ 20% RPD	80-120%
	Duplicate or Matrix Spike/Matrix Spike Duplicate	≤ 20% RPD	---
	Matrix Spikes	---	80-120%
	Reference Sample	---	80-120%
	EPA Audit Samples	---	50-150%
Method 26A Sampling Train			
Particulate Matter	Replicate Weighings	± 0.5 mg	± 0.5 mg
Hydrogen Chloride/Chlorine	Matrix Spike/Matrix Spike Duplicates	≤ 35% RPD	± 30%
	Duplicates	≤ 35% RPD	---
	Reference Sample	---	± 10%
	EPA Audit Samples	---	50-150%
Continuous Emissions Monitors			
Carbon Monoxide	Performance Specification 4B	± 3% of Span	± 5% of Span
Oxygen	Performance Specification 4B	± 0.5% Oxygen	± 0.5% Oxygen
Total Hydrocarbons	EPA Method 25A	± 3% of Span	± 5% of Certified Calibration Gas
Carbon Dioxide	EPA Method 3A	± 3% of Span	± 2% of Span
Oxygen	EPA Method 3A	± 0.5% Oxygen	± 0.5% Oxygen
Spiking Materials			
Spiking Materials Composition/Concentration	Preparation Documentation/Certified Composition/Manufacturers' Specifications	± 1% of expected final concentration/purity	± 1% of expected final concentration/purity
Scales (for differential weights approach)	Pre- & Post-Test Calibration	± 0.1 lb up- and downscale check	± 0.1 lb
Continuous Mass Flow Metering Systems (if used)	Pre- & Post-Test Calibration	± 0.1 lb	± 0.1 lb

Table 5-1 Test Analytical Data Quality Objectives
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Note a: Method 0023A PCDD/PCDF Sampling Surrogate Compound Recoveries

Compound	Target Recovery
$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	70 – 130%
$^{13}C_{12}$-2,3,4,7,8-PeCDF	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%
$^{37}Cl_4$-2,3,7,8-TCDD	70 – 130%

Note b: Method 0023A PCDD/PCDF Isotope Dilution Internal Standard Compound Recoveries

Compound	Target Recovery
$^{13}C_{12}$-2,3,7,8-TCDD	40 – 130%
$^{13}C_{12}$-2,3,7,8-TCDF	40 – 130%
$^{13}C_{12}$-1,2,3,7,8-PeCDD	40 – 130%
$^{13}C_{12}$-1,2,3,7,8-PeCDF	40 – 130%
$^{13}C_{12}$-1,2,3,6,7,8-HxCDD	40 – 130%
$^{13}C_{12}$-1,2,3,6,7,8-HxCDF	40 – 130%
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDD	25 – 130%
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDF	25 – 130%
$^{13}C_{12}$-OCDD	25 – 130%

Note c: Method 0023A PCDD/PCDF Recovery Standard Compounds

Compound	Target Recovery
$^{13}C_{12}$-1,2,3,4-TCDD	Recovery Standards are used to calculated the recoveries of internal standards
$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	

PCDD/PCDF - polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans
QC - quality control
RPD - relative percent difference
RSD - relative standard difference

6.0 SAMPLING AND MONITORING PROCEDURES

6.1 GENERAL

The objective of this test program is the collection of representative waste feed and stack gas samples that demonstrate compliance with the HWC MACT performance and emissions standards. To meet this objective requires minimizing the potential sources of sample contamination or bias imparted to the samples by the sampling equipment, ambient conditions, handling, and preservation. The test program samples will be collected using the methods summarized in Table 6-1. The total numbers of field samples expected to be generated during the CPT are also summarized Table 6-1.

Guidelines followed to determine sampling equipment to be used, sampling points, and the frequency at which samples are to be taken are presented in the CPT plan, and are incorporated here by reference. The reference sources for the standard sampling method references include:

- Appendix A to 40 CFR 60, Test Methods and Procedures, New Source Performance Standards, 40 CFR 60 (EPA)
- Test Methods for Evaluating Solid Waste, SW-846, Third Edition, 1986 and updates (SW-846)
- American Society for Testing and Materials (ASTM) Annual Book of ASTM Standards.

The sampling and analytical procedures to be used during the test program are located in Appendix E-15 of the CPT plan. Reference sampling and analytical methods are identified throughout the CPT plan and this QAPP. The specifics of the sampling and analytical methodologies followed during the course of test execution by the selected sampling and analytical contractors include the referenced nationally recognized methods (ASTM, SW846, 40 CFR 60 Appendix A, etc.) and/or the contractor-specific standard operating procedures (SOPs).

During the course of sampling and analysis, situations may still arise that require modifying the specific sampling or analytical procedures included or referenced in the CPT plan or this QAPP. For the stack gas samples, there are few alternatives to the analysis methods prescribed in SW-846 or 40 CFR 60. For the samples from the single sampling train (e.g. Method 23 for PCDD/PCDFs), the proposed procedures for the sample extractions and analyses are noted in the analytical procedure in Appendix E-15 of the CPT plan and are discussed in this QAPP. Laboratory SOPs, which include a number of procedures for special circumstances, will be followed. In cases where the laboratory finds it necessary to make adjustments to the analytical methods, the changes will be documented following the corrective action procedures noted in Section 14.0 of this QAPP. Any such changes must be approved by the test-

designated Quality Assurance Officer (QAO). Regulatory observer approval will be requested if significant deviations from planned sampling procedures are encountered during the testing.

All stack sampling equipment and glassware will be prepared prior to the test according to the method specifications. Following each test run, the samples will be recovered from the sampling trains. The sample recovery procedures include prescribed solvent rinses of the trains, which serve a dual purpose of sample recovery and decontamination of the train in preparation for the next run. Rinses that are not included in the sample recovery will be placed into a waste solvent container and disposed of by TAPI.

Process samples will be collected using dedicated sampling equipment (sample bottles, funnels, jars, etc.) at each sampling location, thus eliminating the potential for cross contamination from one sample matrix to another. New sampling containers are used for each test run. If the same equipment will be used for more than one run, the equipment will be decontaminated by additional solvent rinses. Any decontamination solution generated will be collected by the facility operators for proper disposal.

During the test program, the incinerators will be operated and tested at the conditions specified in the CPT plan. The following samples will be collected during the test:

- Waste Feed Samples for properties and metals
- Spiking Materials
- Stack Gas Samples
  - SW-846 Method 23 for PCDD/PCDFs
  - EPA Method 26A for particulate and HCl and Cl_2
  - EPA Method 29 for metals
  - Installed CEMS for carbon monoxide and oxygen.

Refer to Section 7.0 of this QAPP. Sample tracking is documented using unique alphanumeric sample numbering applied to every sample, completed sample collection forms, completed request for analysis (RFAs) forms, completed chain of custody (COC) forms and sample collection checklists.

6.2 FIELD SAMPLING METHODS

6.2.1 Waste Feed and Process Samples

Standard methods, procedures, and dedicated sampling equipment will be used for the collection of process samples associated with this test program. The Process Sampling Coordinator monitors the process sampling during the testing to assure that proper documentation is completed and that

adherence to prescribed sampling procedures is observed. Sample tracking is documented using the sample numbering system, completed RFAs and COCs, the field sampling record, and sample collection checklist.

6.2.2 Stack Gas Samples

During the test program, the Stack Sampling Team Leader and the Sample Custodian are responsible for monitoring the sampling team's adherence to the standard stack sampling procedures, especially sampling train preparation; leak checks and recoveries (including blank trains); and reagent, field, and trip blanks. The Stack Sampling Team Leader is responsible for operation and recovery of the stack sampling equipment and stack gas samples. The Sample Custodian is responsible for preparing the stack gas and process samples for shipment to the laboratory. Sampling train calibration procedures are discussed in Section 8.0.

EPA Methods 1 and 2 will be used to determine the number and location of sampling traverse of isokinetic sampling locations. Documentation of Methods 1 and 2 will be included in the stack sampling report.

During each test run, carbon dioxide and oxygen concentrations will be determined using CEMS. The precision and accuracy of the carbon dioxide and oxygen continuous emissions monitoring system (CEMS) analyzers will be assessed using the recommended calibration gases in accordance with 40 CFR 60, Appendix A Performance Specifications 3A. Refer to Appendix E-16 of the CPT Plan for the procedures to be implemented during the CPT.

Stack gas moisture content will be determined for each isokinetic sampling train via EPA Method 4 (sampling train moisture gain). Isokinetic sampling train silica gel impingers will be filled with fresh, dry indicating silica gel at the beginning of the test program. During the sampling train recovery process, and subsequent test runs, each indicating silica gel impinger will be inspected prior to reuse to verify that sufficient capacity remains for moisture absorption during the next test run. Silica gel more than 50% utilized will be discarded and the impinger recharged with fresh dry indicating silica gel.

6.2.2.1 Method 23 for PCDD/PCDFs

A Method 23 sampling train will be used to sample stack gas dioxin and furans (PCDD/PCDFs). The extracts from the Method 23 sampling train will be analyzed for PCDD/PCDFs via Method 8290A [high resolution gas chromatography/high resolution mass spectrometry (HRGC/HRMS)].

At 40 CFR 63.1208(b)(1)(iii), the HWC MACT rule requires that the Method 23 sampling train be operated for a minimum of 180 minutes (3 hours) to sample a minimum of 2.5 dry standard cubic meters of stack gas during each sampling run so that any PCDD/PCDF congener that is non-detect may be counted as zero in determining compliance.

Prior to each test run, the Method 23 sampling train will be assembled and leak checked. At the end of each run, the sampling train will be disassembled and all train samples collected.

6.2.2.1.1 Method 23 Recovery

The Method 23 sample recovery considerations are covered in the sampling procedure found in Appendix E-15 of the CPT plan. For the combined Method 23 sampling train, the following general procedures will be used for sample recovery:

- Particulate Filter -- The particulate filter is removed from its holder and placed into its original Petri dish (Container No. 1) which is sealed with Teflon tape and placed in a plastic bag.
- Front Half Acetone/Methylene Chloride Rinses -- The internal surfaces of the nozzle, probe, front half of the filter holder, and any connecting tubing or glassware are brushed and rinsed three times each with acetone, and then rinsed three times with methylene chloride. The acetone and methylene chloride front-half rinses are collected in a single glass sample bottle (Container No.2). The final liquid level is marked on the sample container.
- Front Half Toluene Rinse -- The internal surfaces of the nozzle, probe, front half of the filter holder, and any connecting tubing or glassware are rinsed two times with toluene. The front half toluene rinses are collected in a glass sample bottle (Container No. 2A). The final liquid level is marked on the sample container.
- XAD-2 Adsorbent Resin Trap -- The XAD-2 adsorbent resin trap is removed from the train, and both ends are capped. The trap is then labeled, covered with aluminum foil, sealed in a plastic bag and stored on ice in an insulated cold chest (Container No. 3).
- Back Half Acetone/Methylene Chloride Rinses -- The back half of the filter holder, the filter support, transfer line (if used), and condenser (if separate from trap) are rinsed three times with acetone followed by two rinses with methylene chloride. The acetone and methylene chloride back-half rinses are placed into a single glass sample bottle (Container No. 4). The final liquid level is marked on the sample container.
- Back Half Toluene Rinse -- The back half of the filter holder, the filter support, transfer line (if used), and condenser (if separate from trap) are rinsed two times with toluene. The back half toluene rinses are placed into a glass sample bottle (Container No. 4A). The final liquid level is marked on the sample container.
- Impinger Liquids -- The contents of the impingers 2, 3, and 4 are measured to the nearest milliliter or weighed to the nearest 0.5 g and observed for the presence or absence of color or film, which is recorded on the sample recovery sheet. The impinger water may then be discarded.
- Silica Gel -- The silica gel contents of the last impinger are weighed to the nearest 0.5 g. The color and condition of the silica gel is noted on the sample recovery sheet. The silica gel may be discarded or recovered for reuse.

The Method 23 sample recovery procedure allows a combined recovery of the front-half components (filter element and probe rinses) and back-half components (XAD-2 resin trap and condenser rinses) however, they are typically collected separately and combined in the laboratory. For the front-half and back-half solvent rinses, Method 23 requires a series of three solvent rinses: acetone, followed by methylene chloride and then toluene. The toluene solvent rinses of the combined Method 23 sampling train is to be collected in containers separate from the acetone and methylene chloride rinses, and labeled accordingly in the field. Method 23 does not require recovery of the condensate fraction for the PCDD/PCDF analysis.

6.2.2.1.2 Method 23 Preparation for Analysis

Sample preparation considerations are covered in the analysis procedure for the Method 23 train found in Appendix E-15 of the CPT plan and are generally described in the following paragraphs.

Method 23 allows the sampling train front-half and back-half components to be prepared and analyzed as a single fraction. Surrogates compounds discussed below are applied to the XAD-2 resin.

The concentrated probe rinses are added to the filter and XAD-2 resin in the Soxhlet apparatus. Isotope dilution internal standard compounds for the PCDD/PCDFs are added directly to the extraction thimble before the Soxhlet extraction. The sample is Soxhlet extracted for 16 hours using toluene. The extract is removed from the Soxhlet extractor and is then blown down to less than 5 mL.

For PCDD/PCDFs, a number of spiking materials are applied to the Method 23 sampling train samples:

- Sampling Surrogate Spikes (listed in ‘note a’ of Table 5-1) – Isotopically labeled compounds spiked directly on the XAD-2 resin in the laboratory during XAD tube preparation prior to stack sampling use. The recovery of these compounds provides a comprehensive accuracy indication (stack to final analysis) of the PCDD/PCDFs found using the Method 23 sampling method.
- Isotope Dilution Internal Standard Spikes (listed in ‘note b’ of Table 5-1) - Isotopically labeled PCDD/PCDF compounds applied to the sample just prior to the Soxhlet extraction. The recoveries of these compounds reflect the overall relative accuracy of the sample handling and analysis by the laboratory.
- Alternate Standard Spike- For PCDD/PCDFs, an isotopically labeled compound may be applied to the sample after Soxhlet extraction and before extract cleanup. The recovery of this compound reflects the impacts on the sample of the extract cleanup step of sample preparation.
- PCDD/PCDF Recovery Standards (listed in ‘note c’ of Table 5-1)- Isotopically labeled compounds applied to the Soxhlet extracts just before GC/MS analysis. These compounds are providing the relative response factors, which are used to calculate analyte concentrations.

As noted above, the Method 23 sampling train will be operated a minimum of 180 minute (3 hours) to sample a volume of 2.5 dry standard cubic meters of stack gas during each sampling run. In accordance with 40 CFR 63.1208(b)(1)(iii), any PCDD/PCDF congener that is non-detect will be counted as zero in determining compliance.

6.2.2.2 EPA Method 29 for Metals

An EPA Method 29 sampling train will be used to sample stack gas for the project target metals. Samples are subjected to acid digestion using nitric and hydrofluoric acid per the methodology described in Method 29. Metals will be analyzed by SW-846 Method 6010C [inductively coupled argon plasma (ICP or ICAP)]. Accuracy and precision are measured through the use of matrix spike and post digestion spike analyses. The two Method 29 sampling train fractions will undergo separate analyses as follows:

- The nitric acid probe rinse and the particulate filter will be combined and digested in the laboratory as the front-half composite sample and analyzed for Hg and the non-Hg target metals.
- The combined condensate knockout impinger (impinger 1) and the HNO_3/H_2O_2 impingers (impingers 2-3) catches will be prepared in the laboratory and analyzed for Hg and the non-Hg target metals.

6.2.2.3 EPA Method 5/Method 26A for PM/HCl/Cl_2

An EPA Method 5/26A sampling train will be used to sample the stack gas for particulate matter (PM), HCl, and Cl_2. The stack gas HCl/Cl_2 is sampled by bubbling the gas through impingers containing 0.1N H_2SO_4 (acid) and 0.1N NaOH (alkaline) solutions in series. In the acid impingers, HCl gas is captured. Any Cl_2 in the sampled stack gas passes through to the acid impingers and is captured in the alkaline impingers. The chloride concentrations of the acid and alkaline impinger samples are analyzed separately for chloride ion, and are reported as HCl and Cl_2 catches respectively. During the sampling train recovery, the pH of the NaOH impingers are checked separately and noted on the sampling train recovery sheet. Precision for these samples is determined through the use of duplicate analyses of field, reagent blank, calibration standard, and QC samples, and the use of matrix spike duplicate analyses of field samples. Accuracy is determined by matrix spike analyses.

In the alkaline impinger, Cl_2 is captured in solution by its dissociation into chloride ion (Cl^-) and hypochlorite ion (OCl^-). The analysis of the alkaline impinger includes the careful addition by the laboratory analyst of sodium thiosulfate ($Na_2S_2O_3$) to reduce the hypochlorite (OCl^-) in the sample to chloride (Cl^-). The sample is then analyzed for chloride ion concentration. In the data reduction, the

chloride analysis result for the alkaline impingers is reported as Cl_2. Thiosulfate addition is not necessary to preserve the Cl_2 captured by the alkaline impingers and should not be performed in the field as part of the sample recovery. The random addition of thiosulfate in the field could result in overdosing. Overdosing with thiosulfate can lead to the formation of a thiosulfate peak in the ion chromatography output that will mask the chloride peak during the analysis resulting in necessary sample dilutions and elevated chloride detection limits.

The analysis of Method 5/26A includes H_2SO_4, NaOH and deionized water reagent blanks to assess blank contamination. Precision for the chloride analyses is determined through the use of matrix spike duplicate analyses of field samples. Accuracy is determined by matrix spike analyses.

The stack gas particulate emissions are determined by separate analysis of the Method 26A sampling train tare weighed filter and the front-half acetone probe rinses.

The tare weighed particulate filter PM catch is determined by the differential weight of the particulate collected by the Method 26A sampling train. Filter samples are dried to a constant weight to the nearest 0.1 mg. Constant weight shall mean a difference between two consecutive weighings of no more than 0.5 mg.

The acetone probe rinse fraction is transferred to a tare weighed flask, evaporated, and dried to a constant weight to the nearest 0.1 mg. Constant weight shall mean a difference between two consecutive weighings of no more than 0.5 mg.

The corresponding test run filter and probe rinse residue differential weights are added together. The sum is reported as the test run filterable particulate catch.

The analysis of the Method 5/26A include acetone reagent blank is used to assess blank contamination. Precision for the PM analyses is determined via replicate weighings. Accuracy is determined by using Class-S weight to verify the scale accuracy.

6.3 FIELD QUALITY CONTROL SAMPLES

Field QC samples will be collected during the test to provide an indication of quality assurance for the test samples. The field QC samples include:

- XAD-2 resin blanks for Method 23
- Reagent blanks for all sampling trains
- Blank trains for Method 23 and Method 29.

Table 6-1 includes the field QC samples that will be collected.

6.3.1 Resin Blanks

Two XAD-2 resin traps prepared for the Method 23 PCDD/PCDF sampling train will be spiked with internal standards and matrix spike compounds. These samples will be extracted and analyzed for PCDD/PCDF by the XAD-2 trap preparation laboratory to demonstrate the resin is free of background contamination, and to confirm that efficient surrogate recoveries are achievable.

6.3.2 Blank Trains and Reagent Blanks

Blank train samples are the samples recovered from sampling trains that have been assembled and charged with all the required chemical reagents and collection media in the same manner as the sampling trains used to sample the stack gases. The sampling trains are leak checked and heated to temperature in a location near the stack. The sampling train remains sealed at the stack location for a period equivalent to the length of time the corresponding sampling train is operated during the test run. The blank train is then recovered in the same way that actual stack gas sampling trains are recovered. The recovered blank train components are labeled as blank train samples and submitted for analysis with the actual stack gas train samples. The results of the blank train samples provide an indication of possible contamination introduced to the samples by reagents, glassware, sampling environment, and sampling recovery. The blank train samples for the stack sampling trains used during this test program will be collected as summarized in Table 6-1. For this test program, blank trains will be collected:

- One Method 23 PCDD/PCDF blank train
- One Method 29 metals blank train.

Reagent blanks are samples of the reagent source solvents, solutions, and other media used in stack sampling. Reagent blank samples for all sampling trains as summarized in Table 6-1.

Table 6-1. Sample Collection Locations, Equipment, and Methods

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Sample Name	Sampling Reference Method	Sample Container	Analysis	General Procedure/Frequency	Test	Field QC	Total Field Samples
Organic Waste Feed	ASTM E-300-86, EPA S004	250 mL glass bottle	Properties	Collect a 250 mL grab sample at each 15-minute interval during each test run. Grab samples will be combined in a 4 liter bottle to build the run composite. Collect four 250 mL samples of the homogenized composite at the end of the test run.	3	--	3
		250 mL glass bottle	Moisture		3	--	3
		250 mL glass bottle	Metals		3	--	3
Aqueous Waste Feed	ASTM E-300-86, EPA S004	250 mL glass bottle	Properties	Collect a 250 mL grab sample at each 15-minute interval during each test run. Grab samples will be combined in a 4 liter bottle to build the run composite. Collect four 250 mL samples of the homogenized composite at the end of the test run.	3	--	3
		250 mL glass bottle	Moisture		3	--	3
		250 mL glass bottle	Metals		3	--	3
Venturi Scrubber Blowdown Incinerator 1	ASTM E-300-86, EPA S004	250 mL glass bottle	Properties	Collect a 250 mL grab sample at each 15-minute interval during each test run for both incinerators. Grab samples will be combined in a 4 liter bottle to build the run composite. Collect two 250 mL samples of the homogenized composite at the end of the test run.	3	--	3
		250 mL glass bottle	Total Solids		3	--	3
Venturi Scrubber Blowdown Incinerator 2	ASTM E-300-86, EPA S004	250 mL glass bottle	Properties	Collect a 250 mL grab sample at each 15-minute interval during each test run for both incinerators. Grab samples will be combined in a 4 liter bottle to build the run composite. Collect two 250 mL samples of the homogenized composite at the end of the test run.	3	--	3
		250 mL glass bottle	Total Solids		3	--	3
Makeup Water	ASTM E-300-86, EPA S004	250 mL glass bottle	Total Chlorides	Collect two 250 mL glass sample bottles during each test run.	3	--	3
		250 mL glass bottle	Total Solids		3	--	3

Table 6-1. Sample Collection Locations, Equipment, and Methods
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Sample Name	Sampling Reference Method	Sample Container	Analysis	General Procedure/Frequency	Test	Field QC	Total Field Samples
Auxillary Fuel	ASTM E-300-86, EPA S004	250 mL glass bottle	Properties	Collect two 250 mL glass sample bottle once during the test.	1	--	1
		250 mL glass bottle	Metals		1	--	1
Sodium chloride Spiking Solution	ASTM E-300-86, EPA S004	250 mL glass bottle	Total Chlorides	Collect one 250 mL sample bottle of the material once during each test run	3	--	3
Methylene Chloride Spiking Solution	ASTM E-300-86, EPA S004	250 mL glass bottle	Total Chlorides	Collect one 250 mL sample bottle of the material once during each test run	3	--	3
Lead Spiking Solution	ASTM E-300-86, EPA S004	250 mL glass bottle	Lead	Collect one 250 mL sample bottle of the material once during each test run	3	--	3
Chromium Spiking Solution	ASTM E-300-86, EPA S004	250 mL glass bottle	Chromium	Collect one 250 mL sample bottle of the material once during each test run	3	--	3
Method 23 Particulate Filter	SW846 Method 23	Petri Dish	PCDD/PCDFs	Collect integrated sample for PCDD/PCDFs during each test run. Sample for a minimum 180 minutes to sample a minimum of 3.0 dry standard cubic meters of stack gas.	3	1-blank train	4
Method 23 Front Half Acetone and Methylene Chloride Rinses		500 mL glass sample bottle	PCDD/PCDFs		3	1-blank train	4
Method 23 Front Half Toluene Rinses		250 mL glass sample bottle	PCDD/PCDFs		3	1-blank train	4
Method 23 XAD-2 Resin		Resin Trap	PCDD/PCDFs		3	1-blank train	4
Method 23 Back Half Acetone and Methylene Chloride Rinses		500 mL glass sample bottle	PCDD/PCDFs		3	1-blank train	4
Method 23 Back Half Toluene Rinses		250 mL glass sample bottle	PCDD/PCDFs		3	1-blank train	4

Table 6-1. Sample Collection Locations, Equipment, and Methods
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Sample Name	Sampling Reference Method	Sample Container	Analysis	General Procedure/Frequency	Test	Field QC	Total Field Samples
Method 23 Acetone Reagent Blank	SW846 Method 23 Cont.	250 mL glass sample bottle	PCDD/PCDFs	Reagent Blank	--	1	1
Method 23 Methylene Chloride Reagent Blank		250 mL glass sample bottle	PCDD/PCDFs	Reagent Blank	--	1	1
Method 23 Toluene Reagent Blank		250 mL glass sample bottle	PCDD/PCDFs	Reagent Blank	--	1	1
PCDD/PCDF Audit Sample		Ampoule with spiked XAD-2 Resin	PCDD/PCDFs	As provided	--	1	1
Method 29 Particulate Filter	EPA Method 29	Petri Dish	Metals	Collect integrated sample for metals and mercury during each test run. Sample for a minimum 2 hours to sample approximately 0.75-1.0 dry standard cubic meters of stack gas.	3	1-blank train	4
Method 29 Front Half Nitric Acid Rinses		250 mL glass sample bottle	Metals		3	1-blank train	4
Method 29 Acidified Peroxide Impingers and Rinses		1-liter glass sample bottle	Metals		3	1-blank train	4
Method 29 Particulate Filter Reagent Blank		Petri Dish	Metals	Reagent Blank	--	1	1
Method 29 Nitric Acid Reagent Blank		250 mL glass sample bottle	Metals	Reagent Blank	--	1	1
Method 29 Water Blank		250 mL glass sample bottle	Metals	Reagent Blank	--	1	1
Method 29 Acidified Peroxide Reagent Blank		250 mL glass sample bottle	Metals	Reagent Blank	--	1	1
Metals Audit Sample Filter	SW846 Method 6010C	Filter in Petri Dish	Metals	As provided	--	1	1
Metals Audit Sample Liquid		Ampoule with spiked	Metals	As provided	--	1	1

Table 6-1. Sample Collection Locations, Equipment, and Methods

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Sample Name	Sampling Reference Method	Sample Container	Analysis	General Procedure/Frequency	Test	Field QC	Total Field Samples
Organic Waste Feed	ASTM E-300-86, EPA S004	250 mL glass bottle	Properties	Collect a 250 mL grab sample at each 15-minute interval during each test run. Grab samples will be combined in a 4 liter bottle to build the run composite. Collect four 250 mL samples of the homogenized composite at the end of the test run.	3	--	3
		250 mL glass bottle	Moisture		3	--	3
		250 mL glass bottle	Metals		3	--	3
Aqueous Waste Feed	ASTM E-300-86, EPA S004	250 mL glass bottle	Properties	Collect a 250 mL grab sample at each 15-minute interval during each test run. Grab samples will be combined in a 4 liter bottle to build the run composite. Collect four 250 mL samples of the homogenized composite at the end of the test run.	3	--	3
		250 mL glass bottle	Moisture		3	--	3
		250 mL glass bottle	Metals		3	--	3
Venturi Scrubber Blowdown Incinerator 1	ASTM E-300-86, EPA S004	250 mL glass bottle	Properties	Collect a 250 mL grab sample at each 15-minute interval during each test run for both incinerators. Grab samples will be combined in a 4 liter bottle to build the run composite. Collect two 250 mL samples of the homogenized composite at the end of the test run.	3	--	3
		250 mL glass bottle	Total Solids		3	--	3
Venturi Scrubber Blowdown Incinerator 2	ASTM E-300-86, EPA S004	250 mL glass bottle	Properties	Collect a 250 mL grab sample at each 15-minute interval during each test run for both incinerators. Grab samples will be combined in a 4 liter bottle to build the run composite. Collect two 250 mL samples of the homogenized composite at the end of the test run.	3	--	3
		250 mL glass bottle	Total Solids		3	--	3
Makeup Water	ASTM E-300-86, EPA S004	250 mL glass bottle	Total Chlorides	Collect two 250 mL glass sample bottles during each test run.	3	--	3
		250 mL glass bottle	Total Solids		3	--	3

Table 6-1. Sample Collection Locations, Equipment, and Methods
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Sample Name	Sampling Reference Method	Sample Container	Analysis	General Procedure/Frequency	Test	Field QC	Total Field Samples
Auxillary Fuel	ASTM E-300-86, EPA S004	250 mL glass bottle	Properties	Collect two 250 mL glass sample bottle once during the test.	1	--	1
		250 mL glass bottle	Metals		1	--	1
Sodium chloride Spiking Solution	ASTM E-300-86, EPA S004	250 mL glass bottle	Total Chlorides	Collect one 250 mL sample bottle of the material once during each test run	3	--	3
Methylene Chloride Spiking Solution	ASTM E-300-86, EPA S004	250 mL glass bottle	Total Chlorides	Collect one 250 mL sample bottle of the material once during each test run	3	--	3
Lead Spiking Solution	ASTM E-300-86, EPA S004	250 mL glass bottle	Lead	Collect one 250 mL sample bottle of the material once during each test run	3	--	3
Chromium Spiking Solution	ASTM E-300-86, EPA S004	250 mL glass bottle	Chromium	Collect one 250 mL sample bottle of the material once during each test run	3	--	3
Method 23 Particulate Filter	SW846 Method 23	Petri Dish	PCDD/PCDFs	Collect integrated sample for PCDD/PCDFs during each test run. Sample for a minimum 180 minutes to sample a minimum of 3.0 dry standard cubic meters of stack gas.	3	1-blank train	4
Method 23 Front Half Acetone and Methylene Chloride Rinses		500 mL glass sample bottle	PCDD/PCDFs		3	1-blank train	4
Method 23 Front Half Toluene Rinses		250 mL glass sample bottle	PCDD/PCDFs		3	1-blank train	4
Method 23 XAD-2 Resin		Resin Trap	PCDD/PCDFs		3	1-blank train	4
Method 23 Back Half Acetone and Methylene Chloride Rinses		500 mL glass sample bottle	PCDD/PCDFs		3	1-blank train	4
Method 23 Back Half Toluene Rinses		250 mL glass sample bottle	PCDD/PCDFs		3	1-blank train	4

Table 6-1. Sample Collection Locations, Equipment, and Methods
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Sample Name	Sampling Reference Method	Sample Container	Analysis	General Procedure/Frequency	Test	Field QC	Total Field Samples
Method 23 Acetone Reagent Blank	SW846 Method 23 Cont.	250 mL glass sample bottle	PCDD/PCDFs	Reagent Blank	--	1	1
Method 23 Methylene Chloride Reagent Blank		250 mL glass sample bottle	PCDD/PCDFs	Reagent Blank	--	1	1
Method 23 Toluene Reagent Blank		250 mL glass sample bottle	PCDD/PCDFs	Reagent Blank	--	1	1
PCDD/PCDF Audit Sample		Ampoule with spiked XAD-2 Resin	PCDD/PCDFs	As provided	--	1	1
Method 29 Particulate Filter	EPA Method 29	Petri Dish	Metals	Collect integrated sample for metals and mercury during each test run. Sample for a minimum 2 hours to sample approximately 0.75-1.0 dry standard cubic meters of stack gas.	3	1-blank train	4
Method 29 Front Half Nitric Acid Rinses		250 mL glass sample bottle	Metals		3	1-blank train	4
Method 29 Acidified Peroxide Impingers and Rinses		1-liter glass sample bottle	Metals		3	1-blank train	4
Method 29 Particulate Filter Reagent Blank		Petri Dish	Metals	Reagent Blank	--	1	1
Method 29 Nitric Acid Reagent Blank		250 mL glass sample bottle	Metals	Reagent Blank	--	1	1
Method 29 Water Blank		250 mL glass sample bottle	Metals	Reagent Blank	--	1	1
Method 29 Acidified Peroxide Reagent Blank		250 mL glass sample bottle	Metals	Reagent Blank	--	1	1
Metals Audit Sample Filter	SW846 Method 6010C	Filter in Petri Dish	Metals	As provided	--	1	1
Metals Audit Sample Liquid		Ampoule with spiked	Metals	As provided	--	1	1

Table 6-1. Sample Collection Locations, Equipment, and Methods
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Sample Name	Sampling Reference Method	Sample Container	Analysis	General Procedure/Frequency	Test	Field QC	Total Field Samples
Method 26A Particulate Filter	EPA Method 26A	Petri Dish	Filterable	Collect integrated sample for particulate and HCl/Cl_2 during each test run. Sample for a minimum 2 hours to sample approximately 0.75-1.0 dry standard cubic meters of stack gas.	3	--	3
Method 26A Front Half Acetone Rinses		250 mL glass sample bottle	Filterable Particulate		3	--	3
Method 26A Sulfuric Acid Impingers and Rinses		1-liter glass sample bottle	Chloride Ion		3	--	3
Method 26A Sodium Hydroxide Impingers and Rinses		500 mL glass sample bottle	Chloride Ion		3	--	3
Method 26A Particulate Filter Reagent Blank		Petri Dish	Filterable Particulate	Reagent Blank	--	1	1
Method 26A Acetone Reagent Blank		250 mL glass sample bottle	Filterable Particulate	Reagent Blank	--	1	1
Method 26 Deionized Water Reagent Blank		250 mL glass sample bottle	Chloride Ion	Reagent Blank	--	1	1
Method 26 Sulfuric Acid Reagent Blank		250 mL glass sample bottle	Chloride Ion	Reagent Blank	--	1	1
Method 26A Sodium Hydroxide Reagent Blank		250 mL glass sample bottle	Chloride Ion	Reagent Blank	--	1	1
Chloride in Acid Media Audit Sample		Ampoule with spiked liquid	Chloride Ion	As provided	--	1	1
Chloride in Basic Media Audit Sample		Ampoule with spiked liquid	Chloride Ion	As provided	--	1	1

Table 6-1. Sample Collection Locations, Equipment, and Methods
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Sample Name	Sampling Reference Method	Sample Container	Analysis	General Procedure/Frequency	Test	Field QC	Total Field Samples
Method 26A Particulate Filter	EPA Method 26A	Petri Dish	Filterable	Collect integrated sample for particulate and HCl/Cl_2 during each test run. Sample for a minimum 2 hours to sample approximately 0.75-1.0 dry standard cubic meters of stack gas.	3	--	3
Method 26A Front Half Acetone Rinses		250 mL glass sample bottle	Filterable Particulate		3	--	3
Method 26A Sulfuric Acid Impingers and Rinses		1-liter glass sample bottle	Chloride Ion		3	--	3
Method 26A Sodium Hydroxide Impingers and Rinses		500 mL glass sample bottle	Chloride Ion		3	--	3
Method 26A Particulate Filter Reagent Blank		Petri Dish	Filterable Particulate	Reagent Blank	--	1	1
Method 26A Acetone Reagent Blank		250 mL glass sample bottle	Filterable Particulate	Reagent Blank	--	1	1
Method 26 Deionized Water Reagent Blank		250 mL glass sample bottle	Chloride Ion	Reagent Blank	--	1	1
Method 26 Sulfuric Acid Reagent Blank		250 mL glass sample bottle	Chloride Ion	Reagent Blank	--	1	1
Method 26A Sodium Hydroxide Reagent Blank		250 mL glass sample bottle	Chloride Ion	Reagent Blank	--	1	1
Chloride in Acid Media Audit Sample		Ampoule with spiked liquid	Chloride Ion	As provided	--	1	1
Chloride in Basic Media Audit Sample		Ampoule with spiked liquid	Chloride Ion	As provided	--	1	1

Table 6-1. Sample Collection Locations, Equipment, and Methods
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Sample Name	Sampling Reference Method	Sample Container	Analysis	General Procedure/Frequency	Test	Field QC	Total Field Samples
Carbon Monoxide	40 CFR Part 60 Appendix B Performance Specification 4B	Installed Continuous Emissions Monitor	Carbon Monoxide	Continuous during each test run	--	--	--
Oxygen	40 CFR Part 60 Appendix B Performance Specification 4B	Installed Continuous Emissions Monitor	Oxygen	Continuous during each test run	--	--	--
Carbon Dioxide	EPA Method 3A	Temporary Continuous Emissions Monitor	Carbon Dioxide	Continuous during each test run	--	--	--
Oxygen	EPA Method 3A	Temporary Continuous Emissions Monitor	Oxygen	Continuous during each test run	--	--	--
TOTAL SAMPLES							115

ASTM - American Society for Testing and Materials
EPA Method - New Source Performance Standards, Test Methods and Procedures, Appendix A, 40 CFR 60.
mL - milliliter
PCDD/PCDF - polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans
QC - quality control
SW846 - Test Methods for Evaluating Solid Waste, Third Edition, November 1986, and Updates.

7.0 SAMPLE HANDLING, TRACEABILITY, AND HOLDING TIMES

7.1 SAMPLE CUSTODY AND SECURITY

A sample will be considered to be in the custody of a person if it is in his or her possession, in his or her sight, or secured by that person in an approved location accessible only to authorized personnel.

During the test, once the samples are transferred from the sampling technician to the Sample Custodian, sample custody becomes the responsibility of the Sample Custodian until the samples arrive at the analytical laboratory. When overnight couriers are utilized, the air bill will serve to document the transfer of custody from the Sample Custodian to the courier. The courier's air bill becomes part of the chain of custody (COC) record. Upon transfer of the samples from the courier to the analytical laboratory, sample custody will be maintained by the analytical laboratory performing the analyses.

Samples for organic analysis (Method 23, etc.) will be kept on ice ($4 \pm 2^{o}C$) and shipped to the analytical laboratory in sealed, insulated shipping containers. All ice used for shipping samples shall be double bagged in Ziplock® bags to prevent leakage of water during shipping. "Blue ice" may also be used to chill samples. Samples not requiring chilling (particulate, chloride, properties, etc.) may be shipped in sealed shipping containers without ice.

7.2 SAMPLE IDENTIFICATION

Refer to Figure 7-1. In consultation with the Test Coordinator, the Laboratory Analysis Coordinator will prepare the master sample list for the test program. Once the master sample list is set, the alpha-numeric sample numbers will be assigned to every sample. The sample numbers are used to track individual samples from collection through analysis. From the master sample list, the analytical laboratory will prepare the pre-labeled EPA Class III clean sample containers for field use, and the XAD-2 resins according to the specifications of the methods as described in the CPT plan. These items will be shipped to the test site in sealed transport containers. The stack sampling contractor will provide the sampling reagents for field use.

7.3 PROCESS SAMPLE COLLECTION FORMS

While a process sample is being taken in the field, the sampling technician will complete a field sampling record. An example field sampling record is presented as Figure 7-2. The field sampling record will be filled out in its entirety for every sample. This will provide information to be used in the final report. The

sampling technician shall provide the completed field sampling record to the Sample Custodian with the associated sample.

7.4 STACK SAMPLE COLLECTION FORMS

While stack sampling is being performed, the sampling technician will complete a stack sampling record. An example stack field sampling record for iso-kinetic sampling is presented as Figure 7-3. The stack sampling record will be completed in its entirety for every sampling train. This will provide information necessary to perform the emissions calculations. The sampling technician shall provide the completed stack sampling record to the Stack Sampling Coordinator at the completion of each sampling run.

7.5 SAMPLE LABELING

An example sample label format is presented in Figure 7-4. Each sample container will be labeled to show the source of the sample as TAPI; the project identification; sampler's initials; laboratory to which the sample will be shipped; the unique alphanumeric sample number; date and time; sample description; test number; and run number. If a single sample requires multiple containers, the number of the container and the total number of containers will be noted on the label. Project samples will be tracked via the assigned unique alphanumeric sample numbers. The sample number will appear on the sample label, the request for analysis (RFA), and the chain of custody (COC).

7.6 SAMPLE COLLECTION CHECKLIST

The master sample list identifies every sample by the assigned unique alphanumeric sample numbers (Refer to Figure 7-1), and the corresponding analytical test(s) required. As field samples are acquired and routed through the Sample Custodian, the samples will be checked off against the master list to ensure that all of the appropriate samples have been collected.

7.7 REQUEST FOR ANALYSIS/CHAIN OF CUSTODY

Collected samples will be shipped from the site to the laboratory in sealed containers with COC and RFA forms. Example RFA and COC forms are presented as Figures 7-5 and 7-6 respectively. The Sampling Technician and Sample Custodian will complete the COC and RFA forms for every sample. Some samples may consist of several sub-samples. Each individual component of the sample will be listed separately on the RFA/COC with its own unique alphanumeric sample identification number. The samples will be preserved as needed, and will remain in the possession of the Sample Custodian. The Sample Custodian will secure the samples in a location accessible only to authorized personnel until custody is transferred to a courier for delivery to the laboratory.

7.8 SAMPLE SHIPMENT

Field samples may be transported directly to the analytical laboratory by the test management or sampling contractor. If the samples are shipped via overnight courier, e.g. Federal Express, an individual trained in Federal Department of Transportation (DOT) and International Air Transport Association (IATA) regulations will package the samples to assure compliance with the applicable portions of these regulations.

Prior to shipping any samples, the Sample Custodian will verify the condition of the samples: sample temperatures for organic analyses samples, condition of all containers, level of sample within all containers (to be marked on the outside of the container), and type of packing material used. RFA/COCs will be checked to verify there is a RFA and COC for every sample being shipped. Before shipping the samples from the site, the Sample Custodian shall make a photocopy set of all the RFA/COCs to remain with the Test Coordinator.

7.9 SAMPLE DELIVERY

Upon receipt of samples at the laboratory, the receiver will accept custody for the shipment by an exchange of signatures with the delivering agent. The shipping containers will be opened by the Laboratory Analysis Coordinator (or designee) and inspected. The container contents will verified against the accompanying RFA/COC. Any damage to the contents of the shipping container or deviations from the original shipment documents will be noted on the COC. A labeled temperature blank (labeled VOA vial or sample bottle with water) will be shipped in every container with samples for organic analysis expressly for the purpose of determining sample temperatures. The Laboratory Analysis Coordinator or designee will, immediately upon opening the sample packaging, open the temperature blank and measure the temperature of the water inside the temperature blank using a thermometer. This temperature will be recorded on the COCs and any applicable laboratory documentation (sample receipt log).

Individual samples will be sorted and directed to the respective laboratory section responsible for the analyses noted on the RFA. Samples will be secured in a location accessible only to authorized personnel. Samples for organic analysis shall be secured in refrigerated sample storage. The COC forms are used to specifically to track the samples. To provide specific instructions to the analysts, the RFAs will accompany the respective COCs.

Transfer of custody to and within the analytical laboratory is addressed in the Laboratory's QA Manual. Upon completion of analysis, samples will be maintained at the laboratory under COC until they are released for proper disposal.

7.10 SAMPLE PRESERVATION

Table 7-1 shows the appropriate containers, preservation, and holding times for all samples to be collected during the test.

XAD-2 traps and other train sample components for the Method 23 PCDD/PCDF trains will be preserved after sampling by placing them in a cooler on double bagged ice or blue ice. Solvent samples from these sampling trains may be stored and shipped with the XAD-2 traps.

Any waste feed organic analysis samples will be preserved after sample collection by placing them on double bagged ice or blue ice in a dedicated sample cooler. All waste feed and process samples, for organic or inorganic analyses, will be stored separately and away from the stack gas samples, and shipped in separate packages to preclude possible contamination of the stack gas samples.

For non-organic analysis stack gas samples (particulate, chloride, etc.), sample preservatives (if applicable, refer to Table 7-1) will be used as required by the target analyte. These samples will be stored in dedicated sample packaging or coolers. These samples do not require chilling.

Table 7-1. Sample Containers, Preservation, and Holding Times

Page 1 of 2

Parameter	Sample Name/Matrix	Sample Containers	Preservation	Maximum Holding Time[a]
Process Physical Properties	Organic Waste Feed	Amber glass Boston round bottles with Teflon-lined caps	NA	180 days
	Aqueous Waste Feed	Amber glass Boston round bottles with Teflon-lined caps	NA	180 days
	Venturi Scrubber Blowdown	Amber glass Boston round bottles with Teflon-lined caps	NA	180 days
	Makeup Water	Amber glass Boston round bottles with Teflon-lined caps	NA	180 days
	Auxiliary Fuel	Amber glass Boston round bottles with Teflon-lined caps	NA	180 days
Process Chlorine	Organic Waste Feed	Amber glass Boston round bottles with Teflon-lined caps	NA	30 days
	Aqueous Waste Feed	Amber glass Boston round bottles with Teflon-lined caps	NA	30 days
	Venturi Scrubber Blowdown	Amber glass Boston round bottles with Teflon-lined caps	NA	30 days
	Makeup Water	Amber glass Boston round bottles with Teflon-lined caps	NA	30 days
	Auxiliary Fuel	Amber glass Boston round bottles with Teflon-lined caps	NA	30 days
	Spiking Materials	Amber glass Boston round bottles with Teflon-lined caps	NA	30 days
Process pH	Organic Waste Feed	Amber glass Boston round bottles with Teflon-lined caps	NA	As soon as possible
	Aqueous Waste Feed	Amber glass Boston round bottles with Teflon-lined caps	NA	As soon as possible
Process Metals	Organic Waste Feed	Amber glass Boston round bottles with Teflon-lined caps	ICP - NA Hg - Chill to 4°C	180 days/28 days for Hg
	Aqueous Waste Feed	Amber glass Boston round bottles with Teflon-lined caps	ICP - NA Hg - Chill to 4°C	180 days/28 days for Hg. Deliver Hg to lab within 48 hrs
	Auxiliary Fuel	Amber glass Boston round bottles with Teflon-lined caps	ICP - NA Hg - Chill to 4°C	180 days/28 days for Hg
	Spiking Materials	Amber glass Boston round bottles with Teflon-lined caps	ICP - NA	ICP - 180 days

Table 7-1. Sample Containers, Preservation, and Holding Times
Page 2 of 2

Parameter	Sample Name/Matrix	Sample Containers	Preservation	Maximum Holding Time
Stack Gas PCDD/PCDF	Stack gas Method 23 filter	Glass Petri dish	Chill to 4°C	30 days until extraction, 45 days after extraction
	Stack gas Method 23 sorbent tube	Standard cartridge wrapped in aluminum foil and sealed in plastic bag	Chill to 4°C	30 days until extraction, 45 days after extraction
	Stack gas Method 23 solvents	Amber glass Boston round bottles with Teflon-lined caps	Chill to 4°C	30 days until extraction, 45 days after extraction
Stack Gas Metals	Method 29 filters	Glass or plastic Petri dish	NA	180 days
	Method 29 liquids	Amber glass Boston round bottles with Teflon lined caps	NA	180 days
Stack Gas Particulate	Method 26A filters	Glass or plastic Petri dish	NA	180 days
	Method 26A acetone probe rinses	Amber glass Boston round bottles with Teflon-lined caps	NA	180 days
Stack Gas Chlorine	Method 26A impinger liquids	Amber glass Boston round bottles with Teflon-lined caps or polyethylene bottles	NA	28 days
Stack Gas O_2 & CO_2	Method 3A Temporary Continuous Emissions Monitor	Sample probe made of glass, stainless steel, or other approved material	Sample temperature will be maintained above the moisture dew point	NA – Sample transported directly to CEMS

Notes:

Reference: Quality Assurance/Quality Control (QA/QC) Procedures for Hazardous Waste Incineration, EPA/625/6-89/023, January, 1990 and promulgated method.

Figure 7-1. Example Master Sample List

TAPI Comprehensive Performance Test **Test America, Knoxville, TN**
Guayama, Puerto Rico **TAPI CPT MASTER SAMPLE LIST** **April 14, 2011**
Focus Project No.101002

Field Sample No.		Test No.	Run No.	RFA/COC No.	Sample Source	Sample Description	Sample Container	Analytical Parameters	Analytical Laboratory	QC Analysis
K-	3010	1	1	003	Organic Waste Feed	Waste Feed	250 mL amber bottle	Metals & Hg	TA, Knoxville	DUP/MS/MSD
K-	3011	1	1	003	Organic Waste Feed	Waste Feed	250 mL amber bottle	Properties	TA, Knoxville	DUP/MS/MSD
K-	3012	1	1	003	Organic Waste Feed	Waste Feed	250 mL amber bottle	Moisture	TA, Knoxville	DUP
K-	3013	1	1	003	Aqueous Waste Feed	Waste Feed	250 mL amber bottle	Metals & Hg	TA, Knoxville	DUP/MS/MSD
K-	3014	1	1	003	Aqueous Waste Feed	Waste Feed	250 mL amber bottle	Properties	TA, Knoxville	DUP/MS/MSD
K-	3015	1	1	003	Aqueous Waste Feed	Waste Feed	250 mL amber bottle	Moisture	TA, Knoxville	DUP
K-	3016	1	1	003	Venturi Scrubber Blowdown	Venturi Scrubber Blowdown	250 mL amber bottle	Properties	TA, Knoxville	DUP/MS/MSD
K-	3017	1	1	003	Venturi Scrubber Blowdown	Venturi Scrubber Blowdown	250 mL amber bottle	Total Solids	TA, Knoxville	DUP
K-	3018	1	1	003	Makeup Water	Makeup Water	250 mL amber bottle	Total Chloride	TA, Knoxville	DUP/MS/MSD
K-	3019	1	1	003	Makeup Water	Makeup Water	250 mL amber bottle	Total Solids	TA, Knoxville	DUP
K-	3020	1	1	007	Method 26A Train	Particulate Filter	Petri dish	Particulate	TA, Knoxville	
K-	3021	1	1	007	Method 26A Train	Acetone Probe Rince	500 mL amber bottle	Particulate	TA, Knoxville	
K-	3022	1	1	007	Method 26A Train	0.1N H_2SO_4 Impingers	1 Liter amber bottle	Hydrogen Chloride	TA, Knoxville	
K-	3023	1	1	007	Method 26A Train	0.5N NaOH Impingers	500 mL amber bottle	Chlorine	TA, Knoxville	
K-	3024	1	1	007	Method 26A Reagent Blank	Particulate Filter Reagent Blank	Petri dish	Particulate	TA, Knoxville	FB
K-	3025	1	1	007	Method 26A Reagent Blank	Acetone Reagent Blank	250 mL amber bottle	Particulate	TA, Knoxville	FB
K-	3026	1	2	007	Method 25A Reagent Blank	0.1N H_2SO_4 Reagent Blank	250 mL amber bottle	Hydrogen Chloride	TA, Knoxville	FB
K-	3027	1	2	007	Method 25A Reagent Blank	0.5N NaOH Reagent Blank	250 mL amber bottle	Chlorine	TA, Knoxville	FB

Client:	TAPI	**Unit**	Trane
Location:	Guayama, Puerto Rico	**Sheet No.:**	1 of 1
Program:	CPT	**Run Start:**	0800
Stream:	Organic Waste Feed	**Run End:**	1335
Sampler:	ARE	**Sample Frequency:**	250 mL every 15-minutes
Date:	14-Apr-11	**Sample Type:**	Composite
Test No.:	1	**Equip/Container:**	250 mL grab/ 4-L Composite
Run No.:	1	**Source:**	Tap on feed line

Sample No.	Sample Time	Comment	Sample No.	Sample Time	Comment
1	0800	Run Start 0800	26	:	
2	0830		27	:	
3	0900		28	:	
4	0930		29	:	
5	1000		30	:	
6	1030		31	:	
7	1100		32	:	
8	1130		33	:	
9	1200		34	:	
10	1230		35	:	
11	1300		36	:	
12	1330	Run End 1335	37	:	
13	:		38	:	
14	:		39	:	
15	:		40	:	
16	:		41	:	
17	:		42	:	
18	:		43	:	
19	:		44	:	
20	:		45	:	
21	:		46	:	
22	:		47	:	
23	:		48	:	
24	:		49	:	
25	:		50	:	

Total No. of Grabs:

Comments/Notes:

Samples for analysis were prepared at the end of the test run using aliquots of the homogenized composite sample.
The balance of the composite remaining was discarded.
250 mL for properties; 250 mL for metals; 250 mL for Moisture; 250 mL for Ultimate

Figure 7-2. Example Process Sampling Record

Isokinetic Stack Sample Data Collection Sheet

Contract No.	101002	Method:	M29 (Metals)			Page 1 of 1	
Facility	TAPI Guayama, Puerto Rico	Initial Leak Rate (ft^3 @ in.Hg)	<0.010 @ 10"			Operator	MJK
Source	Trane	Final Leak Rate (ft^3 @ in.Hg)	<0.010 @ 10"			Pitot No.	K-004
Date	18-Sep-09	Start Time	0800	Meter No.	1442	PTCF	0.84
Condition No.	1	End Time	1015	DGMCF	1.004	Init. Pitot Leak Check	0.0
Run No.	1	Duration (min)	120	Δ H @	1.645	Final Pitot Leak Check	0.0
Stat. Press. (in. H_2O)	-0.94	Bar. Press. (in.Hg)	29.73	Nozzle Dia.(")	0.251	Kf	2.3

Point	Time	Volume	Δ P	Δ H	Temperatures (^oF)							Vacuum
No.	(24 Hr)	(ft^3)	(in. H_2O)	(in. H_2O)	Flue Gas	Probe	Filter	Impingers	Meter in	Meter Out	Cond. Exit	(in. Hg)
A-1	0800	704.25	0.78	1.79	294	225	258	68	103	105	NA	6.0
A-1	0805	707.88	0.78	1.79	294	260	257	67	105	104		6.0
A-2	0810	711.50	0.74	0.17	294	257	261	66	106	104		6.0
A-2	0815	714.96	0.74	1.7	294	261	258	66	107	104		6.0
A-3	0820	718.09	0.68	1.56	292	258	257	64	108	104		6.0
A-3	0825	721.50	0.68	1.56	292	257	258	63	109	104		6.0
A-4	0830	725.36	0.77	1.77	292	258	258	67	104	104		6.0
A-4	0835	729.35	0.77	1.77	292	258	256	67	109	103		6.0
A-5	0840	733.20	0.77	1.7	293	258	259	61	110	104		6.0
A-5	0845	737.10	0.77	1.7	289	256	258	61	108	104		6.0
A-6	0850	740.67	0.74	1.43	285	259	255	62	106	105		6.0
A-6	0855	744.12	0.74	1.43	290	258	255	62	105	103		6.0
STOP	0900	747.21										
B-1	0915	747.42	0.62	1.77	292	255	259	66	96	95		7.0
B-1	0920	750.94	0.62	1.77	292	259	257	65	96	95		7.0
B-2	0925	754.76	0.77	1.43	293	257	257	62	99	95		7.0
B-2	0930	758.21	0.77	1.29	289	257	258	62	102	95		6.0
B-3	0935	761.52	0.62	1.04	285	258	257	62	104	97		6.0
B-3	0940	764.52	0.56	1.1	290	257	253	61	106	99		7.0
B-4	0945	767.79	0.45	1.5	296	257	257	63	109	100		6.0
B-4	0950	767.92	0.56	1.5	296	253	258	64	111	101		6.0
B-5	0955	774.51	0.45	0.99	296	257	259	61	112	103		6.0
B-5	1000	777.52	0.44	0.94	297	258	258	60	112	104		5.5
B-6	1005	780.47	0.65	0.85	297	259	258	61	113	105		5.5
B-6	1010	783.17	0.65	0.85	294	258	257	61	112	105		5.5
END	1015	785.94										

Comments:

Figure 7-3. Example Stack Sampling Record

TAPIe Comprehensive Performance Test
Guayama, Puerto Rico
Focus Project No. 101002

Sample Type:	Method 29 Filter	**Sample No.:**	**K-3014**
Test No. ____1___	**Run No.** ____1___	**Container(s):**	____ of ____
Analysis Required:	Metals: As, Be, Cd, total Cr, & Pb		
Analysis Laboratory:	Test America, Knoxville, TN		
Date:	14-Feb-11	**Initials:**	MJK
Time:	1415	**Preservation:**	NA

Figure 7-4 Example Sample Label Format

Request for Analysis/Chain of Custody No. 007
TAPI Comprehensive Performance Test
Guayama, Puerto Rico

Guayama, Puerto Rico
Focus Project No. 101002

Test America-Knoxville Lot No. _H-XXXXXXXX_____
Test America-Knoxville Project No. ___XXXXXXX_____

Project Description:	CPT Program
Client Project No.:	040809
Test America Project No:	XXXXXXX
Client Project Mgr:	Anthony Eicher 865-694-7517
Test America Contact:	Patti Carswell 865-291-3010
Test America Project Mgr:	Dr. William C. Anderson 865-291-3080

Laboratory Deliverable Requirements

Analytical Due Date: 21 days from lab receipt

Data Package Due Date: 30 days from lab receipt

Analytical Testing QC Requirements:
MS - Matrix Spike
MSD - Matrix spike duplicate
PDS - Post-digestion spike
DUP - Duplicate
BT- Blank train

Laboratory Destination:
Laboratory Destination
Test America-Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921
(865)-291-3000
Courier: Hand deliver

Project Deliverables:

Holding Time Requirements:	
Hydrogen Chloride (HCl) & Chlorine (Cl)	28 days to analysis

Field Sample No.	Test No.	Run No.	Sample Collection Date/ Time	Sample Container	Sample Description	Analysis Specifications	Project QC Requirements
K- 3024	1	1	14-Feb-11 1415	1 Liter amber bottle	0.1N H2SO4 Impingers	Analyze for Hydrogen Chloride (Cl^-) by Ion Chromatography (Method SW-9057) Method 26A HCl/Cl_2 Train	
K- 3025	1	1	14-Feb-11 1415	500 mL amber bottle	0.5N NaOH Impingers	Treat his sample with $Na_2S_2O_3$ for hypochlorite conversion and analyze for Chlorine (Cl_2) by Ion Chromatography (Method SW-9057) Method 26A HCl/Cl_2 Train	
K- 3028	1	2	14-Feb-11 1415	250 mL amber bottle	0.1N H2SO4 Reagent Blank	Analyze for Hydrogen Chloride (Cl^-) by Ion Chromatography (Method SW-9057) Method 26A HCl/Cl_2 Train	FB

Figure 7-5. Example Request for Analysis

Request for Analysis/Chain of Custody No. 007
TAPI Comprehensive Performance Test
Guayama, Puerto Rico
Focus Project No. 101002

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 non-conformances).	_____

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

Relinquished by: _____
Name Company Date/Time

Accepted by: _____
Name Company Date/Time

Figure 7-6. Example Chain of Custody

8.0 SPECIFIC CALIBRATION PROCEDURES AND FREQUENCY

8.1 GENERAL

Equipment and instruments used to generate data for determining compliance with performance requirements or to establish quantitative allowable operating limits will be calibrated according to the manufacturer's instructions, prior to and/or during the test as necessary. The calibration procedures are separated into groups according to the personnel who will perform them. TAPI operations personnel will calibrate the process instruments. Stack sampling equipment will be calibrated by the stack sampling contractor. Analytical instruments will be calibrated by the contracted laboratory personnel. Spiking system scales and metering systems will be calibrated by the spiking contractor. The calibration procedures for process instrumentation stack gas sampling, laboratory analytical instruments, and spiking measurement systems are described in the following subsections.

8.2 PROCESS INSTRUMENTATION

The parameter continuous monitoring system (CMS) (thermocouples, flow meters, pressure transducers, etc.) will be calibrated in accordance with TAPI SOPs within 30 days of the start of testing.

The continuous emission monitoring system (CEMS) (installed CO and O_2 monitors) will be undergo a Relative Accuracy Test Audit (RATA)as part of the 60 day CPT test period. The RATA will include calibration drift tests, response time tests, calibration error tests, and relative accuracy tests per the 40 CFR Part 60, Appendix B Specification 4B. During testing, the installed carbon monoxide and oxygen CEMS, the monitors will be calibrated daily before testing. The zero and span checks will be considered a verification of the data quality from these monitors.

CMS and CEMS data will be reported on 1-minute intervals and will be archived in the CMS data acquisition system.

8.3 STACK SAMPLING EQUIPMENT

Sampling equipment is calibrated according to the criteria specified in the reference method being employed. In addition, the guidelines set forth in the Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III, Stationary Source Specific Methods (EPA-600/4-77-027b) will be followed. Dry gas meters, orifices, nozzles, pitot tubes, temporary emissions monitors, etc. are calibrated in accordance with this document. The range of the calibration is specified for all environmental measurements to encompass the range of probable experimental values. This approach ensures that all results are based upon interpolative analyses rather than extrapolative analyses.

Calibrations are designed to include, where practical, at least three measurement points evenly spaced over the range. This practice minimizes the probability that false assumptions of calibration linearity will be made. In addition it is common practice to select, when practical, at least one calibration value approximating the levels anticipated in the actual measurement. Typically, calibration frequency is dictated by the need to demonstrate the stability of the calibration value over the course of measurements. Calibrations are made both pre- and post-test to accomplish the demonstration of stability.

Following the test program, calibrations are checked on all relevant items of sampling equipment to ensure the validity of data collected in the field. New items for which calibration is required are calibrated before initial field use. Equipment whose calibration status may change with use or time is inspected in the field before testing begins and again upon return from each field use. When an item of equipment is found to be out of calibration, it is repaired and recalibrated or retired from service. All equipment is periodically recalibrated in full, regardless of the outcome of these regular inspections.

Data obtained during calibrations are recorded on standardized forms, which are checked for completeness and accuracy by management personnel. Data reduction and subsequent calculations are performed using standard procedures, and are computerized where appropriate. Calculations are checked at least twice for accuracy. Copies of calibration forms are included in the test or project reports.

Emissions sampling equipment requiring calibration include pitot tubes, pressure gauges, thermometers, dry gas meters, and barometers. The following sections elaborate on the calibration procedures for these specific equipment items.

8.3.1 Pitot Tubes

All Type S pitot tubes, whether separate or attached to a sampling probe, are inspected in accordance with the geometry standards contained in EPA Method 2.

For Type S pitot tubes with a D_t between 3/16 and 3/8 inches, the pitot tube may be calibrated according to the procedure outlined in Sections 10.1.2 through 10.1.5 of Method 2 before and after the test, or a baseline (isolated tube) coefficient value of 0.84 may be assigned.

All Type S pitot tubes >3/8 inches are calibrated over an eight-point range with a wind tunnel and a calibration coefficient is calculated for each pitot tube. The acceptance limits are listed in Table 8-1.

8.3.2 Differential Pressure Gauges

Some meter consoles are equipped with 10-inch water column (w.c.) inclined-vertical manometers. Fluid manometers do not require calibration other than leak-checks. Manometers are leak-checked in the field prior to each test series.

8.3.3 Digital Temperature Indicator

One digital temperature indicator is used to determine the flue gas temperature, probe temperature, oven temperature, "train temperature" and dry gas meter temperature. The digital temperature indicator is calibrated over a seven-point range (32°F-450°F) using an ASTM mercury-in-glass thermometer as a reference. The calibration is acceptable if the agreement is within ±2% or 2°F from 50°F-180°F.

8.3.4 Dry Gas Meter and Orifice

A calibrated wet test meter is used to calibrate the dry gas meter and orifice. The full calibration procedure is used to obtain the calibration factor of the dry gas meter. Full calibrations are performed using a calibrated wet test meter as a reference standard.

8.3.4.1 Dry Gas Meter

Each metering system receives a full calibration at the time of purchase and quarterly. Upon request, a post-test calibration can be performed after each field use. If the calibration factor deviates by less than five percent from the initial value, the test data are acceptable. If it deviates by more than 5%, the meter is recalibrated and the meter coefficient (initial or recalibrated) that yields the lowest sample volume for the test runs is used.

EPA Method 5 requires another full calibration anytime the post-test calibration check indicates that the calibration factor has changed by more than 5%. Standard practice is to recalibrate the dry gas meter quarterly and check the orifice calibration during and after each field use.

8.3.4.2 Orifice

An orifice calibration factor is calculated for each of the eighteen flow settings during a full calibration. The arithmetic average of the values obtained during the calibration is used.

8.3.4.3 Temporary Emissions Monitor

Prior to sampling using an emissions monitor, a calibration error test, system bias check, and system response time test will be performed. Additionally, after each run, the system bias check or a 2-point system calibration error check is performed to validate the run.

8.3.5 Barometer

Each field barometer is adjusted before each test series to agree within ±0.1 inches of a reference aneroid barometer. The reference barometer is checked against the weather station pressure value (corrected for elevation difference) reported by the National Weather Service or mercury barometer. This information is obtained via a call to the weather line or the nearest airport

8.4 LABORATORY ANALYTICAL EQUIPMENT

The laboratory instruments will be calibrated as specified by the appropriate method before analyzing the test samples. The laboratory instrument calibration procedures are based on instructions in the referenced analytical methods and are summarized, along with other routine quality control checks, in Table 8-2. The calibrations performed and the results will be reported as appropriate to assure the quality of data in the laboratory sample analysis report.

8.5 SPIKING METERING SYSTEMS

The delivered feed rates of various spiking materials are determined via the concentrations of the species in the spiking materials, and the rates that the spiking materials are transferred to the waste feed line.

If the scales and differential weights methodology is utilized, the differential weights will be recorded at no less than every 10 minutes during the course of testing. Differential feed rates shall be reported to the nearest 0.1 lb. Up- and down-scale calibration checks of the scales will be performed as part of the spiking equipment setup, and at the conclusion of their use before the scales are recovered for transport from the site or relocated for testing of another on-site unit. The scale checks must include zeroing and range up to at least 50 pounds over the maximum weight of any container of spiking material that may be placed on the scale. The up- and down-scale calibration check increments shall not exceed 100 pounds. The pre- and post-test calibrations of each scale used during testing must be documented and the documentation included in the spiking report.

If continuous mass flow metering systems connected to a personal computer methodology is utilized, the mass flows and differential weights will be electronically recorded at no less than every minute during the course of testing. Differential feed rates shall be reported to the nearest 0.1 lb. Pre- and post-test calibrations of each mass flow metering system used during testing must be performed. Calibrations may

be performed at the spiking contractor's shop or on-site. Calibrations shall be performed using a system of scales and containers with each mass flow meter operated collecting data for a minimum of 30 minutes. Electronically recorded mass transfer calibration check data shall be compared to the calibration measurements via scales and differential weights. Up- and down-scale calibration checks shall be performed on the scales used in the mass flow metering system calibrations. The scale checks must include zeroing and range up to at least 50 pounds over the final weight of either the service or catch container used for the calibration check. The up- and down-scale scale calibration check increments shall not exceed 100 pounds. The continuous mass flow metering system calibration checks, and the up- and down-scale scale calibration checks, must be documented and the documentation included in the spiking report.

Table 8-1. Sampling Equipment Calibration Requirements

Page 1 of 3

Stack Sampling Equipment	Acceptance Criteria	Measurement Frequency	Action If Criteria Are Not Met
Volumetric Flow Measurements			
Type S pitot tube inspection	All dimension specifications met	Calibrate prior to test and visually inspect after each field test	Use pitot tubes that meet face opening specifications; repair or replace as required
Type S pitot tube calibration	± 3% for volumetric flows >1,000 fpm ± 5-6% for volumetric flows >600 and <1,000 fpm	Refer to Section 10.0 of Method 2: If D_t is between 0.48 and 0.95 cm (3/16 and 3/8 in.), and if P_A and P_B are equal and between 1.05 and 1.50 D_t, there are two possible options: (1) the pitot tube may be calibrated according to the procedure outlined in Sections 10.1.2 through 10.1.5 of Method 2 before and after the test, or (2) a baseline (isolated tube) coefficient value of 0.84 may be assigned to the pitot tube with pitot tube inspection before and after the test.	Check for blockage. If blockage is significant, recalculate calibration coefficient.
Barometers	±0.1 inches Hg (± 2.5mm Hg) of mercury-in-glass barometer	Calibrate initially versus mercury-in-glass barometer; check before and after field test	Adjust to agree with a certified barometer
Stack gas temperature measurement system	Capable of measuring within ± 2°F (± 1°C) of mercury-in-glass thermometer	Calibrate prior to test and after each field use	Adjust to agree with Hg bulb thermometer; construct calibration curve, correct readings
Pressure sensors (excludes inclined manometer)	Agree within ± 5 percent of inclined manometers	Prior to and after field use	Adjust to agree with Hg bulb thermometer; construct calibration curve, correct readings
Wet test meter	$Y_{mi} = Y_m \pm 0.030$ Y (before test) Y_{mf}/Y_{mi} is 0.95 to 1.05 (after test)	Calibration prior to test Check calibration after test	Before test: Adjust until specifications are met. After test: Recalculate calibration coefficient.

Table 8-1. Sampling Equipment Calibration Requirements
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Stack Sampling Equipment	Acceptance Criteria	Measurement Frequency	Action If Criteria Are Not Met
Volumetric Flow Measurements			
Dry gas meters	$Y_i = Y \pm 0.02\ Y$ (before test) Y_{mf}/Y_{mi} is 0.95 to 1.05 (after test)	Calibration versus wet test meter initially, and when post-check exceeds $\Delta Y \pm 0.05$	Before test: Repair or replace and then calibrate After test: Recalculate calibration coefficient.
Assembled isokinetic sampling train leakage	0.02 cfm (0.00057 m^3/min) at vacuum of $\geq$ 10 inches Hg (250 mm Hg) before the start of stack sampling, and $\geq$ maximum vacuum value recorded during sampling run for post sampling leak checks	Just prior to start of first sampling traverse (required); after first sampling traverse (recommended); after moving sampling train from first traverse port to second traverse port (recommended); end of second sampling traverse (required).	Before stack sampling or at post port change: Isolate and repair leak point(s); repeat leak check. If >4% of sampling rate, either record the leakage rate and plan to correct the sample volume as shown in Section 12.3 of this method, or void the sample run
Analytical balance (for moisture)	± 1 mg of Class-S weights	Check with Class-S weights upon receipt and daily	Adjust or repair
Temporary Continuous Emissions Monitor			
Calibration Error Test	Error must be within $\pm$ 2.0 percent of the calibration span or $\leq$0.5 ppmv difference between the certified value and the measured value	Prior to sampling and after any failed system bias test.	If the calibration error specification is not met, take corrective action and repeat until acceptable results are achieved.
System Bias Check or System Calibration Error	Within $\pm$5.0 percent of the calibration span or $\leq$0.5 ppmv difference between the certified value and the measured value	Prior to sampling	If the initial system bias or system calibration error specification is not met, take corrective action and repeat until acceptable results are achieved.

Table 8-1. Sampling Equipment Calibration Requirements
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Stack Sampling Equipment	Acceptance Criteria	Measurement Frequency	Action If Criteria Are Not Met
Sampling Train Heating Systems and Thermocouples			
Probe heating system (isokinetic sampling trains)	Capable of maintaining 248° ± 25°F (120°C ± 14°C) at a flow of 0.75 cfm (21.2 L/min)	Calibrate initially by APTD-0576(11) or use published calibration curves	Repair, or replace, and then verify the calibration
Probe nozzle (isokinetic sampling trains)	Average of three ID measurements of nozzle within 0.001 inches (0.0025 mm); difference between high and low 0.002 inches (0.0050 mm)	Use a micrometer to measure to nearest 0.025mm (0.001 in.); check before and after field test	Recalibrate, reshape, and sharpen when nozzle becomes nicked, dented, or corroded
Thermocouples (stack gas meters and final impinger)	Impinger thermocouple ± 1°C (2°F) [Method 5]; dry gas thermocouple ± 3°C (5.4°F) [Method 0010]; stack thermocouple within ± 1°C(± 2°F) of absolute temperature.	Calibrate prior to test against a mercury thermometer	Adjust; determine a correction factor or reject

Sources:
Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III, Stationary Source Specific Methods, EPA-600/R-94/038c, September 1994.
Maintenance, Calibration, and Operation of Isokinetic Source Sampling Equipment, APTD-0576, U.S. EPA, Office of Air Programs, March 1972.
Construction of Isokinetic Source Sampling Equipment, APTD-0581, U.S. EPA, Office of Air Programs, April 1971.
Method 0030, Volatile Organics Sampling Train and Method 0010, Modified Method 5 Sampling Train, Test Method for Evaluating Solid Waste Physical/Chemical Methods (SW-846), U.S. EP A Office of Solid Waste, Update III, December 1997.
Determination of Particulate Emissions from Stationary Sources, U.S. EPA, Test Methods and Procedures, New Source Performance Standards, 40 CFR 60, Appendix A.

Table 8-2. Summary of Laboratory Analytical Quality Control Checks, Frequencies, Acceptance Criteria, and Corrective Actions

Page 1 of 3

Parameter/Method	Quality Control Check	Method of Determination	Frequency	Acceptance Criteria	Corrective Action
PCDD/PCDF by High Resolution GC/ High Resolution MS (SW846 8290A)	Initial Calibration	All five high resolution concentration calibration solutions must be used for the initial calibration	Prior to sample analysis	PCDD/PCDF: The %RSD for the mean RRF from the each of the labled and unlabeled standards must not exceed ± 20%.	Recalibrate
	Continuing Calibration	Midlevel standard	At the beginning and end of each 12 hour shift	PCDD/PCDF: RFs must be within ± 20% of the initial calibration mean RRF for unlabeled standards and + 30% for labeled standards	Reanalyze standard. If second analysis does not meet criteria, recalibrate and reanalyze samples or justify acceptance of sample results since the last successful check.
	Retention time window verification and GC column performance	Monitor retention times	Start of each 12 hour shift	PCDD/PCDF: Compliance with Sections 6.2 and 9.3 of Method 8290	Correct according to method
	Method Blank	Analysis of blanks	Analyze one with each analytical batch	Results less than method detection limit	Flag data as discussed in case narrative
Metals by ICP or CVAA (SW846 6010C ICP and CVAA by SW846 7240A/7471B)	Initial calibration	Multiple standards (CVAA) or 1 standard (ICP) and a calibration blank, bracketing the expected concentrations. Critical level should be at least twice the lowest calibration standard.	Prior to sample analysis	Correlation coefficient of linear plot >0.995 (CVAA). Not applicable for ICP.	Recalibrate
	Reagent blank	Analysis of blank	After every 10 samples and at end of analysis	Less than instrument detection limit (IDL)	Reanalyze if greater than the reporting limit and discuss in case narrative if greater than the IDL
	Initial calibration verification (ICV)	Analysis of independent calibration check standard	Once after initial calibration	90 - 110% of theoretical value	Reanalyze and recalibrate, if necessary
	Laboratory control sample (LCS)	Analysis of an independent check standard	With each analytical batch	Laboratory historically derived limits or 80 - 120%	Repeat LCS. If second LCS fails, reanalyse all samples since last acceptable LCS.

Table 8-2. Summary of Laboratory Analytical Quality Control Checks, Frequencies, Acceptance Criteria, and Corrective Actions
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Parameter/Method	Quality Control Check	Method of Determination	Frequency	Acceptance Criteria	Corrective Action
Metals by ICP or CVAA (SW846 6010C ICP and CVAA by SW846 7240A/7471B) Cont.	Low level initial calibration verification (LLICV)	Analysis of LLICV (may be labled as CRDL)	after initial calibration	70 - 130% of theoretical value	Reanalyze and recalibrate, if necessary
	Post digestion spike	Analysis of post digest spike, spiked at 2 to 5 times the original sample value	One sample per test for ICP	85 - 115% of theoretical value	Flag data; discuss in case narrative
	Calibration accuracy (ICP only)	Reanalysis of high level standard	After every initial calibration	90 - 110% of theoretical value	Recalibrate and recheck
	Interference check (ICP only)	Analysis of interference sample	After every initial calibration and at the end of each run	80 - 120% of theoretical value	Recalibrate and recheck
	Method Blank	Analysis of a Method Blank	With each analytical batch	In complaince with Section 9.6 of Method 6010C	Reanalyze method blank once and if the method blank is still not in compliance, reprep and reanalyze associated samples if possible.
	Matrix Spike/Matrix Spike Duplicate or Matrix Spike and Unspiked Duplicate	Analysis of either a MS/MSD or a MS and unspiked duplicates of waste feed and process samples	With each analytical batch	75 - 125% recovery of Matrix spikes and MS/MSD or duplicate RPD $\leq$ 20%.	Perform additional quality control test as specified in Section 9.9
	Initial Calibration blank (ICB) and continuing calibration Blanks (CCBs)	Analysis of blanks	Immediately following the Initial calibration verification (ICV) and following each Continuing calibration verification (CCV).	Less than the lower limit of quantitation	Contamination source must be found and corrected. All samples analyzed since the last acceptable CCB must be reanalyzed.
	Initial Calibration Verification (ICV) and Continuing Calibration Verifications (CCVs)	Midlevel standard	After every 10 samples and end of each analysis batch	ICP – Midlevel standard 90 - 110% of theoretical value; blank <50% of lowest calibration standard or within 3 SD of average blank.	Identify and correct problems; reanalyze samples run since last acceptable continuing calibration check.
Particulate and Gravimetric (EPA Method 26A)	Calibration check	Calibration of balance with standardized weights	Prior to analysis, between each group of sample weighings, and at the end of each day.	99 – 101% of theoretical value	Recalibrate and recheck sample weights.

Table 8-2. Summary of Laboratory Analytical Quality Control Checks, Frequencies, Acceptance Criteria, and Corrective Actions
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Parameter/Method	Quality Control Check	Method of Determination	Frequency	Acceptance Criteria	Corrective Action
Chloride by Ion Chromatography	Initial Calibration	4 standards bracketing expected concentrations Note:	Prior to sample analysis	Linear correlation coefficient >0.995	Recalibrate
	Retention time check for ion identification	Determine average retention time for ions of interest or relative retention time of several ions for every calibration curve	Prior to sample analysis	Average Retention Time - Sample identification is positive if results are within retention time window of standards Relative Retention Time – Sample identification is positive if results are within 3 SD of average RRT	Ions of interest are not present if criteria are not met.
	Initial Calibration Verification (ICV) and Continuing Calibration Verifications (CCVs)	Midlevel standard	Beginning and end of each analysis period and after every 10 samples	90 – 110% of theoretical value	Repeat calibration check. If second check fails criteria, regenerate analytical system and reanalyze all samples since last acceptable calibration check.
	Reagent blank - Inicial calibration blank (ICB) and Continuing calibration blanks (CCBs)	Analysis of blanks	Immediately following the Initial calibration verification (ICV) and following each Continuing calibration verification (CCV).	Less than 1 mg/L	Contamination source must be found and corrected. All samples analyzed since the last acceptable CCB must be reanalyzed.
	Method Blank	Analysis of blanks	Analyze one with each analytical batch	Results less than method detection limit	Flag data as discussed in case narrative
	Matrix Spike/Matrix Spike Duplicate or Matrix Spike and Unspiked Duplicate	Analysis of either a MS/MSD or a MS and unspiked duplicates	With each analytical batch	Plus or minus 20% of the spiked value or from historical data.	Investigate cause of failure and qualify associated data
	Laboratory control sample (LCS)	Analysis of an independent check standard	With each analytical batch	Laboratory historically derived limits	Repeat LCS. If second LCS fails, reanalyse all samples since last acceptable LCS.

9.0 ANALYTICAL PROCEDURES

Analytical procedures and methods are summarized in Tables 9-1. Individual analytical methods are described in detail in Appendix E-15 of the CPT plan and are incorporated here by reference. The following is a list of the analytical reference methods for the procedures presented in Table 9-1:

- Test Methods for Evaluating Solid Waste, SW-846 (SW-846), Third Edition, November 1986 and Updates
- Sampling and Analysis Methods for Hazardous Waste Incineration, EPA 600/8-84-002.
- American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards, Philadelphia, Pennsylvania, Annual Series
- Appendix A, Test Methods and Procedures, New Source Performance Standards, 40 CFR 60.
- Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-020.
- Performance Specifications for Continuous Emissions Monitoring Systems, 40 CFR Part 60, Appendix B Performance Specification 4B.

Table 9-2 presents the waste feed target metals analytes and expected detection limits.

Table 9-3 presents the stack gas PCDD/PCDF target analytes for the Method 23 samples and expected detection limits.

Table 9-4 presents the stack target metals expected detection limit for the Method 29 samples and expected detection limits.

Table 9-5 presents expected detection limits for stack gas particulate, HCl, and Cl_2 for the Method 26A samples. These data show the expected resolution for particulate, HCl, and Cl_2 for emissions determinations.

The specifics of the sampling and analytical methodologies followed during the course of test execution by the selected sampling and analytical contractors include the referenced nationally recognized methods (ASTM, SW846, 40 CFR 60 Appendix A, etc.) and/or the contractor-specific standard operating procedures (SOPs).

During the course of sampling and analysis, situations may still arise that require modifying the specific sampling or analytical procedures included or referenced in the CPT plan or this QAPP. The laboratory SOPs, which include a number of procedures for special circumstance, will be followed. In cases where

the laboratory finds it necessary to make adjustments to the analysis methods, the changes will be documented following the corrective action procedures noted in Section 14.0 of the QAPP. Any such changes must be approved by the Test Coordinator and Quality Assurance Officer (QAO).

Table 9-1. Summary of Analytical Procedures and Methods

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Analysis	Sample Name	Sample Matrix	Analytical Procedure	Reference Method
Process Samples				
Heating Value	Organic WasteFeed	Organic liquid	Bomb calorimeter	ASTM D-240
	Aqueous WasteFeed	Aqueous Liquid		
Density	Organic WasteFeed	Organic liquid	Volumetric/Gravimetric	ASTM D-1963
	Aqueous WasteFeed	Aqueous Liquid		
Viscosity	Organic WasteFeed	Organic liquid	Kinematic viscometer	ASTM D-445
	Aqueous WasteFeed	Aqueous Liquid		
Ash Content	Organic WasteFeed	Organic liquid	Muffle furnace	ASTM D-482
	Aqueous WasteFeed	Aqueous Liquid		
	Ventur Scrubber Blowdown	Aqueous Liquid		
	Auxillary Fuel	Organic liquid		
Chlorine Content	Organic WasteFeed	Organic liquid	Ion chromatography analysis of combustion residue	SW846 5050/9056A
	Aqueous WasteFeed	Aqueous Liquid		
	Ventur Scrubber Blowdown	Aqueous Liquid		
	Makeup Water	Aqueous Liquid		
	Auxillary Fuel	Organic liquid		
	Spiking Materials	Aqueous or Organic Liquid		
pH	Organic WasteFeed	Organic liquid	pH meter	EPA 9045D
	Aqueous WasteFeed	Aqueous Liquid		EPA 9040C
Moisture	Organic WasteFeed	Organic liquid	Titration	ASTM D-4928 (Karl Fisher)
	Aqueous WasteFeed	Aqueous Liquid		
Total Solids	Ventur Scrubber Blowdown	Aqueous Liquid	Gravimetric	EPA 160.3
	Makeup Water	Aqueous Liquid		
Metals & Mercury	Organic WasteFeed	Organic liquid	Acid digestion, ICP & CVAA	SW846 3010A,3015A, 3050B, or 3051A,; 6010C & 7470A or 7471B
	Aqueous WasteFeed	Aqueous Liquid		
	Auxillary Fuel	Organic liquid		
	Spiking Materials	Aqueous Liquid		

Table 9-1. Summary of Analytical Procedures and Methods
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Analysis	Sample Name	Sample Matrix	Analytical Procedure	Reference Method
Stack Gas Samples				
PCDD/PCDFs	Method 23 train particulate filter, XAD-2 resin & solvent rinses	Particulate filter, XAD-3 resin & acetone/methylene chloride/toluene solvent rinses	Soxhlet extraction, HRGC/HRMS	EPA 23, SW846 0023A; 8290A
Metals	Method 29 filter and nitric acid probe rinses	Particulate filter & front half 0.1N nitric acid rinses	Acid digestion, ICP	EPA Method 29; SW846 0060; 6010C
	Method 29 acidified peroxide impinger solutions	5% nitric acid/10% hydrogen peroxide		
Particulate	Method 26A filter and acetone probe rinses	Particulate filter and acetone probe rinses	Gravimetric	EPA Method 5
Hydrogen Chloride (HCl)	Method 26A sulfuric acid impinger solutions	0.1N sulfuric acid	Ion chromatography	EPA Method 26A; SW846 9057
Chlorine (Cl_2)	Method 26A sodium hydroxide impinger solutions	0.1N sodium hydroxide		

ASTM - American Society for Testing and Materials
EPA Method - New Source Performance Standards, Test Methods and Procedures, Appendix A, 40 CFR 60.
SW846 - Test Methods for Evaluating Solid Waste, Third Edition, November 1986, and Updates.

Table 9-2. Waste Feed Metal Target Analytes

Metal	Method Detection Limit (mg/kg)	Reporting Limit (mg/kg)
Enumerated MACT Metals		
Arsenic (As)	0.59	1.0
Beryllium (Be)	0.020	0.50
Total Chromium (Cr)	0.40	1.0
Total LVM (As+Be+Cr)	1.0	2.5
Cadmium (Cd)	0.080	0.50
Lead (Pb)	0.11	0.30
Total SVM (Cd+Pb)	0.19	0.80
Total Mercury (Hg)	0.010	0.033

Table 9-3. Stack Gas Dioxin/Furan Target Analytes

Compound	CAS No.	Per Analysis EDL (pg)	Train Detection Limit (ng)[a]	Train Detection Limit (ng/m^3)[b]	2,3,7,8-TCDD TEQ Factor	2,3,7,8-TCDD TEQ Limit (ng/m^3)[b]
2,3,7,8 - TCDD	1746-01-6	1.8	0.0018	0.0006	1	0.0006
Total TCDD	NA	1.8	0.0018	0.0006	NA	NA
2,3,7,8 - TCDF (DB225)	51207-31-9	1.9	0.0019	0.0006	0.1	0.00006
Total TCDF	NA	1.9	0.0019	0.0006	NA	NA
1,2,3,7,8 - PeCDD	40321-76-4	1.8	0.0018	0.0006	0.5	0.00030
Total PeCDD	NA	1.8	0.0018	0.0006	NA	NA
1,2,3,7,8 - PeCDF	57117-41-6	1.9	0.0019	0.0006	0.05	0.000032
2,3,4,7,8 - PeCDF	57117-31-4	1.9	0.0019	0.0006	0.5	0.00032
Total PeCDF	NA	1.9	0.0019	0.0006	NA	NA
1,2,3,6,7,8 - HxCDD	57653-85-7	2.2	0.0022	0.0007	0.1	0.00007
1,2,3,4,7,8 - HxCDD	39227-28-6	1.7	0.0017	0.0006	0.1	0.00006
1,2,3,7,8,9 - HxCDD	19408-74-3	2.0	0.0020	0.0007	0.1	0.00007
Total HxCDD	NA	1.9	0.0019	0.0006	NA	NA
1,2,3,6,7,8 - HxCDF	57117-44-9	1.9	0.0019	0.0006	0.1	0.00006
1,2,3,4,7,8 - HxCDF	70648-26-9	1.6	0.0016	0.0005	0.1	0.00005
1,2,3,7,8,9 - HxCDF	72918-21-9	2.1	0.0021	0.0007	0.1	0.00007
2,3,4,6,7,8 - HxCDF	60851-34-5	2.3	0.0023	0.0008	0.1	0.00008
Total HxCDF	NA	1.9	0.0019	0.0006	NA	NA
1,2,3,4,6,7,8 - HpCDD	35822-39-4	3.1	0.0031	0.0010	0.01	0.000010
Total HpCDD	NA	3.1	0.0031	0.0010	NA	NA
1,2,3,4,6,7,8 - HpCDF	67562-394	1.9	0.0019	0.0006	0.01	0.000006
1,2,3,4,7,8,9 - HpCDF	55673-89-7	2.2	0.0022	0.0007	0.01	0.000007
Total HpCDF	NA	2.0	0.0020	0.0007	NA	NA
Total OCDD	3268-87-9	12	0.012	0.0040	0.001	0.0000040
Total OCDF	39001-02-0	4.2	0.0042	0.0014	0.001	0.0000014
TOTALS				0.011		0.0018

Notes:

[a] The detection limits values represent approximate, relative limits using isotope dilution and HRGS/HRMS analysis which can result in detection limit variations.

[b] Based on 3.0 cubic meters of stack gas sampled.

Table 9-4. Stack Gas Metals Detection

Metal	Front Half MDL (ug)	Back Half MDL(ug)	Train MDL (ug/m^3)[c]	Front Half Reporting Limit (ug)	Back Half Reporting Limit (ug)	Train Reporting Limit (ug/m^3)[c]
Enumerated MACT Metals						
Arsenic (As) [b]	0.35	0.33	0.91	1.0	1.0	2.7
Beryllium (Be) [b]	0.16	0.16	0.43	0.50	0.50	1.3
Total Chromium (Cr) [b]	0.31	0.31	0.83	1.0	1.0	2.7
Total LVM (As+Be+Cr) [b]	0.82	0.80	2.16	2.5	2.5	6.7
Cadmium (Cd) [b]	1.0	0.063	1.42	1.0	0.50	2.0
Lead (Pb) [b]	2.0	0.35	3.13	2.0	1.0	4.0
Total SVM (Cd+Pb) [b]	3.0	0.413	4.55	3.0	1.5	6.0

Notes:

[a] Method detection limits (MDLs) and reporting limits are for Inductively Coupled Argon Plasma(ICP) analysis SW-846 Method 6010 for all metal analytes. MDLs and reporting limits are based on previous similar Method 29 sampling and analysis.

[b] Sum of detection limits for probe rinse/filter and acidified peroxide impinger fractions from Multi-Metals Train.

[c] Based on 0.75 cubic meters of stack gas sampled.

Table 9-5. Stack Gas Particulate and HCl/Cl_2 Detection and Resolution

Parameter	Probe Rinse (mg)	Filter (mg)	Train Detection Limit (mg/m^3)[c]	Train Detection Limit (gr/dscf)[c]
Particulate				
Particulate Matter [b]	0.5	0.5	1.3	0.00058

Parameters	H_2SO_4 Impinger Method Detection Limit (ug)	NaOH Impinger Method Detection Limit (ug)	Train Method Detection Limit (ug/m^3)[c]	H_2SO_4 Impinger Reporting Limit (ug)	NaOH Impinger Reporting Limit (ug)	Train Reporting Limit (ug/m^3)[c]
HCl/Cl_2						
Hydrogen Chloride [b]	2000	NA	2667	3500	NA	4667
	ug/m^3 as HCl:		2742	ug/m^3 as HCl:		4798
	ppm as HCl:		1.8	ppm as HCl:		3.2
Chlorine [b]	NA	300	400	NA	525	700
	ug/m^3 as Cl_2:		400	ug/m^3 as Cl_2:		700
	ppm as Cl_2:		0.14	ppm as Cl_2:		0.24
Total as Cl^-	2000	300	3067	3500	525	5367
	ug/m^3 as Cl^-:		3067	ug/m^3 as Cl^-:		5367
	ppm as Cl^-.:		2.1	ppm as Cl^-.:		3.6

Notes:

[a] For particulate, the measurement is of differential weight, EPA Method 5. The detection limit accuracy for gravimetric is ±0.5 mg or ±50 ug for each of the two fractions, the filter and the probe rinse. The stack gas concentration limit is based on 0.75 cubic meters of stack gas sampled using a Method 5 or 26A sampling train.

[b] Detection limits are for chloride ion via Ion Chromatography (IC) analysis, SW-846 Method 9057. The stack gas concentration limit is based on 0.75 cubic meters of stack gas sampled using a Method 26A sampling train. MDL and reporting limit are based on previous similar testing.

[c] Based on 0.75 cubic meters of stack gas sampled.

10.0 SPECIFIC INTERNAL QUALITY CONTROL CHECKS

10.1 DEFINITIONS

The various types of QA/QC checks that may be performed as part of the test, both for sampling and analysis, are defined below. One or more of these QA/QC checks are associated with each measurement system in order to assess the compliance of the data to the DQOs established in Section 5.0. Table 10-1 is a summary of all the sample analyses and their associated internal quality control checks associated with this test program.

Audit Sample An audit sample is a field or alternate laboratory prepared blank spike submitted to the test laboratory to assess accuracy or potential sample degradation.

Blank, Field A field blank is a sampling train or sampling component that is set-up in the field but is not used for test sampling. The field blank is used to assess background contamination that may affect the representativeness of the field samples.

Blank, Media A sample of unused sampling media analyzed to ensure the media are uncontaminated. This type of sample may also be referred to as a “reagent blank” (see below).

Blank, Method A method blank is a sample of unused media that is prepared and analyzed in the test laboratory to assess background contamination that may exist in the laboratory, on glassware, or in the analytical system.

Blank, Reagent A sample of unused reagent(s) used to demonstrate the absence of contamination in the reagents.

Blank, Spike A blank spike is a laboratory prepared sample of blank media that is spiked with a known amount of target analyte(s) used to assess the accuracy of the analytical method.

Blank, System An aliquot of uncontaminated reagent used to clean out the analytical system after high level samples have been analyzed or before analysis begins.

Calibration Check A standard solution from a source other than the calibration standards used to verify the integrity of an instrument's calibration.

Calibration Standards High purity compounds or mixtures of compounds used to adjust the response of an analytical instrument. The laboratory will use traceable standards and submit standard preparation logs as part of the deliverables package.

Contingency Sample An archived portion of a field sample from the same location as other field samples that is collected and held in case of breakage or QA/QC failure during the handling or analysis of the primary sample. This type of sample is sometimes referred to as an "archive sample.

Continuing Calibration Verification A mid-point standard, from the same Calibration source as the initial calibration solution analyzed periodically to verify that calibration conditions have not drifted from the initial calibration.

Duplicate Analysis A duplicate is a sample that is split in the laboratory and prepared and analyzed twice. The results of the two analyses are compared as a measure of precision.

Duplicate Injection A second analysis of a single sample preparation. This QC test may be used to assess analytical QC failures, matrix interferences, or as a measure of analytical system precision.

Initial Calibration A series of analyses of solutions, that have known concentrations, used to establish the correspondence between the amount of an analyte present in the solution and the instrument's response across the expected analytical range of the samples. Initial calibrations also establish retention time windows for identification purposes in chromatographic methods.

Internal Standard Recovery Internal standards are non-target spikes added to samples for quantitation purposes. The percent recovery of the internal standards is checked to assess whether or not significant matrix interferences may affect the accuracy and precision of analytical results.

Performance Evaluation (PE) Sample See Audit Sample.

Proficiency Test A series of blank spikes analyzed in the test laboratory to demonstrate an analyst's ability to successfully perform the method with acceptable precision and accuracy.

Replicate One of a series of identical samples or splits of a single sample used to assess precision.

Serial Dilution The result of the analysis of a highly contaminated sample, run undiluted, is compared to the results for the same sample after serial dilution. The two results are expected to match to within method specified criteria. This test is a measure of the linearity of ICP calibration and the analysis technique.

Spike, Field See Audit Sample.

Spike, Matrix Spike of the known or controlled amount of an actual target analyte to an actual sample matrix that is then analyzed for that analyte. The percent recovery of the spiked analyte provides a measure of the matrix bias.

Surrogates Non-target or isotopically labeled analytes spiked into field samples as a measure of method efficiency and accuracy.

10.2 SPECIFIC QUALITY CONTROL CHECKS AND ACCEPTANCE CRITERIA

A variety of QC checks are required both in the field and in the laboratory to ensure the collection of samples that accurately represent the field conditions under study, to assess compliance with the Data Quality Objectives (DQOs), and to assess biases in the measurement system.

10.2.1 Field Activities

In order to ensure the representativeness of samples collected during the test, and to ensure integrity of field measurements, a variety of QC checks and controls will be implemented throughout the sampling program. These checks and controls will include:

- Standard forms and/or standard field notebooks will be used to document field activities and for data collection. The data collection forms and field notebooks will be reviewed routinely by senior staff for accuracy, completeness, and internal consistency.
- The strict adherence to detailed operating procedures as documented in the various project controlling documents and related SOPs will be enforced by experienced senior technical staff.
- Project personnel will be selected based on appropriate levels of training and experience and will receive site-specific training prior to working on-site. The site-specific training will include health and safety requirements; security requirements; briefings on overall project goals, objectives, and schedules; and, specific technical training related to their assigned tasks.
- Routine calibration will be performed on measurement systems and sampling equipment including metering systems, thermocouples, barometers, rotameters, and pitot tubes. Guidance related to equipment calibration is provided in Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III, Stationary Source Specific Methods and Quality Assurance/Quality Control Procedures for Hazardous Waste Incinerators, Appendix A. The detailed specifications, acceptance criteria, and corrective action requirements are presented in Section 8.0 of this QAPP. All calibrations will be documented and the documentation maintained in the project files.
- Leak checks will be performed according to method specifications before and after sampling.
- Field QC samples will be routinely submitted including audit (PE) samples, field blanks, media blanks, reagent blanks, trip blanks, and contingency samples. The frequency of submittal for these field QC samples and other field samples are provided in Tables 5-1 and 8-2.
- Field audits/surveillance will be performed periodically by the QAO to assess conformance to specifications. If nonconforming conditions are noted, the corrective action provisions of the QA plan will be invoked.

10.2.2 Laboratory Activities

Standard laboratory QA procedures, required of each laboratory, provide discussions related to QA/QC checks and controls within the laboratory. Specific data quality objectives, calibration requirements, acceptance criteria, and corrective action requirements for this test program are presented in Table 5-1 and Table 8-2 of this plan.

In addition to the requirements referenced above the laboratory will provide for quality control of sampling media and sample collection equipment. Sorbents used in the organic sampling trains will be prepared according to method specifications. Samples of the prepared media will be tested according to the intended method of use. The results of these tests will be retained in the laboratory's files for future reference.

Table 10-1. Summary of Test Program Analyses

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Analysis	Sample Matrix	Field		Reference Preparation Method	Reference Analytical Method	QC Analysis	QC Analysis Frequency [a]	QC Analyses	Total Analyses [b]
		Test	Field QC						
Heat Content	Organic Waste Feed	3	--	NA	Bomb calorimeter (ASTM Method D-240)	Duplicate	One per test	1	4
Viscosity				NA	Viscometer (ASTM Method D-445)	Duplicate	One per test	1	4
Density				NA	Gravimetric/volumetric (ASTM Method D-1963)	Duplicate	One per test	1	4
pH				NA	Meter (EPA 9045D)	Duplicate	One per test	1	4
Ash Content				NA	Residue after muffle furnace combustion (ASTM Method D-482)	Duplicate	One per test	1	4
Total Chloride				Bomb combustion (SW-846 Method 5050)	Ion chromatography of residue (SW-846 Method 9056A)	MS/MSD	One per test	2	5
Moisture		3		NA	Karl Fisher (ASTM D-4928)	Duplicate	One per test	1	4
Heat Content	Aqueous Waste Feed	3	--	NA	Bomb calorimeter (ASTM Method D-240)	Duplicate	One per test	1	4
Viscosity				NA	Viscometer (ASTM Method D-445)	Duplicate	One per test	1	4
Density				NA	Gravimetric/volumetric (ASTM Method D-1963)	Duplicate	One per test	1	4
pH				NA	Meter (EPA 9040C)	Duplicate	One per test	1	4
Ash Content				NA	Residue after muffle furnace combustion (ASTM Method D-482)	Duplicate	One per test	1	4
Total Chloride				Bomb combustion (SW-846 Method 5050)	Ion chromatography of residue (SW-846 Method 9056A)	MS/MSD	One per test	2	5

Table 10-1. Summary of Test Program Analyses
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Analysis	Sample Matrix	Field		Reference Preparation Method	Reference Analytical Method	QC Analysis	QC Analysis Frequency [a]	QC Analyses	Total Analyses [b]
		Test	Field QC						
Total Chloride	Venturi Scrubber Blowdown Incinerator 1	3	--	NA	Ion chromatography of residue (ASTM E-442; SW-846 Method 9056A)	MS/MSD	One per test	2	5
Ash				NA	Residue after muffle furnace combustion (ASTM Method D-482)	Duplicate	One per test	1	4
Total Solids		3		NA	Gravimetric (EPA 160.3)	Duplicate	One per test	1	4
Total Chloride	Venturi Scrubber Blowdown Incinerator 2	3	--	NA	Ion chromatography of residue (SW-846 Method 9056A)	MS/MSD	One per test (included in Incinerator 1)		3
Ash				NA	Residue after muffle furnace combustion (ASTM Method D-482)	Duplicate	One per test (included in incinerator 1)		3
Total Solids		3		NA	Gravimetric (EPA 160.3)	Duplicate	One per test (included in incinerator 1)		3
Total Chloride	Makeup Water	3		Bomb combustion (SW-846 Method 5050)	Ion chromatography of residue (SW-846 Method 9056A)	MS/MSD	One per test	2	5
Total Solids		3		NA	Gravimetric (EPA 160.3)	Duplicate	One per test	1	4
Ash Content	Auxillary Fuel	1	--	NA	Residue after muffle furnace combustion (ASTM Method D-482)	Duplicate	One per test	1	2
Total Chloride		1		Bomb combustion (SW-846 Method 5050)	Ion chromatography of residue (SW-846 Method 9056A)	MS/MSD	One per test	2	3
Total Chloride	Sodium Chloride Spiking Solution	3	--	Bomb combustion (SW-846 Method 5050)	Ion chromatography of residue (SW-846 Method 9056A)	Duplicate	One per test	1	4
Total Chloride	Methylene Chloride Spiking Solution	3	--	Bomb combustion (SW-846 Method 5050)	Ion chromatography of residue (SW-846 Method 9056A)	Duplicate	One per test	1	4

Table 10-1. Summary of Test Program Analyses
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Analysis	Sample Matrix	Field		Reference Preparation Method	Reference Analytical Method	QC Analysis	QC Analysis Frequency [a]	QC Analyses	Total Analyses [b]
		Test	Field QC						
Metals by ICP	Organic Waste Feed	3	--	Acid Digestion	ICP (SW-846 Method 6010C)	MS/MSD [d]	One set for test program	2	5
	Aqueous Waste Feed	3	--			MS/MSD [d]	One set for test program	2	5
	Auxillary Fuel	1	--			MS/MSD [d]	One set for test program	2	3
	Lead Spiking Solution	3	--	Acid Digestion	ICP (SW-846 Method 6010C) (Lead only)	Duplicate	One per test	1	4
	Chromium Spiking Solution	3	--	Acid Digestion	ICP (SW-846 Method 6010C) (chromium only)	Duplicate	One per test	1	4
	Analytical system QC	NA	NA	Acid Digestion	ICP (SW-846 Method 6010C)	LCS	One per batch/ matrix specific	2 or more	6
						Serial dilution	One per batch/ matrix specific	2 or more	
						Method Blank	One per batch/ matrix specific	2 or more	
Mercury by CVAA	Organic Waste Feed	3	--	CVAA (SW-846 Method 7470A, 7471B, 245.1, 245.5)	CVAA (SW-846 Method 7470A, 7471B, 245.1, 245.5)	MS/MSD [d]	One set for test program	2	5
	Aqueous Waste Feed	3	--	CVAA (SW-846 Method 7470A, 7471B, 245.1, 245.5)	CVAA (SW-846 Method 7470A, 7471B, 245.1, 245.5)	MS/MSD [d]	One set for test program	2	5
	Auxillary Fuel	1	--	CVAA (SW-846 Method 7470A, 7471B, 245.1, 245.5)	CVAA (SW-846 Method 7470A, 7471B, 245.1, 245.5)				
	Analytical system QC	NA	NA	CVAA (SW-846 Method 7470A, 7471B, 245.1, 245.5)	CVAA (SW-846 Method 7470A, 7471B, 245.1, 245.5)	LCS	One per batch/ matrix specific	2 or more	2
				CVAA (SW-846 Method 7470A, 7471B, 245.1, 245.5)	CVAA (SW-846 Method 7470A, 7471B, 245.1, 245.5)	Method Blank	One per batch/ matrix specific	2 or more	2

Table 10-1. Summary of Test Program Analyses
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Analysis	Sample Matrix	Field		Reference Preparation Method	Reference Analytical Method	QC Analysis	QC Analysis Frequency [a]	QC Analyses	Total Analyses [b]
		Test	Field QC						
PCDD/PCDFs by SW846 Method 23	Method 23 composite; filter, XAD-2 resin and solvent rinses.	3	1	Soxhlet extraction (SW-846 Methods 23)	HRGC/HRMS for PCDD/PCDFs (SW-846 Method 8290A)	PCDD/PCDF pre-sampling surrogate spikes	Every XAD-2 resin tube before sampling	4	4
						PCDD/PCDF isotope dilution internal standard spike	Every analysis [c]	4	
						PCDD/PCDF recovery standard spike	Every analysis [c]	4	
	Method 23 spiked XAD-2 resin blank	--	2	Soxhlet extraction (SW-846 Methods 23)	HRGC/HRMS for PCDD/PDDFs (SW-846 Method 8290A)	PCDD/PCDF pre-sampling surrogate spikes	Every XAD-2 resin tube before sampling	2	2
						PCDD/PCDF isotope dilution internal standard spike	Every analysis [c]	2	
						PCDD/PCDF recovery standard spike	Every analysis [c]	2	
	Method 23 audit sample spiked XAD-2 resin	--	1	Soxhlet extraction (SW-846 Methods 23)	HRGC/HRMS for PCDD/PDDFs (SW-846 Method 8290A)	PCDD/PCDF pre-sampling surrogate spikes	Every XAD-2 resin	1	1
						PCDD/PCDF isotope dilution internal standard spike	Every analysis [c]	1	
						PCDD/PCDF recovery standard spike	Every analysis [c]	1	

Table 10-1. Summary of Test Program Analyses
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Analysis	Sample Matrix	Field		Reference Preparation Method	Reference Analytical Method	QC Analysis	QC Analysis Frequency [a]	QC Analyses	Total Analyses [b]
		Test	Field QC						
PCDD/PCDFs by SW846 Method 23 Cont.	Method 23 Acetone Reagent Blank		1	Soxhlet extraction (SW-846 Methods 23)	HRGC/HRMS for PCDD/PDDFs (SW-846 Method 8290A)	reagent blank	One for test program	1	1
	Method 23 Methylene Chloride		1			reagent blank	One for test program	1	1
	Method 23 Toluene Reagent Blank		1			reagent blank	One for test program	1	1
	Analytical system QC	NA		Soxhlet extraction (SW-846 Methods 23)	HRGC/HRMS for PCDD/PDDFs (SW-846 Method 8290A)	Method blank	1 per analytical batch	1 or more	1
Metals by Method 29	Method 29 front half: filter, and nitric acid probe and front half filter holder rinses	3	1	Method 29	ICP (SW-846 Method 6010C)	PDS/PDSD & MS/MSD [d]	One per test	4	8
	Method 29 10%HNO3/5% H2 O2 impinger contents and rinses	3	1	Method 29	ICP (SW-846 Method 6010C)	PDS/PDSD & MS/MSD [d]	One per test	4	8
	Method 29 0.1 N Nitric Acid Blank		1	Method 29	ICP (SW-846 Method 6010C)		One per test to be archived unless contamination suspected	1	1
	Method 29 Water Blank		1	Method 29	ICP (SW-846 Method 6010C)		One per test to be archived unless contamination suspected	1	1

Table 10-1. Summary of Test Program Analyses
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Analysis	Sample Matrix	Field		Reference Preparation Method	Reference Analytical Method	QC Analysis	QC Analysis Frequency [a]	QC Analyses	Total Analyses [b]
		Test	Field QC						
Metals by Method 29 Cont.	Method 29 Acidified Peroxide Blank		1	Method 29	ICP (SW-846 Method 6010C)		One per test to be archived unless contamination suspected	1	1
	Method 29 Filter Blank		1	Method 29	ICP (SW-846 Method 6010C)		One per test to be archived unless contamination suspected	1	1
	Spike filter audit sample for metals	--	1	Method 29	ICP (SW-846 Method 6010C)	Audit Sample	One for test program	1	1
	Liquid audit sample for metals	--	1	Method 29	ICP (SW-846 Method 6010C)	Audit Sample	One for test program	1	1
	Analytical system QC	NA	NA	NA	ICP (SW-846 Method 6010C)	LCS	One per batch/ matrix specific	1 or more	1
						Serial dilution	One per batch/ matrix specific	1 or more	1
						Method blank	One per batch/ matrix specific	1 or more	1
Particulate by Method 26A	Method 26A particulate filter	3	--	Desiccate to constant mass	Gravimetric (Method 5)	Replicate weighing to constant weight	Every sample	3	3
	Method 26A probe and filter holder acetone rinses	3	--	Evaporate/Desiccate to constant mass	Gravimetric (Method 5)	Replicate weighing to constant weight	Every sample	3	3
	Method 26A filter reagent blank	--	1	Desiccate to constant mass	Gravimetric (Method 5)	Replicate weighing to constant weight	Every sample	1	1
	Method 26A acetone reagent blank	--	1	Evaporate/Desiccate to constant mass	Gravimetric (Method 5)	Replicate weighing to constant weight	Every sample	1	1

Table 10-1. Summary of Test Program Analyses

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Analysis	Sample Matrix	Field		Reference Preparation Method	Reference Analytical Method	QC Analysis	QC Analysis Frequency [a]	QC Analyses	Total Analyses [b]
		Test	Field QC						
HCl by Method 26A	Method 26A H2SO4 impingers	3	--	NA	Ion chromatography (EPA Method 26A & SW-846 9056A/9057)	MS/MSD[d]	1 per batch	2	8
						Duplicate analysis	Each sample	3	
	Method 26A H2SO4 reagent blank	--	1	NA		Reagent Blank	One for test program	1	2
HCl by	Method 26A NaOH impingers	3	--	NA	Ion chromatography (EPA Method 26A & SW-846 9056A/9057)	MS/MSD[d]	1 per batch	2	8
						Duplicate analysis	Each sample	3	
	Method 26A NaOH reagent blank	--	1	NA		Reagent Blank	One for test program	1	2
Cl^- ion by Method 26A	Method 26A deionized water reagent	--	1	NA	Ion chromatography (EPA Method 26A & SW-846 9056A/9057)	Reagent Blank	One for test program	1	2
Cl^- ion chromatography	Liquid audit sample	--	1	NA		Audit Sample	One for test program	1	1
TOTAL									**210**

[a] The test condition is comprised of three replicate sampling runs.
[b] Total laboratory analyses includes field sample analyses and laboratory QC analyses
[c] Surrogate spikes are applied to all samples. Refer to Table 5-1 notes for the surrogate compounds.
[d] MS = Matrix spike MSD = Matrix spike duplicate
PDS = Post-digestion spike PDSD = Post-digestion spike duplicate
[e] Refer to Table 5-1 notes for the matrix spike compounds.
ASTM - American Society for Testing and Materials
CVAA - cold vapor atomic absorption
CWA - Methods for Chemical Analysis of Water and Waste, EPA-600/4-79-020. EPA, Environmental Monitoring and Support Laboratory, Cincinnati, OH, 1979.
EPA Method - New Source Performance Standards, Test Methods and Procedures, Appendix A, 40 CFR 60.
HRGC/HRMS - high resolution gas chromatography/high resolution mass spectroscopy
IC - ion chromatography
ICP - inductively coupled argon plasma spectroscopy
NA - not applicable
PCDD/PCDF - polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans
QC - quality control
SW846 - Test Methods for Evaluating Solid Waste, Third Edition, November 1986, and Updates.

11.0 DATA REDUCTION, DATA VALIDATION, AND DATA REPORTING

11.1 DATA REDUCTION

This section of the QAPP describes the approach that will be used to report, review, and reduce the field and laboratory data. The raw data include field samples and sampling documentation, sample tracking documentation, laboratory preparation documentation, and raw analytical data. The analytical results from the laboratory are assembled into complete analytical data packages. The analytical data packages include the analytical results and their defensible backup data. The analytical data are evaluated for compliance with the project DQOs. Data determined to meet the analytical requirements will be used to calculate the unit performance and emissions.

11.2 PCDD/PCDF ANALYSES

PCDD/PCDF analyses will be conducted using high resolution gas chromatography/high resolution mass spectrometry (HRGC/HRMS). Method 23 should be consulted for details of data reduction. A summary of the data reduction scheme is presented below.

Analytical instrumentation is calibrated using 5 points covering the expected analytical range. HRGC/HRMS methods employ an internal standard technique. Response factors (RF) are calculated using the formulas provided in Section 9 of method 23:

The response factors must agree to within method specified criteria (20% RSD) for the percent relative standard deviation (%RSD).

When samples are analyzed, the integrated ion current of the two ions characteristic of the compounds in the sample is compared to the integrated ion current of the two ions characteristic of the internal standard in the samples to arrive at an analytical result according to the formula provided in Section 9.3 of Method 23:

Samples containing a concentration of an analyte exceeding the concentration the instrument is calibrated for will have a dilution performed, if such a dilution is practical given the sample preparation method. In that case the dilution factor is used to arrive at the final result. If, under the circumstances of the method, a dilution is not possible, the analytical result must be considered estimated.

11.3 METALS ANALYSES

The analysis of metals also begins with an instrument calibration. For inductively coupled argon plasma spectroscopy (ICP) using SW846 Method 6010C and EPA Method 29 for non-mercury (non-Hg) metals analyses and cold vapor atomic adsorption spectroscopy (CVAA) using SW846 Method 7470A or 7470B and EPA Method 29 for mercury (Hg) analyses, instruments are profiled and calibrated according to the instrument manufacturer's and method instructions. A calibration blank and an initial calibration verification are then analyzed to ensure appropriate instrument response. A percent recovery (%R) is calculated for the initial calibration verification according to the following formula:

$$\%R = \frac{Found}{True} \times 100$$

Where: $\%R$ = Percent Recovery

$Found$ = The Result of the Analysis

$True$ = The Expected Result

The %R is expected to be within method specifications before analysis can begin. The calibration is verified after every 10 samples using a continuing calibration blank and continuing calibration verification following the same techniques.

Cold vapor atomic absorption instruments are calibrated using at least 5 standards. A linear regression is performed and a correlation coefficient is calculated to assess linearity of the curve. It is beyond the scope of this document to provide a detailed explanation of the statistics supporting linear regression and the calculation of the correlation coefficient. Reference can be made to any standard statistics text for additional information. Calibration checks are performed as above and periodically verified.

Analytical results for metals are read directly from the instrument in terms of concentration. Dilution factors must be used as discussed above if applicable. In order to combine the results of the sub-samples of a metals sampling train, the concentration is converted back to mass using the following formulas provided in section 12 of Method 29. The concentration in the gas sample can then be calculated.

11.4 ION CHROMATOGRAPHY

Anions, such as chloride, are separated on the ion chromatograph using a system comprising separator columns, guard columns, and eluents as described in EPA Method 26A for stack gas samples and

SW846 method 9056A for waste samples. The system is calibrated using a minimum of 3 points and the calibration is verified with a mid-range standard. Samples are quantitated in the same manner as described above.

11.5 DIRECT READING INSTRUMENTS

Gravimetric, temperature, pressure, flow, and CEMS data are directly read from the measurement instrumentation. The instrumentation will be calibration checked prior to the test, and routinely prior to reading measurements, however, no data reduction beyond formatting into tables is expected

11.6 ANALYTICAL DATA PACKAGES

Analytical data packages will be organized in accordance with the laboratory standard operating procedures. The complete analytical data package is a stand-alone deliverable that includes the final analysis results, raw analytical instrument data, initial and continuing calibration data, parameter-specific quality control documentation, sample preparation documentation, and records of sample traceability. These data are sufficient for performing independent verification of the final analytical results. Every analytical data package includes the following:

- Cover Page—Identifies the laboratory-assigned lot number, project identification, laboratory project manager, and issue date.
- Table of Contents—Organization of the data package.
- Sample Summary—Cross reference to project sample identifications and laboratory sample identifications.
- Analytical/Preparation Methods Summary—Identifies the methods used to prepare and analyze the samples.
- Narrative— Summarizes the project-specific information and any pertinent information concerning data quality. The narrative documents sample delivery and condition upon receipt, and any analytical difficulties or anomalies encountered during sample preparation and analysis.
- QC Data Association Summary—Comparison of sample results to the project and laboratory DOQs and association of project samples to laboratory QC.
- Analytical Data Report—Summarized analytical data for all samples and associated quality assurance samples including as appropriate: data flags, duplicate analysis results, surrogate recovery results, method blank results, laboratory control sample results, and matrix spike/matrix spike duplicate/post digestion spike (MS/MSD/PDS) results.
- Chain-of-custody (COC) documentation.

Each analytical data package will include the identification and signature or initials of each analyst who handles the test samples. The Laboratory Analysis Coordinator will certify via signature the contents of each analytical data package.

11.6.1 Organic Analyses

The organic analytical data packages will include the following:

- Sample Results
- Raw Sample Data
  - Sample Data
  - Tentatively Identified Compound Data for Compounds by GC/MS (if applicable)
- Standards Data
  - Initial Calibration Summary(s) and Raw Data
  - Continuing Calibration Summary(s) and Raw Data
  - Initial Calibration(s) Tuning Raw Data (GC/MS only)
  - Continuing Calibration(s) Tuning Raw Data (GC/MS only)
- Raw QC Data
  - Method Blank Data
  - Tentatively Identified Compound Data for Compounds by GC/MS (if applicable)
  - MS/MSD Data and Evaluation Reports
  - Laboratory Control Standard Data and Evaluation Reports
- Miscellaneous data
  - Sample Data Review Checklist
  - Calibration Data Review Checklists
  - Run Logs
  - Extraction sheets.
  - Sample Results
- Example Calculations

11.6.2 Metals Analyses

The metals analytical data packages will include the following:

- Sample Results
- Quality Control Summary
  - Method Blank Report
  - Sample Duplicate Report
  - MS/MSD/PDS Data and Evaluation Report
  - Laboratory Control Sample Data and Evaluation Report
- Quality Control Summaries
  - Initial Calibration Verification and Blank Results
  - Continuing Calibration Verification and Blank Results
  - Interference Check Sample
  - PDS Sample Recovery
  - Serial Dilutions Documentation for ICP
  - Instrument Detection Limits

  - ICP Correction Factors
  - ICP Linear Ranges
- Raw Data
  - Data Review Checklist
  - Sample, Standards, and Quality Control Data
  - Digestion/Extraction Sheets
  - Preparation Log
  - Analysis Run Log.

11.6.3 Other Inorganic Analyses

The data packages for other inorganic analyses will include the following:

- Sample Results
- QC Summary
  - Method Blank Report
  - Sample Duplicate report
  - MS/MSD Data and Evaluation Report(s)
  - Laboratory Control Sample Data and Evaluation Report
- Raw Data
  - Data Review Checklist
  - Sample, Standards, and Quality Control Data
  - Distillation, Extraction, and Sample Preparation Sheets
  - Standards Preparation Logs
  - Run Logs

11.7 DATA VALIDATION

The results of all sample analysis and all QA/QC sample analysis (100% of the laboratory data) will be compared to the specifications given in Tables 5-1 and 8-2. The data validation criteria outlined in: U.S. EPA. Contract Laboratory Program National Functional Guidelines for Low Concentration Organic Data Review, (2001) U.S. EPA Analytical Operations/Data Quality Center (AOC) National Functional Guidelines for Chlorinated Dioxin/Furan Review (2002) and U.S. EPA Contract Laboratory National Functional Guidelines for Inorganic Data Review, (2004); prepared by U.S. EPA Data Review Work Group will be followed as applicable to the individual methods used. Any sample data associated with a QC check that fails to meet the target criteria established in these tables will be flagged in the final report, and an assessment of the impact, if any, of missing the target data quality objective will be provided. Additional guidance will be found in the analytical methods and EPA/625/6-89/023, Quality Assurance/Quality Control (QA/QC) Procedures for Hazardous Waste Incineration.

The method detection limit (MDL), and the reliable detection limit (RDL) or laboratory specified reporting limit (RL) will be reported for all non-isotope dilution method compounds. Results reported between the MDL and the RDL or RL will be flagged as estimated. Non-detects for the isotope dilution methods will be determined using the SW-846 Method 8290 definition of an estimated detection limit (EDL) without the use of empirical factors or other mathematical manipulations specific to the laboratory. The laboratory must include with each data package any calculations or statistical methods sample dilution corrections. The laboratory must maintain on file documentation for the reported detection limits.

Particular attention will be paid to the results of blank data. Analytical data will not be routinely corrected for contamination. They are however evaluated on a case-by-case basis for possible blank correction. Samples associated with contaminated blanks will be flagged so that this information may be assessed in the final report.

The output from the data validation process will be a summary comparison of the QA/QC results to the specified data quality objectives, a review and discussion of any deficiencies identified in the data assessments of laboratory performance, and, overall precision and accuracy, representativeness and completeness of the data set.

Detailed procedures for the internal review of data in the laboratory are found in the laboratories QA Manuals and related standard operating procedures (SOPs).

11.8 DATA REPORTING

11.8.1 Project Reporting Format

The outline for the final test report is presented in Figure 11-1.

11.8.2 Detection Limit Definitions

The detection limit for each project target analyte will be derived according to the referenced analytical method and the laboratory's standard operating procedures. The laboratory will provide detection limits for each analyte. There are a number of types of detection limits associated non-isotope dilution analytical methods. The U.S. EPA Office of Solid Waste (OSW) in the “Human Health Risk Assessment Protocol” (RA Protocol) published in July 1998 defines the following detection limits:

> *<u>Instrument Detection Limit (IDL)</u>-the smallest signal above background that an instrument can reliably detect, but not quantify. Also, commonly described as a function of the signal-to-noise (S/N) ratio.*

Method Detection Limit (MDL)-the minimum concentration of a substance that can be measured (via non-isotope dilution methods) and reported with 99 percent confidence that the analyte concentration is greater than zero, and is determined from analysis of a sample in a specific matrix type containing the analyte. The MDL is considered the lowest level at which a compound can be reliably detected. The MDL is based on statistical analyses of laboratory data. In practice, the MDLs are determined on analytical reagents (e.g., water) and not on the matrix of concern. MDLs for a given method are laboratory and compound specific. The determine the MDL as specified in 40 CFR Part 136, Appendix A, at least seven replicate samples with a concentration of the compound of interest near the estimated MDL are analyzed. The standard deviation among these analyses is calculated and multiplied by 3.14. The result of the calculation becomes the MDL. The factor of 3.14 is based on a t-test with six degrees of freedom and provides a 99 percent confidence that the analyte can be detected at this concentration.

Reliable Detection Limit (RDL)-the detection level recommended by the National Environmental Research Laboratory in Cincinnati, Ohio. The RDL is defined as 2.63 times the MDL. The RDL is a total of eight (8) standard deviations above the MDL development test data (3.14 times 2.63).

Reporting Limit (RL)-the laboratory determined detection, normally the lowest calibration standard.

The risk assessment protocol recommends that non-isotope dilution methods quantify non-detects using the method MDL and the derived RDL.

Component 2 of the EPA Region 6 Hazardous Waste Combustion Unit Permitting Manual uses the term sample quantitation limit (SQL). The SQL is the matrix-specific MDL. The SQL may be equal to the laboratory-specific MDL or some factor greater than (e.g., 5X-10X) the laboratory-specific MDL that takes into consideration matrix specific interferences or sample serial dilutions.

Isotope dilution methods quantify non-detects using estimated detection limits (EDLs) as defined in SW-846 Method 8290. The EDL is defined as follows:

EDL (from SW-846 Method 8290) -*"The sample specific estimated concentration of a given analyte required to produce a signal with a peak height of 2.5 times the background signal level."*

The laboratory will provide the MDL or SQL for each non-isotope dilution analyte on the analytical certificate. The laboratory will maintain documentation and validation for the reported MDL. If matrix interference(s) occurs or serial dilutions are necessary, the sample specific MDL (SQL) will be reported. If a sample specific MDL (SQL) is applicable, the analytical data package shall include the documentation

of the serial dilutions or other measures taken to determine the detection limit. EDLs are sample-specific and analyte-specific, and will be provided on the analytical certificate for each sample and each analyte.

11.8.3 Detection Limits and Data Reduction

Analytical results for all analyses, except Method 23 samples for PCDD/PCDFs, that are reported as "not-detect" in compliance demonstration samples will be handled in the following manner. The analytical result will be reported as "non-detect" and the appropriate detection limit as discussed above will be shown. In subsequent calculations, the following rules will apply for data reporting and performance demonstrations:

- For analyses of single component samples (e.g., feed or residue samples) that are reported as non-detect, the values will be accompanied by a "less than" ("<") and/or a data flag that denotes a non-detect result was obtained. .
- For analyses of single component samples (e.g., feed or residue samples) that are reported as non-detect, any subsequent calculations using detection limit values will be accompanied by a "less than" ("<") sign.
- For analyses of multi-component samples (e.g., Method 23), where multiple analytical results must be combined or summed for use in subsequent calculations and the calculations involve the use of one or more non-detect values in combination with one or more detectable values, the final calculated values shall also include "<".
- For analyses of multi-component samples where all of the multiple analytical results are non-detect values, the final calculated values shall include a data flag such as "ND" or "U" with the "<" to indicate that the target analyte was non-detect in all of the relevant sample fractions.
- Where destruction and removal efficiency (DRE), system removal efficiency (SRE), or similar performance measurements are calculated using emissions rates reported with "<" or non-detect flagged values, the resulting performance measurement will be accompanied by a "greater than" (">") sign.

For Method 23 sampling train PCDD/PCDFs results, any dioxin/furan congener that is non-detect will be counted as zero in calculating and reporting the 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) toxicity equivalents (TEQ) corrected to 7% oxygen. For the front-half and back-half separate analyses of the Method 23 samples, if a fraction is non-detect for a specific congener, the specific congener's EDL will reported. In subsequent compliance calculations, the congener concentration for a fraction that is reported as non-detect will be counted as zero for that fraction.

11.8.4 Other Quality Control Data Reporting

Other quality control data that are included in the analytical reports and may be discussed or commented on in the final test reports are:

- Sample holding times
- Sample surrogate recovery results
- Duplicate results

- MS/MSD results
- Blank train results
- Reagent blank results (if analyzed)
- Field blank results
- RPD and RSD evaluations of accuracy or precision.

These data will be evaluated against the target DQOs. Any data that fall outside of the DQO limits will be flagged, footnoted, and assessed relative to the performance and emissions testing objectives. The data from the field blanks and trip blanks will be used to assess possible contamination from field handling and transport of the samples to the laboratory. The reagent blank and blank train results will be used to assess contamination resulting from reagents used, sample handling, and sample recovery procedures. Any blank results that may have impacted performance and emissions testing results or evaluations will be flagged, footnoted, and discussed in the test reports.

11.8.5 Final Case Files

At a minimum, the following documents will be retained upon the completion of the project in the final case file, which must be maintained at the TAPI facility for a period at least three years:

- All legal documents and orders,
- All field documents including those used for preliminary field activities,
- Copies of all analytical data,
- Copies of the final report and background documents, and
- All correspondence relating to the project as well as corrective action requests.

Figure 11-1. Example CPT Report Outline

1.0 EXECUTIVE SUMMARY

2.0 TEST PROGRAM SUMMARY
- **2.1** Summary of Test Plan and Objectives
- **2.2** Test Implementation Summary

3.0 PROCESS OPERATIONS
- **3.1** Process Operating Conditions
- **3.2** Waste Feed Material Characteristics
- **3.3** Waste Feed Spiking

4.0 MACT COMPLIANCE RESULTS
- **4.1** POHC Destruction and Removal Efficiency
- **4.2** Particulate Emissions
- **4.3** Hydrogen Chloride and Chlorine Emissions
- **4.4** Metals Emissions
- **4.5** Dioxin and Furan Emissions
- **4.6** Stack Gas Oxygen, Carbon Monoxide, and Total Hydrocarbons
- **4.7** CMS Performance Evaluation Results
- **4.8** CEMS Performance Evaluation Results

5.0 QUALITY ASSURANCE/QUALITY CONTROL RESULTS
- **5.1** QA/QC Activities and Implementation
  - **5.1.1** QA Surveillance
  - **5.1.2** Sample Collection
  - **5.1.3** Sample Analysis
  - **5.1.4** Process Instrumentation
  - **5.1.5** Stack Sampling Equipment
  - **5.1.6** Laboratory Analytical Instrumentation
- **5.2** Audits and Data Validation
- **5.3** Calculations
- **5.4** Conclusions

6.0 ANTICIPATED PERMIT OPERATING CONDITIONS
- **6.1** Development of Operating Limits
- **6.2** Specific Control Parameters

APPENDICES
- A. Process Operating Data
- B. Test Manager's Log
- C. Spiking Report and Certificate of Analysis for Spiking Material
- D. Process Instrument Calibration Data
- E. Continuous Emissions Monitoring Data
- F. Sampling Report
- G. List of Samples
- H. Analytical Report
- I. Calculations
- J. Data Validation Report
- K. CMS Performance Evaluation Report
- L. CEMS Performance Evaluation Report

12.0 ROUTINE MAINTENANCE PROCEDURES AND SCHEDULES

12.1 SAMPLING EQUIPMENT

All equipment used in emission testing measuring systems must be maintained in good operating order. To achieve this objective, a routine preventive maintenance program is necessary. Procedures used in this program follow those outlined in Maintenance Calibration and Operation of Isokinetic Source Sampling Equipment, Publication No. APTD-05-76 and Volume III of the Quality Assurance Handbook for Air Pollution Measurement Systems.

The potential impact of equipment malfunction on data completeness is minimized through two complementary approaches. First, an equipment maintenance program is part of routine operations. The maintenance program's strengths include:

- Trained technicians experienced in the details of equipment maintenance and fabrication,
- Adequate spare parts inventory, and
- The availability of tools and specialized equipment.

The second approach is based upon equipment redundancy. Backup equipment, spare parts and tools are included on the materials transported to the field for each sampling task. This approach allows the sampling team to respond to equipment breakage or malfunction in a timely fashion, minimizing the quantity of lost data.

For field equipment, preventive maintenance schedules are based on the results of routine inspections and on accumulated experience. At a minimum, equipment will be inspected prior to the beginning of and at the conclusion of each test. A record of each inspection (Figure 12-1) will be kept as part of the final case file. Maintenance schedules for continuous emissions monitors follow manufacturer's recommendations.

Each item of field test equipment is assigned a unique, permanent identification number. An effective preventive maintenance program is necessary to ensure data quality. Each item of equipment returning from the field is inspected before it is returned to storage. During the course of these inspections, items are cleaned, repaired, reconditioned, and recalibrated where necessary. Each item of equipment transported to the field for this test program is inspected again before being packed to detect equipment problems that may originate during periods of storage. This minimizes lost time on the job site due to equipment failure. Occasional equipment failure in the field is unavoidable despite the most rigorous

inspection and maintenance procedures. For this reason, adequate spare parts are kept in a central location so the sampling contractor can quickly respond to the job site with replacement equipment for all critical sampling train components.

12.2 LABORATORY INSTRUMENTS

The laboratories perform regular maintenance on all analytical instruments. An inventory of replacement parts is kept to prevent downtime. Manufacturers' service representatives are also contracted, as required, for major instrument repairs.

Preventive and routine maintenance is covered in each of the laboratories' QA Manuals and SOPs or in accordance with manufacturer's recommendations (i.e., instrument manuals). Daily maintenance (such as replacement of injector septa, etc.) is covered in instrument SOPs. Inoperative equipment is tagged as non-usable until repairs are performed. Logbooks are maintained for each instrument to record usage, maintenance, and repairs.

12.3 PROCESS INSTRUMENTS

On-site personnel perform regular maintenance on all process instrumentation. Routine and preventive maintenance programs are used. Where appropriate, manufacturers' recommendations for maintenance of process instruments are followed. Operators conduct daily reviews of process instrumentation by noting suspicious or inconsistent readings. Maintenance logs are used to record the frequency and type of repairs necessary for process instruments. Process instruments used to demonstrate compliance with operating limits will be calibrated prior to the test. Records of these calibrations will be included in the final test report.

Equipment Inspection Record

TAPI Puerto Rico, Inc., Guayama, Puerto Rico

Date/Time of inspection: _____

Equipment Inspected:

1) _____

Condition: Good See Problems Section Below

2) _____

Condition: Good See Problems Section Below

3) _____

Condition: Good See Problems Section Below

4) _____

Condition: Good See Problems Section Below

5) _____

Condition: Good See Problems Section Below

Problems Noted:

_____

_____

_____

_____

Action Taken

_____

_____

_____

Inspector's Signature_____

Figure 12-1. Example Equipment Inspection Record Form

13.0 ASSESSMENT PROCEDURES FOR ACCURACY, PRECISION, & COMPLETENESS

The QA activities implemented in this study will provide a basis for assessing the accuracy and precision of the analytical measurements. Section 5.0 discusses the QA activities that will generate the accuracy and precision data for each sample type. The generalized forms of the equations that will be used to calculate accuracy and precision are presented below.

13.1 ACCURACY

When a reference standard material is used in the analysis, percent Accuracy (A) will be calculated as follows:

$$A = \frac{\text{Found concentration}}{\text{True concentration}} \times 100$$

Percent analyte Recovery (R) will be calculated as follows:

$$R = \frac{X - N}{S} \times 100$$

Where X is the experimentally determined value, N is the amount of native material in the sample, and S is the amount of spiked material of the species being measured. Recoveries are used to determine accuracy when standards are not available, or are not appropriate for a given matrix.

13.2 PRECISION

When less than three analyses of the same parameter are available, precision will be calculated as a Relative Percent Difference (RPD) from the average of replicate measurements according to:

$$\text{RPD} = \frac{(X_1 - X_2)}{\text{Average } X} \times 100$$

Where X_1 and X_2 are the highest and lowest results of replicate measurements.

Where three or more analyses of the same parameter are available, the precision will be determined as the Relative Standard Deviation (RSD) according to:

$$\text{RSD} = \frac{\text{Standard deviation}}{\text{Average X}} \times 100$$

13.3 COMPLETENESS

Completeness of data generated from a test program is usually calculated as follows:

$$\%\,\text{Completeness} = \frac{\text{Valid data}}{\text{Expected data}} \times 100$$

Data completeness is defined in Section 5.0 of this QAPP as the percentage of valid data collected from the total number of valid tests conducted and as ninety percent of all of the data quality objectives for all samples collected meeting the requirements specified in the QAPP. Three valid test runs, at each test condition, are required for the test to be completed. If an individual sample from a test run is lost or broken, the data for that individual analytical parameter may not be 100% complete. This, however, may not invalidate the test run. The completeness objective for this test program is to generate sufficient data for the regulatory agencies to judge the performance of the system and for ninety percent of all of the data quality objectives for all samples collected meeting the requirements specified in the QAPP.

14.0 AUDIT PROCEDURES, CORRECTIVE ACTION, AND QA REPORTING

14.1 PERFORMANCE AND SYSTEM AUDITS

This section presents information related to the procedures used by the QA staff to assess conformance of the project staff to the specifications contained in the relevant project controlling documents. Further, auditing may be employed to assess the ability of subcontractors to successfully perform the work.

14.1.1 Field Audits

The QAO assigned to the project will continuously evaluate the operations at the site to ensure that work is being performed in accordance with the various project controlling documents and associated standard operating procedures. Checklists appropriate to the activities may be used. The field audit will cover, but is not necessarily be limited to, such areas as:

- Conformance to SOPs
- Completeness and accuracy of documentation
- Chain of custody procedures
- Compliance with Health and Safety requirements.

14.1.2 Performance Evaluations

The QAO will submit Performance Evaluation (PE) samples (referred to elsewhere as "audit samples") to the laboratory. PE samples provided will be submitted for analysis to demonstrate analytical performance on an as required basis.

A performance audit samples for the Method 23, Method 26A, and Method 29 sampling trains will be obtained and submitted to the laboratory for analysis.

14.1.3 Laboratory Audits

TAPI or its appointed representative may choose to audit the laboratories at any time during the course of the project on an as-required basis to assess the laboratory's ability to successfully perform the work and to ensure mutual agreement between TAPI and the laboratory with regard to the scope of work, QA/QC requirements, and deliverable requirements. Reasonable notice will be provided prior to any on-site inspection of the laboratory.

14.2 CORRECTIVE ACTION

The following procedures have been established to ensure that nonconforming conditions, such as malfunctions, deficiencies, deviations and errors are promptly investigated, documented, evaluated and corrected. Every person employed in the test is expected to function as a QC inspector to ensure the

quality of the final product. Quality, as it relates to this project, is defined as "performing the work according to the agreed upon specifications contained in the CPT plan and relevant SOPs or causing the specification to be changed *in a controlled manner*." Each individual is encouraged to identify any condition adverse to the successful completion of the work or any modification to the specifications that might result in a better end product. These improvements might be framed in terms of higher quality, greater safety, greater efficiency, and/or lower cost.

14.2.1 Field

When a nonconforming condition or an opportunity for improvement is noted at the site or contractor location, the corrective action provisions of this plan will be invoked to identify the condition and recommend corrective action. Condition identification, cause, reference documents and the corrective action planned to be taken will be documented and reported at a minimum to the employee's immediate supervisor.

A Corrective Action Request (CAR), as shown in Figure 14-1, should be used to identify the adverse condition or opportunity for improvement, reference document(s) and recommended corrective action(s). The CAR is directed to the Test Coordinator. The Test Coordinator affixes his signature and the date to the corrective action block that states the cause of the condition(s) and corrective action(s) to be taken. The Test Coordinator is responsible for first notifying the regulatory agency representative of any problems or deviations from the QAPP, or the CPT plan identified in the CAR. The Test Coordinator then forwards the requested response to the QAO for follow-up and filing. The QAO maintains the log for status control of CARs and responses confirms the adequacy of the intended corrective action(s) and verifies its implementation. The QAO will issue and distribute copies of completed CARs to the originator, Test Coordinator, TAPI Environmental Manager, and the involved contractor(s) if any. CARs are transmitted to the project file for future reference, and are incorporated into the test reports.

14.2.2 Laboratory

The laboratories' QA Manuals and the related SOPs, contain detailed discussions of corrective actions to be taken if established criteria fail during laboratory analysis. The laboratory has the responsibility to immediately notify the Test Coordinator and/or QAO when any analytical QC nonconformance occurs, so a mutually acceptable course of action can be pursued.

14.3 QAO REPORT

The QAO will provide a written report to be included as a section to the final test reports. The QAO report will address:

- Overview of activities and significant events related to QA/QC

- Summary of audit results
- Review of corrective action request status
- Laboratory QA/QC reports
- Data validation results
- Summary of significant changes in procedures or QA/QC programs
- Recommendations.

Corrective Action Request

Number:
Date:
File Name:
Client: TAPI Puerto Rico, Inc., Guayama, Puerto Rico

REQUEST

To:

You are hereby requested to take corrective actions indicated below and as otherwise determined by you (A) to resolve the noted condition and (B) to prevent it from recurring. Your written response is to be returned to the project Quality Assurance Officer or other responsible manager by.

Condition:

Reference Documents:

Recommended Corrective Actions:

_____	_____	_____	_____	_____	_____
Originator	Date	Approval	Date	Approval	Date

RESPONSE

Cause of Condition:

Resolution:

Prevention:

Affected Documents:

Test Manager	Date
Quality Assurance Officer	Date
QAO Follow-up	Date

Figure 14-1. Example Corrective Action Request Form

Attachment A

Resumes of Key Individuals

Test Coordinator

Anthony Eicher

ANTHONY R. EICHER

Professional Qualifications

Mr. Eicher is a chemical engineer, with over 30 years of project management and engineering experience in the design, evaluation, operation, and testing of hazardous materials treatment systems and air pollution control devices. Mr. Eicher is the founder and past CEO of Focus Environmental, Inc. He currently serves as a Senior Consultant to Focus Environmental, Inc., and manager of its Regulatory Services Group. Mr. Eicher's experience includes providing a full range of engineering services for the waste management and air pollution control industry, from waste or emissions characterizations and feasibility studies through complete process design and detailed design reviews, to permitting, startup assistance, troubleshooting, performance testing, and operator training. He has prepared and assisted clients in developing permit applications and supporting documents for RCRA, TSCA, NPDES, PSD, MACT and state air and state solid waste permits in the USA, and for similar programs in other countries. He has represented clients in permitting negotiations with federal and state regulators, and in public hearings. He has participated in over 150 trial burn and compliance testing projects and has managed the implementation of numerous comprehensive testing programs. These projects have been conducted across 28 states (plus Puerto Rico), all 10 EPA regions, and 8 countries. Mr. Eicher has developed process designs and control strategies for a variety of processes and components including combustion systems; liquid, solid, and semi-solid material handling; energy recovery; wet and dry air pollution control systems; acid recovery, non-electrical utilities distribution (air, water, steam, etc.); vent controls; and several separation processes (e.g., air and steam stripping, liquid extraction, thin film evaporation). He has been involved in numerous new facility designs, upgrades of existing systems, and demonstration of emerging/innovative technologies. This experience has spanned a wide range of industries and applications including chemical and petrochemical processing, pharmaceuticals, metals and minerals, power generation, commercial waste treatment, mixed radioactive and hazardous waste management, as well as hazardous materials emergency response and waste site remediation. Mr. Eicher has authored or co-authored over 20 technical papers that have been presented in a variety of symposia or published in national and international journals. He served a two-year term as the Technical Chair for the International Conference on Incineration and Thermal Treatment Technologies, sponsored annually by the Air and Waste Management Association (and formerly by the University of California, Irvine, and the University of Maryland), and remains as an active member of the Conference Executive Committee and Program Advisory Committee. Mr. Eicher is recognized internationally for his expertise in the hazardous waste thermal treatment and air pollution control industry, especially in the areas of regulatory compliance and performance testing.

Education

B.S., Chemical Engineering, University of Cincinnati, Cincinnati, Ohio; 1981

Experience and Background

1988-Present <u>Senior Consultant, Focus Environmental, Inc., Knoxville, Tennessee</u>. Manages the Regulatory Services Group at Focus Environmental, Inc. Provides engineering design, permitting, startup, project management, and project oversight services to the environmental management industry with an emphasis on incineration and thermal treatment of hazardous materials, as well as various air pollution control processes, and innovative waste treatment technologies. Specific experience includes:

- Preparation of permit documents and performance testing plans (over 150 projects world-wide). Projects included development of performance test protocols and operating conditions, selection of sampling and analytical methods, specification of appropriate QA/QC procedures, integration of regulatory compliance and risk assessment objectives, and negotiation of permit conditions with regulatory agencies. Projects have also included management and implementation of the performance test operations, sampling, and analytical program followed by interpretation and complete documentation of performance test results. Thermal treatment technologies have included numerous incinerators (liquid injection, stationary hearth, rotary kiln, fluidized bed); a variety of boilers, industrial furnaces, and halogen acid furnaces; several directly- and indirectly-heated thermal desorbers; pyrolyzer/gasifier designs; and a range of innovative treatment systems (including plasma, glass melter, steam reforming, and molten salt designs). Waste types include a wide range of liquid, solid, and semi-solid hazardous materials, including chemical and pharmaceutical process wastes, contaminated soils, propellants, explosives, chemical warfare agents, and mixed hazardous and radioactive wastes.
- Process design, operator training, permitting, and performance testing for a new hazardous waste incinerator at a major pharmaceutical manufacturer. Project included conceptual and process design of a fluidized bed incinerator and tank farm to replace existing liquid injection and multiple hearth incinerators; participation in HAZOP evaluations; development and conduct of operator training; air, RCRA, and HWC MACT permitting (including risk assessment); and comprehensive performance testing of the completed system. Obtained all required permits within 12 months of permit application submittal.
- Design of various process and emissions control components for a facility to thermally treat spent “pot liner” from the reduction of aluminum ore.
- Developed recommendations for optimization of process chemistry and process controls in a “reactive” scrubbing system used for abatement of sulfur dioxide and mercury from a gold ore roasting process. Conducted field testing of various process operational modifications that demonstrated significant reductions in mercury emissions.
- Process design, including P&ID development, equipment specifications, and mass/energy balance calculations for a replacement air pollution control system. Shift supervisor, and lead engineer during system startup and commissioning.
- Process development, design, startup, and compliance testing of a new rotary kiln incineration system for a large plastics manufacturer. Lead engineer in process design of the rotary kiln, secondary combustion chamber, and ash handling system. Design included provision for oxidative and pyrolytic operation of the kiln. Conducted pilot testing to confirm applicability of the process concept and to generate environmental and design data for the full-scale unit. Provided on-site process coordination during startup and shakedown of the full-scale system. Developed and conducted operator training courses, and assisted in developing and implementing control strategies, operating procedures, and in programming the operator interface with the computerized control system. Developed test protocols and conducted testing to demonstrate the incineration systems' compliance with regulatory performance standards.

- Expert witness for international arbitration concerning two rotary kiln incinerators supplied for treatment of paper recycling wastes in Indonesia. Performed on-site inspection and assessment; developed expert report on system design and operations; provided expert testimony to the Singapore International Arbitration Court.
- Provided independent technical review of design concepts, drawings, and calculations, as well as permitting documentation prepared by a major environmental management company for construction of several new commercial incineration facilities. Worked with management and technical staff to incorporate appropriate system designs to meet stated objectives and to develop complete and technically correct design and permitting documents.
- Active oversight management for a CERCLA waste removal action at a defunct chemical recycling facility. Acted as PRP committee's representative providing on-site direction and control of day-to-day project activities, including ongoing technical and management review of each task being performed under a primary contract. Reported project status and resolved technical issues with PRP committee and acted as liaison between primary contractor and EPA.
- Process design, detail design review, and process control development for two large transportable incineration systems. Primary responsibilities included developing process control strategies for major process areas, preparing logic diagrams, establishing startup and shutdown sequencing, and coordinating interlock and control logic for each plant. Also participated in design-phase HAZOPs.
- Project manager for waste inventory, process conceptualization, and process design for a rotary kiln incineration system for a major refinery and styrene plant. Unique features of the project included requirements for handling highly energetic pasty materials as well as wet, high inert solid content sludges. Conducted pilot-scale feed system testing and laboratory combustion testing to confirm the process concepts and to define equipment performance requirements.
- Evaluation of incineration and air pollution control equipment used for the destruction of lethal chemical warfare agents by the U.S. Army. Coordinated field testing operations and participated in engineering evaluations and recommendations for a liquid injection incinerator and several pollution control trains used for the demilitarization of agents GB and VX at the Chemical Agent Munitions Disposal System site at the Tooele Army Depot in Tooele, Utah.
- Operations manager for demonstration of new technology involving radiation heat transfer for treatment of dioxin-contaminated solids.
- Field inspection, evaluation, and modification of an existing liquid waste incinerator. Emphasis on destruction efficiency and particulate emission control.

1981-1988 <u>Senior Project Engineer, Thermal Projects Division, IT Corporation, Knoxville, Tennessee (Formerly part of Dow Hydroscience division of Dow Chemical Company)</u>. Prepared waste characterizations, process flow diagrams, piping and instrumentation diagrams, mass and energy balances, equipment specifications, and field coordination in startup and test burn activities related to chemical and thermal treatment of chemical wastes.

Also involved in identification and evaluation of air pollution control equipment and regulatory requirements applicable to specific processes.

Chemical Engineer, Environmental Emergency Response Unit, Operations and Training Group, IT Corporation, Cincinnati, Ohio. Emergency response to hazardous material incidents and uncontrolled hazardous waste sites throughout the country and identification and evaluation of treatment/disposal options during site cleanups. Responsible for course development and presentation as course director in nationwide training of federal, state, and local regulatory and response personnel. Conducted over 40 courses in response operations, incident mitigation, treatment and disposal options, and personnel protection and safety.

1977-1980 PEDCo Environmental, Inc., Cincinnati, Ohio and Kansas City, Missouri. Involved in various environmental control and assessment projects, especially in sampling and computerized diffusion modeling of air pollutants. Design, startup, and maintenance of industrial process simulation facility for study of organic solvent emissions and control. Published technical report on particulate modeling techniques. Assistant project manager on modeling study for several coal strip mining lease proposals in western United States. Developed specialty models for air pollutant dispersion and prediction of visibility limitations. Participated in numerous air pollutant sampling and control equipment evaluation projects throughout the country.

Professional Affiliations

- American Institute of Chemical Engineers, Environmental Division and Process Safety Division
- Air and Waste Management Association
- American Society of Mechanical Engineers Committee on Training and Certification of Hazardous Waste Incinerator Operators.

Publications and Presentations

Eicher, A.R., White, T., and McLeod, R., "Evaluation of the Recovery of Volatile Organic Compounds on Solids Sorbents used in Stack Gas Sampling Systems", presented at the International Conference on Incineration and Thermal Treatment Technologies, sponsored by the University of Maryland, College Park; New Orleans, Louisiana, May 13-17 2002.

Eicher, A.R., "Calculation of Combustion Gas Flow Rate and Residence Time Based on Stack Gas Data", presented at the International Conference on Incineration and Thermal Treatment Technologies, sponsored by the University of Maryland, College Park; Philadelphia, Pennsylvania, May 14-18, 2001.

Whiting, K.J., and Eicher, A.R., "A Review of Metal Partitioning in Thermal Treatment Processes", presented at the Third International Symposium on Incineration and Flue Gas Treatment Technologies, IChemE, Brussels, Belgium, July 2-4, 2001.

Schomer, T.L., and Eicher, A.R., "Preparation of a Comprehensive Performance Test Plan in Accordance with the New Hazardous Waste Combustor MACT Provisions of 40 CFR 63 Subpart EEE", presented at the International Conference on Incineration and Thermal Treatment Technologies, sponsored by the University of California, Irvine, Portland, Oregon, May 8-12, 2000.

Keener, M.E., and Eicher, A.R., “Transitioning from a RCRA Permit to a Clean Air Permit for Hazardous Waste Combustors under the New HWC MACT Rule”, presented at the Air and Waste Management Association Specialty Conference on Waste Combustion, 2000.

Moran, T.M., Eicher, A.R., and McBride, C.E., “Evaluating the Combustion Operational Parameters that Impact the Destruction and Removal Efficiency of Hydrogen Cyanide”, presented at the International Conference on Incineration and Thermal Treatment Technologies, sponsored by the University of California, Irvine; Orlando, Florida, May 10-14, 1999.

Eicher, A.R., "Guide for Thermal Treatment System Trial Burns", Standard Handbook of Hazardous Waste Treatment and Disposal, Second Edition, Harry M. Freeman, Editor, McGraw-Hill Book Company, New York, New York, 1997.

Eicher, A.R., "Selection and Application of Thermal Systems for VOC Control", presented as part of the Incineration Topical Seminars at the International Incineration and Thermal Treatment Conference, sponsored by the University of California, Irvine. Presented in 1996.

Eicher, A.R., "Innovative VOC Control Technologies", presented at the AIChE/AOCS Joint Meeting and Chem Show, Memphis, Tennessee, 1995.

Eicher, A.R., "Process Control and Monitoring for Combustion and Air Pollution Control Systems", presented as part of the Incineration Topical Seminars at the International Incineration Conference, sponsored by the University of California, Irvine. Presented in 1992 and in 1993.

Cudahy, J.J., and A.R. Eicher, "Issues Concerning Metals Emissions from Hazardous Waste Combustion - An Engineering Consultant's Viewpoint", EPA/ASME Metals Workshop, Cincinnati, Ohio, November 7-8, 1991.

Zink, R.P., D.M. Pitts, and A.R. Eicher, "Quantitative Comparison of Slagging vs. Ashing Mode Rotary Kiln Systems for Hazardous Waste Incineration", Proceedings of the 1991 Incineration Conference, sponsored by the University of California, Knoxville, Tennessee, May 14, 1991.

Eicher, A.R., "Incineration System Permitting", presented as part of the Incineration Basics Course, International Conference on Incineration and Thermal Treatment Technologies, sponsored by the University of California, Irvine (1989 – 2000) sponsored by the University of Maryland, College Park (2001 - 2009) sponsored by the Air and Waste Management Association (2005 – present). Updated and presented each year 1989 through 2008.

Eicher, A.R., "An Update on Particulate and Acid Gas Removal Technologies for Small Combustion Sources," presented at ISA/AIChE Mid-South Industrial Instrumentation and Chem Show, Memphis, Tennessee, February 20, 1990.

Eicher, A.R., and M.L. Ambrose, "Operation and Permitting of the DOE's RCRA/TSCA/Mixed Waste Incinerator at the K-25 Plant in Oak Ridge, Tennessee - A Case History", presented at Air and Waste Management Association International Specialty Conference on Thermal Treatment of Municipal, Industrial and Hospital Wastes, Pittsburgh, Pennsylvania, November 7-10, 1989.

Eicher, A.R., and J.J. Cudahy, "Thermal Remediation Industry - Markets, Technologies, Companies", Pollution Engineering, November 1989.

Eicher, A.R., "Trial Burn Planning", 1989 International Conference on Incineration of Hazardous, Radioactive, Infectious, and Mixed Wastes, Knoxville, Tennessee, May 1989.

Eicher, A.R., "Use of the New EPA Incineration Guidance Document in RCRA Trial Burn Planning", presented at Haztech International Conference, Cleveland, Ohio, September 1988.

Eicher, A.R., and J.J. Cudahy, "Hazardous Waste Incineration Notebook" and short course presented to U.S. Department of Energy and EG&G Idaho, Inc., Idaho National Engineering Laboratory, Idaho Falls, Idaho, August 1988.

Eicher, A.R., and J.J. Cudahy, "The Impact of Trial Burns on Incinerator Operating Flexibility", 80th Annual Meeting of the Air Pollution Control Association, New York, New York, June 1987.

Eicher, A.R., and J.J. Cudahy, "Hazardous Waste Incineration Redundant Permit Conditions", Eleventh Annual EPA/APCA/ASME Environmental Information Exchange, Research Triangle Park, North Carolina, December 1986.

Eicher, A.R., "Incinerator Design Principles", EPA Short Course 502, Hazardous Waste Incineration, University of Cincinnati and U.S. Environmental Protection Agency, Cincinnati, Ohio, December 1986.

Eicher, A.R., J.J. Cudahy, and W.L. Troxler, "Thermodynamic Equilibrium of Halogen and Hydrogen Halide During the Combustion of Halogenated Organics", presented at Sixth National Conference on the Management of Uncontrolled Waste Sites, Washington, D.C., November 1985.

Eicher, A.R., "Selection and Use of Personal Protection Equipment During Hazardous Materials Emergency Response and Site Investigation", American Industrial Hygiene Association Hazardous Material Monitoring and Personal Protection Symposium, Cincinnati, Ohio, 1984.

Eicher, A.R., "Workshop: On-Site Treatment Techniques", California Environmental Health Association Hazardous Materials Conference, San Diego, California, April 1984.

Stack Sampling Team Leader

Patrick Clark

Patrick Clark, P.E.

Background

Mr. Clark has over 20 years experience in the air emissions field. He is experienced in all facets of air pollution sampling and continuous emissions monitoring. Recently, his focus has been on the development and execution of test programs involving Hazardous Air Pollutants (HAPs) as well as Comprehensive Performance Tests (CPTs). In addition, Mr. Clark is experienced in the regulatory issues that affect compliance determinations. Mr. Clark has taught at many EPA and private seminars on air toxics sampling and analysis.

Relevant Experience

- Managed and performed test projects involving the use of EPA Methods 1-29, 201-204, 300-308, and various SW846, OSHA, TO and conditional test methods. He has supervised test programs involving up to fifteen technicians with testing of as many as eight sampling locations simultaneously.
- Experienced in the coordination and execution of miniburns, trialburns and CPT's at municipal, medical and hazardous waste incinerators. Coordinated air sampling as well as collection and analysis of process samples.
- Experienced in EPA enclosure methods for determining capture efficiency as well as mass balance procedures that utilize a statistical approach to determining compliance.
- Experienced in developing organic test methods for unusual or difficult applications as well as performing on-site gas chromatography, ion chromatography and spectrophotometry.
- Experienced in the construction of CEMS, development of CEMS QA/QC plans, and execution of CEMS maintenance programs.
- Supervised a laboratory that performed gas chromatography (GC), ion chromatography (IC), Method 25, and fly ash resistivity analysis. Developed additional QA/QC procedures for Method 25 sampling and analysis.
- Participated as an instructor on the sampling and analysis of air toxics at private and AWMA sponsored seminars.
- Experienced in preparing operating permits and conducting emission inventories.

Education

Bachelor of Science, Chemical Engineering, December, 1984
University of Illinois, Chicago

Publications and Presentations

"Clarification on Sampling Methods and on the Definition of VOC's as related to Heavy Organics in Source Emissions," paper presented at the 88th Annual Meeting of the Air and Waste Management Association, San Antonio, TX, June 1995.

"Examination of Organic Emissions and Test Methods at a Trona Facility," paper presented at the 89th Annual Meeting of the Air and Waste Management Association, Nashville, TN, June 1996.

Acted as co-chairman for the 1998 Engineering Foundation Conference: Stationary Source Sampling and Analysis for Air Pollutants held in Palm Coast, Florida.

Acted as chairman for the 1999 Engineering Foundation Conference: Stationary Source Sampling and Analysis for Air Pollutants held in Ventura, California.

"Experiences with EPA Method 5i, Calibrating PM CEMS, and Stack Testing in the New Millennium," presented at the Indiana AWMA quarterly meeting in February 2000.

"MACT Compliance, Experience with Reference Methods New and Old," presented at the 2000 Engineering Foundation Conference: Stationary Source Sampling and Analysis for Air Pollutants held in Destin, Florida.

"Successfully Demonstrating Incinerator Performance with A Problem POHC by Active Management of the Quality Assurance Program" presented at the 2007 IT3 conference held in Phoenix, Arizona.

Certifications

Registered Professional Engineer in the following states:
State of Illinois License, 062-045855
State of Connecticut License, PEN.22531
State of Indiana License, PE10201332
State of Michigan License, 6201049341
State of Minnesota License, 42492
State of New York License, 080378

Group 1, 2 and 4, Qualified Stack Test Individual (QSTI)

Spiking Contractor

Scott Neal

Resume: Robert Scott Neal

Career Summary: More than 18 years of pertinent experience with >13 years of general management experience including , (1) supervision of military and major civilian supply train operations, and (2) more than 5 years experience as Plant Manager of a processing plant including process design; equipment selection, procurement, and installation; and plant pre-commissioning, startup, & operation and (3) Eight 8 yrs in the hazardous waste management industries conducting and managing Spiking Projects. With special talent for resourceful problem solving and bringing projects to completion has lead to successfully completing > 100 spiking projects for HWC and Thermal Treatment Facilities since 2004.

Personal PROFILE: Exposure to various aspects of business in cluding management, finace, accounting, human resources, marketing and merchandising. Special talent for using innovated and resoureful methods in problem solving, time management and planning. Adaptable, quick learner, highly motivated and goal orientated.

Professional Experience:

SSI, Inc. **2010-Present**
Pasadena, Texas. **Project Manager**

Responsibilities Include: All aspects of SSI' spiking materials preparation and spiking services delivery to facilities conducting HWC MACT CPTs, Miniburns, RCRA (& TSCA) Trial Burns and BIF Tests and HWC MACT CPTs and Vent Incinerators (TOUs) conducting MON, HON, Pharma, PAI, etc MACT CPTs. Is directly responsible for all **SSI** projects from initial project definition & costing, proposal preparation, project planning including equipment selection, spiking materials specification and composition certification, off-site technical & trouble-shooting support to **SSI** Technicians during on-site spiking efforts, and spiking report preparation and spiking rate results certification. direct responsibility for certification of spiking material composition and reported spiking rate results.

***ESS*, Inc.** **2004-Present**
Pearland, Texas. **Operations Manager**

Responsibilities Include: Planned, managed, &/or reported the results of HWC Comprehensive Performance Tests (CPTs), Trial Burns (TBs), Miniburns (MBs), and Boiler & Industrial Furnace (BIF) Certification/Re-Certification of Compliance (CoC/RCoC) Tests.

All operation functions for the project, including: (1) spiking materials preparation, (2) pre-mob and pre- & post-test verification of spiking equipment operability and accuracy, (3) satisfaction of all client's spiking rate requirements, and (4) capture of all spiking material composition, spiking rate, and QA/QC data for this project.

Summary: Eight (8) years of experience directly related to hazardous waste combustion (HWC): (1) regulations, (2) testing (including spiking), (3) compliance, and (4) operations. Successfully completed more than 125 spiking projects for HWC and Thermal Treatment Facilities since 2004. Contributed to the development of several spiking techniques that are now considered Industry Standards &/or Best Practices. Consistently produced a wide range of innovative solutions to challenges encountered throughout career.

EUNICE RICE MILL, INC **1995-2004**
EUNICE, LOUISIANA **PLANT MANAGER**

RESPONSIBILITIES INCLUDE: PROCESS DESIGN; EQUIPMENT SELECTION, PROCUREMENT, AND INSTALLATION; AND PLANT PRE-COMMISSIONING, STARTUP, & OPERATION. DEVELOPED AND IMPLEMENTED COORPARATE POLICIES AND PROCEDURES. HIRED AND TRAINED ALL STAFF. HEADED UP QUALITY CONTROL PROGRAM TO MEET FGIS (USDA) STANDARDS.

NORTHLAND FROZEN FOODS **1992-1995**
LE COMPTE, LOUISIANA **PLANT MANAGER**

RESPONSIBILITIES INCLUDE: PROCESS DESIGN; EQUIPMENT SELECTION, PROCUREMENT, AND INSTALLATION; AND PLANT PRE-COMMISSIONING, STARTUP, & OPERATION. DEVELOPED AND IMPLEMENTED COORPARATE POLICIES AND PROCEDURES. HIRED AND TRAINED ALL STAFF.

USAF **1989-1992**
CIVIL ENGINEERING PRODUCTION/DAMAGE CONTROL MANAGER
PANAMA CITY, PANAMA - OPERATION JUST CAUSE
DHAHRAN, SAUDI ARABIA - OPERATION DESSERT STORM
CARIBOU, ME – LORING AIR FORCE BASE

PROFESSIONAL ACHIEVEMENTS:
1. WROTE AND IMPLEMENTED SAFETY PROGRAMS THAT EXCEEDED OSHA STANDARDS AND HELD SAFETY MEETINGS, RESULTING IN NO LOSE TIME OR OSHA REPORTABLE INCEDENTS DURNING EMPLOYMENT HISTORY.
2. HONORABLE DISCHARGED FROM USAF.

EDUCATION:
ST EDMOND HIGH SCHOOL -1988
LOUISIANA STATE UNIVERSITY OF EUNICE -1989
USAF -1989-1992
OVER 2,000 LOGGED HRS OF PLANT SAFETY AND ORIENTATIONS

SSI has proudly retained William R.Schofield PhD, PE ; Owner/Project Manager of the Successful Spiking Company ***ESS*** as a CONSULTANT to help insure SSI's drive for PERFECTION.

Bill Schofield, CONSULTANT:

Summary Qualifications: Forty years of experience w 26 years directly related to hazardous waste combustion (HWC): (1) regulations, (2) testing (including spiking), (3) compliance, and (4) operations. Planned, managed, and reported the results of >30 HWC Tests and successfully completed >400 spiking projects. Conceived and developed, or contributed to the development of several spiking techniques that are now Industry Best Practices.

Completed >1,600 technical/regulatory/operations reports, mathematical/statistical/economic models, and permit applications & compliance system designs/implementations. Published >40 papers on the regulatory, testing, and operating aspects of HWC devices including eight on technical/quality/regulatory aspects of the spiking function. PE Registration (Texas) for >20 years. Adjunct faculty of the University of Houston-Clear Lake and the University of Texas, School of Public Health, Houston Health Science Center, where he has taught postgraduate courses related to HWC regulations, HW management, and the application of strategy in real-world compliance contexts.

Resume: Bill Schofield, PhD, PE Project Manager & Sr Consultant

Functional Summary: Dr. Schofield has overall responsible for ***ESS*** projects from initial project definition & costing, proposal preparation, project planning including equipment selection, spiking materials specification and composition certification, off-site technical & trouble-shooting support to ***ESS*** Technicians during on-site spiking efforts, and spiking report preparation and spiking rate results certification.

Qualifications Summary: Dr. Schofield is a chemical engineer (BS & MS) and statistician (MS & PhD) with more than 39 years of engineering experience primarily in the petrochemical and hazardous waste management industries including assignments in:

Engineering with application to:
- Environmental control
- Process development
- Process control
- Plant optimization

Operations

Economic evaluation

R&D including:
- Pilot plant operation
- Product development

He has 25+ years of engineering, regulatory, and test design experience in hazardous waste combustion (HWC) and 18+ years operating plant experience in the chemical manufacturing and HWC industries.

Completed more than 1,600 technical, regulatory, operations, and financial reports, plans, studies, papers; mathematical, statistical, & economic models; and CAA (including HWC MACT), RCRA, and TSCA regulatory permit applications, audit & gap analysis reports, and compliance system designs.

Planned, managed, &/or reported the results of more than 30 HWC Comprehensive Performance Tests (CPTs), Trial Burns (TBs), Miniburns (MBs), and Boiler & Industrial Furnace (BIF) Certification/Re-Certification of Compliance (CoC/RCoC) Tests.

Successfully completed more than 150 spiking projects for HWC and Thermal Treatment Facilities since 1982.

Conceived and developed, or contributed to the development of several spiking techniques that are now considered Industry Standards &/or Best Practices. Consistently produced industry leading studies and documents and developed a wide range of innovative solutions to challenges he has encountered throughout his career (See example list below).

Served as Session Chair at various national and international hazardous waste combustion conferences, and Published more than 40 papers on the regulatory, testing, and operating aspects of HWC devices (eight of which specifically address the technical, quality, and regulatory aspects of the spiking function).

Professional Engineering Registration in the State of Texas for 20 years.

Member of Pi Mu Epsilon (Mathematics), and Phi Kappa Phi (Science & Engineering) National Honor Societies.

Adjunct facility: University of Houston-Clear Lake & University of Texas, School of Public Health, Houston Health Science Center, where he has taught postgraduate courses primarily related to RCRA Regulations, hazardous waste management, and the application of strategy in real-world environmental compliance contexts.

Education:

PhD	Statistics	Virginia Tech	Blacksburg, Virginia	1972
MS	Statistics	Virginia Tech	Blacksburg, Virginia	1971
MS	Chemical Engineering	Clemson University	Clemson, South Carolina	1969
BS	Chemical Engineering	Clemson University	Clemson, South Carolina	1966

Professional Experience:

***ESS*, Inc.** **1995-Present**
Pearland, Texas. **Project Manager and Sr. Consultant**

Responsibilities Include: All aspects of ***ESS***' spiking materials preparation and spiking services delivery to facilities conducting HWC MACT CPTs, Miniburns, RCRA (& TSCA) Trial Burns and BIF Tests and HWC MACT CPTs and Vent Incinerators (TOUs) conducting MON, HON, Pharma, PAI, etc MACT CPTs.

BSPE **1995-Present**
Pearland, Texas. **Sr. Consultant**

Responsibilities Include: Providing specialized hazardous waste combustion related engineering, regulatory, and testing services to the chemical and pharmaceutical manufacturing industries.

DRE Environmental Services, Inc. **1995**
Nashville, Tennessee **Vice President, Regulatory Affairs**

Responsibilities Included: Principal in charge of health, safety, and environmental compliance for the firm, which specialized in engineering and regulatory services for HWC units.

Responsible for developing and implementing QA/QC program and staff-training program to upgrade the quality of the firm's work products.

Provided senior consulting services to staff and clients on engineering and regulatory projects for the waste combustion industries.

DRE Southwest, Inc. **1993-1995**
Kemah, Texas **President**

Responsibilities Included: Opened, managed, and expanded this operation to 1995 billings of approaching $1.5 MM.

Schofield Environmental Associates **1991-1993**
Kemah, Texas **Principal**

Responsibilities Included: Project management, primary author, and other lead roles for a number of BIF compliance, RCRA permitting/engineering projects for, among others, Olin Chemicals (now Arch Chemicals, CoPC, CTN/CTP, CoC tests and documents, WAP, etc.), Mobil Chemical (CoC document, test coordination), and Chemical Waste Management (economic analysis for a proposed RCRA storage/ processing facility). The Olin CoPC required RE estimates of all BIF constituents at each APCS-type unit in a multi-unit manufacturing operation, which removed BIF constituents from the process gas stream.

Chemical Waste Management **1986-1991**
Port Arthur, Texas **Technical Manager** (1987-1991)**, Reg. Incin Marketing Mgr** (1986-1987)

Responsibilities Included: Was responsible for development of the initial financial analysis and marketing services for a world-scale commercial RCRA/TSCA incinerator.

Project managed RCRA and TSCA trial burns to demonstrate the performance of state-of-the-art combustion and air pollution control systems.

Held leadership role in successful and innovative effort to minimize impact of slagging on incinerator availability and throughput, which produced a 10:1 benefit: cost ratio. Held numerous project management roles including RCRA and TSCA trial burns, and LDR Certifications Program for treatment Residues. Proposed and managed the development of a unique treatment process for managing 1.5 MM gallons of Dinoseb-contaminated water without incineration at an estimated savings of >$1.5 MM.

Established rigorous regulatory compliance system for all functions in responsibility area (no NOVs or regulatory discrepancies ever cited) and developed an innovative residual certification protocol, which was adopted throughout the Chemical Waste Management incineration system with no regulatory questions and a savings estimated at >$1 MM/year/site.

J. M. Huber Corporation **1982-1986**
Borger, Texas **Manager, Marketing & New Product Development, & Pilot Plant Mgr**

Responsibilities Included: Was sole author of RCRA and TSCA permit applications for Huber's prototype high temperature facility. The RCRA permit was the nation's first RCRA permit ever granted allowing dioxin treatment. The TSCA permit was nation's fifth TSCA (PCB) permit. Received RCRA permit within 16 months and TSCA permit within 12 months of application submission.

Provided process engineering ideas and technical leadership, which increased DRE values for Huber's process from 99% to 99.9999999% within three months.

Directed dioxin treatment demonstrations at Borger, TX (1984), Gulfport, MS (1985), and the world's first field demonstration of dioxin treatment at Times Beach, MO (1984).

Additional Experience 1966-1982:

Dr. Schofield has more than 14 years of additional engineering & operations experience with EPA and several major chemical manufacturers including Westinghouse, Eastman Chemicals, and Air Products and Chemicals, holding titles, which included Operations Manager, Technical Manager, EPA Section Chief, Engineer, and Process Engineer.

Registration/Certification:

Registered Professional Engineer, Texas

Conference Session Chair/Co-Chair:

2000, 1999, 1998, 1997, 1996, 1995, 1994, and 1993 Incineration Conferences, University of California (Now **AWMA IT3** Conference). 1993 **AWMA** Annual Conference, Dioxin and Furan Formation and Control

Publications and Presentations:

1. Schofield, Bill, Anderson, Billy, McBride, Chris, "Model QA/QC Program for the Spiking Function," Proceedings of the 2007 **IT3** Conference in Phoenix, AZ.
2. Schofield, Bill, Fleming, Jeff, McBride, Chris, "An Extended Analysis of Measurement Uncertainty in the Spiking Function," Proceedings of the 2006 **IT3** Conference in Savannah, GA.
3. Schofield, W. R., Anthony R. Eicher, and Sean O'Brien, "The Effect of Measurement Uncertainty on Spiking Material Composition and Overall Specie Spiking Rate Uncertainties," Proceedings of the 2004 **IT3** Conference in Phoenix, AZ.
4. Schofield, W. R., Anthony R. Eicher, and Sean O'Brien, "The Effect of Measurement Uncertainty on Field Spiking Rate and Overall Specie Spiking Rate Uncertainties," Proceedings of the 2004 **IT3** Conference in Phoenix, AZ.
5. Schofield, W.R., Ron Bastian, and Terry Schomer, "Statistical Demonstration of Compliance with Feed Rate Limits," Proceedings of the 2002 **IT3** Conference in New Orleans, Louisiana.
6. Cudahy, James, Shelly Forbes, Carrie Wintersteen, and W. R. Schofield, "The HWC Phase II MACT and Waste Energy Recovery," Proceedings of the 2002 **AWMA BIF** Specialty Conference.
7. Schofield, W.R., and Terry Schomer, "Statistical Demonstration of Compliance with **HWC MACT** Feed Rate Limits," Proceedings of the 2001 **IT3** Conference in Philadelphia, Pennsylvania.
8. Schofield, W. R., and Anthony R. Eicher, "Risk Burn/Risk Assessment Database-Early Results," Proceedings of the 2000 **IT3** Conference. Third in a series of three papers presented at this conference in 1998, 1999, and 2000.
9. Schomer, T. L., W. R. Schofield, and D. Gonzales, An Innovative Approach for Meeting the HWC MACT Standards Utilizing the 'Fast Track' Regulations," Proceedings of the 1999 **IT3** Conference.
10. Schofield, W.R., and Anthony R. Eicher, "Trends in Risk Assessment Results in Texas," Proceedings of the 1999 **IT3** Conference.
11. Schofield, W.R., and Anthony R. Eicher, "Trends in Risk Assessment Results in Texas[1]," Proceedings of the 1998 **IT3** Conference.
12. Schofield, W.R., "Conducting a BIF Certification of Compliance Test on an Integrated Multiple Combustor, Multiple Air Pollution Control Device," Proceedings of the 1997 International Incineration Conference (now **IT3**), Oakland, California.
13. Schofield, W.R., et al, "Conducting the Maximum Waste Feed Rate, Minimum Combustion Temperature Test Condition for Boilers which Burn High BTU Wastes - A Case Study," Proceedings of the 1997 Incineration Conference (now **IT3**), Oakland, California.
14. Neuman, Barry S. and Schofield, W. R., "EPA's Proposed Comparable Fuels Exemption under RCRA: Does It Spell Relief?" Bureau of National Affairs, Dec. 13, 1996 (0013-9211/96).
15. Schofield, W.R. and Barry S. Neuman, "EPA's New Comparable Fuels Exemption," Proceedings of the 1996 International Incineration Conference (now **IT3**), Savannah, Georgia.
16. Schofield, W.R., Ron Copeland, James Leitheiser, and John Schroer, "EPA's Evolving Guidance on Waste Testing Frequency and Its Impact on Selected BIF Units," Proceedings of the 1996 International Incineration Conference (now **IT3**), Savannah, Georgia.
17. Schofield, W.R., et. al., "De-bottlenecking an In-House Liquid Incinerator by Process Analysis and Miniburn Testing," Proceedings of the 1995 International Incineration Conference (now **IT3**), Seattle, Washington.
18. Schofield, W.R., et. al., "Designing Trial Burns to Provide PIC and BIF Metals Emissions Data for Comprehensive Risk Assessments," Proceedings of the 1995 **AWMA BIF** Specialty Conference, Kansas City, Kansas.

19. PFEFFER, FLOYD L., BILL SCHOFIELD, AND ERIC TIEMEYER, "BEST AVAILABLE CONTROL TECHNOLOGIES FOR CEMENT KILN AIR POLLUTION CONTROL EQUIPMENT USING THE COMMERCIAL HAZARDOUS WASTE INCINERATION INDUSTRY AS THE STANDARD," PROCEEDINGS OF THE 1995 **AWMA BIF** SPECIALTY CONFERENCE, KANSAS CITY, KANSAS.

20. SCHOFIELD, W.R., AND MAYNARD ENGLER, "DESIGNING TRIAL BURNS TO MINIMIZE ONGOING WASTE ANALYSIS COST," PROCEEDINGS OF THE 1995 INTERNATIONAL INCINERATION CONFERENCE (NOW **IT3**), SEATTLE, WASHINGTON.

21. WEITZMAN, LEO, ADRIAN GEORGE, BILL SCHOFIELD, AND FLOYD L. PFEFFER, "CHEMICAL FORM OF METAL SPIKES FOR INCINERATOR TRIAL BURNS AND **BIF** TESTS," PROCEEDINGS OF THE 2004 INTERNATIONAL INCINERATION CONFERENCE[1] (NOW **IT3**), HOUSTON, TX.

22. SCHOFIELD, W.R., AND JOHN HERRON, "EPA'S NEW POLICY FOR HAZARDOUS WASTE COMBUSTION - WHAT DOES IT MEAN TO YOU?" PROCEEDINGS OF THE 1994 INTERNATIONAL INCINERATION CONFERENCE (NOW **IT3**), HOUSTON, TEXAS.

23. SCHOFIELD, W.R., "FOREWARNED IS FOREARMED: WHAT YOU CAN DO TO MINIMIZE COMPLIANCE PROBLEMS AND COSTS," PRESENTED AT THE 1994 COMBUSTION POLICY SEMINAR SPONSORED BY DRE ENVIRONMENTAL SERVICES, HOUSTON & AUSTIN, TX.

24. SCHOFIELD, W.R., AND L. WEITZMAN, "METAL DISPERSION SPIKING SYSTEMS FOR RCRA TRIAL BURNS," PROCEEDINGS OF THE 1993 **AWMA BIF** SPECIALTY CONFERENCE, CLEARWATER, FLORIDA.

25. SCHOFIELD, W.R., ET. AL., "METAL SPIKE APPROACHES FOR INCINERATOR TRIAL BURNS - A COMPARATIVE ANALYSIS," PROCEEDINGS OF THE 1993 INTERNATIONAL INCINERATION CONFERENCE (NOW **IT3**), KNOXVILLE, TENNESSEE.

26. SCHOFIELD, W.R., JOHN LUTZMAN, AND GENE PATTERSON, "A SURVEY OF SLAG AND SLAG AVOIDANCE TECHNIQUES WITH EMPHASIS ON METHODS TO CONTROL MELT TEMPERATURES," PROCEEDINGS OF THE 1992 INTERNATIONAL INCINERATION CONFERENCE (NOW **IT3**), ALBUQUERQUE, NEW MEXICO.

27. SCHOFIELD, BILL, JOHN LUTZMAN, AND GENE PATTERSON, "THE USE OF CHEMICAL ADDITIVES TO REDUCE THE IMPACT OF SLAG FORMATION IN HAZARDOUS WASTE INCINERATION," COVER/FEATURED ARTICLE FOR HAZARDOUS MATERIALS CONTROL MAGAZINE, SEPTEMBER/OCTOBER 1992, VOLUME 5, NUMBER 5.

28. SCHOFIELD, W.R., ET. AL., "THE USE OF CHEMICAL ADDITIVES TO REDUCE THE IMPACT OF SLAG FORMATION IN HAZARDOUS WASTE INCINERATION - FOUR CASE STUDIES," PROCEEDINGS OF THE 1991 **AWMA BIF** SPECIALTY CONFERENCE.

29. SCHOFIELD, W. R., AND JOHN KOLOPANIS, "CERTIFICATION PROTOCOL FOR MEETING ORGANICS TREATMENT STANDARDS FOR INCINERATION ASH," PROCEEDINGS OF THE 1991 INTERNATIONAL INCINERATION CONFERENCE (NOW **IT3**), KNOXVILLE, TN.

30. SCHOFIELD, W. R., JOHN KOLOPANIS, AND TERESA JOHNSON, "CERTIFICATION PROTOCOL FOR MEETING THE (40 CFR 268 LAND BAN) ORGANICS TREATMENT STANDARDS FOR INCINERATION ASH," PROCEEDINGS OF THE **AWMA** 1991 ANNUAL MEETING IN VANCOUVER, BRITISH COLUMBIA.

31. SCHOFIELD, W.R., W. V. WALLS, AND THOMAS JONES, "THE EFFECT OF KILN TEMPERATURE ON **DRE** AND ORGANICS CONCENTRATIONS IN INCINERATOR ASH," PRESENTED AT 1991 **HAZMAT** SOUTH[1], ATLANTA, GEORGIA.

32. SCHOFIELD, PE, DR. BILL, "HAZARDOUS WASTE INCINERATION TECHNOLOGY," BIC MAGAZINE APRIL/MAY, 1991

33. SCHOFIELD, W.R., J. LEVY, AND R. VINGRIS, "ADDITIONAL HAZARDOUS WASTE INCINERATION CAPACITY COMING ON-LINE," PRESENTED AT THE 1990[1] **HAZMAT** CONFERENCE[1], WASHINGTON DC.

34. SCHOFIELD, W. R., "SUPPLY – DEMAND ANALYSIS FOR **US** BASED COMMERCIAL HAZARDOUS WASTE INCINERATION CAPACITY[1]," PRESENTED AT 1987[1] **HAZMAT**[1], WASHINGTON, DC.

35. SCHOFIELD, W. R., ET. AL., "DIOXIN DESTRUCTION DEMONSTRATIONS WITH THE AER HIGH TEMPERATURE PYROLYSIS PROCESS[1]," PRESENTED AT 1985[1] **HAZMAT EUROPA**, HAMBURG, WEST GERMANY.

36. SCHOFIELD, W.R., ET. AL., "THE USE OF THE HIGH TEMPERATURE AER PYROLYSIS PROCESS FOR DESTROYING ORGANIC AND ENCAPSULATING INORGANIC HAZARDOUS WASTES[1]," PRESENTED AT THE 1985[1] **HAZMAT** CONFERENCE[1], WASHINGTON DC.

37. LEE, K. W., W. R. SCHOFIELD, ET. AL., "MOBILE REACTOR DESTROYS TOXIC WASTES IN 'SPACE', "CHEMICAL ENGINEERING MAGAZINE, APRIL 2, 1984.

38. SCHOFIELD, W.R., ET. AL., "THE USE OF THE HIGH TEMPERATURE AER PYROLYSIS PROCESS FOR DESTROYING ORGANIC AND

ENCAPSULATING INORGANIC HAZARDOUS WASTES[1]," PRESENTED AT THE 1984[1] **HAZMAT**, WASHINGTON, DC.

39. SCHOFIELD, WILLIAM R., AND KRUTCHKOFF, RICHARD G., "DETERMINISTIC MODEL OF DYNAMIC EUTROPHIC ESTUARY," JOURNAL OF THE ENVIRONMENTAL ENGINEERING DIVISION, **ASCE**, VOL. 100, NO. EE3, PROC. AUGUST, 1974

40. SCHOFIELD, WILLIAM R., AND KRUTCHKOFF, RICHARD G., "STOCHASTIC MODEL OF DYNAMIC EUTROPHIC ESTUARY," JOURNAL OF THE ENVIRONMENTAL ENGINEERING DIVISION, **ASCE**, VOL. 100, NO. EE3, PROC. PAPER 10578, JUNE 1974, PP.613-628

41. SCHOFIELD, WILLIAM R., AND KRUTCHKOFF, RICHARD G., "STOCHASTIC MODEL FOR A DYNAMIC ECOSYSTEM," BULLETIN 60, WATER RESOURCES RESEARCH CENTER, VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY, BLACKSBURG, VIRGINIA, 1973.

42. SCHOFIELD, WILLIAM R., AND KRUTCHKOFF, RICHARD G., "STOCHASTIC MODEL OF BOD AND OD IN SEGMENTED ESTUARY," JOURNAL OF THE SANITARY ENGINEERING DIVISION, **ASCE**, VOL. 98, NO. SA5, PROC. PAPER 9296, OCTOBER 1972, PP. 745-762.

1. COPIES OF THESE PAPERS COULD NOT BE RETRIEVED FOR CITATION CONFIRMATION. THEREFORE, DATES, TITLES, &/OR LOCATION OF PUBLICATION MAY BE APPROXIMATE.

Spiking Innovations: Dr. Schofield conceived and developed or contributed to the development of several specialized spiking techniques for unusual spiking circumstances &/or challenging waste applications. Several are briefly described here:

1. **Spiking Waste Streams Containing Anhydrous HF**: The addition of even minor amounts of water to an anhydrous **HF** waste stream results in an extremely aggressive and corrosive material. Dr. Schofield developed an ash/metals spiking approach that did not involve addition of water (at greater than low ppm levels) to these streams; thus, avoiding expensive and potentially dangerous piping, valve, burner, etc. corrosion problems. This approach was successfully demonstrated in the test completed on behalf of Arkema (formerly Elf AtoChem) in Calvert City, KY circa 1993.

2. **Spiking High Melt-Point Waste Streams:** High melt-point waste streams will freeze if spiked with high heat-sink spiking materials such as aqueous solutions, resulting waste feed line plugging, and/or burner tip blinding. In anticipation of this problem, Dr. Schofield successfully developed a spiking method, which avoided "freezing" of high melt-point wastes in 1993. This technique was successfully demonstrated in 1994 for Marathon Oil in Garyville, LA, and on several other occasions since, including several tests for Merisol (formerly MeriChem) in Houston, TX since 1996.

3. **Spiking a Large Number of Different Metals:** Under the BIF Rule, which was frequently applied to incinerators under the Omnibus Provision, most commercial, and a number of private facilities found it necessary to spike a large number of regulated metals in order to achieve workable feed rate limits for those metals. The established practice at that time was to utilize a number of spiking systems for spiking aqueous solutions of soluble metal salts-one system for each metal or group of solubility compatible metals (in order to avoid the possibility of metal precipitation due to the common ion or other solubility effects). In addition to operating complexity, unreliability, and high cost, this approach represented a significant risk to the environment should these highly mobile metal solutions be spilled. In 1990 and 1991, Dr. Schofield originated a method of feeding all necessary metals in one spiking system, each with a known feed rate, and in an immobile physical form. This approach has been successfully utilized on >100 commercial and private HWC facilities beginning in 1991 for Peak Sulphur (formerly Olin Chemical) in Beaumont, TX and is now an industry standard.

4. **Spiking Materials Designed to Meet a BTU Specification:** Numerous trial burn, BIFs, and HWC MACT CPTs require spiking of a material with a controlled BTU content in order to achieve the desired test conditions. For example, metal spiking into a secondary combustion chamber frequently requires energetic material such as organic based dispersions instead of a zero BTU-content aqueous solution). Spiking aqueous metal solutions can result in:

   The inability to reach the desired maximum combustion chamber temperature and subsequent failure to achieve sufficiently high combustion chamber temperature limits during the test. A lower than desired maximum combustion chamber temperature limit could result in an excessive number of AWFCO events during subsequent routine operations, and

   Flame quenching and instability &/or an inadequate destruction efficiency.

   Similarly, site-specific circumstances may exist which call for little of no BTU content in the spike material.

   From 1991 to 1994, Dr. Schofield with others developed a range of spiking materials to match a wide range of test BTU requirements. These materials have been used in widely varying applications and have consistently achieved the desired test objective.

5. **Rheologically Sensitive Applications:** In some waste atomization cases, such as bio-sludge atomization, the addition of even a minor amount of an aqueous metal solution can cause undesirable viscosity and (potentially) other rheological effects in the waste stream. For example, with bio-sludge the addition of a small amount of water causes the bulk biosludge to drop in mass from the feed device onto the combustion chamber hearth without atomization and thorough thermal treatment. Dr. Schofield assisted in the development process for using a metal dispersion to solve this problem. This technique was first demonstrated in full-scale testing during the mid-1990s at Eastman Chemicals.

First of Their Kind Innovations &/or Industry Leading Studies:

1. Discovered (in 1967) a previously unexpected linear, Log-Log relationship between the most economically significant measure of cellulose acetate fiber spinning efficiency, e.g., Bleb (B) & Interruption (I) rates versus fiber diameter expressed as denier (D) per filament (F), e.g., (Log[B/I Rates]) vs. (Log[D/F]).

2. Developed (in 1967) the first practical, production-scale, continuous viscometer for extremely viscous cellulose acetate in acetone solutions.

3. Designed and constructed (in 1968) a unique, bench-scale, variable agitation speed, differential-bed, catalytic reactor for measuring catalytic activity in the absence of inter-phase heat and mass transfer effects. Designed temperature control system for the reactor that controlled reactor temperature within a fraction of a F degree despite the presence of significant thermal lag and inertia due to the thick metal reactor walls. This reactor produced reaction rate (Rx) versus temperature data with R^2>0.995 when plotted as an Arrhenius Diagram (e.g., Rx vs. 1/T).

4. Advanced the state of the art in stochastic modeling of DO, BOD, etc in an estuarine environmental (from 1970 to 1972). Advanced stochastic models from a simple model with two (2), first order, ordinary differential equations with parameters, boundary conditions, and driving functions which were constant with respect to time and position to a model with a coupled set of twelve (12), second order, partial differential equations with parameters, boundary conditions, and driving functions which varied with respect to time and position. The 12 equations were coupled in their respective chemical and biological kinetics terms.

5. Completed a study (in less than one man-week during 1974) of the US DoC, ICC, Department of Pipeline Safety's records on pipeline breaks, which demonstrated that some pipeline companies had pipeline break rates at least an order of magnitude better (or worse) than the national average. Made contact with the companies with the best records and bartered a copy of this study for their pipeline design and installation specifications. These specifications were subsequently adopted by the corporation's design team.

6. Recognized (in 1974) the potential of an early-stage, adiabatic rarification wave measuring device for detecting ruptures in poisonous gas pipelines. When a pipeline breaks suddenly, adiabatic rarification waves move in both directions out from the break at the speed of sound (at pipeline conditions). Verified the systems functionality in tests conducted on full-scale, high-pressure N_2 pipelines (N_2 & CO have almost identical thermodynamic properties for this application), i.e., was able to demonstrate detection of a pipeline break as small as 1/2" diameter hole at a distance of more than 10 miles even at a very early point in the technology development cycle.

7. Was the sole author (in 1974) of a state-of-the-art risk analysis study for a CO pipeline then being considered from Air Product's, La Porte, synthesis gas plant to Monsanto's (now Sterling) HAc plant in Texas City, Texas. The Board cancelled the project when the study predicted a once in 10,000 years accident in Texas City that that resulted in 1,800 fatalities.

8. Developed (in 1974) a dynamic model of a first-of-its-kind, full-scale HNO_3 production plant. The model included the effects of chemical kinetics, flow dynamics through the process equipment, aerodynamics, and thermodynamics of four (4) un-coupled turbo-compressors (prime movers), and the technology provider's process control system. Simulations with the model indicated that the process with the existing control system would not function as designed, but would instead encounter surge in the third stage compressor prior to reaching nameplate capacity. Six (6) months of start up efforts confirmed this result. Developed and tested a control system using the model. The HNO_3 plant first met nameplate capacity during the initial run with the recommended control system. Received a US patent for this innovative and effective control system.

9. Developed (in 1982) the first-ever chemical equilibrium model for the full-scale production of carbon black.

10. Provided the process engineering concepts and technical leadership (in 1983) for increasing the DRE of the J.M. Huber AER Process from 99% to 99.99999999+% within three (3) months.

11. Conducted (in 1987) the market study, which justified the CWM commercial incinerator facility in Port Arthur, Texas. Was the first to predict (in 1987) that the then severe commercial incineration capacity shortfall would end in 1991 or 1992 (the shortage actually ended in the summer of 1991). All market condition, market size, and pricing aspects of this study proved to be accurate. Described by the President of the parent company as the best market study ever done within the entire company.

12. Designed, justified and supervised construction; staffed; and equipped and supplied a state of the art analytical

LABORATORY FOR A COMMERCIAL INCINERATOR FACILITY (FROM 1988 TO 1990). THE LAB WAS DESIGNED TO COMPLETE THE FULL SUITE OF WASTE ANALYSIS PARAMETERS INCLUDING ALL BIF METALS AND TARGET VOLATILE & SEMI-VOLATILE ORGANIC COMPOUNDS FOR 1,000 WASTE SAMPLES/MONTH WITHIN THREE (3) DAYS OF SAMPLE RECEIPT. THE CAPABILITIES OF THIS LAB WERE SUCH THAT IT SUBSEQUENTLY BECAME THE REGIONAL LAB INCLUDING D/F ANALYTICAL CAPABILITIES WITHOUT THE NEED FOR STRUCTURAL EXPANSION. FACILITY WAS DESCRIBED BY THE FRUGAL CORPORATE CHIEF FINANCIAL OFFICER AS "A BARGAIN."

13. CONCEIVED, DEVELOPED, AND SUCCESSFULLY IMPLEMENTED (IN 1990) A STREAMLINED LANDBAN CERTIFICATION SYSTEM FOR TREATMENT RESIDUALS AT THE CWM PORT ARTHUR COMMERCIAL INCINERATOR FACILITY. THIS SYSTEM WAS ULTIMATELY ADOPTED AT THE CWM INCINERATOR FACILITIES AT SAUGET AND CHICAGO, ILLINOIS WITH A SUBSEQUENT REDUCTION IN THE AVERAGE RESIDUAL CERTIFICATION TIME AT THE ILLINOIS FACILITIES FROM >60 DAYS TO <14 DAYS. THIS SYSTEM RESULTED IN SYSTEM-WIDE SAVINGS ESTIMATED AT MORE THAN $3 MILLION/YEAR.

14. IN 1990, DEVELOPED A CHEMICAL PROCESS FOR PURIFYING DINOSEB CONTAMINATED BRINE (W/I TWO WEEKS AT A TOTAL DEVELOPMENT OF <$5K). IMPLEMENTED THE PROCESS AND PURIFIED MORE THAN 1.5 MILLION GALLONS OF DINOSEB CONTAMINATED BRINE WITHIN ONE WEEK AT A TOTAL TREATMENT COST OF <$5K. THE SUCCESSFUL COMPLETION OF THIS PROJECT RESULTED IN THE ANTICIPATED INCINERATION OF THE CONTAMINATED BRINE UNNECESSARY THEREBY SAVING MORE THAN $1.5 MILLION.

15. IMPLEMENTED NUMEROUS SLAG CONTROL MEASURES (IN 1990) WITH SIGNIFICANTLY IMPROVED THROUGHPUT AND ON-STREAM TIME. THESE MEASURES IN AGGREGATE HAD A 10:1 BENEFIT TO COST RATIO.

16. ORIGINATED, DEVELOPED, AND/OR CONTRIBUTED TO THE DEVELOPMENT OF SEVERAL HWC SPIKING MATERIALS/METHODS (FROM 1991 TO 1994), WHICH ARE NOW CONSIDERED TO BE "STANDARD PRACTICE" OR "BEST PRACTICES" WITHIN THE SPIKING INDUSTRY.

17. DESIGNED AND MANAGED A MINIBURN ON A CAPTIVE INCINERATOR (IN 1993), WHICH DEMONSTRATED (IN LESS THAN 8 HOURS OF TESTING) OPERATING CAPACITY, WHICH WAS >220% ABOVE THE PREVIOUS MAXIMUM OPERATING CAPACITY AND >75% MORE CAPACITY THAN THE TECHNOLOGY PROVIDER THOUGHT WAS POSSIBLE.

18. COMPLETED (IN 1994) A STATE OF THE ART STUDY OF A MODERN MUNICIPAL WASTE INCINERATOR, WHICH ESTABLISHED THE FATE AND EMISSION RATES OF 189 HAPS FROM THE EXISTING FULL-SCALE PROCESS.

19. DEVELOPED (FROM 1994 TO 2002) SEVERAL INNOVATIVE STATISTICAL METHODS FOR DEMONSTRATING COMPLIANCE WITH FEED RATE AND EMISSION LIMITS FOR COMMERCIAL AND CAPTIVE HWC FACILITIES. THE MOST RECENT SUGGESTION FOR AN ALTERNATIVE APPROACH TO THE HWC MACT 80% UCL REQUIREMENT WAS DESCRIBED BY A SENIOR EPA HEADQUARTERS STAFF MEMBER AS "NEAR BRILLIANT."

CONCEIVED OF AND NEGOTIATED AGENCY ACCEPTANCE OF A PERMITTING STRATEGY TO REPLACE TOTALLY AN OUTDATED HWC INCINERATOR UNDER A CLASS 1[1] PERMIT AMENDMENT.

Laboratory Analysis Coordinator

William Anderson

Personnel Resume

William C. Anderson, Ph.D

Senior Chemical and Analytical Project Consultant

Qualifications Summary

Dr. Anderson is a senior chemical and analytical project consultant with particular expertise in analytical methodology and supporting quality assurance programs related to trial burn programs. He has extensive project experience regarding the analytical program design of incinerator and ambient air permitting activities. As an analytical chemist he directly participates in the design and implementation of new analytical methods developments, project specific testing, and supporting quality assurance protocols. Much of the work produced by Dr. Anderson and his staff is used to generate legally defensible performance demonstration test reports that are to be judged by various regulatory agencies including the EPA and state authorities. Dr. Anderson and his associates staff write detailed analytical project plans, quality assurance project plans (QAPPs), and final trial burn report publications. He currently serves as the division manager for TestAmerica Knoxville's Analytical Consulting Services (ACS) group. He has twenty (24) years of continuous service within the Analytical Services Division.

Background

Division Manager and Senior Project Consultant
Analytical Consulting Services (ACS) Division of TestAmerica Knoxville, formerly Severn Trent Services, Inc.
Knoxville, TN—1997 to Present

Senior Chemical and Analytical Project Consultant
Severn Trent Services, Inc. Analytical Consulting Services
Knoxville, TN--1990 to 1997
Responsibilities include:

- Direct supervision of an analytical project management staff during the implementation of various analytical and quality assurance project activities.
- Acting as Analytical Program Manager for permitting activities associated with incineration and other thermal treatment permitting and environmental cleanup projects.
- Provision of Analytical Quality Assurance oversight for regulatory agencies (State and EPA) conducting waste incineration or thermal treatment at various commercial locations or Superfund sites.
- Acting as Analytical Program Quality Assurance Manager for permitting activities associated with incineration and other thermal treatment environmental cleanup projects.
- Supervision of an analytical project staff responsible for the completion of various technical projects including trial burns and quality assurance planning.

Some key project roles for Dr. Anderson include:

- Senior Analytical Project Manager for the New Waste Calciner Facility Off-gas Sample Characterization at Idaho National Engineering and Environmental Laboratories (INEEL) for Bechtel BWXT Idaho, LLC (formerly Lockheed Martin Idaho Technologies Company, LMITCO) possible permitting activities (1999-2000).

- Senior Analytical Project Manager for the Background Soils Investigation at the Umatilla Chemical Agent Disposal Facility (UMCDF) in Hermiston, Oregon, for Raytheon Demilitarization Company (1998).
- Senior Analytical Project Manager for the Chemical Agent Munitions Disposal System (CAMDS) Sampling and Characterization of GB Ton Containers at the Deseret Chemical Depot in Tooele, Utah, for Battelle Columbus (1998).
- Quality Assurance Manager and Analytical Project Manager for the Times Beach Remediation Project trial burn at St. Louis, Missouri (1996)
- Quality Assurance Manager and Analytical Project Manager for the Chemical Agent Munitions Disposal System (CAMDS) Trial Burn on the Metal Parts Furnace (MPF) at Tooele Army Depot in Tooele, Utah (1995)
- Analytical Project Manager for EPA Region VI Thermal Treatment Initiative that included the publication of Quality Assurance Project Plan (QAPjP) guidance document for trial burns. The guidance incorporated SW-846 Update III methods for trial burn samples (1997).
- Analytical Project manager for Schenectady Chemical International trial burn in EPA Region II and the State of New York DEC (1997).
- Analytical Project Manager for Aberdeen Pesticides Dumps Site in Aberdeen, North Carolina. Primacy oversight was conducted be EPA Region IV, and the State of North Carolina, (1997).
- Quality Assurance and Analytical Project Manager for trial burn incinerator performance testing at Bayou Bonfouca Superfund Site in Slidell, Louisiana.
- Quality Assurance consultant to the State of Arkansas and EPA Region VI for conducting oversight of contractor performance during trial burn testing at the Old Midland Superfund Site in Ola, Arkansas.
- Analytical Program Manager for the development of Quality Assurance Plans specifically designed to permit an onsite incinerator at the Times Beach Superfund Site in Times Beach, Missouri. This permit uniquely qualified the incinerator to process dioxin and furan soil and waste in the State of Missouri and EPA Region VII.

* Severn Trent Services was created in February 2000 when Severn Trent bought Quanterra, Inc.

* Quanterra Environmental Services was created in June 1994 when IT Corporation's Analytical Services Division merged with ENSECO's laboratory group.

Special Projects Coordinator and Analytical Program Manager
Field Analytical Services Division of IT Corporation--
Knoxville, TN--1987 to 1990
Responsibilities included:

Some key project roles for Dr. Anderson include:

- Direct supervision of analytical project staff during the planning and implementation of trial burn projects.
- Management of the execution of specialized laboratory testing during trial burn projects requiring legally defensible data.
- Management of analytical project designs including testing method requirements and project specific data quality objectives (DQO's).
- Analytical program manager on Resource Conversation and Recovery Act (RCRA) trial burn for Pfizer Chemicals, Inc. in Groton, Connecticut.

- Analytical program manger on trial burn for Department of Energy's Dual Purpose RCRA/Toxic Substance Control Act (TSCA) incinerator in Oak Ridge, Tennessee.
- Analytical program manger on RCRA trial burn at Schenectady Chemical Company in Schenectady, New York.
- Analytical program manager on RCRA trial burn at Searle Pharmaceuticals, Inc. in Augusta, Georgia.
- Direct participation in RCRA and TSCA trial burn projects in the role of Analytical Program Manager or Quality Assurance Manager.

Senior Field Analytical/Field Sampling Specialist
Field Analytical Services Division of IT Corporation--
Knoxville, TN--1983-1987
Responsibilities included:

- Analytical project management on U.S. Army Toxic and Hazardous Materials Agency (USATHAMA) polychlorinated biphenyls (PCB) trial burn at Tooele Army Depot in Utah.
- Project Management of field sampling and analytical activities for Y-12's Bear Creek Valley field assessment program.
- Sampling and analysis coordination for conducting EPA's mobile incinerator dioxin trial burn in Missouri.
- Sampling and analysis coordination for pollution abatement testing and performance assessment at the Tooele Army Depot in Utah incinerator for agent munitions.
- Field supervision at Pine Bluff, Arkansas train derailment for sampling and analysis during site remediation activities.
- Project manager for a site assessment at Reichhold Chemicals, Inc. in Tacoma, Washington.
- In-house laboratory project manager for projects requiring specialized sampling handling. Included are special chemical preps, procurement of field operation supplies, data review, and nonroutine analyses.

Teaching and Laboratory Assistant, Graduate Research Assistant
University of Tennessee Chemistry Department
Knoxville, TN --1978-1983
As a student teaching and research assistant, taught undergraduate and upper-level graduate courses in chemistry for a research stipend. Concurrently executed an individual research project as part of the university graduate program.

Education

Ph.D., Analytical Chemistry--
University of Tennessee--Knoxville, TN--1988

B.A., Chemistry--
University of Tennessee--Knoxville, TN--1975

Professional Affiliations

American Chemical Society

Alpha Chi (Chemistry) Fraternity

Publications

J. C. Lodmell, W. C. Anderson, M. F. Hurley, and J. Q. Chambers, "High Performance Liquid Chromatography of Electrolysis Solutions: A Study of the Reduction of Carbon Disulfide in N,N-Dimethylformamide", Analytica Chemica Acta, 1981, 129, 49.

Hu-lin Li, W. C. Anderson, J. Q. Chambers, and D. T. Hobbs, "Electrocatalytic Reduction of Nitrate in Sodium Hydroxide Solution in the Presence of Low-Valance Cobalt Cyclam Species," Inorganic Chemistry, 1989, 28, 863.

R.G. Wilbourn, W.C. Anderson and M.L. Foster, "Planning and Implementing Effective Thermal Site Remediation Operations", IT Corporation Technology Exchange Symposium, June 1992.

M.L. Keever, R.L. McBride, and W.C. Anderson, "Demonstrated Stability of Hexavalent Chromium (Cr^{+6}) in Spiked Stack Gas Samples Analyzed by EPA Method 218.6", IT Corporation Technology Exchange Symposium, June 1993.

P. B. Carswell, D. C. Wasmund, and W. C. Anderson, “The Application of Traditional Data Quality Objectives (DQOs) to the Measurement of Stack Gas Unspeciated Mass: Techniques and Observations”, presented at the 1999 International Conference on Incineration & Thermal Treatment Technologies (IT3), published in Elsevier Science Ltd., Waste Management Journal 20 (5-6) (2000) pp. 385-394.

P. B. Carswell, D. C. Wasmund, and W. C. Anderson, “The Derivation of Procedurally Corrected Method Detection Limits for Use in Source Emission Risk Assessment Evaluation”, presented at the 2001 International Conference on Incineration & Thermal Treatment Technologies (IT3).

P. B. Carswell, D. C. Wasmund, and W. C. Anderson, “Preparation of Incinerator Organic Waste Feed Materials for the Determination of Low-Level Total Metals Content to Meet Compliance Data Quality Objectives”, presented at the 2003 International Conference on Incineration & Thermal Treatment Technologies (IT3).

Patti Carswell, Kevin R. McGee, Donald C. Wasmund, and William C. Anderson, "The Combination of TCO/GRAV Unspeciated Mass Sampling Trains with Method 0010 Semivolatile Trains", presented at the IT3 Conference, May 9-13, 2005, Galveston, Texas.

Quality Assurance Officer

Teresa Bales

TERESA L. BALES

Professional Qualifications

Ms. Bales has over 25 years of experience in the environmental industry. Her experience includes providing data validation services, working as a laboratory analyst, performing regulatory compliance inspections, and serving as a program manager for a state environmental regulatory agency. She has extensive experience in providing data validation services for large, multidisciplinary environmental projects. These projects have included site investigations and remedial actions at CERCLA sites and incineration and thermal desorption system performance tests. Data validation services have included reviewing analytical data to determine compliance with both U.S. EPA national and regional guidelines, including Contract Laboratory Program (CLP) Functional Guidelines and project specific quality objectives. Deviations from required quality control objectives found during these reviews have been evaluated as required to determine the affect on analytical results and the affect on project objectives including any corrective actions required. Data validation services have been provided for projects that have been conducted under a number of regulatory programs including CERCLA, RCRA, CAA, CWA, TSCA and various state regulatory programs. Ms. Bales also has experience in complying with waste transportation regulations and industry guidelines, including U.S. DOT regulations and IATA. Ms. Bales has also developed Field Sampling and Analysis Plans, Feedstream Analysis Plans, and Quality Assurance Project Plans for a variety of types of projects.

Education

B.S., Environmental Science, Livingston University, Livingston, Alabama; August, 1980

Experience and Background

1998 - Present <u>Data Validation Manager, Focus Environmental, Knoxville, TN.</u> Primary responsibilities include providing analytical data review (data validation) for compliance with project specific quality objectives and managing data validation projects. Data validation services for each project include providing a comprehensive data validation report with summary tables of deviations from the prescribed data quality objectives and their affect on the quality of the analytical data. Other responsibilities include development of Quality Assurance Project Plans, Field Sampling Plans, Sampling and Analysis Plans, Feedstream Analysis Plans, and Performance Test Plans. Ms. Bales also provides internal technical assistance to Project Managers as needed to address various types of sampling and analytical issues.

1991 - 1997 <u>Data Validation Project Manager, IT/Quanterra Field Analytical Services, Knoxville, TN</u>. Primary responsibility involved supervisory reviews of analytical data validation conducted by junior data validators for consistency and accuracy. Also responsible for management of personnel to meet project schedule and budget requirements. Projects included QA/QC review (data validation) of data from the U.S. Department of Energy Hazardous Waste Remedial Actions Program (HAZWRAP), validation of data for compliance with U.S. EPA Contract Laboratory Program (EPA-CLP) requirements, and validation of data and development of validation guidelines from project SOPs for non-CLP data. Other responsibilities include writing analytical data validation reports, developing sampling and quality assurance plans, and providing technical assistance to clients as necessary.

1989 - 1990 Environmental Quality Coordinator over the Water Quality Management Unit, Louisiana Department of Environmental Quality, Baton Rouge, Louisiana. Responsible for the overall coordination and supervision of the activities of the personnel in this unit. These activities included development and negotiation of work plans and applications to obtain federal grant money, managing state contracts including tracking invoices and submittal of deliverables, managing U.S. EPA grants to assure that all grant commitments were met and that moneys were spent appropriately, development and implementation of the states Non-point Source Pollution program, and the development and updating of Water Quality Management Plan Documents.

1987 - 1989 Environmental Quality Specialist, Biotoxicity Laboratory, Louisiana Department of Environmental Quality, Baton Rouge, Louisiana. Responsibilities included culturing test organisms (*Daphnia pules, Ceriodaphnia dubia, Pirnephales promelas, Cyprinodan variezatus,* and *Mysidopsis labia*), performing acute and chronic toxicity test using these organisms and managing the wet chemistry lab for the regional office.

1985 - 1987 Environmental Quality Specialist, Louisiana Department of Environmental Quality, Baton Rouge, Louisiana. Responsibilities included inspection of state and federally permitted facilities for compliance with NPDES and state water regulations, inspection of un-permitted facilities to identify possible discharge sources, responding to citizens complaints, collecting water, fish, and sediment samples for analysis, setting up and managing a wet chemistry laboratory for the regional office, assisting in biotoxicity analysis, and assisting in stream surveys.

1983 - 1985 Environmental Specialist, Industrial Waste Division, Oklahoma State Department of Health, Oklahoma City, Oklahoma. Responsibilities included enforcing RCRA and State Industrial Waste Regulations. This included inspection of waste generators, transporters and treatment-storage-disposal facilities (TSD), providing technical assistance to facilities concerning industrial and hazardous waste issues, response to and follow-up monitoring of spills and clean-ups, and work with DOT regulations to provide assistance to facilities during the transition from using individual state manifests to the RCRA uniform manifest system.

1982 - 1983 Environmental Specialist, Oklahoma State Department of Health, Oklahoma City, Oklahoma. Responsibilities included all aspects of environmental health at the county level. Tasks included inspection and enforcement of state regulations for food establishments, lodging, public water supply and sewage treatment facilities, solid waste disposal sites, swimming pools, and private water supplies and sewage systems. Also worked rabies complaints, nuisance complaints, and provided technical assistance for environmentally related problems.

1982 Laboratory Technician, Champion Chemicals, Inc., Oklahoma City, Oklahoma. Responsibilities included performing a variety of types of chemical and physical analyses including water analysis for chlorides, calcium, magnesium, iron, barium, sulfate, phosphate, pH, alkalinity, oil carryover, and the calculation of scaling index; analysis of scale deposit samples to determine the existence and ratios of given constituents and insoluble materials; corrosion and scale coupon analysis; and paraffin dispersion and inhibition test.

1981 - 1982 Oil Well Logging Engineer, The Analyst/Schiumberger, Lafayette, Louisiana. Responsibilities included recording and drawing logs of drilling parameters, collection and description of cutting samples, calibration and maintenance of equipment and monitoring hydrocarbon GC readings for hydrocarbons in the well.

Selected Publications & Presentations

1. Holcomb, D.H., C. H. Vail, and T. M. White, Establishing Risk-Based Acceptable Ambient Air Concentrations and Offsite Ambient Air Monitoring, Remediation of Chlorinated and Recalcitrant Compounds Conference, Monterey, California, May, 2000.

2. Eicher, Anthony R., Teresa White, and Ron McLeod, Evaluation of the Recovery of Volatile Organic Compounds on Solids Sorbents Used in Stack Gas Sampling Systems, International Thermal Treatment Conference, New Orleans, Louisiana, May 2002.