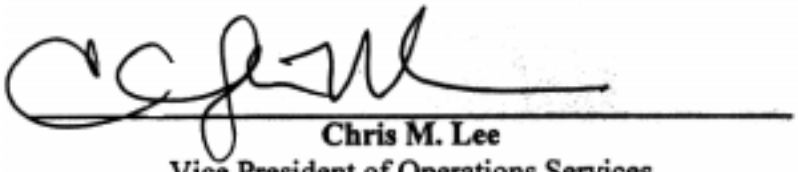
Quality Assurance Management Plan

Approved by:

Mark A. Matthews
Chief Operating Officer



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Revision 3
November 2, 1998

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Preface

The purpose of the Quanterra® Quality Assurance Management Plan (QAMP) is to provide internal quality assurance (QA) guidance to Quanterra® operating units. This guidance allows Quanterra® to operate under a standardized, rigorous quality management system (QMS) and ensures that our clients are consistently provided with data that are of known and documented quality and are legally defensible. The QAMP outlines the purpose, policies, organization, responsibilities, and operations related to ensuring high quality performance in all Quanterra® activities. The QAMP also fulfills the requirement of our clients and of government programs to document our QMS.

The QAMP contains many references to other essential Quanterra® quality documents. These quality documents, including the QAMP, Policy Documents, and Standard Operating Procedures (SOPs), both corporate and laboratory-specific, help ensure the quality of our products and intertwine to produce a strong QMS within Quanterra®. This system is the foundation that provides our operations with guidance and ensures consistently-produced quality deliverables. The project-specific requirements delineated in project plans may supersede the general quality requirements described in this manual.

The document is designed to follow the basic outline required for a quality management plan as described by the United States Environmental Protection Agency (EPA). Table 2.3-1 cross-references the narrative sections of the QAMP to the appropriate sections of the EPA document and other nationally recognized quality standards. This revision reflects specific changes to meet the Quality Standard Requirements of the National Environmental Accreditation Conference (NELAC) dated July, 1998.

There are two basic types of information included in the QAMP. General information is applicable to all Quanterra® operating units. Operation-specific information, provided in the Facility-Specific Appendix, describes the quality control (QC) requirements that apply only to a specific laboratory. The Facility-Specific Appendix includes information such as method detection limits (MDLs), performance evaluation (PE) studies, and laboratory SOPs that cannot be standardized throughout the Quanterra® laboratory network due to client-specific, laboratory-specific, or instrument-specific nature.

Forward

QAMP Revision 3 Implementation:

Quality Assurance Managers are to distribute the document and conduct training on the changes to the QAMP within 45 days of the issuance date. Implementation of the changes to the QAMP shall be completed within 60 days of the issuance date.

Table of Contents

Table of Contents (continued)

Table of Contents (continued)

Table of Contents (continued)

Table of Contents (continued)

Table of Contents (continued)

Page

List of Figures

List of Tables

List of Tables (continued)

List of Appendices

Appendix A — Corporate Key Personnel List and Quanterra® Operations Organizational Chart

Appendix B — Addresses of Quanterra® Locations

Appendix C — Facility-Specific Appendix: ***This appendix contains facility-specific quality-related information and requirements for*** Quanterra® ***laboratories. These laboratories are located in the following cities:***

- Anchorage, Alaska
- Austin, Texas
- City of Industry, California
- Denver, Colorado
- Knoxville, Tennessee
- North Canton, Ohio
- Pittsburgh, Pennsylvania
- Richland, Washington
- Sacramento, California
- Santa Ana, California
- St. Louis, Missouri
- Tampa, Florida

Each laboratory section in this appendix contains information specific to that laboratory only and contains the following basic outline:

Section	Contents
0	Table of Contents
1	Organizational Chart
2	Instrument List
3	Standard Operating Procedures List
4	Analytical Methods
5	MDLs, RLs, and CRDLs
6	Performance Evaluation Studies
7	Additional Operation-Specific Information

Acronyms and Initialisms

A2LA	American Associatio for Laboratory Accreditation
AA	Atomic Absorption
ANSI	American National Standards Institute
AR/COC	Analysis Request/Chain-of-Custody
ASQC	American Society for Quality Control
ASTM	American Society for Testing and Materials
BFB	Bromofluorobenzene
BLK	Blank
BOD	Biochemical Oxygen Demand
CCC	Calibration Check Compound
CEO	Chief Executive Officer
CF	Calibration Factor
CFR	Code of Federal Regulations
CHP	Chemical Hygiene Plan
CLP	Contract Laboratory Program
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act (Superfund)
COC	Chain-of-Custody
COD	Chemical Oxygen Demand
CRDL	Contract Required Detection Limit
CRQL	Contract Required Quantitation Limit
CSM	Customer Service Manager
CSRM	Certified Standard Reference Material
CST	Customer Service Team
CUR	Condition Upon Receipt
CV	Coefficient of Variation
CVAA	Cold Vapor Atomic Absorption (Spectroscopy)
DFTPP	Decafluorotriphenylphosphine
DOC	Dissolved Organic Carbon
DOE	Department of Energy
DOT	Department of Transportation
DQO	Data Quality Objective

Acronyms and Initialisms (continued)

EH&S	Environmental Health and Safety
EPA	(U. S.) Environmental Protection Agency
FAS	Field Analytical Services
FLAA	Flame Atomic Absorption (Spectroscopy)
FTIR	Fourier Transform Infrared (Spectrometry)
GC	Gas Chromatograph(y)
GC/MS	Gas Chromatography/Mass Spectrometry
GFAA	Graphite Furnace Atomic Absorption (Spectroscopy)
HDPE	High Density Polyethylene
HPLC	High Performance Liquid Chromatography
HRGC	High Resolution Gas Chromatography
HRMS	High Resolution Mass Spectrometry
ICAP	Inductively Coupled Argon Plasma (Spectroscopy)
ICAP/MS	Inductively Coupled Argon Plasma/Mass Spectrometry
ICS	Interference Check Sample
IDL	Instrument Detection Limit
IR	Infrared (Spectroscopy)
IS	Information Systems
IS	Internal Standard
ISO	International Organization for Standardization
IT	Information Technology
KRI	Key Result Indicator
LAN	Local Area Network
LCL	Lower Control Limit
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
LIMS	Laboratory Information Management System
LRGC	Low Resolution Gas Chromatography
LRMS	Low Resolution Mass Spectrometry
LWL	Lower Warning Limit
MBAS	Methylene Blue Active Substance

Acronyms and Initialisms (continued)

MDC	Minimum Detectable Concentration
MDL	Method Detection Limit
MS	Matrix Spike
MSA	Method of Standard Additions
MSD	Matrix Spike Duplicate
MSDS	Material Safety Data Sheet
NELAC	National Environmental Laboratory Accreditation Conference
NCM	Nonconformance Memo
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards Technology
NMOC	Non-Methane Organic Compounds
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
NRM	National Reference Material
PAH	Polynuclear Aromatic Hydrocarbons (or PNA)
PC	Personal Computer
PCB	Polychlorinated Biphenyls
PDS	Post Digestion Spike
PE	Performance Evaluation
PEM	Performance Evaluation Mixture
PM	Project Manager
PQL	Practical Quantitation Limit
PSRL	Project-Specific Reporting Limit
PUF	Polyurethane Foam
QA	Quality Assurance
QAMP	Quality Assurance Management Plan
QAPP	Quality Assurance Project Plan or Quality Assurance Program Plan
QAS	Quality Assurance Summary
QC	Quality Control
QMS	Quality Management System
QuantIMS	Quanterra® Laboratory Information Management System

1.0 Management Commitment and Organization

1.1 Vision Statement

Quanterra®'s vision is to be a world-class, profitable analytical services company providing high-value, compliant, innovative problem solutions and state-of-the-art products at a competitive price wherever they are required.

1.2 Statement of Management Commitment to Quality

Quanterra®'s management is committed to providing quality services that meet the requirements of our clients and satisfy applicable regulatory requirements. Management is dedicated to providing an environment that encourages the achievement of excellence, demands integrity in all aspects of its operations, and requires active participation of all associates and vendors in meeting its quality goals.

A comprehensive Quality Management System (QMS) has been developed to ensure that Quanterra®'s clients receive high-quality analytical and environmental services that are timely, reliable, and meet their intended purpose in a cost-effective manner. The QMS provides the organizational structure that ensures quality in its work processes, products, and services. The Quanterra® QMS is described in this Quanterra® Quality Assurance Management Plan (QAMP) and applies to all technical, business, and administrative functions at Quanterra®. The principles and practices described in this QAMP apply to all Quanterra® associates at every level and are fundamental to the services we provide and to the way we do business.

The Quanterra® QAMP provides the foundation for planning, implementing, and assessing the Quanterra® QMS. It is an overall statement of quality policy as well as a plan used to implement quality programs throughout the company. Each business function of the organization shall put in place plans, policies, and procedures that will meet the requirements of the QAMP. The QAMP provides guidance to Quanterra®'s associates in fulfilling their responsibilities and serves as a statement to clients, agencies, and associates of Quanterra®'s commitment to quality. The QAMP by definition documents the policies, elements of, procedures, objectives and commitment to accepted laboratory practices.

Implementation of the QAMP is the responsibility of all Quanterra® associates. Management at every level has the responsibility and authority to lead the

development and implementation of a structured management system that supports the quality programs. Management must ensure that the principles and practices of the quality program are followed and implemented at all levels.

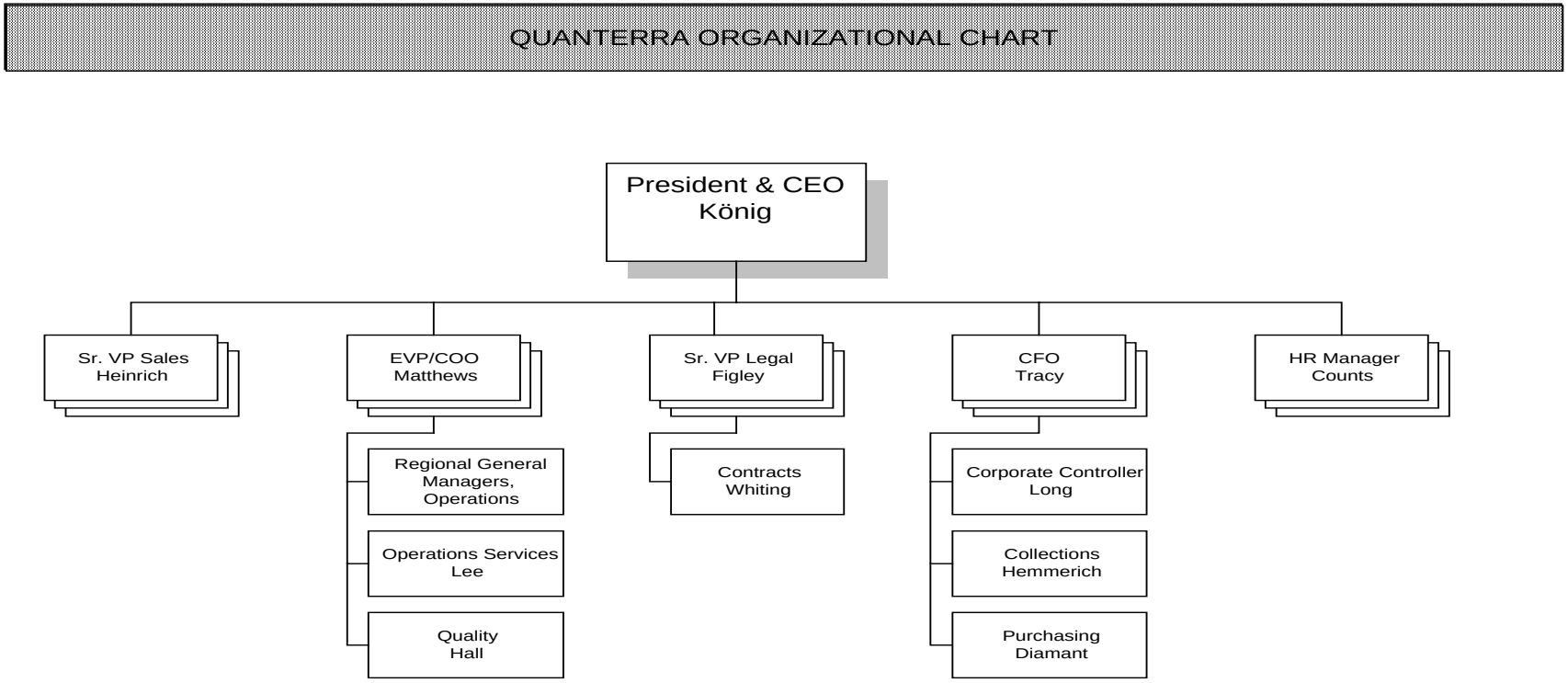
1.3 Organizational Structure and Relationships

Quanterra® is incorporated in the state of Delaware with corporate headquarters located in Englewood, Colorado. The organizational structure for Quanterra® is presented in Figure 1.3-1. Laboratory locations are given in the List of Appendices in the Table of Contents. A list of key corporate personnel and an organizational chart for Quanterra® operations including Corporate Quality Assurance are given in Appendix A. The organizational structure for each laboratory is presented in the Facility-Specific Appendix C. The responsibilities and authorities of the members of the organization, as they relate to quality management, are outlined in Section 1.4.

At some Quanterra® laboratories, positions identified in this section may not exist due to the laboratory size or other factors. In these cases, the responsibilities and authorities described here are assigned to other positions by the Laboratory Manager or next senior level of management as appropriate.

Each Quanterra® laboratory has day-to-day independent operational authority that is overseen by the various corporate functions (Senior Management, Health and Safety, Technology, Quality Assurance, Finance and Human Resources). The laboratory has, therefore, the operational staff supported by local management, namely, a QA manager, safety coordinator, technical manager, human resources, controller, reporting personnel and administrative support. This team is directed by the laboratory manager to meet daily workload commitments with a degree of autonomy. The team participates in the planning and execution of projects as defined in Section 7.0. These support functions have a level of responsibility to the Corporate level staff and management. Quality Assurance is an example of a function which is independent from the laboratory's day-to-day operations. Even though a key member on the laboratory team, the QAM has direct access to the Corporate Director of Quality Assurance (DQA) on all quality issues and their proper reporting. All QA candidate selection, hiring and disciplinary actions are approved by the Corporate DQA. This approach ensures independence of judgement and integrity without the influence of financial and scheduling pressures.

FIGURE 1.3-1



1.4 Quality Organization

The achievement of quality in all activities that pertain to their organizational/technical function is the responsibility of each Quanterra® associate. Quality-related responsibilities within the organization provide for the implementation of the QAMP and for completion of quality control (QC) activities. The following sections describe these activities for key Quanterra® positions. The quality-related responsibilities may be reassigned by assigning the activities among different individuals or enhanced by adding activities, but they must not be eliminated. If an operation does not have the titled position outlined below, the responsibilities under that position go to next upward position. The accountability is retained by the person delegating the activity or by the person assigned the activity by the next senior level of management.

1.4.1 President and Chief Executive Officer (CEO)

- Reports directly to the Board of Directors
- Responsible for overall corporate policy and strategy for quality
- Responsible for maintaining effective quality management
- Provides the resources to implement the Quanterra® QAMP.

1.4.2 Chief Operating Officer

- Reports directly to the President and CEO
- Approves the Quanterra® QAMP
- Responsible for implementation of an effective QMS
- Implements improvements in operations and quality programs
- Provides feedback regarding customer satisfaction.

1.4.3 Vice President of Operations Services

- Reports directly to the Chief Operating Officer
- Approves the Quanterra® QAMP and Quality Policy Documents
- Recommends improvements in operations and quality programs
- Oversees evaluation of new technology and required quality control

1.4.4 Corporate Director of Quality Assurance

- Reports directly to the Vice President of Operations Services and Chief Operating Officer on all quality issues
- Reviews and approves changes in laboratory quality assurance (QA) staff
- Maintains a strong line of communication to and provides guidance to the QA Managers

- Approves the Quanterra® QAMP, the Facility Appendices to the QAMP, Quality Policy Documents, and Corporate Standard Operating Procedures (SOP)
- Serves as a technical consultant and resource on quality issues to ensure uniform excellence in quality and regulatory analytical compliance at all Quanterra® operations
- Responsible for assessing, maintaining, and improving the Quanterra® QAMP implementation
- Supervises and provides guidance to corporate QA staff
- Suspends processing when significant quality requirements are not met
- Oversees independent systems and performance audits of Quanterra® laboratories to identify areas where improvement is needed to comply with the QAMP
- Responsible for reporting all matters of quality assurance to the President and senior management.
- Issues Corporate Quality Assurance Directives as required to clarify policy
- Duties completed by Assistant QA Director in absence of the Director

1.4.5 Assistant Quality Assurance (QA) Director

- Reports directly to the Corporate Director of Quality Assurance
- Serves as a back-up to the Corporate Director of Quality Assurance in their absence
- Completes special projects related to corporate QA issues

1.4.6 Quality Assurance (QA) Manager

- Reports directly to the Laboratory Manager and indirectly for all QA matters to the Corporate Director of Quality Assurance
- Approves the Facility-Specific Appendix to the Quanterra® QAMP
- Approves operation-specific SOPs
- Responsible for assessing and maintaining the QAMP implementation within the facility operations
- Responsible for ensuring and improving quality within facility operations
- Recommends resolutions for ongoing or recurrent nonconformances within the laboratory
- Supervises and provides guidance and training to laboratory QA staff
- Responsible for issuing “stop work orders” in analytical areas when significant quality requirements are not met

- Assists in maintaining regulatory analytical compliance
- Serves as the in-house client representative on all project inquiries involving data quality issues
- Monitors data quality measures via statistical methods to verify that the laboratory routinely meets stated quality goals
- Performs QA assessments
- Issues QA directives, policy or local QA SOPs to meet the Corporate requirements or to clarify such requirements for their facility.
- Tracks and closes external and internal findings of QA audits
- Reviews and approves corrective action plans for nonconformances, trends nonconformances to detect systematic problems, and initiates additional corrective actions as needed.
- Assists in the preparation of and approves Quality Assurance Project Plans (QAPPs)
- Serves as a QA officer for significant projects.
- Coordinates laboratory certification and accreditation programs
- Maintains controlled quality documents
- Prepares a monthly quality report to management
- Responsible for approving reference data and changes on LIMS.

1.4.7 Regional General Manager

- Reports directly to the Chief Operating Officer
- Responsible for implementing and adherence to the Quanterra® QAMP in their operating units and approves the QAMP Facility-Specific Appendices for those units.
- Assigns specific responsibilities within operational units to resolve quality-related problems within their region
- Maintains a dialogue with the Chief Operating Officer, regional QAMs and the Corporate Director of Quality Assurance
- Assesses the effectiveness of the Quanterra® QMS within their region.

1.4.8 Laboratory Manager

- Reports directly to the Regional General Manager
- Responsible for implementing and adherence to the Quanterra® QAMP and all corporate policies and procedures within the laboratory
- Approves the Facility-Specific Appendix to the Quanterra® QAMP and Facility-Specific SOPs
- Annually assesses the effectiveness of the QAMP within the operation

- Maintains adequate staffing documented on organization charts
- Responsible for implementing internal/external audit findings corrective actions

1.4.9 Operations Manager

- Reports directly to the Laboratory Manager
- In Operations where this positions does not exist, these responsibilities lie with Group (Area) Leader or Team Leader.
- Supervises daily activities of the Operational Groups
- Schedules analytical operations
- Supervises QC activities performed as a part of routine analytical operations
- Implements data review procedures
- Supervises the preparation and maintenance of laboratory records
- Supervises maintenance of instruments and scheduling of repairs
- Works with the Systems Manager and Group/Team Leaders to assure the requirements of projects are met in a timely manner
- Responsible for meeting quality requirements.

1.4.10 Laboratory Technical Manager

- Reports directly to Laboratory Manager
- Responsible for coordinating development of SOPs
- Performs technical training in area(s) of expertise
- Overall, responsible for a defined technical area(s) of the laboratory. In a small laboratory, these responsibilities may be shared with another position. Other laboratories may have one or more technical managers
- Interfaces with management on technical needs and solving day-to-day technical issues
- Determines qualification required for technical positions and evaluates job candidates against those requirements
- Investigates technical issues related to projects as directed by QA
- Evaluates new methods, technical proposals, and statements of work.
- Certifies the qualification of laboratory personnel.

1.4.11 Systems Manager

- Reports directly to the Laboratory Manager
- Supervises daily activities of the Project Management, and/or Sample Control, and/or Administrative, and/or Report Production Groups

- In some laboratories the CSM may have all or some of the responsibilities of the Systems Manager.

- Works with the Operations Manager and/or Group/Team Leaders to ensure the requirements of projects are met in a timely manner

- Responsible for meeting quality requirements.

1.4.12 Customer Service Managers (CSMs)

- Reports directly to the Laboratory Manager

- Defines customer requirements through project definition

- Assesses and assures customer satisfaction

- Provides feedback to management on changing customer needs

- Brings together resources necessary to ensure customer satisfaction.

1.4.13 Project Manager

- Monitors analytical and QA project requirements for a specified project

- Acts as a liaison between the client and the laboratory staff

- Prepares Quality Assurance Summary (QAS) or equivalent summary form and communicates project-specific requirements to all parties involved

- Assists the laboratory staff with interpretation of work plans, contracts, and QAPP requirements

- Reviews project data packages for completeness and compliance to client needs

- Keeps the laboratory and client informed of project status

- Together with the QA Manager, approves customer requested variances to methods and to standard laboratory protocols

- Monitors, reviews, and evaluates the progress and performance of projects

- Reports client inquiries involving data quality issues or data acceptability to the facility QA Manager and to the operations staff

- Conducts project reviews to assess the laboratory's performance in meeting customer requirements

- Prepares reissue requests for project data

- Responsible for meeting quality requirements.

1.4.14 Group (Area) Leader or Team Leader

- Reports directly to either the Systems Manager, or Operations Manager or Laboratory Manager depending on specific laboratory organization.

- Supervises daily activities of analyses within the group

- Supervises QC activities performed as a part of routine analytical operations
- Implements data review procedures
- Supervises the preparation and maintenance of laboratory records
- Evaluates instrument performance and supervises the calibration, preventive maintenance, and scheduling of repairs
- Oversees or performs review and approval of all analytical data
- Reports nonconformances to the appropriate managers
- Responsible for meeting quality requirements.

1.4.15 Analyst

- Performs analytical methods and data recording in accordance with documented procedures
- Performs and documents calibration and preventive maintenance
- Performs data processing and data review procedures
- Reports nonconformances to the Supervisor/Manager and QA Manager
- Ensures sample and data integrity by adhering to internal chain-of-custody procedures
- Responsible for meeting quality requirements.

1.4.16 Sample Custodian

- Ensures implementation of proper sample receipt procedures, including maintenance of chain-of-custody
- Reports anomalies associated with condition-upon-receipt of samples to the Project Manager
- Logs samples into the LIMS
- Ensures that all samples are stored in the proper environment
- Assists Environmental Health and Safety staff with sample disposal
- Responsible for meeting quality requirements.

1.4.17 Report Production Staff

- Accurately generates and compiles analytical reports and associated deliverables for delivery to the client
- Responsible for meeting quality requirements.

1.5 General Responsibilities

It is the responsibility of each Quanterra® associate to perform their job-related duties in compliance with all Quanterra® corporate and operation-specific SOPs and policies applicable to their position.

1.6 Waste, Fraud, and Abuse

Quanterra®, through its ethics policy (Corporate Policy Number LEG-001) and ethics training, and the Quanterra® Compliance Program (Corporate Policy Number LEG-009) requires and encourages all associates to report any activity that may be considered wasteful or fraudulent. Any incidents reported are subject to a complete investigation per Quanterra® Corporate Policy Number LEG-005, "Internal Investigation". Associates involved in such activities are subject to immediate dismissal.

Substance abuse is unacceptable behavior for Quanterra® associates and abuses are subject to Human Resources disciplinary policies. Prior to hiring, all Quanterra® associates undergo drug screening and are subject to random screening on an annual basis. The Quanterra® procedures on substance abuse meet the federal contracting guidelines.

2.0 Quality System and Description

Quanterra® has defined Quality as meeting the requirements of our clients, both internal and external. The QMS provides the structure to achieve the total quality management goals necessary to obtain world class standards of performance and quality in all areas.

2.1 Quality Management System

The purpose of the QMS is to ensure the quality of products and services. The QMS is a structured management system of principles, objectives, policies, responsibilities, and implementation plans at the organizational and project-specific levels. At the organizational level, the QMS provides the framework within which project-specific planning, implementation, and performance assessment may occur. The QAMP documents the QMS and describes both the organizational and project-specific principles, goals, controls, and tools of the QMS. The QMS is described in detail in this QAMP, Quality Policy Documents, and SOPs.

The QMS steering committee is comprised of the Quanterra® President and CEO and his staff. This committee establishes the Quanterra® Vision and its strategic plan and provides leadership and support for the achievement of all quality goals and objectives. It is the responsibility of all Quanterra® directors and managers to implement the QMS elements by setting goals and objectives which lead to the achievement of the Quanterra® Vision.

2.2 Quality Assurance

Quality Assurance (QA) is defined as a system of activities which ensures a process, product, or service that meets the needs and expectations of the customer. QA is an integral part of Quanterra® 's QMS.

The organizational and project-specific systems of the Quanterra® QMS, discussed in Section 2.1, are used to define QA goals. Controls at the organizational level regulate activities that support common or standardized functions such as associate qualifications and training, document control, and material procurement. Controls at the project level regulate the definition and implementation of customer requirements to produce the desired type and quality of product. Some specific examples of quality controls are:

- Measuring lab and instrument performance on a daily basis to ensure that the measurement systems are in statistical control
- Demonstrating lab capability through data quality assessments which document the

overall qualification of the laboratory to perform environmental analyses

- Utilizing SOPs to ensure uniformity and compliance in the measurement process
- Providing controlled flexibility in routine methodology to meet project-specific sample and data requirements
- Monitoring operational performance of the laboratory on a routine basis and providing corrective action if needed
- Recognizing and promptly correcting any factors which adversely affect quality
- Maintaining complete records of sample receipt, laboratory analysis, data evaluation and reporting, and sample disposal.

2.3 Quality Documents

The QMS is defined by a series of documents which are described in Sections 2.3.1 through 2.3.5. The review and control of these documents are described in Section 5.0.

Following is a list of documents used to develop Quanterra®'s QAMP. The requirements of several of these documents are cross-referenced with the content of the QAMP in Table 2.3-1. A cross-reference of the QAMP and Quanterra® documents to NELAC Quality Systems Standards is presented in Table 2.3-2.

- Draft Interim Final EPA Requirements for Quality Management Plans, U.S. Environmental Protection Agency, EPA QA/R-2, August 1994
- EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5 Final, August 1997
- Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs, American Society for Quality Control, Energy and Environmental Quality Division, Environmental Issues Group, ANSI/ASQC E4-1994 (Formerly EQA-1), January 1994
- Quality Assurance Program Requirements for Nuclear Facilities, The American Society of Mechanical Engineers, ASME NQA-1-1989 edition
- Quality Assurance, Office of Nuclear Energy & Office of Environment, Safety, and Health, United States Department of Energy, DOE ORDER 5700.6C, August 1991
- Title 10 Code of Federal Regulations, Part 830.120 Quality Assurance Requirements
- Implementation Guide for Use with Independent and Management Assessment Requirements of 10CFR, Part 830.120 and DOE 5700.67, DOE G414.1-1, August, 1996
- Implementation Guide for Use with 10CFR, Part 830.120, Quality Assurance, 6830 - Rev. 0, April 15, 1994
- Performance Criteria for Radiobioassay, ANSI N 13.30, September 1989

- Measurement Quality Assurance for Radioassay Laboratories, ANSI N 42.2, Revised May 21, 1992, Revision 10A

- Quality Management and Quality System Elements for Laboratories - Guidelines, American National Standard, American Society for Quality Control, ANSI/ASQC Q2-1991

- International Standard ISO/IEC Guide 25-1990

- Interim Standard National Environmental Laboratory Accreditation Conference Draft Standards January 12, 1998 and Standards dated July 2, 1998

2.3.1 Quality Assurance Management Plan

This Quanterra® Quality Assurance Management Plan (QAMP), along with Quality Policy Documents and SOPs, provides the criteria and specifications for the generation of environmental analytical data. The QAMP provides QC criteria for standard procedures and facility-specific instrumentation as well as method detection limit (MDL) information.

2.3.2 Quality Policy Documents

Quality Policy Documents provide further detail to the QAMP. They describe the requirements for a specific program on a corporate-wide level. Quality Policy Documents use the concepts and requirements contained in the QAMP and provide sufficient detail so that corporate or facility-specific SOPs can be developed.

2.3.3 Standard Operating Procedures

Standard Operating Procedures (SOPs) describe step-by-step instructions for performing a method or activity. In addition, there are SOPs which relate to other support services performed in the company. In general, SOPs will be corporate or operation specific. Corporate SOPs specify procedures that are standard across Quanterra®. Operation-specific SOPs detail procedures that pertain to a specific facility operation only. SOPs specify procedures, methods, corrective action requirements, documentation, review, and verification requirements. SOP format and document control are described in Quanterra® Policy Number QA-001, "Standard Operating Procedures." SOPs that are performed by each Quanterra® operating unit are listed in Section 3 of the Facility Appendix to this QAMP. SOPs are living documents and may supersede some requirements in this document until the QAMP update every two years.

2.3.4 Quality Assurance Project or Program Plans (QAPPs)

Regulations and contracts may contain QA requirements which are different from

Quanterra® 's QAMP. To address unique or project requirements, Quality Assurance Project Plans (QAPP) may be prepared and implemented. The requirements documented in a QAPP take precedence over the Quanterra® QAMP for that project.

Similarly, some regulatory programs such as Florida Department of Environmental Protection (FDEP) and Florida Department of Health (FDH) require QA Plans specific to their program. The FDEP and FDH require that each laboratory certified in the state submit and maintain a Comprehensive QA Plan. Many state certifying agencies have reciprocal certification agreements with Florida. In these situations, the QA Plan submitted for regulatory programs takes precedence over the Quanterra® QAMP.

If requested and approved by the client, project-specific requirements may be less stringent than the Quanterra® quality program. Typical specifications contained in a QAPP or documentation include:

- New or modified testing methods
- Unique QC logic
- Special requirements for equipment use and maintenance
- Special handling due to safety considerations
- Project-specific detection and reporting limits
- Project-specific accuracy and precision limits or the statistical treatment of data
- Additional or unique documentation or records management requirements.

2.3.4.1 Quality Assurance Summary

Quality Assurance Summaries (QAS) or equivalent are used to distill client-specific requirements typically documented in project QA plans onto a concise format. The summary describes for each project the required quality control samples, batching schemes, flagging conventions, deliverables, or other special client requests that may differ from routine laboratory operations. The QAS or equivalent is disseminated to laboratory operations by the Project Manager to document client-specific requirements. The QAS may be used alone or in conjunction with the project-specific QA plans.

2.3.5 Other Documents

Other documents which can affect the quality program may include the Chemical Hygiene Plan (CHP), the Quanterra® Compliance Program , memos, guidance documents, work instructions, and periodic management assessment reports. These documents may further define or guide the implementation of quality standards at Quanterra® but shall not conflict with the QAMP or diminish the effectiveness of the QMS.

3.0 Associate Qualification and Training

All activities performed by Quanterra® shall be accomplished by qualified associates. The following definitions are relevant to the discussion of associate qualification and training presented in this section:

- Qualification - The characteristics or abilities gained through education, training, or experience that enable an individual to perform a required task.
- Orientation - The act or process of acquainting individuals with an existing situation, environment, or condition.
- Training - In-depth instruction to develop proficiency in the application of requirements, methods, and procedures. Instruction may be internal or external classroom sessions, courses, or on-the-job training.

Employee orientation and training must be performed in compliance with Quanterra® Corporate SOP Number CORP-QA-0013, "Employee Orientation and Training".

3.1 Associate Qualifications

Each operating unit shall have job descriptions for all positions. These job descriptions must specify the minimum qualifications for education and experience, knowledge, and skills which are necessary to perform at a satisfactory level. An associate's performance shall be compared with the requirements of his/her job description at least annually, in conjunction with the associate's annual performance review. Due to their length and detailed nature, job descriptions for all employees are provided in a separate Human Resource (HR) Manual available at each laboratory.

Quanterra® expects the necessary knowledge, experience, and skills to be demonstrated by formal academic training. Qualifications of professional associates shall be documented by resumes which include academic credentials, employment history, experience, and professional registrations. A copy of the resume will be placed in the associate's training file or may be maintained in electronic format.

3.2 Orientation and Technical Training of Laboratory Staff

Associates receive internal, external, formal, and informal training. Training is performed to maintain and develop proficiency, and to promote improvement. Training is performed by individuals knowledgeable in the subject matter.

Quanterra® associates are qualified based on the experience and training documented in

the individual's training file, and are assigned duties within their experience and training. Each new associate shall receive orientation and training in quality and health and safety. Each new associate shall be supervised in their assigned duties by their supervisor or designee. The authorization to perform independently shall be documented in the training files and must be approved by the Technical Manager or designee. In addition, training for associates may include professional, managerial, communication, and interpersonal skills as appropriate. On-going or periodic assessments will be performed to determine training needs and effectiveness of instruction.

3.2.1 Quality Orientation

Each newly hired Quanterra® associate receives a Quality orientation. The QA Manager or designee shall conduct this orientation within two weeks of the associate's report-to-work date. This orientation will be documented in the associate's training file. The QA Manager shall review the following topics (at a minimum) with the new associate as they apply to individual's assigned responsibilities:

- Quanterra® Quality Policy and applicable documents including the Quanterra® QAMP
- Quanterra® policies on ensuring data integrity, meeting client requirements, and ethics
- Identification and documentation of nonconformance and corrective action procedures
- Proper data recording practices
- Key elements of Quanterra® Quality Control Program Policy (No. QA-003).

The QA orientation or on-going training shall be documented using a written exam, a checklist, or a preprinted form. This documentation is required to demonstrate an understanding of the Quality orientation and to determine if any areas covered require further training.

3.2.2 Quality Training

Continued training in the mission and goals of the QAMP shall be provided at least once per year. Formal training sessions are conducted and documented by the QA Manager or designee. The training program shall address relevant regulatory requirements, basic QC practices, responsibilities of the technical and QA staff, and the reporting of nonconformances.

In addition, each Quanterra® associate shall become familiar with the operating unit's quality programs by reading the relevant

sections of the Quanterra® QAMP, policies, and SOPs pertinent to his/her position.

3.2.3 Health and Safety Orientation and Training

Each newly hired Quanterra® associate, contract worker, or working visitor is required to go through health and safety orientation and training as per the laboratory Chemical Hygiene Plan (CHP). The orientation must be performed as soon as possible after the associate's report-to-work date and before chemicals are handled. Quanterra® associates and contract workers shall be given comprehensive health and safety training within ninety days of the start-to-work date. Documentation is maintained in the associate's training file. A detailed description of this training is also provided in the CHP.

3.2.4 QA Manager Training

All QA Managers shall receive training so that they are proficient in the requirements of the Quanterra® QAMP. Continued proficiency of QA Managers shall be maintained through active participation in QA audits and the preparation and review of QA documents.

3.3 Training Files

Each active Quanterra® associate has an individual training file maintained by the QA Manager or designee. The types of training documents included in the training file are as follows:

- Associate's resume (if not maintained electronically)
- Quality assurance and quality control
- Health and Safety
- Technical proficiency
- Professional Development
- Regulatory/Compliance.

Information is filed in the training file as training is received. Not all associates will have training records for all areas depending upon their job function or tenure with the company.

3.3.1 Associate Resumes

A copy of the associate's current resume will be placed in the associate's training file or maintained in electronic format. Qualifications of associates, as documented on resumes, include academic credentials, employment history, experience, and professional memberships and registrations.

3.3.2 Individual Training Records for the Areas of Quality, Health and Safety, and Technical Proficiency Monitoring

Training of each associate shall be summarized and documented on training

forms or in a data base. These include documentation of participation in training, one-on-one training, on-the-job training initial and ongoing proficiency, or participation in classes and other presentations, and any other formal training sessions, either internal or external. Examples of some of the forms used to document this training are provided in the Corporate SOP, "Employee Orientation and Training", SOP Number CORP-QA-0013. Initial or ongoing technical proficiency training records shall include documentation of the ability to perform sample preparation or analysis using internally prepared laboratory control samples and/or externally available blind standard reference materials per the most current version of the method or SOP. For further details on initial or ongoing technical training refer to "Employee Orientation and Training", SOP Number CORP-QA-0013. In addition, if any tests are given as part of the training in each of these areas, the results are filed in the individual's training file. Technical proficiency of analysts must be approved by the Technical Manager or designee.

3.3.3 Training Records for Professional Development

This category includes documentation of all courses taken relating to an individual's professional development. Examples of courses include Conflict Resolution, Management/Supervision, Time Management, Conducting Effective Meetings, and Interviewing Skills.

3.3.4 Training Records for Regulatory/Compliance Information

This category provides for documentation of training on topics required by law (with the exception of safety documented previously). Examples of this category are Sexual Harassment, Drug-Free Workplace, and Quanterra® ethics.

4.0 Procurement of Items and Services

This section defines the Quanterra® requirements for the procurement of items and services. Controlling the quality of items and services procured by Quanterra® will help us meet the needs of our customers. The Quanterra® procurement program requires:

- Assurance that purchased items and services meet Quanterra®-established requirements and perform as expected
- Definitions and descriptions of the documentation levels required for the applicable technical and administrative requirements
- Evaluation and qualification of vendors.

4.1 Selection of Vendors

Prospective vendors are selected based upon criteria appropriate to the materials or services provided. For national vendors and contracts, the vendor is selected by the Corporate Director of Contracts through either a competitive proposal/bid process, strategic business alliance or negotiated vendor partnership. Potential vendors are required to complete a vendor acceptance application and are evaluated on the following criteria as appropriate:

- The vendor's history of providing identical or similar products that perform satisfactorily in actual use
- The vendor's service record and ability to provide a complete product line and commensurate service
- The vendor's ability to administer inventory at Quanterra® facilities through a fully developed inventory management system that will ensure correct stocking levels as well as shelf-life tracking
- Software systems that will integrate with Quanterra® systems
- Objective evaluation of the vendor's current quality records supported by documentation
- Ability of the vendor to provide service agreements for instruments that meet Quanterra® specifications
- Evaluation of the vendor's business strategy and the ability of that strategy to complement Quanterra®'s quality program
- Results of audits by Quanterra® of the vendor's technical and quality capability.

A Quanterra® quality representative shall determine the appropriate level of evaluation criteria for the item or service being purchased. Vendors that provide test and measuring equipment, solvents, standards, instrument-related service contracts, or subcontracted laboratory services shall be subject to more rigorous controls than vendors that provide off-the-shelf items. For the procurement of testing and measuring equipment it is recognized that

the environment in which the measurement system is placed may have a bearing on its performance. Therefore, in lieu of other supplier qualification activities, the quality representative shall ensure that an acceptance testing plan is in place to ensure that the measurement system is able to meet specifications in the intended operating environment.

4.2 Procurement of Quality-Related Items

The quality of instruments, equipment, standards, reagents, solvents, other chemicals, gases, water, and laboratory containers used in analyses must be known so that their effect upon analytical results can be defined. Quality-related items (QRIs) are items that are used in the operational unit that must meet a minimum quality requirement. All QRIs purchased by Quanterra® operating units shall be evaluated to ensure that they meet the requirements and specifications established by Quanterra®. These requirements and specifications include, but are not limited to, client contracts, project-specific QA requirements, data quality objectives (DQOs) and analytical method requirements, and defined technical specifications.

Quality specifications shall be included or referenced in the purchasing documents for the procurement of the applicable items. Reference to an approved model, lot number or chemical grade is sufficient. If items which may affect laboratory quality are requested from non-preapproved vendors, quality approval must be obtained prior to placing the order.

When ordering QRIs, a system shall be put in place to verify the quality of the item received. Each laboratory shall assign individuals responsible for material procurement and control. Duties include:

- Specifying, in purchase orders or requisitions, suitable grades of materials (grade shall be defined by the responsible manager and detailed in SOPs)
- Verifying upon receipt that materials meet requirements (see section 4.2.3) and that, as applicable, material certificates are provided and maintained
- Identifying and storing materials
- Verifying that material storage is properly maintained, and removing materials from use when shelf life has expired.

4.2.1 Role of Corporate Director of Contracts

The Corporate Director of Contracts supports the laboratory by:

- Maintaining, issuing, and negotiating contracts
- Identifying potential vendors and subcontractors
- Identifying vendors for unique or scarce materials

- Preparing and communicating corporate policies regarding purchasing and procurement
- Developing and implementing with QA a review of the purchasing program as it pertains to procurement of QRIs.

In order to enhance the quality and consistency of the product within the laboratory network, the Director of Contracts shall pursue national contracts for laboratory supplies, standards, and instruments of known quality and proven reliability.

4.2.2 Role of Quanterra® Purchasing

Quanterra® Purchasing supports the laboratory by:

- Identifying vendors for unique or scarce materials
- Maintaining a system to facilitate purchases made by each facility
- Maintaining lists of available items through catalogs or contract agreements with approved vendors
- Preparing and communicating corporate policies regarding purchasing and procurement.

4.2.3 Procurement Procedures

The specifications for standards, chemical reagents, solvents, gases, water, and other QRIs shall be documented in SOPs. In addition, each laboratory must have SOPs that cover the following:

- Checking purity of standards, reagents, reagent grade water, and other chemicals as appropriate versus intended use
- Preparation, storage and expiration of standards, reagents, and other chemicals as appropriate
- Requirements for lab containers (e.g., volumetric glassware).

Corporate SOPs will be developed for these processes where appropriate. Operation-specific SOPs shall be in place if a corporate SOP does not exist.

Corrective actions for failure of an item to meet required specifications are as follows:

- Review current supplies and eliminate from use; this must include communication to the Quanterra® laboratory network and corporate purchasing to avoid additional problems in other facilities
- Return to vendor
- Evaluate a new lot or alternate supplier
- Evaluate the impact on product or process.

The Corporate Director of Purchasing or the Corporate Director of Quality Assurance shall be notified promptly of any quality problems with national vendors.

4.2.4 Evaluation of QRIs

Most QRIs will be evaluated as a function of the standard analytical process. This involves the analysis of method blanks, as well as other QC samples as described in Section 8.0. For some QRIs, small variability in the item may significantly affect analytical results. For these QRIs the analysis and evaluation must take place prior to using the item. The Corporate SOP CORP-QA-0001; "Quality Testing of Solvents, Acids, and Reagents (QRI Program)"; documents the testing procedures and acceptance criteria. A list of QRIs that require testing prior to use is listed in Table 4.2-1. If any QRI is determined during routine use to be the source of quality problems, or has demonstrated variability that affects analytical results, the QRI may be added to the list in Table 4.2-1. Facility QA Managers must forward such requests to the Corporate Director of Quality Assurance, the Director of Purchasing, and Corporate Technology.

For items that are used regularly by Quanterra® facilities where no unique requirements or specifications are required, the items may be purchased off-the-shelf. These items are ordered from the supplier on the basis of specifications set forth in the supplier's published product description. Off-the-shelf items include general laboratory supplies such as glassware, filter paper, pipettes, and chromatography columns. These items are evaluated as a function of the standard analytical process. An off-the-shelf item can be added to the list in Table 4-2.1 when it is determined that evaluation prior to use is required. Requests to add items to this list are made to the facility QA Manager.

Evaluation of instruments purchased shall be conducted according to the acceptance testing plan as established in the procurement documents. Acceptance criteria may include instrument reliability, sensitivity, stability, accuracy, and ability to interface with existing computer systems and networks.

4.2.5 Special Requirements for Standard Reference Materials

For all standard reference materials (SRMs), Quanterra® will use materials of known quality for the intended use. Where available, SRMs will be traceable to the National Institute of Standards Technology (NIST), the American Association for Laboratory Accreditation (A2LA), or to an equivalent source. If the traceability is not commercially accessible, the best available standard for the material or isotope shall be used. Certificates for Certified Standard Reference Materials (CSRMs) shall be procured from the supplier. Documentation received with each standard shall include the following information as appropriate:

- Traceability to an approved source (where available) or other certificate of analysis
- Radionuclide identification with activity and error
- Reference Material Certificate
- Certification Report that will include pertinent information such as:
    - Starting material characteristics including purity and traceability
    - Expiration date
    - Lot number
    - Preparation date
    - Methods of measurement and associated uncertainty
    - Actual weights and measurements determined by gravimetric or volumetric measurement
    - Unique identifying number
    - Formula weight
    - Density
    - Half-life of radionuclide(s)
    - Mass and volume of standards
    - Percent of impurities

Receipt, storage, evaluation, use, control, and disposal of all standards as well as documentation of these activities are described in operation-specific SOPs. Additional discussion of standards can be found in section 8.5.4.

4.3 Procurement of Subcontract Laboratory Services

A subcontract laboratory is defined, for the purposes of this QAMP, as a laboratory external to the Quanterra® laboratory network. However, for certain federal programs, a branch location of the Quanterra® laboratory network may also be defined as a subcontractor and require client and agency approval prior to use on a project. If required, Quanterra® will meet those requirements. A subcontracted laboratory will be used only in the event that any of the Quanterra® laboratories do not have the capability or capacity to perform the requested testing, or as directed by the customer. A subcontracted laboratory shall be used only after approval is obtained from the client and the quality of the laboratory is determined to be acceptable according to Quanterra® Corporate SOP Number CORP-QA-0012, “Selection and Evaluation of Subcontractor Laboratories”. Once these conditions are met, the subcontract laboratory will be added to an approved subcontractor list maintained in a database.

Subcontracted laboratories may be removed from approved status on the basis of a failure to perform adequately, as a result of audit findings, nationally recognized or other performance evaluation sample results, or at the request of the

Corporate Director of Quality Assurance. The QA staff are responsible for evaluating, approving, and recommending subcontractors. The Project Manager of the primary laboratory is responsible for identifying and initiating prequalification of the subcontract laboratory and managing the subcontractor throughout project implementation.

4.4 Vendor Partnerships

Quanterra® may enter into partnership agreements with vendors under the auspices of the technology organization. The purpose of these vendor partnerships is to standardize instruments, data handling systems, and other products or services which enable or enhance our ability to meet or exceed the requirements of our clients. Vendor partnership agreements must meet the requirements in Section 4.1.

5.0 Documentation and Record Keeping System

5.1 Quality Documents and Records

Quality documents are those which define the objectives, policies, and procedures that ensure the quality of items and services provided by Quanterra®. A system has been designed to revise, distribute, and control quality documents. Quanterra® quality documents are listed in Table 5.1-1 along with their approval requirements.

Records are documents that provide objective evidence of the performance of an item or process. Records are further discussed in Sections 5.5 through 5.7.

5.2 Document Review and Revision

Quality documents have multiple levels of review and approval appropriate for the document. These reviews are demonstrated by the signature of the reviewer on the document. Quality documents are required to be periodically reviewed and, if necessary, revised. The frequency of this review is dependent upon the type of document and regulatory and client requirements. Table 5.2-1 lists the Quanterra® quality documents along with their required frequency of review and the individuals responsible for performing those reviews. In addition to periodic review and revision, quality documents must be revised when the activity, policy, or procedure they describe changes in a significant manner. All changes shall be subject to the same review and approval process. Amendments included in documents shall be clearly marked.

5.3 Document Control and Distribution

Document control is necessary to ensure that:

- the system produces unequivocal, accurate records which document all laboratory activities
- associates have access to current policies and procedures located in or near the area in which work is performed at all times
- only current, authorized versions of policies and procedures are used
- obsolete documents are archived in a manner that allows easy retrieval
- the history of use for particular versions of documents can be reconstructed.

Quality documents that are placed under a controlled distribution include, but are not limited to this QAMP, Quality Policy Documents, and SOPs. Format and control of SOPs are described in Quanterra® Policy Number QA-001, "Standard Operating Procedures." QAPPs are also placed under a

controlled distribution when that document is entirely generated by Quanterra®. These documents shall clearly indicate the effective date of the document and the revision number.

Quality documents are controlled by initially distributing them to the associates who need to be aware of or follow the contained information or procedures. All subsequent revisions or updates to the document are also distributed to the associate. The controlled copy distribution list is maintained with the name of each associate who received a copy along with their controlled copy number. Subsequent revisions or updates to the documents are also controlled and issued based on the distribution list. Obsolete versions of documents are removed from service when new revisions are issued. Further details of responsibilities and systems used for document control are described in facility-specific SOPs. Records of controlled distribution are maintained by Quanterra® and demonstrate that current policies and procedures have been issued to all appropriate personnel.

Controlled documents are marked "Controlled Copy" and are numbered according to the controlled copy distribution list or file. Copies of documents placed under controlled distribution are sometimes released as uncontrolled with the understanding that no further updates or revisions of that document will be issued to that individual document holder. Quality documents are considered proprietary to Quanterra®, but may be issued to outside parties when approved by QA. These are normally issued as uncontrolled copies. Those copies are marked "Uncontrolled" and are not assigned a control number. Uncontrolled copies can also be issued to lab personnel for review prior to implementation. Uncontrolled copies of documents cannot be used to perform work in the laboratory because no updates or revisions will be provided for those copies, and they are not retrieved when new versions are released.

5.4 Effective Dates and Document History

The effective date of any quality document, except the QAMP, is the laboratory designated implementation date, the date when controlled copies are distributed and the document is first put into use at a given Quanterra® facility. The implementation date is indicated on the title page of the document. The QAMP implementation date is 60 days after the revision date. Prior to this date, all required reviews of the document are complete; training is completed for personnel who will be using the document; and resources needed to perform the functions described in

the document are in place. The document control systems must include a master list or file that identifies the current revision status of quality documents and records the effective date for each update and version of the documents so that the history of use for each at the facility can be demonstrated.

5.5 Records Management

Information for each business function of the organization is stored appropriately according to its type of information. The record keeping system is intended to allow historical reconstruction of all laboratory activities that produce the resultant analytical data whether manual or computerized. All records, certificates, and project reports shall be safely stored as electronic or hardcopy, held secure, and in confidence for the client. Details of the records management program are contained in the Quanterra® Record Retention Policy No. LEG-004 and supporting documents.

Quanterra® is committed to providing scientifically sound, legally defensible data of known and documentable quality. Legally defensible data are referred to as data which will stand against reasonable adversarial inquiry in the courts-of-law. Data must be supported by a QAPP, client agreements, contractual documents, or the Quanterra® QAMP. Data must also be documented so that the analytical process can be reconstructed.

Project files must be organized so that the project events can be reconstructed if necessary. Accountability for the completeness and accuracy of information must be specified. Supporting information, including data that demonstrates a facility's ability to perform specific analyses, shall be properly maintained.

Records are divided into two distinct types, Quality and Project Records, which are discussed in the following sections. Each laboratory shall have a system in place that provides for appropriate and adequate implementation of these records management requirements.

5.5.1 Quality Records

Quality records demonstrate overall laboratory operation. Examples of quality records include the following:

- Instrument logbooks
- Equipment monitoring records
- Calibration records
- Instrument calibration data
- Maintenance log books
- QC sample data
- Standard preparation logbooks

- Standard certificates
- Standard operating procedures
- Internal and external PE sample results
- Laboratory licenses and accreditations
- Quality reports to management
- Internal and external audit reports
- Nonconformance memos
- Training records.

These records may apply to one or more projects, but in general they are applicable to many projects. Quality records must be properly maintained in the facility files.

5.5.2 Project Records

Project records are documents which are specific to a project or a group of samples within an on-going project. Examples of project records are as follows:

- Chain-of-custody forms
- Raw analytical data
- Final data reports with case narrative and cover letter
- QC and calibration results
- Project-specific nonconformance memos
- Project correspondence including phone logs
- Quotes and Contracts where applicable
- Project-specific QAPPs and SOPs.

Project records shall be properly maintained.

5.5.3 Electronic Data

Where computers or automated equipment are used for capturing, processing, recording, reporting, storage or retrieval of analytical data, the Quanterra's® record handling system is designed to ensure that:

- The requirements in the EPA Good Automated Laboratory Practices (GALP), as expressed in our SOPs are followed
- Computer software is documented and adequate for use
- Procedures are established and implemented for protecting the integrity of electronic media data in terms of data entry or capture, data storage, data transmission, and data processing
- Computers and automated equipment are maintained to ensure proper functioning and the environmental and operating conditions necessary to maintain the integrity of calibration and analytical data
- Security of data, including the prevention of unauthorized access and modification of computer data, is maintained.

Further discussion of control of computer hardware and software is given in the following chapter.

5.6 Storage, Retention and Disposal of Records

When records, as contained in files, are transferred to a records storage area or off-site storage area, they shall be placed in suitable containers and an inventory sheet (hard copy or electronic) prepared by the person submitting the records. The contents of each container will be compared to the inventory sheet and labeled. If there are any discrepancies, the container and inventory sheet shall be returned to the supervisor or Group/Team Leader submitting the records for resolution. In accordance with NELAC requirements, Quanterra® will store all quality records and quality documents, as defined in this Chapter, for a period of five years. Other records and documents will be maintained and disposed of according to Quanterra® Policy Number LEG-004, "Record Retention." All information necessary for the historical reconstruction of data must be retained by the lab. Records which are only stored on electronic media must be supported by the hardware necessary for their retrieval.

5.7 Data Confidentiality

Quanterra® considers the data and associated information for a project to be confidential and the property of the client. In order to preserve client confidentiality, reports and supporting records are only released to third party persons or organizations after consultation with the client and laboratory management. If however directed by courts-of-law or other competent authorities, such as regulatory agencies, Quanterra® will provide required records and notify its clients and provide information as to the identification of the requester and the records that will be released.

The audit reports supplied by federal, state, and local regulatory agencies are public information and can be released without written consent of those agencies. However, specific project audits are confidential and must be approved by the client before releasing them to a third party.

Regardless of confidentiality clauses contained in contractual documents, no information or records are released without first obtaining written approval from the client.

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6.0 Computer Hardware And Software

The purpose of defining controls for computer hardware and software is to protect the integrity of computer-resident data. SOPs shall be put in place to ensure that computer-resident data and programs are accurate, controlled, and secure. The required SOPs and their scope will be presented in the Quanterra® Software Quality Assurance Plan.

Quanterra®'s commitment to meeting good automated laboratory practices is presented in the Quanterra® Corporate Policy Number CORP-IT-013, Software Quality Assurance.

6.1 Use of Hardware

Computer hardware used in the generation, measurement, or assessment of client data shall be of appropriate design and of adequate capacity to function according to specifications. Computer hardware shall be suitably located for operation, inspection, cleaning, and maintenance. The computer shall be installed in accordance with the manufacturer's recommendations. Any changes to the equipment shall be approved by the laboratory Information Technology (IT) representative.

6.2 Security

Procedures shall be in place to insure the integrity of client data. These may include both physical and logical protection and will ensure that access is limited to authorized persons.

Data files will have backup copies made at regular intervals to protect data against accidental loss through a hardware or software failure.

6.3 Use of Software

If computer software is used to acquire, process, or report client data, that software will be tested to ensure that it correctly performs its intended function. Software may be validated or verified, depending upon its complexity, size, and whether it was purchased or developed by Quanterra®. The following definitions are used by Quanterra®:

- Validation - the process of establishing documented evidence which provides a high degree of assurance that a specific process will consistently produce a product meeting predetermined specifications and quality attributes. This process demonstrates and documents that the software performs correctly and meets all specified requirements.

- Verification - the process of checking the accuracy of automatically (electronically) calculated information.

6.3.1 Industry Standard Software

Industry standard software programs are defined as those which are purchased and widely used without modification to the program itself. The program is initially verified for use by using test problems with known solutions to demonstrate that the program is operational for the desired application.

All purchased software must be used in accordance with the terms of its software license. Any use of software contrary to its license terms is expressly prohibited by Quanterra®.

6.3.2 Quanterra®-Developed Software

For programs used to process client data and developed within Quanterra®, and externally prepared programs which are modified by Quanterra®, validation or verification must be performed. The process used is dependent upon the function of the software as follows:

- Large complex systems consisting of several programs operating in unison to produce an intended result must be validated.

- For smaller software which only performs numerical manipulation, sample sets of numbers for which results are known should be processed and the results verified. In this case, known results are usually generated by performing hand calculations using the same equations and procedures as the software to verify that the software produces identical results.

- Software which performs as part of instrument operation should be verified as previously described and by processing reference materials through the instrument system. Processed instrument response should be evaluated against expected instrument response and performance.

6.3.3 Control of Software Changes

Changes to software used for processing client data shall be controlled and documented according to the procedures presented in the Quanterra® Corporate Policy Number CORP-IT-013, Software Quality Assurance.

6.3.4 Software Revalidation

Whenever a program is changed, the change will be evaluated to determine if revalidation is necessary. If the software has had features added, previous test problems should be rerun to demonstrate that their function has not been affected. New test problems should be processed, as previously discussed, to verify added performance. If software revision changes the basic operation of the program, complete revalidation of the program may be required.

Spreadsheets and unprotected software used to acquire, process, or report client data must be

documented and reverified when changes are made. The test problems used to provide initial verification shall be reprocessed and the results compared to demonstrate that performance of the software is unchanged.

Laboratory operations is responsible for the generation of the validation and verification data for instrument level software. QA will maintain the necessary documentation. Corporate Information Technology is responsible for generation and maintenance of documentation relating to verification and validation of the Quanterra® LIMS system. This is described in the Quanterra® Corporate Policy Number CORP-IT-013, Software Quality Assurance.

6.4 Documentation

Documentation shall be established for system development, change control, validation, verification, and security. Documentation will be retained according to the Quanterra® Records Retention Policy No. LEG-004.

6.5 Computer Viruses

Quanterra® shall employ the use of anti-virus software to detect and remove viruses from software.

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7.0 Planning

The generation of environmental analytical data is an intricate process. Success is dependent upon the timely execution of interrelated steps, many of which may be project-specific. Quanterra® has an organizational system in place to ensure that all projects are properly planned prior to project initiation, and are monitored for conformance to project requirements during the course of the project. This system ensures that Quanterra®'s clients receive quality deliverables, as well as quality service.

Quanterra® communicates with its clients to identify the client's needs. Project Managers (PMs) work together with Customer Service Managers (CSMs), or designee, to assess and coordinate Quanterra®'s resources. Each client is assigned a single point of contact, usually a PM, to ensure that there is a strong line of communication between the client and Quanterra®. Projects receive technical and QA support at the laboratory or corporate level as needed to ensure that project DQOs are achievable.

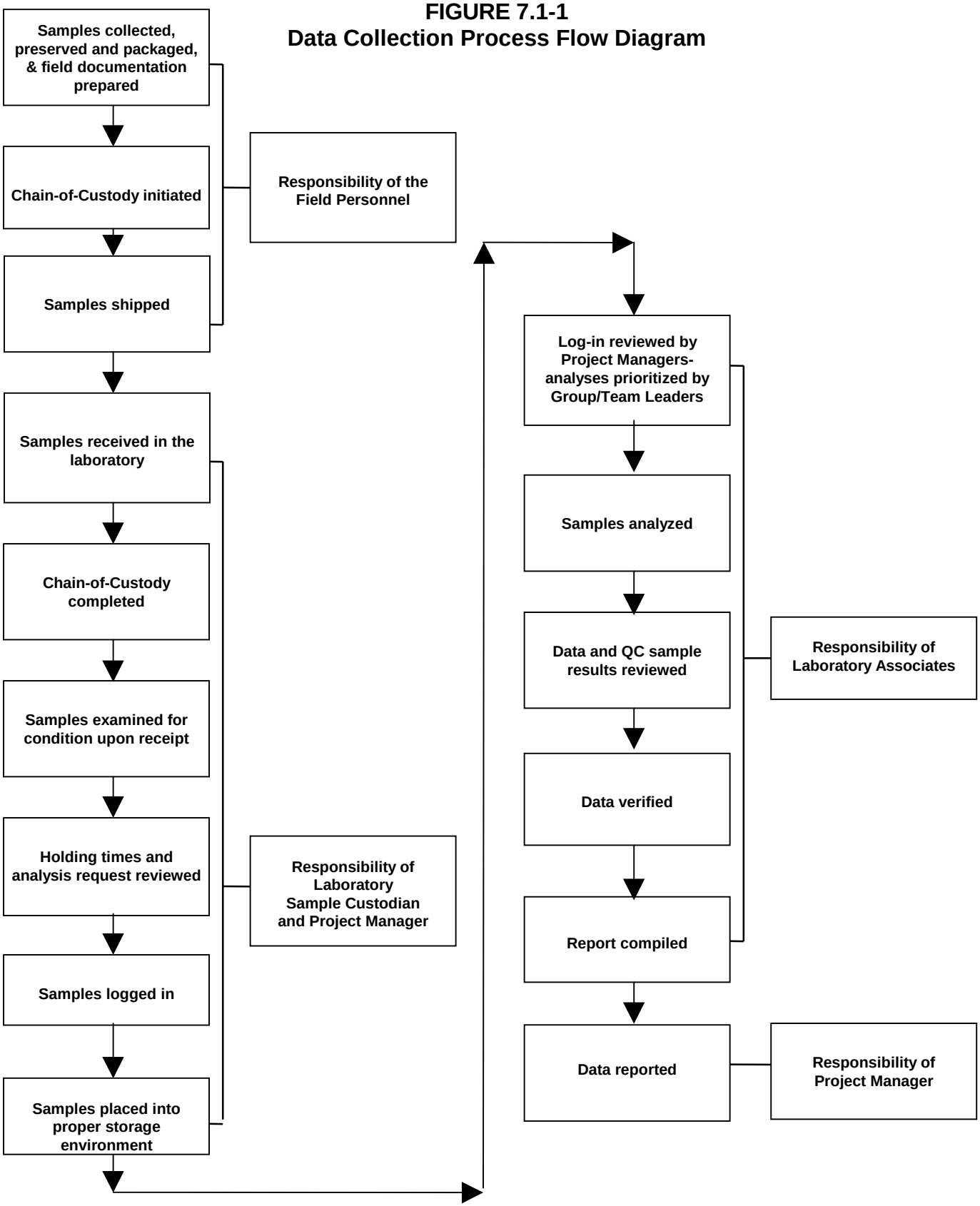
7.1 Data Collection Process

The sample collection and data generation processes are designed to produce analytical data that accurately reflect the nature of the site or sampling point. Figure 7.1-1 shows the sample collection and data collection processes. To ensure our services meet client and project requirements, communication and planning with the client are emphasized. The organization described in Section 7.2 is in place to ensure that these goals are achieved.

7.2 Organizational Responsibilities

Project planning is normally performed within Quanterra® by the operational units. Each operating unit also has the responsibility for customer service within their operating unit. CSMs or designee, Account Managers (AMs), PMs, Operations Managers, and Laboratory Managers play an integral part that will collectively ensure that all projects are thoroughly planned and communicated to all appropriate personnel. Successful project planning and communication of project requirements ensures that the laboratory has facilities and resources to perform the tests required, samples will be handled appropriately and that analytical data will be reported in compliance with project requirements. As a matter of policy, CSMs or designee, AMs, PMs, Lab Managers, and Operations Managers work together to ensure that the following will occur prior to receipt of samples at the laboratory:

FIGURE 7.1-1
Data Collection Process Flow Diagram



- Samples are scheduled for arrival at the laboratory
- All unique project requirements have been identified and communicated to all appropriate personnel
- Standardized client, state, federal, or Quanterra® programs are appropriately selected
- Fully-qualified subcontract laboratories have been selected if needed
- A review has been performed on all pre-project documents such as proposals, contracts, and/or QAPPs to identify range of tests required and within scope of laboratory being used
- All appropriate and required preparations have been made at the laboratory to accommodate or meet project requirements as described in proposals, contracts, and/or QAPPs
- It has been determined that the laboratory has the capability and the capacity to analyze the samples including equipment, staff, space and workload.
- The laboratory has been determined to be able to meet the required sample holding times and is able to report the resulting data within the time line specified by the client
- All known safety hazards associated with the samples have been communicated to all appropriate personnel.

Approval and issuance of a quote, bid or contract document is documentation that this process has occurred. Large projects may require formal management review to assure the above are met.

7.3 Determination of Project QC Requirements

A system must be in place to review project documents [e.g., Request for Proposals (RFP), Request for Quote (RFQ), QAPPs, technical Statements of Work (SOW), or other contractual materials] before a project begins. For larger projects this can involve an inter-laboratory Customer Service Team (CST) (see Section 7.5). Within the laboratory it generally involves the CSM, or PM, or designee working in conjunction with staff from laboratory operations, QA, IT, and management. The goal of the evaluation process is to ensure that client needs and expectations are properly understood, and that the laboratory can meet those requirements before project initiation. Internal and external communications should be in writing to avoid misunderstandings. The CSM, or PM, or designee, with support of others in the laboratory, will work with clients to ensure that project requirements are properly aligned with laboratory capabilities.

When QC requirements are not specified by a client, Quanterra® will follow the requirements given in Corporate Policy Number QA-003, "Quanterra® Quality Control Program" as applicable to the type of project being performed.

7.4 Communication of Project-Specific Requirements

Each operating unit shall use a Quality Assurance Summary (QAS) (example shown in Figure 7.4-1) or an equivalent summary form to document all project-specific requirements. This document is prepared by the PM for all projects prior to sample receipt even if an approved project QA Plan is on file at the laboratory.

Each laboratory shall put into place a hard copy or electronic system that will ensure that the project-specific requirements are disseminated to all appropriate laboratory personnel prior to project initiation.

To further ensure that project-specific requirements regarding analytical methods, QC, and data reporting are thoroughly understood by the laboratory staff, the PMs may conduct project initiation meetings. For large projects that continue over time, the PMs may hold project refresher meetings to ensure that project requirements are continually being met. The PM takes the lead role in implementation of project requirements at the laboratory including changes in project requirements during the course of a project.

7.5 Customer Service Teams

Each operating unit shall establish and maintain long term and substantive relationships with our clients, identify customer needs, and seek to attain value for our customers according to our customers' definitions. An operating unit may create, at any time, client-specific Customer Service Teams (CST). A CST may be created before any discrete projects exist, during on-going projects, or even after the completion of a project. In addition to the PM or customer service representative the team may also contain associates from the operations, technical, QA, IT, contracts, and/or accounting organizations.

7.6 Contingency Planning

An effective QA Program must emphasize contingency planning, actions to prevent problems from reoccurring, and to ensure timely and effective completion of a measurement effort. The following are considered relative to contingency planning:

- Staffing - A primary objective is to ensure that qualified staff are always available to perform the necessary analytical work, regardless of employee turnover, vacation (personal time off), illness, or other absence. Sources of qualified staffing may include temporary agencies specializing in providing technically trained personnel and other Quanterra® facilities. Employee qualification requirements are described in Section 3.0.

FIGURE 7.4-1 (Page 1 of 2)
Example Quanterra® Quality Assurance Summary

Client: _____ Project Code: _____ Contract Name: _____ Site: _____ Project Mgr: _____ **Analysis Type:** ____ Chemical ____ Radiochemical	**RAD SCREEN** by: _____ Code _____ Client-Specific _____ Screens not needed	**SAMPLE DISPOSAL**: _____ Disposal by Lab _____ Return to Client _____ Archive **ANY SPECIAL QC DOCUMENTS?** ____ Yes ____ No	**QAS No.:** _____ Date Initiated: _____ Revision No.: _____ Date Revised: _____

REPORTING

Report to Client: _____ Lab PQL _____ MDL/IDL/MDA _____ < Client DLs _____ Other: _____	**QC Samples to be Reported:** _____ BLK _____ MS _____ LCS _____ MSD _____ DUP _____ Other: _____	**Report Type:** _____ Certificate of Analysis _____ CLP _____ Other: _____	**Report Grouping:** _____ SDG _____ Chain-of-Custody _____ Analytical Batch _____ Other: _____

Report Deliverables: ____ No. of Hard Copies to: _____ ____ Electronic Data Deliverable to: (Diskette Type: _____) Client: _____ Address: _____ _____ ATTN: _____	**Report Deliverables**: ____ No. of Hard Copies to: ____ Electronic Data Deliverable to: (Diskette Type: _____) Client: _____ Address: _____ _____ ATTN: _____

INVOICING

Invoice to: Client: _____ Address: _____ _____ _____ _____ ATTN: _____	Supporting Documentation: _____ Certificate of Analysis _____ RFA/COC _____ Screening Records _____ Other (list):_____ _____	No. of Invoices: _____ Special Instructions: _____ _____ _____ _____

ADDITIONAL COMMENTS OR INSTRUCTIONS:

_____
_____

Project Manager's Approval: _____ Date: _____

FIGURE 7.4-1 (Page 2 of 2)
Example Quanterra® Quality Assurance Summary

Client: _____
Project Code:_____
QAS No.:_____ **Revision No.:** _____

Number of Samples Expected by Matrix:
_____ **Air (A)** _____ **Water (W)**
_____ **Soil (S)** _____ **Other (O):** _____

Analysis/Product Code	Matrix (circle)	Method Prep/Analysis	QC Samples		Required Reporting Limit/Units/ Report as*	Holding Time (Days)	TAT** (Days)	Radiochemical-Specific	
			Type (circle)	Frequency				Count Time	Sample Size
	A W S O		B LCS DUP MS MSD	per					
	A W S O		B LCS DUP MS MSD	per					
	A W S O		B LCS DUP MS MSD	per					
	A W S O		B LCS DUP MS MSD	per					
	A W S O		B LCS DUP MS MSD	per					
	A W S O		B LCS DUP MS MSD	per					
	A W S O		B LCS DUP MS MSD	per					

* A = "As Is" or D = Dry Weight Basis

**TAT = Turn Around Time

SAFETY HAZARDS: Chemical? _____ No _____ Yes: Define: _____
Radioactive? ____ No ____ Yes:
Isotopes Expected:_____ RSO Approval (sign/date): _____

Special lnstructions:_____

Comments:_____

- Redundant Instrumentation or Equivalent Methods - At most locations, duplicate instrumentation may be available to ensure uninterrupted work flow. A laboratory may also choose to lease equipment when there is a sufficient time window prior to arrival of samples. However, in circumstances where a catastrophic instrument failure occurs, alternative but equivalent methods may be recommended to the client for approval and implementation.

- Preventive Maintenance - Quanterra®'s preventive maintenance program is designed to minimize analytical instrument malfunctions, permit simple adjustments, and to ensure fewer and shorter breakdowns of critical analytical equipment. (See Section 8.11, "Preventive Maintenance and Service".)

- Network Laboratories & Subcontractor Laboratories - To support the laboratory during peak periods or in the event of a critical instrument malfunction, Quanterra® has the capability to arrange the use of other network laboratories or qualified analytical laboratories as subcontractors for short-term backup analytical support. Through an extensive process, QA personnel evaluate, identify, and select qualified analytical laboratories before an analytical contract is awarded. In order to qualify, a subcontractor laboratory must pass this evaluation. Furthermore, any use of a subcontractor laboratory is approved by the client prior to award of a contract or sample shipment for existing contracts.

- Uninterruptable Power Supply - An Uninterruptable Power Supply (UPS) system which provides line conditioning and backup power to the LIMS computer system/server. This contingency plan allows sufficient time for the main computer system to be shut down and for data archival. All electronically generated data that are stored on the main computer system and on the individual personal computer (PC) hard drives are backed up at regular intervals. In the event that the main laboratory computer system fails, the analytical data can be retrieved from the PC hard drives.

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8.0 Work Processes and Operations

Much of the environmental project activity is planned and designed externally to the laboratory or field operation and presented in the form of a contract, work plan, or QAPP. Laboratory and field activities are in turn planned, implemented, and assessed to meet client requirements according to approved procedures and methodologies. The QAMP provides the systems to document and implement these activities. The execution and assessment of the implemented operational systems are detailed in Quanterra® Corporate or Operation-specific SOPs. The entire process is assessed on a regular basis for conformance to prescribed requirements.

Standard practices for Quanterra® operations are detailed in this section. Specific project or program requirements which differ from those described here can be met. These must exist in approved contracts, work plans, or QAPPs.

In the Facility Specific Appendices are lists of the major equipment and floor plan of the facilities available along with the SOP list for the tests the laboratory performs. Calibration/reference measurement standards are detailed in the SOPs.

8.1 Standard Operating Procedures

SOPs are required in all Quanterra® operating units for analytical and administrative activities from the receipt of samples in the laboratory through analysis, reporting, and subsequent sample disposition. Training, health and safety procedures, QC, method procedures, and instrument and equipment calibrations are included in SOPs. Preprinted forms, either standardized across Quanterra® through a Corporate SOP requirement, or shown as an example form when not standardized, are included in SOPs as appropriate. Standard SOP formats for all activities related to the generation and reporting of data are discussed in the Quanterra® Quality Policy Document No. QA-001, "Standard Operating Procedures". SOPs shall be reviewed by technically-qualified associates. SOPs are controlled documents and are distributed and maintained as described in this policy. SOP requirements for approval and frequency of review are given in Tables 5.1-1 and 5.2-1.

8.2 Analytical Methods

Whenever possible, Quanterra® operations use industry- and regulatory agency-recognized analytical methods from source documents published by agencies such as the Environmental Protection Agency (EPA), Department of Energy (DOE), the American

Society for Testing and Materials (ASTM), and the National Institute for Occupational Safety and Health (NIOSH) as described in Quanterra®'s SOPs. The analytical methods performed by Quanterra® are given in Section 4 of the Facility Appendix for each laboratory. A list of methods routinely performed by Quanterra® is given in Table 8.2-1.

Method performance data (i.e., detection limits, precision and accuracy data) are developed by the laboratory operations staff. The operations staff and the QA staff will evaluate and must approve the performance data before a methodology is performed routinely. The method must also be described and documented with an SOP. In the event that the laboratory staff is required to modify a procedure to meet a unique project requirement, the client will be notified to obtain written approval prior to implementing the change.

All SOPs contain Quanterra®'s interpretation of the published methods. Significant modifications to the published method are described in the SOP. Operations are performed as described in these SOPs. Changes in procedure which may occur due to sample matrix or other events shall be documented in the project-specific case narratives, nonconformance memos (NCMs), or in QAPPs.

8.3 Data Quality Objectives

Data quality objectives (DQOs) are qualitative and quantitative statements used to ensure the generation of the type, quantity, and quality of environmental data that will be appropriate for the intended application (EPA 1994)[1]. Typically, DQOs are identified during project scope and the development of sampling and analysis plans. In this QAMP, however, we refer to only the analytical DQOs because laboratories generally do not have any authority over sample collection, shipment, or other field-related activities that may affect the data quality of the environmental sample before the sample is received in the laboratory. The EPA has established six primary analytical DQOs for environmental studies. These DQOs are precision, accuracy, representativeness, completeness, comparability, and detectability.

The components of analytical variability (uncertainty) can be estimated when QA and QC samples of the right types and quantities are incorporated into measurement procedures at the analytical laboratory. Quanterra® incorporates numerous QA and

[1] "Guidance for the Data Quality Objectives Process", EPA 600/R-96/005, September 1994.

QC samples to obtain data for comparison with the analytical DQOs and to ensure that the measurement system is functioning properly. The QA/QC samples and their applications, described in Section 8.4, are selected on the basis of method- or client-specific requirements. Field blanks, field duplicates, and performance evaluation (PE) samples are received from the client as unknown samples. Analytical laboratory QC samples for inorganic, organic, and radionuclide analyses may include calibration or instrument blanks, method blanks, background, duplicates, replicates, laboratory control samples (LCSs), calibration standards, matrix spikes (MSs), matrix spike duplicates (MSDs), surrogate spikes, and yield monitors.

8.3.1 Precision And Accuracy

Precision is an estimate of variability, that is, it is an estimate of agreement among individual measurements of the same physical or chemical property, under prescribed similar conditions. The precision of a measurement system is affected by random errors. Precision is expressed either as relative standard deviation (RSD) for replicate measurements greater than two or as relative percent difference (RPD) for duplicate measurements. Table 8.6-1 illustrates the formulae used to calculate units of precision (i.e., RSD and RPD).

Accuracy is the degree of agreement between a measurement and the true or expected value, or between the average of a number of measurements and the true or expected value. Systematic errors affect accuracy. For chemical properties, accuracy is expressed either as a percent recovery (R) or as a percent bias (R - 100).

The precision and accuracy DQOs that are to be used in evaluating inorganic, organic, and radionuclide constituents at Quanterra® are provided in Tables 8.4-5, 8.4-6, and 8.4-7, method-specific SOPs, and in the documentation for the analytical method of interest.

Precision and accuracy are determined, in part, by analyzing data from matrix spike and matrix spike duplicates, unspiked duplicates, LCSs, and single blind audit samples. For radiochemical determinations, counting statistics can also provide an estimate of uncertainty. A description of these QC samples is provided in Section 8.4.

8.3.2 Completeness

Completeness is a measure of the percentage of measurements that are judged to be valid measurements. At a minimum, the objective for completeness of data is 90% for each constituent analyzed.

8.3.3 Representativeness

Representativeness is the degree to which data accurately and precisely represent a characteristic of a population, a variation in a physical or chemical property at a sampling point, or an environmental condition. Data representativeness is primarily a function of sampling strategy; therefore, the sampling scheme must be designed to maximize representativeness. Representativeness also relates to ensuring that, through sample homogeneity, the sample analysis result (concentration) is representative of the constituent concentration in the sample matrix. At each Quanterra® laboratory, every effort must be made to analyze an aliquot that is representative of the original sample, and to ensure the homogeneity of the sample before subsampling.

8.3.4 Comparability

Comparability is a measure of the confidence with which one data set can be compared to another. To ensure comparability, all laboratory analysts are required to use uniform procedures (i.e., SOPs) and a uniform set of units and calculations for analyzing and reporting environmental data.

8.3.5 Method Detection Limits

It is Quanterra® policy to strictly follow the specification in the U.S. EPA 40 CFR Part 136 Appendix B in determining MDLs for chemical tests. The Quanterra® requirement for this procedure is further detailed in Quanterra® Policy Number QA-005 entitled "Determination of Method Detection Limits for Chemical Tests." This policy requires that the MDLs be determined for each analyte of interest representing the aqueous and solid matrices within the capability of the primary analytical methods. Following the EPA's guidelines, Quanterra® does not provide MDLs for each instrument representing a group of constituents using the same analytical techniques. This policy is based on the statement in the scope and application of the CFR procedure which states that "The MDL procedure was designed for applicability to a broad variety of physical and chemical methods. To accomplish this the procedure was made device- or instrument- independent." Exceptions to this approach are described in Quanterra® Corporate Policy Number CORP-QA-005, "Determination of Method Detection Limits for Chemical Tests". MDLs determined by each laboratory are listed in Section 5 of the Facility Appendix to this QAMP.

8.3.6 Instrument Detection Limits

Instrument Detection Limits (IDLs) are required to be performed quarterly for metals constituents and cyanide when analyses are performed in support of Comprehensive

Environmental Response, Compensation and Liability Act (CERCLA) activities or when the USEPA CLP SOW protocol is required. The requirement for this procedure is described in the Quanterra® Policy Number QA-014, "Determination of Instrument Detection Limits."

IDL samples are introduced at a later stage of the analytical process so that the IDL is a more direct indication of instrument sensitivity. The primary distinction is that the IDL estimates the detection limit of the instrument under ideal conditions, whereas the MDL estimates the detection limit in more-practical terms by subjecting a known concentration matrix to the total method process. IDLs are not required by the SW-846 methods, except for method 6020 where the IDLs are a requirement.

When required, IDLs will be performed in accordance with the procedures defined in the applicable USEPA SOW, ILMO3.0 or subsequent versions, and Quanterra® Policy Number QA-014, "Determination of Instrument Detection Limits".

Prior to acceptance and use for reporting purposes, all data from detection limit studies and reporting limits must undergo technical review and approval by the laboratory management and QA staff.

8.3.7 Reporting Limits

Two reporting limit conventions are used within Quanterra®: the Reporting Limit (RL) and the Project-Specific Reporting Limit (PSRL). Quanterra® Reporting Limit (RL) is the lowest level at which measurements become quantitatively meaningful. An RL is greater than the statistically determined MDLs. In some limited situations, higher RLs may be established based on maximum contaminant level (MCLs), applicable or relevant and appropriate requirements (ARARs), or project-specific data quality objectives (DQOs). The Quanterra® RLs and PSRLs are maintained in the LIMS.

Reporting limits are established and modified within Quanterra® according to the Corporate Policy Number QA-009, "Establishment Reporting Limits."

PSRLs are used when project data quality objectives (DQO) require a reporting limit other than the RL. PSRLs tailor Quanterra®'s product to meet customer requirements.

For radiochemistry, whether the net result is negative, zero, or positive, the actual calculated result is reported with its associated propagated uncertainty. The minimum detectable concentration (MDC) is

affected by many factors, such as the length of count, chemical yield, half-life, background of the instrument, counting efficiency, and the matrix interference. The MDC for radiochemical analyses is defined as the smallest amount (activity or mass) of an analyte in a sample that will be detected with a probability beta of non-detection (Type II error) while accepting a probability alpha of erroneously deciding that a positive (non-zero) quantity of analytes is present in an appropriate blank sample (Type I error). MDCs are determined according to Quanterra® Policy Number QA-007, "Determination of Minimum Detectable Concentration for Radiochemical Tests."

8.4 Quality Control Samples

Two types of Quality Control (QC) samples are field QC samples and laboratory QC samples. Field QC samples are collected during the sampling event and are useful in determining sampling precision and accuracy and monitoring for contamination that may occur during collection, transport or storage of environmental samples. Laboratory QC samples are routinely added at the laboratory to the normal sample stream. Successful analysis of these samples demonstrates that the laboratory is operating within prescribed requirements for accuracy and precision. In addition, utilizing matrix-specific laboratory QC samples, information regarding the effect of the matrix or field conditions on the analytical results can be obtained. The following sections describe common field and laboratory QC samples.

8.4.1 Field QC Samples

When field QC sample collection and analysis are required for a project, it is the responsibility of the project sampling supervisor to ensure that this sampling is performed correctly and at the project-required frequencies. Field QC samples may or may not be identified as such to the laboratory and are considered by the laboratory as field samples for the purpose of QC batching, sample preparation and analysis. Field QC sample results are reported in the same manner as actual field samples, unless a specific deliverable is requested by the client. No correction of the analytical data is done in the laboratory based on the analysis of field QC samples.

Field QC sample types, applicability to organic and inorganic analyses, precision and accuracy applications and by whom they are introduced are summarized in Table 8.4-1. The following sections provide descriptions of field QC samples.

8.4.1.1 Trip Blank

Volatile organic samples are susceptible to contamination by diffusion of organic contaminants through the septum of the

sample vial. Trip blanks, also referred to as travel blanks, are analyzed to monitor for possible sample contamination during shipment for volatile organics only. Trip blanks are prepared by filling preserved VOA vials (with no headspace) with organic-free water. Trip blanks accompany the sample bottles during collection and shipment to the laboratory and are stored with the samples.

8.4.1.2 Rinsate Blank

A rinsate blank or equipment blank is a volume of rinse solution (deionized, distilled water or organic solvent) used to rinse a sampling tool. The rinse solution is collected after the sampling equipment has been cleaned in order to demonstrate that there is no residual contamination remaining on the tool that would carry over into the next sample.

8.4.1.3 Field Blank

A field blank is a contaminant-free volume of water or soil that is provided by the sample collector to demonstrate the absence of contamination introduced during sampling. Deionized, distilled water or previously-prepared solid material (e.g., Ottawa sand) is placed into sample containers by the sample collection crew, packaged, and shipped with the other field samples.

8.4.1.4 Field Duplicate

A field duplicate sample is a replicate taken from the same sampling event for that location. The field duplicate sample is submitted to the laboratory as a separate sample by the sample collection personnel. Results of field duplicate samples can provide a measure of sampling precision.

8.4.1.5 Field Matrix Spike

A field matrix spike sample is created by spiking target analytes into a sample in the field at the point of sample acquisition. These sample results provide information on the target analyte stability after collection and during transport and storage.

8.4.1.6 Collocated Samples

Collocated samples are independent samples collected in such a manner that they are equally representative of the variable(s) of interest at a given point in space and time. Examples of collocated samples include: samples from two air quality analyzers, sampling from a common sample manifold, or two water samples collected at the same time and from the same point in a lake.

Collocated samples processed and analyzed by the same organization provide intralaboratory precision information for the entire measurement system including sample

acquisition, handling, shipping, storage, preparation, and analysis. Both samples can be carried through the steps in the measurement process together to provide an estimate of short-term precision for the entire measurement system. Likewise, the two samples, if separated and processed at different times or by different people, and/or analyzed using different instruments, provide an estimate of long-term precision of the entire measurement system. Collocated samples processed and analyzed by different organizations provide interlaboratory precision information for the entire measurement system.

8.4.1.7 Split Sample

A split sample is a sample divided into two portions at the sampling site. One portion is sent to a different organization or laboratory and subjected to the same environmental conditions and steps in the measurement process as the other portion sent to another laboratory.

A split sample can be divided into portions at different points in the sampling and analysis process to obtain precision information on the various components of the measurement system. For example, a field split sample provides precision information about all steps after sample acquisition including the effects of storage, shipment, analysis, and data processing. Field split sample results may also reflect the degree of sample homogeneity.

8.4.2 Laboratory QC Samples

Laboratory performance QC is required to ensure the laboratory systems (instrumentation, sample preparation, analysis, data reduction, etc.) are operating within acceptable QC guidelines during data generation as required to meet the client's objectives. Laboratory QC samples consist of method blanks (MB), instrument blanks, laboratory control samples (LCS) and calibration verification samples. In addition to laboratory performance QC, matrix-specific QC is utilized to determine the effect of the sample matrix on the data being generated. Typically, this includes matrix spikes (MS), matrix spike duplicates (MSD), sample duplicates, and the use of surrogate compounds.

Laboratory and matrix-spike QC sample types are summarized in Tables 8.4-2, 8.4-3 and 8.4-4. In addition, Tables 8.4-5, 8.4-6 and 8.4-7 list laboratory QC samples, acceptance criteria and corrective actions by reference method for inorganic methods, organic methods, and the USEPA CLP Statements of Work respectively. The following sections provide descriptions of laboratory QC samples and their frequency

of use. Quanterra® Policy Number QA-003, "Quanterra® Quality Control Program", describes in detail the QC data evaluation process.

8.4.2.1 Quality Control (QC) Batch

The QC batch consists of a set of up to 20 field samples that behave similarly (i.e., same matrix) and are processed using the same procedures, reagents, and standards within the same time period. This definition of a QC batch is utilized by Quanterra® unless there is clear regulatory guidance, contract specifications, or differing client requirements that are explicitly documented. Further details and requirements for the application of the definition of QC batch are described in QA Policy Number QA-003.

8.4.2.2 Method Blank

The method blank (MB) is a QC sample that consists of all reagents specific to the method and is carried through every aspect of the procedure, including preparation, cleanup, and analysis. The method blank is used to identify any interferences or contamination of the analytical system that may lead to the reporting of elevated analyte concentrations or false positive data. Potential sources of contamination include solvent, reagents, glassware, other sample processing hardware, or the laboratory environment. In general, the method blank is a volume of deionized laboratory water for water samples, or a purified solid matrix for soil/sediment samples, that is processed as a sample. In the event that no appropriate solid matrix exists, deionized water may be used. The volume or weight of the method blank must be approximately equal to the sample volume or sample weight processed. A method blank shall be prepared with each group of samples processed.

8.4.2.3 Instrument/Calibration Blank

The instrument blank is an unprocessed aliquot of reagent used to monitor the contamination of the analytical system at the instrument. System contamination may lead to the reporting of elevated analyte concentrations or false positive data. The instrument blank does not undergo the entire analytical process and generally consists of an aliquot of the same reagent(s) used for a sample dilution. Instrument blanks are also referred to as continuing calibration blanks (CCBs).

8.4.2.4 Laboratory Control Sample

A laboratory control sample (LCS) is a laboratory-prepared suitable clean matrix sample that is fortified with target analytes or a solid reference material purchased from an approved vendor. The LCS contains all target analytes specified in the method, and

must contain the same analytes as the matrix spike and matrix spike duplicate. For certain regulatory or client programs, an LCS may contain a full list of analytes. However, in these cases, a subset of analytes, as defined by the program, is used to determine the acceptability of a batch of sample data. The LCS recovery data are used to monitor the analytical method performance in terms of analytical accuracy. On-going evaluation of the LCS recoveries demonstrates that the laboratory is performing the method within statistical control (i.e., accuracy and precision) in the absence of matrix interference. The LCS results, coupled with MS data, help determine whether the laboratory performed the method correctly or the sample matrix affected the analytical results. When a laboratory control sample duplicate (LCSD) is required, a percent recovery for each target analyte is calculated, as well as a relative percent difference (RPD) between the LCS and the LCSD.

8.4.2.5 Matrix Spike

A matrix spike (MS) is an environmental sample to which known concentrations of target analytes have been added. MS samples are analyzed to evaluate the effect of the sample matrix on the analytical methodology. MS samples are generated by taking a separate aliquot of an actual client sample and spiking it with the selected target analyte(s) prior to sample extraction. The MS sample then undergoes the same extraction and analytical procedures as the unfortified client sample. Due to the potential variability of the matrix of each sample, these results may have immediate bearing only on the specific sample spiked and not on all samples in the QC batch.

8.4.2.6 Matrix Spike Duplicate

A matrix spike duplicate (MSD) is a second aliquot of a sample that is spiked with the selected target analyte(s) and analyzed with the associated sample and MS sample. The results of the MS and MSD are used together to determine the effect of a matrix on the accuracy and precision of the analytical process. Due to the potential variability of the matrix of each sample, the MS/MSD results may have immediate bearing only on the specific sample spiked and not all samples in the QC batch. When a full-analyte spike is required, a selected list of analytes is used to measure statistical control or matrix effects.

8.4.2.7 Sample Duplicate

A sample duplicate is a second aliquot of an environmental sample taken from the same sample container that is processed identically with the first aliquot of that sample. That is, sample duplicates are

processed as independent samples within the same QC batch. The results are compared to determine the sample homogeneity and the precision of the analytical process.

8.4.2.8 Surrogates

Surrogates are organic compounds that are similar in chemical composition and behavior to the target analytes but that are not normally found in environmental samples. Surrogates are added to all appropriate samples and QC samples being tested for organic analytes to monitor the effect of the sample matrix and the procedure on the accuracy of the process.

8.4.2.9 Analytical Spike

An analytical spike is created by spiking target analytes into a prepared portion (i.e., post digestion) of a sample just prior to analysis. It provides information on matrix effects encountered during analysis such as suppression or enhancement of instrument signal levels. It is most often used in elemental analysis involving various forms of atomic emission or atomic absorption spectroscopy. A single analytical spike serves as a single point application of the "method of standard additions" or MSA.

8.4.2.10 Interference Check Sample

An interference check sample (ICS) is a solution containing known concentrations of both interfering and analyte elements. Analysis of this sample can be used to verify background and interelement correction factors.

8.4.2.11 Internal Standards

An internal standard (IS) is a compound or element with similar chemical characteristics and behavior in the analysis process to the target analytes, but is not normally found in environmental samples. The internal standard is usually added after sample preparation. The primary function of the internal standard is quantitation, however, it also provides a short-term indication of instrument performance. For isotope dilution methods, internal standards are added during sample preparation and are used for quantitation.

8.4.2.12 Radiological QC Samples

The primary QC sample type used for radiological testing to monitor recovery is the yield monitor. The two types of yield monitors are tracers and carriers. A tracer is a radioisotope, usually of the same element and having the same mode of decay as the analyte. A carrier is a non-radioactive solution added to assist in isolating the specific isotope of an element. When standardized, the carrier can also provide recovery information gravimetrically.

Radiological QC samples and their required frequencies are listed in Section 7 of the Facility-Specific Appendix when applicable.

8.5 Data Collection Operations

Laboratory analyses are designed to produce data that are representative of existing conditions present at the time the sample was obtained. The data collection design includes field sampling events, sample handling and custody, analytical operations, data recording procedures, data assessments, data verification, and data reporting requirements and techniques to assess limitations of data use. These operations are discussed in Sections 8.5 through 8.10.

8.5.1 Field Collection and Shipment

In order to provide a sample that most accurately represents the test matrix, field sample collection personnel must abide by the sample collection guidelines and procedures established by involved regulatory agencies.

A significant part of the efforts of regulatory agencies include the use of "approved" sample containers, chemical and physical preservation techniques, and observance of specified holding times. It is imperative that all samples be collected and preserved according to the appropriate analytical method specified in the QAPP (if one exists).

Although the sampling may be performed by non-Quanterra® personnel, the importance of sampling and transportation of the sample to the laboratory is understood and must be considered during data validation.

Sampling requirements must be communicated to the sampling team prior to field collection.

Field personnel are responsible for labeling each individual sample collected with the following information:

- Project name
- Unique client sample number
- Sample location (including as appropriate: borehole and depth or grid coordinates)
- Sampling date and time
- Sample preservation
- Analysis required.

An overriding consideration for the resulting analytical data is the ability to demonstrate that the samples have been obtained from the locations stated and that they have reached the laboratory without alteration. Evidence of collection, shipment, laboratory receipt, laboratory custody, and disposal must be documented to accomplish this. Figure 8.5-1 shows an example Chain-of-Custody (COC) form that is used by the Quanterra® laboratory network to document this evidence. Field personnel are responsible for initiating the COC form.

The prompt shipment of samples to the laboratory is necessary to ensure that required holding times are met. Samples should be shipped by an overnight carrier, be hand-delivered, or transported in a manner that assures prompt delivery to the laboratory.

Some sites require an extensive radioactive screening process before a sample may be shipped. In these cases, it is imperative for the Project Manager to maintain good communications with the client to assure proper staffing of the laboratory in response to a decreased holding time.

Radioactive samples that are shipped to Quanterra® radiochemistry operations must be screened upon receipt and found not to contain radioactivity that exceeds the level stated in the laboratory's operation license. Samples received by a Quanterra® facility containing radioactivity exceeding their license limit will immediately be returned to the project site.

8.5.2 Sample Containers, Shipping Containers, Preservatives, and Holding Times

8.5.2.1 Sample Containers

A sample container is defined as the sealed enclosure, usually made of plastic or borosilicate glass that the sample is collected in and stored in until analysis. All sample containers provided by Quanterra® operations for environmental sampling are new, with the exception of some air sampling canisters, which must be recertified before reuse, and demonstrated to be clean for their appropriate use. All documentation certifying sample container cleanliness must be maintained by the laboratory or the vendor and can be provided to the client upon request. The sample containers to be supplied are listed in Tables 8.5-1 through 8.5-5. Sample containers provided to the client by Quanterra® are transmitted under custody.

Quanterra®

FIGURE 8.5-1
Example Quanterra® Chain-of-Custody Form

Reference Document No. _____
Page 1 of _____

Project Name/No.: _____
Sample Team Members: _____
Profit Center No.: _____
Project Manager: _____
Purchase Order No.: _____
Required Report Date: _____

Sample Shipment Date: _____
Lab Destination: _____
Lab Contact: _____
Project Contact/Phone: _____
Carrier/Waybill No.: _____

Bill To: _____

Report To: _____

ONE CONTAINER PER LINE

Sample Number	Sample Description/Type	Date/Time Collected	Container Type	Sample Volume	Preservative	Requested Testing Program	Condition on Receipt	Disposal Record No.

Special Instructions:

Possible Hazard Identification:
Non-hazard ❑ Flammable ❑ Skin Irritant ❑ Poison B ❑ Unknown ❑

Sample Disposal:
Return to Client ❑ Disposal by Lab ❑ Archive _____ (mos.)

Turnaround Time Required:
Normal ❑ Rush ❑

QC Level:

1. Relinquished by: *(Signature/Affiliation)*	Date: _____ Time:	1. Received by: *(Signature/Affiliation)*	Date: _____ Time:
2. Relinquished by: *(Signature/Affiliation)*	Date: _____ Time:	2. Received by: *(Signature/Affiliation)*	Date: _____ Time:
3. Relinquished by: *(Signature/Affiliation)*	Date: _____ Time:	3. Received by: *(Signature/Affiliation)*	Date: _____ Time:

Comments:

8.5.2.2 Shipping Containers

Shipping containers are defined as the sealed enclosure in which the sample containers are stored during shipment from the sample collection site to the analytical laboratory. Shipping containers must be of sufficient number and size to accommodate the samples in an upright condition. Shipping containers must also meet all requirements for the shipment of environmental and/or radioactive samples.

Packaged samples must be shipped to the analytical laboratory in a safe manner that preserves the integrity of the samples. The most common method of sample shipment employs coolers or ice chests that are sealed with custody tape and shipping tape. These coolers must be durable and resistant to crushing during shipment. All coolers must be well maintained and cleaned to prevent cross-contamination of the samples. It is the ultimate responsibility of the person collecting and packaging the sample for shipment to ensure that the shipping containers are clean and functional.

To help prevent sample breakage during shipment, additional consideration must be given to providing shock absorbency to all samples packaged inside the shipping container. Use of bubble-wrap around each sample container is the best way to provide this protection. Foam packing materials and vermiculite are also successfully used.

8.5.2.3 Sample Preservatives

Most analytes have a finite holding time in a given sample matrix. Sample preservation is the chemical or physical means by which samples are treated during and/or following sample collection to aid in the stability of the analytes of interest in that matrix. Sample holding times are also adversely affected when samples are improperly preserved, or shipped unpreserved. The preservation of samples at the time of sample collection will follow the requirements of the analytical methods used. This preservation includes the addition of reagents to deter chemical and biochemical degradation and the maintenance of refrigeration during transit and ultimate storage in the laboratory. The required preservatives for the analysis to be performed on each matrix are included in Tables 8.5-1 through 8.5-5.

8.5.2.4 Sample Holding Times

Holding time is defined as the maximum allowable time a sample can be stored after sample collection and preservation (or laboratory receipt for CLP) until appropriate processing occurs (preparation or analysis). The holding time may vary according to method or client requirements. Tests designated with holding times as “analyze immediately or ASAP” are considered

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QUANTERRA® INCORPORATED

QAMP Change Form

DOCUMENT: Quality Assurance Management Plan, Revision No. 3
SECTION(S) AFFECTED BY CHANGE: Section 8.5.2, page 58; Appendix B, page 3.
REASON FOR ADDITION OR CHANGE: Section 8.5.2: To clarify the HT requirements and make consistent with Quanterra® Terms and Conditions. Appendix B: To correct area code for North Canton location.
CHANGE EFFECTIVE FROM: February 1, 1999
CHANGE: See attached pages.
SUBMITTED BY/DATE: Chris Rigell, 01/26/99
APPROVED BY:

Mark A. Matthews
Chief Operating Officer
Date 1/1/99

Chris M. Lee
Vice President **of Operations Services**
Date 1/28/99

Jack R. Hall
Corporate **Director of Quality Assurance**
Date 1/26/99

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parameters that should be tested by field personnel or on-site. Each operation has a system in place to ensure that holding times are monitored by each group within the operating unit. It is the responsibility of each Quanterra® associate processing the sample to assure that holding times are met. Quanterra® laboratories are responsible for meeting all holding times for properly preserved samples received within 48 hours of collection or if less than half the holding time has passed at the time of sample receipt if the sample is received after 48 hours of collection. If these conditions are not met, Quanterra® will attempt to expedite sample analysis as soon as possible.

Sample holding times are listed in Tables 8.5-1 through 8.5-5.

8.5.3 Sample Handling

Each Quanterra® laboratory has a facilitly-specific SOP describing sample receipt and log-in in detail. The following sections describe the general policies followed by all Quanterra® laboratories.

8.5.3.1 Sample Receipt

Samples shall be received and logged in at Quanterra® operations by a designated sample custodian or other properly trained associate. Upon sample receipt, the sample custodian shall, as appropriate:

- Wear appropriate personal protective equipment. At a minimum, this consists of gloves, a lab coat, safety glasses, and in some cases a respirator
- Examine the shipping containers to verify that the custody tape is intact
- Examine all sample containers for damage
- Open shipping containers in adequately ventilated areas to assure worker safety
- Determine if the temperature required by the requested testing program has been maintained during shipment. Document the shipping container temperature on the COC
- Compare samples received against those listed on the COC
- Verify that sample holding times have not been exceeded
- Examine all shipping records for accuracy and completeness
- Determine sample pH (if required for the scheduled analysis) (except VOA samples) and record on the COC
- Sign and date the COC immediately (only after shipment is accepted) and attach the waybill
- Note any problems associated with the coolers and samples on the COC, immediately initiate a Condition Upon Receipt Report (CUR) or equivalent format, and notify the PM who in turn notifies the client

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QUANTERRA® INCORPORATED

QAMP Change Form

DOCUMENT: Quality Assurance Management Plan, Revision No. 3
SECTION(S) AFFECTED BY CHANGE: Section 8.5.2, page 58; Appendix B, page 3.
REASON FOR ADDITION OR CHANGE: Section 8.5.2: To clarify the HT requirements and make consistent with Quanterra® Terms and Conditions. Appendix B: To correct area code for North Canton location.
CHANGE EFFECTIVE FROM: February 1, 1999
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Chief Operating Officer
Date 2/1/99

Chris M. Lee
Vice President **of Operations Services**
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Corporate **Director of Quality Assurance**
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- Verify that sample holding times have not been exceeded
- Examine all shipping records for accuracy and completeness
- Determine sample pH (if required for the scheduled analysis) (except VOA samples) and record on the COC
- Sign and date the COC immediately (only after shipment is accepted) and attach the waybill
- Note any problems associated with the coolers and samples on the COC, immediately initiate a Condition Upon Receipt Report (CUR) or equivalent format,

- Attach durable (water-resistant) laboratory sample container labels with unique laboratory identification number and test
- Place the samples in proper laboratory storage.

A CUR or an equivalent form/system is generated by sample control during the sample log-in process to document anomalies identified upon the receipt of samples in the laboratory. These anomalies are outside of laboratory control and do not require corrective actions to be taken within the laboratory. The affected client shall be notified by the PM or designee of all CURs generated for their samples. The PM is responsible for resolving with the client how to proceed with the samples and documenting the decision to proceed with the analysis of compromised samples. CURs must be resolved prior to sample preparation and analysis. The completed CUR form shall be stored in the project file. An example CUR is shown in Figure 8.5-2. The report narrative will include an explanation of sample receiving related anomalies.

8.5.3.2 Sample Log-in

Sample log-in activities at Quanterra® operating units are fully documented in operation-specific SOPs. The following is a general description of the log-in process:

- Enter the samples in the laboratory sample log-in book, and/or the LIMS which contains the following information at a minimum:
  - Project name or identification number
  - Unique sample numbers (both client and internal laboratory)
  - Type of samples
  - Required tests
  - Date and time of laboratory receipt of samples
  - Field ID supplied by field personnel
- Notify the PM and appropriate Group/Team Leader(s) of sample arrival
- Place the completed COCs, waybills, and any additional documentation in the project file.

8.5.3.3 Sample Storage

The primary considerations for sample storage are:

- Maintenance at the method prescribed temperature, if required
- Maintenance of sample integrity through adequate protection from contamination from outside sources or from cross-contamination

FIGURE 8.5-2

Example Quanterra® Condition Upon Receipt Anomaly Report (CUR)
Page 1 of 2

CUR No.: _____
Lot: _____

Date Received: _____
Client: _____ Initiated By: _____
Project Name: _____ RFA/COC Nos.: _____

Condition/Anomaly/Variance (select from legend on back):

Client Sample ID	Analysis Requested	Condition (see legend)	Comments/Actions

Corrective Action:

☐ Client informed verbally on: _____ By: _____ In writing on: _____ By: _____
☐ Sample(s) processed "as is"
☐ Sample(s) ON HOLD until further notice
☐ Other action required (see above comments)
☐ No action required.

Sample Control Reviewer: _____ Project Manager: _____

SIGNED ORIGINAL MUST BE RETAINED IN THE PROJECT FILE

FIGURE 8.5-2
Example Quanterra® Condition Upon Receipt Anomaly Report (CUR)
Page 2 of 2

Legend:

Cooler:
1a Not received, COC available
1b Leaking
1c Other: _____

Temperature:
2a Temp. Blank: _____
2b Cooler Temp: _____
(cooler temp should only be used if there is no Temp. Blank)

Containers:
3a Leaking
3b Broken
3c Extra
3d No labels
3e Headspace (VOA only)
3f Other: _____

Samples:
4a Samples received but not on COC
4b Samples not received but on COC
4c Holding Time Expired
4d Sample Preservative: _____
4e Other: _____

Custody Seals:
5a None
5b Not intact
5c Other: _____

Chain of Custody (COC):
6a Not relinquished by client
6b Incomplete information
6c Other: _____

Container Labels:
7a Doesn't match COC
7b Incomplete information
7c Marking smeared
7d Label torn
7e Other: _____

Other (8): _____
_____
_____

SIGNED ORIGINAL MUST BE RETAINED IN THE PROJECT FILE

of samples. Low-level and high-level samples, when known, must be stored separately. Samples and standards must be stored in separate refrigerators or freezers. Storage areas for volatile organic test requests should be monitored twice per month by the analysis of a holding (refrigerator) blank (an aliquot of contaminant-free water stored in a VOA vial)

- Security of samples within the laboratory.

The requirements listed in Tables 8.5-1 through 8.5-5 for temperatures and holding times shall be used. Placing of samples in the proper storage environment is the responsibility of sample control personnel. Quanterra® operations will assign individuals the responsibility of notifying the Operations Manager and Group/Team Leaders if there are any samples which must be analyzed immediately because of holding time requirements.

8.5.3.4 Internal Sample Chain-of-Custody and Interlaboratory Transfers

Sample custody within Quanterra® laboratories is described in operation-specific SOPs. The sample custody documentation shall include the following minimum requirements:

- Name of associate taking custody of the sample from the sample storage area for preparation or analysis
- Dates sample removed from and returned to the sample storage area
- Identification of tests to be performed on the sample aliquot(s) selected by the associate
- Sample matrix
- Laboratory sample numbers
- Sample storage location.

Additional custody records can be provided by a facility at the specific request of the client. Access to all Quanterra® facilities is restricted to prevent any unauthorized contact with samples, extracts, or documentation.

Samples transferred to a different laboratory than the original receiving facility are transferred under chain-of-custody (COC). The COC is maintained whether the laboratory is another Quanterra® facility or a subcontracted laboratory. If the entire sample volume is transmitted, the original copy of the client's COC form will be used to document the relinquishing of the sample and will accompany the sample to its destination. A copy of the completed COC form shall be retained in the laboratory project file. In the case where an aliquot of a sample is shipped from the laboratory, a new COC will be

generated by the laboratory and shipped with the sample aliquot. The original COC will be retained in the project file at the site holding the original sample container.

Samples are not transferred to other Quanterra® facilities or to subcontractor laboratories without prior approval of the client.

8.5.3.5 Sample Disposal and Return Chain-of-Custody

After the requested analyses on the samples have been completed, any remaining portions of the samples will be maintained by the sample custodian until the samples are disposed of or returned to the client. The disposal of each sample is recorded on the client's COC form, in LIMS, or referenced in the project file. Sample disposal procedures and documentation are described in operation-specific SOPs. Quanterra®'s routine sample retention period is at least thirty days after the analytical report is issued to the client, unless otherwise specified by the client.

For Nuclear Regulatory Commission (NRC) or state licensed laboratories, a real-time inventory of all radioactive isotopes contained in the laboratory (including radioactive samples), as required by the NRC or state, is maintained by the Radiation Safety Officer (RSO). If the quantities of radioactive materials in-house approach the limits stipulated by the laboratory NRC or state license, appropriate action must be taken to ensure the licensed level is not exceeded. This may involve returning samples to clients immediately.

If samples are returned to the client rather than disposed of by the laboratory, the original COC is used to document custody transfer back to the client from the laboratory. A copy of the completed COC is retained in the laboratory project file.

8.5.4 Calibration Procedures and Criteria

All equipment and instruments used at Quanterra® operations for quantitative measurements are controlled by a formal calibration program. Calibrations may be periodic or operational. These are described in operation-specific and corporate SOPs. At a minimum, these procedures shall include:

- Instrument to be calibrated
- Reference standards used for calibration
- Calibration technique (e.g., linear, quadratic)
- Acceptable performance tolerances and corrective actions required if specifications are not met
- Frequency of calibration

- Calibration documentation requirements.

Whenever possible, recognized procedures such as those published by ASTM or the USEPA or procedures provided by manufacturers shall be adopted. If established procedures are not available, a procedure shall be developed considering the type of equipment, stability characteristics of the equipment, required accuracy, and the effect of operation error on the quantities measured.

8.5.4.1 Physical Reference Standards

Physical reference standards associated with periodic calibrations include weights for calibrating balances and certified thermometers for calibrating working thermometers. Whenever possible, physical reference standards shall be calibrated by a body that can provide traceability to nationally or internationally recognized standards. If these standards are not available, the basis for the reference standard shall be documented.

Physical reference standards shall be used only for calibration procedures and shall be stored separately from equipment used for analysis.

8.5.4.2 Chemical Reference Standards and Reagents

Chemical reference standards are generally associated with operational calibration. These standards include reference materials traceable to recognized standards suppliers. This may include vendor-certified materials traceable to national or international standard reference materials (e.g., NIST or A2LA).

All chemical reference standards maintained in the laboratory for use in calibrations (or as QC spiking solutions) shall be labeled or referenced to appropriate documentation with the following information at a minimum:

- A unique identification including concentration (solutions containing several analytes can be identified such that the solution constituents and concentrations can be referenced to a logbook)
- Medium prepared in
- Preparation date
- Expiration date
- Initials of preparer.

Vials containing standard solutions that are not large enough to accommodate labels listing the above information may be referenced to a laboratory logbook or notebook entry. The expiration date of the working standard must not exceed the expiration date of the original material.

8.5.4.3 Standard Verification

When possible, reference standards are purchased from a Quanterra® preapproved vendor. Standards are verified before use by the vendor or Quanterra® where applicable. Prior to use, the laboratories must confirm that the lot they received from the vendor was approved. Special standards that are obtained from another source must be independently verified at the lab. Verification of a reference standard from neat materials is also necessary.

To extend the use of an expired standard, reverification is necessary provided that new analysis produces acceptable data. The verification of an expired standard is performed against a current, independent standard reference material by analyzing within a valid calibration and QC.

Stock and working standards are checked regularly for signs of deterioration, such as discoloration, formation of precipitates, or change in concentration. Care is exercised in the proper storage and handling of standard solutions. Standards are always stored separately from samples.

An independent standard is used to verify initial calibrations. An independent standard is defined as a standard composed of the same target constituents as, but from a different source than those used in the standards for the initial calibration. An independent standard may be a laboratory-prepared or a certified independent standard solution(s). Independence of reference material can be achieved by: (1) purchasing reference materials from two separate vendors, (2) using a different lot, or (3) having two separate individuals prepare the calibration and verification standard solutions if independent sources are not available for neat standards.

Records for all purchased standards and reagents shall include the date of receipt, the date opened, and, where applicable, the expiration date.

8.5.4.4 Periodic Calibration

Periodic calibration is performed at prescribed intervals. In general, equipment which can be calibrated periodically is a distinct, singular purpose unit and is relatively stable in performance. These include balances, micropipettors, counters, thermometers, refrigerators, freezers, and ovens. Equipment employed at Quanterra® operations requiring periodic calibration are listed along with their respective calibration requirements in Table 8.5-6. Each Quanterra® operating unit has SOPs in place for the calibration of this equipment if in use at their location.

8.5.4.5 Operational Calibration

Operational calibration is routinely performed as part of instrument usage, such as the development of a standard calibration curve. The accuracy of initial calibrations are to be verified prior to sample analysis through the use of an independent standard in situations where the source method requires calibration verification. A laboratory control sample (LCS), prepared from an independent standard, may also be used for calibration verification. Detailed requirements for operational calibration are contained in method-specific SOPs. A summary of the various operational calibrations performed at Quanterra® operations is shown in Tables 8.5-7 through 8.5-9.

8.5.4.6 Calibration Failure

Equipment or instruments that fail calibration or become inoperable during use shall be tagged to indicate they are out of calibration. Such instruments or equipment shall be repaired and successfully recalibrated before reuse. Following recalibration or verification, back to control will be documented in the injection/run log and/or maintenance logbook through the routine identification of the required calibration runs specified by the standard operating procedure. The procedure for tagging out such instruments or equipment is described in the Corporate SOP Number CORP-QA-0010, "Nonconformance and Corrective Action."

Recalibration may occur more frequently than scheduled. At any time, if equipment calibration becomes suspect, it shall undergo a calibration check to determine whether the current calibration is still acceptable or if recalibration is required.

8.5.4.7 Calibration Records

Calibration shall be documented for each piece of equipment subject to calibration. All calibration records (periodic and operational) directly affect data and may not be limited to one project. These records shall be stored in either the quality records or the associated project files. Project files that include sample data shall either include the calibration records or include reference to them.

8.6 Quality Assessment

The effectiveness of the QA practices at a laboratory is measured by the quality of data generated by the laboratory. Each Quanterra® operating unit shall establish, implement and document procedures to detect, prevent, and correct quality problems and to ensure quality improvement. Items and processes that do not meet established requirements must be investigated to determine their cause. Improvements must be implemented in the operations which will prevent a recurrence of

these quality problems and provide overall quality performance. All phases of laboratory work should be designed with the objective of preventing problems and improving quality on a continuous basis.

8.6.1 Data Quality Assessment

Data quality is judged in terms of precision, accuracy, representativeness, completeness and comparability. The areas of representativeness, comparability, and completeness for an overall project, inclusive of sampling issues, may be beyond the control of the laboratory. The elements over which the laboratory has direct control are precision, accuracy, and completeness relative to analytical testing results.

Precision and accuracy assessments are made as part of the evaluation of laboratory QC data generated during sample preparation and analysis. The QC samples employed at Quanterra® as part of routine sample analysis are summarized in Section 8.4 of this document. Table 8.6-1 shows the precision and accuracy measurements employed by Quanterra®. Analytical method SOPs and Quanterra® Policy Number QA-003, "Quanterra® Quality Control Program", include information on requirements for the type of QC samples, frequencies, and acceptance criteria. Additionally, the SOPs and Policy describe the appropriate actions to be taken when a QC sample result does not meet acceptance criteria.

8.6.2 Statistical Evaluation of Data

In-house limits for all QC data must be evaluated at least annually and compared to the limits published in the methods for applicable matrices. Method limits will be employed until sufficient QC data are acquired. A minimum of 20 to 30 data points are recommended to establish the in-house QC limits. Calculated results of the QC (LCS) samples are evaluated by comparing against control limits (3-sigma).

Program-specific data analysis requirements for control charts are followed as required for data generated under those programs. These additional requirements shall be documented in a QAPP or QAS.

Precision and accuracy measurements employed by Quanterra® are shown in Table 8.6-1. Calculated results of these QC samples are evaluated using statistical tables or control charts.

8.7 Data Recording Procedures

To ensure data integrity, all documentation of data and records generated or used during the process of data generation must be performed in compliance with Quanterra® Corporate SOP

Number QA-008, "Data Recording Requirements".

8.8 Data Reduction and Verification Procedures

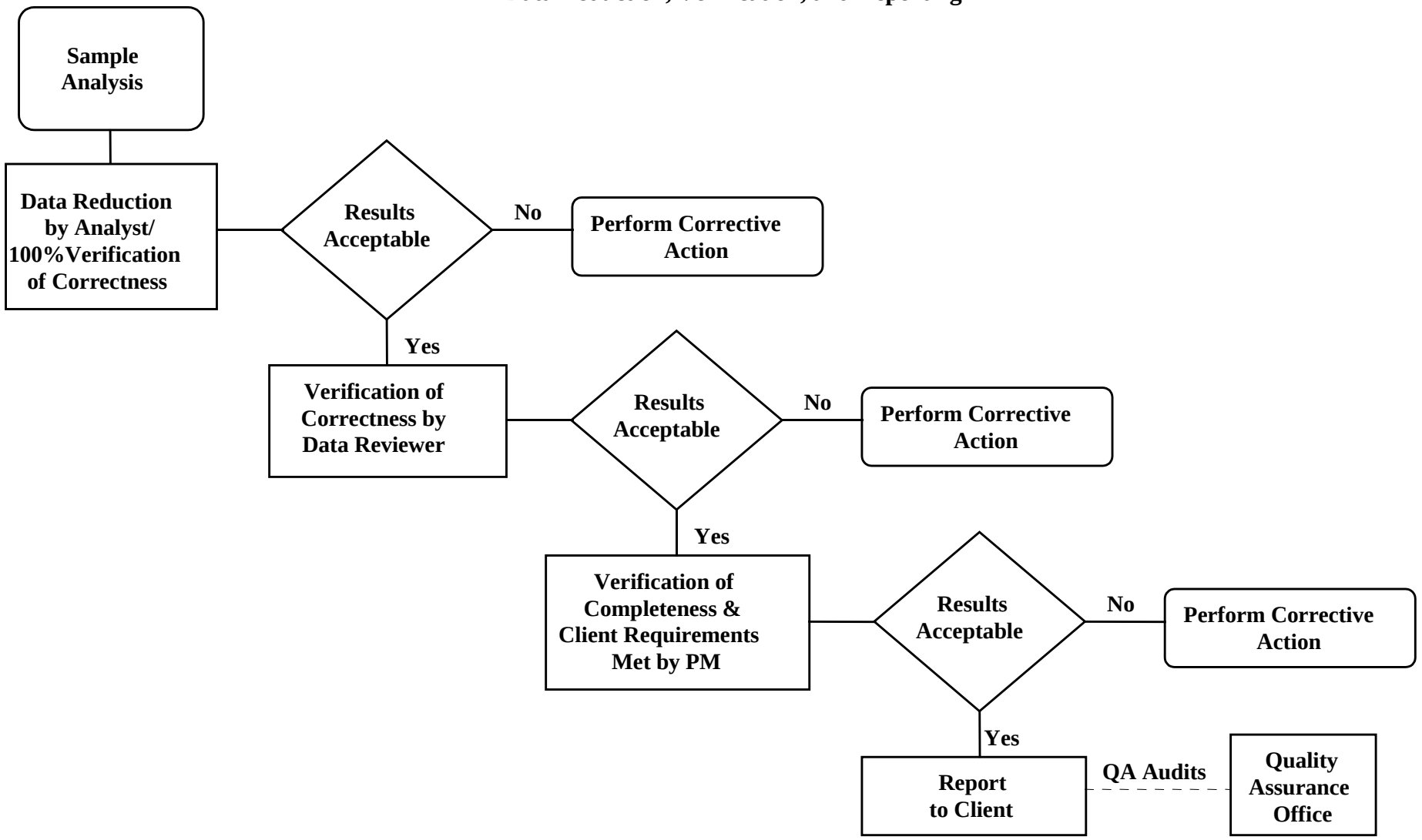
Data review procedures, defined as a set of computerized and manual checks applied at appropriate levels of the measurement process, will be clearly defined for all measurement systems in SOPs. Data review begins with the reduction or processing of data and continues through verification of the data and the reporting of analytical results. Calculations are checked from the raw data to the final value prior to reporting results for each group of samples. Data reduction can be performed by the analyst who obtained the data or by another analyst. Data verification starts with the analyst who performs a 100 percent review of the data to ensure the work was done correctly the first time. Data verification continues with review by a second reviewer who verifies that data reduction has been correctly performed and that the analytical results correspond to the data acquired and processed. This procedure is outlined in Figure 8.8-1.

8.8.1 Data Reduction and Initial Verification

Data reduction and initial verification may be performed by more than one analyst depending upon the analytical method employed. The preparation and analytical data may be reviewed independently by different analysts. In these instances, each item may not be applicable to the subset of the data verified or an item may be applicable in both instances. It is the responsibility of the analyst to ensure that the verification of data in his or her area is complete. The data reduction and initial verification process must ensure that:

- Sample preparation information is correct and complete including documentation of standard identification, solvent lot numbers, sample amounts, etc.

FIGURE 8.8-1
Data Reduction, Verification, and Reporting



- Analysis information is correct and complete including proper identification of analysis output (charts, chromatograms, mass spectra, etc.)
- Analytical results are correct and complete including calculation or verification of instrument calibration, QC results, and qualitative and quantitative sample results with appropriate qualifiers
- The appropriate SOPs have been followed and are identified in the project records
- Proper documentation procedures have been followed
- All nonconformances have been documented
- Special sample preparation and analytical requirements have been met.
- The data generated have been reported with the appropriate number of significant figures as defined by the analytical method in the LIMS or otherwise specified by the client.

In general, data will be processed by an analyst in one of the following ways:

- Manual computation of results directly on the data sheet or on calculation pages attached to the data sheets
- Input of raw data for computer processing
- Direct acquisition and processing of raw data by a computer.

If data are manually processed by an analyst, all steps in the computation shall be provided including equations used and the source of input parameters such as response factors (RFs), dilution factors, and calibration constants. If calculations are not performed directly on the data sheet, they may be attached to the data sheets.

Manual integrations are sometimes necessary to produce good chromatography, but must only be performed when necessary. Further discussion of manual integrations and the required documentation is given in Quanterra Policy Number QA-011, “Acceptable Manual Integration Practices”.

For data that are input by an analyst and processed using a computer, a copy of the input shall be kept and uniquely identified with the project number and other information as needed. The samples analyzed must be clearly identified.

If data are directly acquired from instrumentation and processed, the analyst must verify that the following are correct:

- Project and sample numbers
- Calibration constants and RFs
- Units
- Numerical values used for reporting limits.

Analysis-specific calculations for methods are provided in SOPs. In cases where computers perform the calculations, software must be validated or verified, as described in Section 6.0 of this document, before it is used to process data.

The data reduction is documented, signed and dated by the analyst completing the process. Initial verification of the data reduction by the same analyst is documented on a data review checklist, signed and dated by the analyst. Data review requirements are described in the Quanterra Policy Number QA-012, "Technical Data Review Requirements".

8.8.2 Data Verification

Following the completion of the initial verification by the analyst performing the data reduction, a systematic check of the data that has been fully reduced and checked through Level 1 review is performed by an experienced peer, supervisor, or designee. This check is performed to ensure that level 1 review has been completed correctly and thoroughly. The second level reviewer examines the data signed by the analyst. This review includes an evaluation of all items required in the raw data package. Any exceptions noted by the analyst must be reviewed. Included in this review is an assessment of the acceptability of the data with respect to:

- Adherence of the procedure used to the requested analytical method SOP
- Correct interpretation of chromatograms, mass spectra, etc.
- Correctness of numerical input when computer programs are used (checked randomly)
- Correct identification and quantitation of constituents with appropriate qualifiers
- Numerical correctness of calculations and formulas (checked randomly)
- Acceptability of QC data
- Documentation that instruments were operating according to method specifications (calibrations, performance checks, etc.)
- Documentation of dilution factors, standard concentrations, etc.
- Sample holding time assessment.

This review also serves as verification that the process the analyst has followed is correct in regard to the following:

- The analytical procedure follows the methods and specific instructions given on the project QAS or equivalent summary form
- Nonconforming events have been addressed by corrective action as defined on a nonconformance memo

- Valid interpretations have been made during the examination of the data and the review comments of the initial reviewer are correct

- The package contains all of the necessary documentation for data review and report production and results are reported in a manner consistent with the method used for preparation of data reports.

The specific items covered in the second stage of data verification may vary according to the analytical method, but this review of the data must be documented by signing the same checklist. Data review requirements are described in the Quanterra Policy Number QA-012, "Technical Data Review Requirements".

8.8.3 Completeness Verification

A third-level review is performed by the PM. This review is required before results are submitted to clients. This review serves to verify the completeness of the data report and to ensure that project requirements are met for the analyses performed. The items to be reviewed are:

- Analysis results are present for every sample in the analytical batch, reporting group, or sample delivery group (SDG)

- Every parameter or target compound requested is reported with either a value or reporting limit

- The correct units and correct number of significant figures are utilized

- All nonconformances, including holding time violations, and data evaluation statements that impact the data quality are accompanied by clearly expressed comments from the laboratory

- The final report is legible, contains all the supporting documentation required by the project, and is in either the standard Quanterra® format or in the client-required format.

A narrative to accompany the final report will be finalized by the PM. This narrative will include relevant comments collected during the earlier reviews.

8.9 Data Reporting

8.9.1 Data Reports

Quanterra® is capable of developing a variety of data deliverable reports. In general, Quanterra® reports contain:

- Cover Letter/Narrative - Information on sample types, tests performed, any problems encountered, and general comments are provided.

- Analytical Data - Data are reported by sample or by test with the appropriate significant figures and reporting limits, and have been adjusted for dilution, if appropriate. Pertinent information including dates sampled, received, prepared, extracted, and analyzed are provided.

- Laboratory Performance QC Information -

The results of LCSs and method blanks analyzed with the project are listed. Any data or QC anomalies are discussed in the narrative.

- Matrix-Specific QC Information - Results of any sample duplicates and MS/MSDs analyzed with the samples as batch QC are reported. Other project-specific QC requested by the client are also reported. The results include supporting information such as amount spiked, percent recovery, or percent difference/RPD.

- Methodology - Reference for analytical methodology used is cited.

- Other Deliverables - Other deliverables available include disk deliverables, electronic data transfer, sample raw data packages, complete deliverable packages, and custom report formats.

8.9.2 Verbal Results

Quanterra®, as a policy, discourages the release of data verbally or without full data review. If however, the client requests analytical results to be communicated verbally or by facsimile prior to final review, they must be clearly identified as "Preliminary" results. The client must understand that the data have not undergone the required levels of review and may potentially change.

8.9.3 Reporting Analytical Results

Sample results are reported according to analytical method SOPs or client specifications. Normally, the laboratory uses the Quanterra® Reporting Limit (RL) at which any analyte of interest detected at or above that level is reported as a positive value and any analyte of interest not detectable or detected below that level is reported as "not detected" at the RL. The laboratory will normally report results within the calibration, however, any reported results outside of the calibration range will be documented in the final report.

In some cases a contract, QAPP, or documented client request may require the laboratory to report sample results in a specified manner. Some examples are given below:

- The laboratory may be requested to report all analytes of interest that are less than the laboratory's RL but are greater than the MDL. This data will be flagged with an appropriate qualifier. (See precautions in "Establishing Reporting Limits", Policy Number QA-009.)

- The laboratory may be requested to report any tentatively identified compounds (TICs). This data will be flagged with an appropriate qualifier.

- The laboratory may be requested to report sample results using an RL that is higher than their normal level. In this case, only the analytes of interest found at or above that level would be reported as positive values. In this case, the laboratory will state the PSRL rather than the RL. All analytes of interest not detected or detectable below that level would be reported as "not detected" at the PSRL.

In these types of cases, the laboratory must

include documentation in the project file that supports the reporting procedure employed.

It is the responsibility of the laboratory to provide for a reporting system that assures that any problems associated with an analysis are properly documented on a nonconformance memo, communicated to the appropriate Quanterra® associates, and addressed appropriately in the data report. If, after issuance of a report, Quanterra® observes any mistake that affects the results reported or the QC interpretation of those results, the client will be notified.

8.10 Data Validation

Data validation for Quanterra® refers to data reviews conducted in accordance with the

USEPA CLP "Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses" and "Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses", or modifications thereof, for non-CLP type analyses.

This form of data validation provides an impartial evaluation of the laboratory's results. Data validation may be requested by the client for a percentage of data and is usually performed by a third party, one which was not involved with the sample analysis. Qualifiers are assigned to data, when required, according to the requirements of the data validation protocol being used.

8.11 Preventive Maintenance and Service

Facilities, instruments, equipment, and parts are subject to wear, deterioration, or change in operational characteristics. Within Quanterra®, preventive maintenance, coupled with vendor service agreements, is an organized program of actions taken to maintain facilities and equipment in control.

8.11.1 Analytical Instrumentation and Equipment

The primary purpose of the maintenance program is to prevent instrument and equipment failure and to minimize down time. A properly implemented maintenance program increases the reliability of a measurement system.

At each laboratory each instrument or piece of equipment shall be uniquely identified. Each operating unit shall maintain the following:

- Instrument/equipment inventory list
- Instrument/equipment major spare parts list or inventory
- External service agreement documents (if applicable)
- Instrument-specific preventive maintenance logbook or file for each functional unit.

The records of routine maintenance and non-routine maintenance shall include at a minimum:

- Name and serial number of the item or equipment
- Details of maintenance performed
- Dates and results of recalibrations/reverifications indicating back to control
- Analyst initials and the date maintenance was performed whether by the analyst or a contracted service representative.

Any item or equipment that does not perform to specifications or defective shall be taken out of service, clearly identified and segregated until it has been repaired and shown by calibration/verification to perform satisfactorily.

Quanterra® documents and describes in detail instrument and equipment preventive maintenance procedures and requirements in operation-specific SOPs.

8.11.2 Facilities

Another important aspect of the laboratory operation is the existence and maintenance of adequate, safe, and clean facilities including appropriate engineering controls such as proper ventilation, lighting, dust control, hoods, air flow, protection from extreme temperatures, waste disposal, and a source of stable power.

The maintenance and use of these facilities and proper operations are described in the Quanterra® Chemical Hygiene Plan (CHP). The Laboratory Manager has responsibility for ensuring a properly maintained facility. The Laboratory Manager also has the responsibility for ensuring that samples are stored properly without contamination, work areas are equipped with adequate bench, hood and operational space, and the areas are free from chemical and radiological contamination that may affect analytical results.

8.11.3 Frequency of Maintenance

The frequency of maintenance must consider manufacturer's recommendations and previous experience. Frequency of preventive maintenance along with the recommended preventive maintenance schedules are given in Tables 8.11-1 through 8.11-27 for analytical instrumentation and equipment or defined in operation specific routine maintenance SOPs. These schedules are the recommended default if not otherwise specified by the manufacturer, SOP, or Facility-Specific Appendix for the laboratory. Frequency of maintenance for the facility systems is documented in the Quanterra® CHP.

8.12 Other Requirements

8.12.1 Water

High purity water (i.e., ASTM reagent grade or equivalent water) will be used in all metals, radiological, wet chemistry, and organic analyses. Demonstration of contaminant-free water is shown through the analysis of method blanks consisting of the reagent water on a daily basis for the analyte of interest. This water is obtained by the use of either a commercial ion-exchange deionizing, distillation, or reverse osmosis unit plus an appropriate polishing unit. The resulting water has a maximum conductivity of 1.0 umho-cm at 25°C or a minimum resistivity of 1.0 Mohm at 25°C. Conductivity or resistivity will be monitored and documented daily or on each day that water is dispensed for analytical use.

For volatile analyses the water may be further purified by purging with an inert gas before use to remove potential traces of organic solvents.

Water monitoring procedures used by Quanterra® operating units are detailed in operation-specific SOPs.

8.12.2 Compressed Air and Gases

Ultra high-purity compressed gases from preapproved vendors or in-house gas generators will be used when required for instrumentation. These air and gases must meet the requirements and specifications of the analytical methods performed. In-line filters will be used when appropriate to minimize contamination and moisture from the gases.

8.12.3 Glassware Preparation

Glassware preparation procedures implemented at Quanterra® operating units are designed to ensure that contaminants are not introduced during sample analysis. Procedures describing glassware preparation are detailed in operation-specific SOPs.

8.12.4 Chemical Storage

Storage of chemicals shall be conducted in a manner to minimize the potential for fire or release of hazardous material resulting from an unplanned chemical reaction. Refrigerators used for storing flammable liquids must have spark-free interior construction. Flammable solvents shall be stored in appropriate cabinets meeting all necessary codes. All chemicals are stored according to chemical compatibility. Further details regarding chemical storage are provided in the Quanterra® CHP.

8.12.5 Waste Disposal

Laboratory wastes shall be disposed of safely and in a manner consistent with applicable regulations. The Laboratory Manager or designee is responsible for the development, implementation, and maintenance of site-specific procedures that will document all aspects of the disposal program. These

procedures and the training requirements are described in the Quanterra® CHP.

8.12.6 Facility Security

Each Quanterra® laboratory is a limited access, secure facility. To ensure that only authorized personnel are able to enter the building from an entrance that is not monitored, entry into each building is limited in one or more of the following ways at a minimum:

- The use of key pads or electronic locks activated by swipe or magnetic cards which are issued only to authorized personnel
- Locking doors and issuing keys only to authorized personnel
- Alarm systems to detect unauthorized entrance
- During business hours, entry is possible only through the main entrance. This entrance is monitored at all times, usually by a receptionist. All guests are required to sign in by using a visitor logbook.

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9.0 Quality Assessment and Response

9.1 Nonconformance and Corrective Action

9.1.1 Nonconformance

A nonconformance is an unplanned deviation from an established protocol or plan. The deviation may be the result of Quanterra's® actions as a systematic error, then termed a deficiency. A single isolated event or event beyond the control of Quanterra® is then termed an anomaly.

Nonconformances can be identified on the basis of internal or external systems or performance audits, sample processing, routine calibration and monitoring of analytical and support equipment, or QC sample analyses. The Operations Manager, Project Manager, QA Manager, Area Leader, and analyst may be involved in identifying the most appropriate corrective action. If previously reported data are affected, the issue is immediately brought to the attention of Corporate QA and senior management.

9.1.2 Corrective Action

Corrective actions are measures taken to rectify conditions adverse to quality and, where possible, to prevent their reoccurrence. Corrective actions should be timely, determine the root cause, and evaluate any propagation of the error or problem. Whenever a systematic error is discovered that affects the accuracy or defensibility of results reported to Quanterra®'s clients, client notification will be part of the corrective action. Corrective actions should be implemented with an understanding of the technology and work activities associated with the quality element, with appropriate training of Quanterra® associates and vendors, and should be monitored for progress and success.

Depending on the nature of the problem, the corrective action employed may be formal or informal. In either case, occurrence of the problem, the corrective action employed, and verification that the problem has been eliminated must be documented properly. On-the-spot actions are used to correct minor problems, such as recalibration, retuning, or a minor repair (e.g., replacement of a minor part) of a malfunctioning instrument or the correction of poor analytical technique being used by an analyst. These occurrences are documented in the appropriate injection, run, or analysis logbooks. Similarly, routine instrument maintenance, malfunctions, and power failures are also documented in the appropriate instrument maintenance logbooks. These events do not require a formal NCM process. Corrective actions specific to analytical methods are discussed in the

operational-specific SOPs.

9.1.3 Responsibilities

A detailed description of the responsibilities associated with nonconformance and corrective action, as well as the procedures to be followed, is provided in the Quanterra® Corporate SOP Number CORP-QA-0010, "Nonconformance and Corrective Action."

9.1.4 Nonconformance Memo

As defined in the SOP, deficiencies and anomalies for all activities other than sample log-in or matrix related incidents shall be documented on a nonconformance memo or via an electronic process that meets NCM requirements as approved by QA. Deficiencies and anomalies may be documented on separate systems or forms. A log or computerized data base will be maintained for all nonconformances determined to be deficiencies. Deficiencies will be examined for trends periodically, and this evaluation will be documented and reported to management. A copy of the nonconformance memo will be kept in the project files along with the data it refers to. A copy shall also be kept in the quality files.

9.2 Audits

Audits of Quanterra® laboratories are performed to assess the degree of adherence to established policies, procedures, and standards. These assessments are conducted internally by Quanterra® personnel, who are independent of the area being evaluated, and externally by clients and regulatory agencies. Audits can identify areas for improvement with regard to compliance with policies, procedures, and standards. Audits also provide a means for correction prior to system failure. The following types of audits and assessments are performed at Quanterra® laboratories:

- Performance Audits
- Systems Audits or Internal Systems Evaluations
- Data Audits
- Spot Assessments.

Internal systems audits or evaluations are generally conducted by QA staff, although periodic self-audits may be conducted by the operational units. Audits and assessments are generally conducted through the use of checklists and appropriate reference documents. Internal systems audits or evaluations are conducted with an opening meeting in which representatives from management, key operational staff, and QA staff participate. The opening meeting provides a review of the objectives of the audit and the schedule required to conduct the audit. At the completion of the audit, a debriefing is held to outline the findings, including identification of

positive performance, to discuss requirements in areas of deficiencies, and to answer questions. Spot assessments are generally more informal than systems audits, and may be conducted without prior scheduling.

Internal systems audits or evaluations are conducted at a minimum yearly by QA staff external to the lab. Spot assessments are conducted per schedule by the laboratory QA group.

The findings of all audits and assessments are documented as is the laboratory response and any corrective actions. Follow-up checks are performed and the status of implementation of corrective actions is documented for all categories of audits and assessments. This cycle continues until all issues are closed.

9.2.1 Performance Audits

Performance audits or performance evaluations (PEs) are conducted to verify the ability of the laboratory to correctly identify and quantitate compounds in PE samples. These PE samples may be supplied internally or externally as single-blind or double-blind samples and can be used to assess if a deficiency has been corrected. The results of internal performance audits may be used to document the proficiency of the analyst performing the work or to assess the overall performance of an analytical method. Double-blind performance audits are conducted by Quanterra® Corporate QA to assess the effectiveness of all aspects of laboratory operation from project initiation through analysis and reporting. In addition, any problems detected regarding quotes, bids, and invoicing are brought to the attention of the PM and to the finance/accounting department, as appropriate.

The results of each performance audit shall be reported to laboratory management. All performance audit results which are identified as unacceptable must be investigated. The findings of the investigation and corrective action taken must be documented.

9.2.2 Systems Audits

A systems audit assesses fulfillment of the QAMP and the effectiveness of the quality system. Each laboratory undergoes numerous systems audits performed by external parties, including federal, state, and local regulatory authorities and clients.

9.2.2.1 Independent Internal Systems Audits or Evaluations

Each year, an independent systems evaluation will be performed under the direction of the Corporate Director of Quality Assurance and according to Corporate SOP Number, CORP-QA-0014. This evaluation is performed to assess each laboratory's adherence to the requirements of the QAMP, SOPs, internal

policies, and to assess the status of corrective actions from other audits at that facility.

The Corporate Director of Quality Assurance shall appoint a lead auditor to conduct the systems evaluation. An auditor must be a Quanterra Quality Assurance Manager with direct experience on at least one Quanterra systems audit or a certified Quanterra Lead Auditor as defined in the SOP, CORP-QA-0013, Employee Orientation and Training. A corporate audit outline shall be used. The lead auditor has the authority to lengthen the evaluation, revise the scope of the evaluation, stop work, or specify an accelerated schedule for re-evaluation. The lead auditor shall be responsible for preparing a report detailing the results of the evaluation. The report shall be submitted, after approval by Corporate QA, to the audited Laboratory Manager, Regional General Manager, and Laboratory QA Manager within five weeks of the audit. A copy of the report shall be distributed to the Corporate QA Director. The audit report shall provide a summary of the audit results with the auditor's comments and the findings that were determined by the lead auditor.

The evaluated laboratory must respond to Corporate QA in writing within four weeks of receiving the evaluation report. The QA Manager is responsible for coordinating the response to the evaluation report. The Laboratory Manager or Operations Manager must approve all responses to internal evaluation reports prior to submittal to the auditor.

The evaluation may result in findings, areas needing improvement, and notable practices. Each term will be defined as such:

- Findings - are defined as those noncompliant practices or policies which have significant adverse impact on data quality, technical defensibility, or regulatory acceptance of data. Findings require immediate attention by the laboratory management and must be resolved to comply with Quanterra®'s quality documents and laboratory-established procedures.

- Areas Needing Improvement - represent isolated instances of noncompliance or issues that are judged to have a less immediate impact on data quality. Laboratory management must correct the situation or otherwise ensure that the condition does not recur.

- Notable Practices - should also be pointed out during the audit. These are defined as laboratory practices that increase effectiveness and quality and represent improvements with respect to conventional laboratory operations.

Operations management is responsible for taking corrective action to address the findings and areas needing improvement (deficiencies) identified during the audit.

It is the responsibility of the QA Manager at each facility to verify implementation of the corrective actions and document the closure of all internal evaluation findings. This process shall be documented and provided to the recipients of the original audit report. This process is further described in the Quanterra® Corporate SOP Number CORP-QA-0014, "Laboratory Internal Systems Evaluation".

Internal evaluation reports shall be maintained according to the Quanterra® Record Retention Policy (LEG-004) as confidential documents and shall not be released for use outside the laboratory. External auditors may view internal audit reports as part of their on-site audit.

9.2.2.2 External Systems Audits

Audits of Quanterra® laboratories are performed by external agencies and clients. All scheduled audits shall be placed on the facility's calendar with the knowledge of the Laboratory Manager and the Laboratory QA Manager to assure no scheduling conflicts occur and that appropriate staff will be available to meet the agencies' or clients' objectives.

All deficiencies reported to the laboratory must be responded to within the time line specified by the client. A plan of action to correct the deficiencies, as well as corrective actions taken, must be documented. It is the responsibility of the QA Manager to coordinate the response to the audit report. The development and implementation of the corrective actions is the responsibility of the Operations management as related to their respective areas. All responses must be approved by the Laboratory Manager or Operations Manager prior to submittal to the auditor. A copy of the audit report and the laboratory's response must be provided to the Laboratory Manager. It is the responsibility of the QA Manager to verify implementation of the corrective actions and inform the responsible manager of the closure of all deficiencies from the audit.

9.2.3 Data Audits

Data audits are routinely performed and documented to ensure that project records meet project requirements as described in method SOPs, project plans, or other documented requirements. The data audit is used to identify any lab errors that may have occurred. The laboratory QA Manager or designee is responsible for performing data audits as specified in Quanterra® SOP Number CORP-QA-0004, "QA Data Review". This independent review may also serve as the annual assessment of analysts in verifying initial and/or on-going technical capability of chemists performing routine analyses.

9.2.4 Spot Assessments

Spot assessments are conducted to monitor or observe a process or activity in order to verify conformance to the SOP requirements for that activity. The frequency, normally monthly, for performing these assessments is determined by the facility QA Manager. The scope of the assessment is also determined by the QA Manager and may be directed based on information obtained from client inquiries, trends in recorded nonconformances, performance audits, or other sources. A spot assessment may be used to assess a procedure performance relative to the documented SOP. This assessment identifies deviations from requirements that may not be detected in a detailed review of the data package alone. Such an assessment is conducted by observation of the associates performing the task compared with the documented SOP. In some cases, the assessment may be conducted through interviews with the associate when observation of a task is not possible. Review of relevant documentation for the completed procedure is included in such an assessment. A checklist may be used in conducting the assessment. The results of the assessment are documented, as are the corrective actions. All deficiencies noted as a result of a spot assessment must be corrected by the responsible staff in a timely manner.

9.3 Client Inquiries and Complaints

Client inquiries and complaints are generally received through the PM or a member of the CST. Typically, the PM communicates with the client to determine the details of the inquiries, including technical data problems, deliverable issues, turn-around-time problems, etc. Technical and deliverable issues are coordinated by the PM and usually involve input from operations, QA, and management staff. A formal written response to the client is coordinated by the PM, but may on occasion be delivered by the CSM or the Account Manager. Details of the types and levels of complaints and required documentation are provided in Corporate Policy No. QA-013, “Procedures to Address Customer Complaints”.

9.4 Quality Reports to Management

The QA Manager and Corporate Director of Quality Assurance shall prepare and maintain copies of reports to management on a monthly basis indicating the effectiveness of the QMS. The operations monthly QA reports to management shall, at a minimum, include discussion of the following activities that occurred during the month:

- Internal/external audit findings
- Certification changes
- External/internal PE sample results
- Summary of client inquiries for which QA was asked to assist the laboratory in

developing a response

- Data quality investigations.
- NCM/lab issues

The corporate reports serve as executive summaries to members of senior management of the detailed information provided by the QA Managers.

9.5 Management Process Review

Based upon laboratory audits or input from clients or the QA group, management may elect to assess any of the operations or processes therein. These reviews and corrective actions would be documented and followed up by management. The purpose of these assessments would be to correct systematic issues or processes before they impact data quality.

9.6 Management Review of the QMS

Annually laboratory management will evaluate the status of the quality systems in the laboratory to ensure the procedures and policies are in place and they are adhered to. The Corporate Director of Quality Assurance annually sends to the laboratory management an outline of the Quality Systems with a request that each operation reviews their status including completion dates on any items requiring correction or implementation. The laboratory management report their assessments with any recommendations for changes or improvements to the Corporate QA Director which in turn will report results to the Chief Operating Officer.

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10.0 Quality Improvement

Quality improvement at Quanterra® is a critical element of our quality strategy as well as our business strategy. Quanterra® will become a world class organization through a commitment to continuous quality improvement. Every Quanterra® associate must understand that continuous improvement is a guiding principle pertinent to all aspects of our business.

The key elements of quality improvement are:

- Standardization of procedures
- Continuous quality improvement
- Benchmarking
- Quality assessment
- Understanding the clients' needs
- Quality measures and standards.

10.1 Standardization of Procedures

Due to the vast number of methods that have been introduced into the environmental analytical field, as well as revisions and proposed updates to currently promulgated methods, many methodologies contain conflicting requirements. It is through the generation and use of standard operating procedures, which contain Quanterra®'s best technical interpretation of published methods, that Quanterra® succeeds in providing quality standardized analytical testing to our clients. This standardization is achieved through the implementation of standardized or corporate SOPs and policies. Quanterra® will generate and implement new SOPs and policies as the need arises, and will train associates in their importance and use.

The standardization of procedures, as they are implemented throughout Quanterra®, result in improved quality of our services and deliverables provided to our clients at some level at all operations.

Any departures from the standardized procedures must be documented and, if a deficiency is noted, it is documented with a NCM. For further details refer to Section 9.1.1.

10.2 Continuous Quality Improvement

The continuous improvement of processes throughout Quanterra® is the responsibility of each Quanterra® associate. Processes are followed in every operating unit, group, and by each individual, and each of these processes is applicable to this discussion. All

associates are empowered and encouraged to bring suggestions for process improvement changes to the attention of laboratory management, as well as the Technology and QA groups. Management is responsible for assessing the recommendation for improvement and following through with an implementation plan when appropriate.

10.3 Benchmarking

Benchmarking is a step-by-step method of improving performance by identifying and studying best practices and comparing them to industry practices. Benchmarking is performed within Quanterra®, as well as on the industry. Changes to processes resulting from benchmarking may be tested in a single laboratory under senior technical and QA management. If successful, the process change may be implemented throughout Quanterra®.

10.4 Quality Assessment

Quality improvement is also achieved through the practice of quality assessment and subsequent correction of detected quality-related problems when they occur. Quality assessment and response are described in Section 9.0.

10.5 Understanding the Client's Needs

Client satisfaction must be a goal of all Quanterra® associates. Periodic client surveys provide a useful tool to measure if we are meeting their needs. While quality is defined as meeting the requirements of our clients, both internal and external, we must also strive to exceed our client's expectations. Every Quanterra® associate is either directly or indirectly involved in meeting our client's needs, therefore effective communication of these needs to all associates as described in this QAMP is essential.

Any verbal or written inquires or complaints from clients to any associate must be addressed in a timely manner and any issue concerning data quality must be documented. (See Section 9.3).

10.6 Quality Measures and Standards

Measures and standards used by Quanterra® are fundamental to assessing and achieving our commitment to continuous improvement. With most business processes, performance is generally measured at the end. Quanterra® managers must provide continuous feedback to all associates regarding performance measures and standards.

Key Result Indicators (KRIs) provide one of Quanterra®'s measures. Additional measures

and standards shall be added to track programs, processes, or projects, as appropriate.

KRIs measure performance in areas considered critical to achieving world class Quality in customer satisfaction and business performance. KRIs focus quality measures on the customer as well as the processes that our customers value. KRIs are intended to demonstrate continuous improvement and focus on the "vital few" issues for the business. Quanterra® KRIs include:

- On-time delivery
- Holding time violations
- Reissued reports
- Turn-around-time
- Safety.

Measurements of performance include internal and external audits, performance evaluations, and double-blind evaluations which are further described in Section 9.0. Improved results from these measurements show successfulness of process improvements.

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Tables

Quanterra®
Quality Assurance Management Plan

Table Section

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Table of Contents

Table of Contents (continued)

TABLE 2.3-1

Quanterra® Quality Assurance Management Plan Requirements Matrix

EPA QA/R-2	Quanterra QAMP (Rev 3)	ANSI/ASQC E4-1994	NQA-1[1]	5700.6C[2]	ANSI N 13.30	ANSI/ASQC Q2-1991[3]
1 Management and Organization	1.0 Management Commitment and Organization	2.1 Management and Organization	1 Organization	9.a. General	1.1 Introduction 1.2 Purpose 1.3 Scope	5.0 Management Responsibility
2 Quality System and Description	2.0 Quality System and Description	2.2 Quality System and Description	2 Quality Assurance Program	1 Program	2.1 Special Word Usage 2.2 Specific Terms 5.1 Quality Assurance 5.2 Quality Control	5.2 Quality System
3 Personnel Qualification and Training	3.0 Associate Qualification and Training	2.3 Personnel Training and Qualification	2 Quality Assurance Program	2 Personnel Training and Qualification	3.2 Personnel Preparation	14.0 Personnel
4 Procurement of Items and Services	4.0 Procurement of Items and Services	2.4 Procurement of Items and Services	4 Procurement Document Control 7 Control of Purchased Items and Services	7 Procurement	N/A	7.0 Quality in Procurement 13.0 Subcontracting
5 Documentation and Records	5.0 Documentation and Records	2.5 Documents and Records	6 Document Control 17 Quality Assurance Records	4 Documents and Records	3.6 Direct Bioassay-Record Retention 4.5 Indirect Bioassay-Record Retention	8.4 Quality Documentation and Records
6 Computer Hardware and Software	6.0 Computer Hardware and Software	2.6 Computer Hardware and Software	3 Design Control 11 Test Control	N/A	N/A	ISO 9000-3[4]

TABLE 2.3-1
Quanterra® Quality Assurance Management Plan Requirements Matrix
(Continued)

EPA QA/R-2	Quanterra QAMP (Rev 3)	ANSI/ASQC E4-1994	NQA-1[1]	5700.6C[2]	ANSI N 13.30	ANSI/ASQC Q2-1991[3]
7 Planning	7.0 Planning	2.7 Planning	2 Quality Assurance Program	1 Program	3.1 Facility Criteria	6.3.3 Quality Plans
		3.1 Planning and Scoping	3 Design Control	6 Design	3.4 Direct Bioassay-Performance Criteria for Service Laboratories	
		3.3 Implementation of Planned Operations	5 Instructions, Procedures, and Drawings	N/A	3.5 Direct Bioassay-Reporting Results	
			8 Identification and Control of Items		4.1 Indirect Bioassay-Responsibilities of the Service Laboratory Customer	
			9 Control of Processes		4.2 Indirect Bioassay-Analytical Methodology	
			11 Test Control		4.3 Indirect Bioassay-Performance Criteria for Service Laboratories	
			13 Handling, Storage, and Shipping		5.2 Quality Control	
8 Implementation of Work Processes	8.0 Work Processes and Operations	2.8 Implementation of Work Processes	1 Organization	5 Work Processes	3.1 Facility Criteria	8.0 Laboratory Operations Quality Assurance
			5 Instructions, Procedures, and Drawings	6 Design		9.0 Control of Measuring and Test Equipment
						10.0 Data Validation
						15.0 Use of Statistical Methods

TABLE 2.3-1
Quanterra® Quality Assurance Management Plan Requirements Matrix
(Continued)

EPA QA/R-2	Quanterra QAMP (Rev 3)	ANSI/ASQC E4-1994	NQA-1[1]	5700.6C[2]	ANSI N 13.30	ANSI/ASQC Q2-1991[3]
8 Implementation of Work Processes (Continued)		3.2 Design of Data Collection Operations	10 Inspection 12 Control of Measuring and Test Equipment 14 Inspection, Test, and Operating Status	8 Inspection and Acceptance Testing		
9 Assessment and Response[5]	9.0 Quality Assessment and Response	2.9 Assessment and Response 3.4 Assessment and Response 3.5 Assessment and Verification of Data Usability	2 Quality Assurance Program 13 Handling, Storage, and Shipping 15 Control of Non-conforming Items 16 Corrective Action 18 Audits	9 Management Assessment 10 Independent Assessment	3.3 Direct Bioassay-Interpretation of Measurements 3.5 Direct Bioassay-Reporting Results 4.4 Indirect Bioassay-Reporting Results 6.1 Direct Bioassay Measurements 6.2 Indirect Bioassay Measurements	16.0 Nonconformity 17.0 Corrective Action 18.0 Auditing the Quality System
9 Quality Improvement[5]	10.0 Quality Improvement	2.10 Quality Improvement	N/A	3 Quality Improvement	N/A	N/A

TABLE 2.3-1
Quanterra® Quality Assurance Management Plan Requirements Matrix
(Continued)

Footnotes

(1) Section II, "Basic Requirements."
(2) Criterion from Section 9, "Requirements."
(3) Technically equivalent to ISO 9001.
(4) Quality Management and Quality Assurance Standards, ISO 9000, Part 3, "Guidelines for the Application of ISO 9001 to the Development, Supply and Maintenance of Software."
(5) This document has two sections numbered "9."

TABLE 2.3-2

CROSS-REFERENCE OF QAMP SECTIONS ADDRESSING NELAC QUALITY MANUAL REQUIREMENTS

NELAC QUALITY MANUAL: REQUIRED ELEMENTS*	QUANTERRA® QAMP REVISION 3, QA SOP OR POLICY REFERENCE
a) A quality policy statement, including objectives and commitments, by top management	QAMP Chapter 1
b) The organization and management structure of the laboratory, its place in any parent organization and relevant organizational charts	QAMP Chapter 1
c) The relationship between management, technical operations, support services and the quality system	QAMP Chapter 1 QAMP Chapter 7
d) Procedures to ensure that all records required under this chapter are retained as well as procedures for control and maintenance of documentation through a document control system which ensures that all standard operating procedures, manuals, or documents clearly indicate the time period during which the procedure or document was in force	QAMP Chapter 2 QAMP Chapter 5
e) Job descriptions of key staff and reference to the job descriptions of other staff	QAMP Chapter 1 and Chapter 3 Separate document of job descriptions available from Lab-HR Manual
f) Identification of the laboratory's approved signatories; at a minimum, the title page of the Quality Manual must have the signed concurrence, (with appropriate titles) of all responsible parties including the QA officer, technical director, and the agent who is in charge of all laboratory activities such as the laboratory director or laboratory manager	QAMP Title/Approval Page Facility Specific Appendix Approval Page
g) The laboratory's procedures for achieving traceability of measurements	QAMP Chapter 8

*National Environmental Laboratory Accreditation Conference Standard, Quality Systems, July 2, 1998

TABLE 2.3-2

CROSS-REFERENCE OF QAMP SECTIONS ADDRESSING NELAC QUALITY MANUAL REQUIREMENTS (continued)

NELAC QUALITY MANUAL: REQUIRED ELEMENTS*	QUANTERRA® QAMP REVISION 3, QA SOP OR POLICY REFERENCE
a) A list of all test methods under which the laboratory performs its accredited testing	Facility Specific Appendices
b) Mechanisms for ensuring that the laboratory reviews all new work to ensure that it has the appropriate facilities and resources before commencing such work	QAMP Chapter 7
c) Reference to the calibration and/or verification test procedures used	QAMP Chapter 8 Table 8-4,5,6,7
d) Procedures for handling submitted samples	QAMP Chapter 8
e) Reference to the major equipment and reference measurement standards used as well as the facilities and services used by the laboratory in conducting tests	QAMP Chapter 8 Facility Specific Appendices
f) Reference to procedures for calibration, verification and maintenance of equipment	QAMP Chapter 8
g) Reference to verification practices including interlaboratory comparisons, proficiency testing programs, use of reference materials and internal quality control schemes	QAMP Chapter 9
h) Procedures to be followed for feedback and corrective action whenever testing discrepancies are detected, or departures from documented policies and procedures occur	QAMP Chapter 9 and 10 SOP CORP-QA-0010, “Nonconformance and Corrective Action”

*National Environmental Laboratory Accreditation Conference Standard, Quality Systems, July 2, 1998

TABLE 2.3-2

CROSS-REFERENCE OF QAMP SECTIONS ADDRESSING NELAC QUALITY MANUAL REQUIREMENTS (continued)

NELAC QUALITY MANUAL: REQUIRED ELEMENTS*	QUANTERRA® QAMP REVISION 3, QA SOP OR POLICY REFERENCE
j) The laboratory management arrangements for exceptionally permitting departures from documented policies and procedures or from standard specifications	QAMP Chapter 9
k) Procedures for dealing with complaints	QAMP Chapter 9 Policy QA-013 "Procedures to Address Customer Complaints"
l) Procedures for protecting confidentiality and proprietary rights (including national security concerns)	QAMP Chapter 5 Corporate Legal Policy
m) Procedures for audits and data reviews	QAMP Chapter 8 QAMP Chapter 8 and 9 Policy QA-012, "Technical Data Review Requirements" SOP CORP-QA-0004 "Independent QA Data Review"
n) Processes/procedures for establishing that personnel are adequately experienced in the duties they are expected to carry out and/or receive any needed training	QAMP Chapter 3 SOP CORP-QA-0013, "Employee Orientation and Training"
o) Reference to procedures for reporting analytical results	QAMP Chapter 8 Policy QA-009 "Establishment of Reporting Limits"
p) A table of contents and applicable list of references, glossaries, and appendices	QAMP Table of Contents List of QA Policies and SOPs Table 2.3-2

*National Environmental Laboratory Accreditation Conference Standard, Quality Systems, July 2, 1998

TABLE 4.2-1
List of Quanterra® Quality-Related Items that Require Evaluation Prior to Use

Quality-Related Item	Standard Operating Procedure for Quality Testing
Acetone	CORP-QA-0001
Dichloromethane	CORP-QA-0001
Hexane	CORP-QA-0001
Hydrochloric acid	CORP-QA-0001
Freon	CORP-QA-0001
Methanol	CORP-QA-0001
Nitric acid	CORP-QA-0001
Hydrogen Peroxide	CORP-QA-0001
Sulfuric acid	CORP-QA-0001
Toluene	CORP-QA-0001

TABLE 5.1-1
Quanterra® Quality Documents and Required Approval

Quality Document	Required Approvals
Quality Assurance Management Plan (QAMP)	• Corporate Director of Quality Assurance • Vice President of Operations Services • Chief Operating Officer
Quality Assurance Management Plan (QAMP) Facility Appendix	• Quality Assurance Manager • Technical Manager • Laboratory Manager • Regional General Manager/Laboratory Director • Corporate Director of Quality Assurance
Corporate Standard Operating Procedures (SOPs)	• Corporate Director of Quality Assurance • Corporate Director of Environmental Health and Safety(1) • Management (generally a Vice President) • Technical Specialist (technical SOPs only)
Operation-Specific Standard Operating Procedures (SOPs)	• Quality Assurance Manager • Laboratory Health and Safety Coordinator(1) • Laboratory Manager • Technical Specialist
Quality Policy Documents	• Corporate Director of Quality Assurance • Vice President of Operations Services

(1) Required only if procedure encompasses more than standard office safety requirements.

TABLE 5.2-1
Quanterra® Quality Document Review Requirements

Document Type	Frequency of Review	Responsible Party
Quality Assurance Management Plan (QAMP)	Every Two Years	Corporate Director of Quality Assurance
Quality Assurance Management Plan (QAMP) Facility Appendix	Annual	Quality Assurance Manager
Corporate Standard Operating Procedures (SOP)	Every Two Years	Corporate Technology/QA
Operation-Specific Standard Operating Procedures (SOP)	Every Two Years	Laboratory Staff
Quality Policy Documents	Every Two Years	Corporate Director of Quality Assurance

TABLE 8.4-1
Field Quality Control Samples

Type	Applicability		Accuracy and Precision Application	Introduced By
	Inorganic	Organic		
Trip Blank (volatiles)	No	Yes	Accuracy	Supplier of Containers
Field Blank	Yes	Yes	Accuracy	Field Sampler
Rinsate Blank	Yes	Yes	Accuracy	Field Sampler
Collocated Sample	Yes	Yes	Precision	Field Sampler
Split Sample	Yes	Yes	Precision	Field Sampler
Field Duplicate	Yes	Yes	Precision	Field Sampler
Field Matrix Spike	Yes	Yes	Accuracy	Field Sampler

TABLE 8.4-2
Laboratory Quality Control Samples

Type	Frequency	Applicability		Accuracy and Precision Application	Introduced By
		Inorganic/ Radiochemical	Organic		
Analytical Spike	As specified in methods, or as needed	Yes	No	Accuracy	Analyst/ Prep
Duplicate	1 out of 20 or at least 1/month/run	Yes	Yes	Precision	Analyst/ Prep
Instrument Blank	As specified methods, or as needed	Yes	Yes	Accuracy	Analyst
Interference Check Sample	As specified in methods	Yes	No	Accuracy	Analyst
Internal Standard	Each sample and standard	Yes	Yes	Both	Analyst/ Prep
Laboratory Control Sample	1 per each group of samples processed up to 20 samples.	Yes	Yes	Accuracy	Analyst/ Prep
Matrix Spike	1 per each group of samples processed up to 20 samples.	Yes	Yes	Accuracy	Analyst/ Prep
Matrix Spike Duplicate	1 per each group of samples processed up to 20 samples.	Yes	Yes	Both	Analyst/ Prep
Method Blank	1 per each group of samples processed up to 20 samples.	Yes	Yes	Accuracy	Analyst/ Prep
Surrogate	All standards, method blanks, LCS, and samples.	No	Yes Method Dependent	Accuracy	Analyst/ Prep
Yield Monitor	Operation-specific	Yes	No	Accuracy	Prep

TABLE 8.4-3
Laboratory Performance Quality Control Samples

Sample/Measurement	Purpose
Method Blanks	Demonstrates that the laboratory systems (*e.g.*, glassware cleaning procedures) and laboratory reagents used for the preparation and analysis of samples have not contributed to a false positive or negative measurement.
Instrument Blank	Demonstrates that the analytical system has not contributed to a false positive or negative measurement.
Laboratory Control Sample	Demonstrates the laboratory's ability to perform an analysis within the performance requirements of the method.

TABLE 8.4-4
Matrix Specific Quality Control Samples

Quality Control Sample	Purpose
Duplicate Samples	Estimates the ability of the laboratory to obtain precise measurements on a sample. This measure is dependent on the homogeneity of the sample being duplicated. Solid samples often portray poor sample homogeneity and therefore often have poor duplication with regards to the sample result.
Matrix Spike Sample	Estimates the ability of the laboratory to obtain accurate measurements on a sample. The measure is dependent on the bias a sample matrix may cause regarding a given analyte.
Matrix Spike Duplicate Sample	In addition to verifying the accuracy of the matrix spike sample, the matrix spike duplicate can be used with the matrix spike sample as a measure of precision by calculating the relative percent difference (RPD).

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846) [2]
Acidity	Method Blank	305.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	—	Not Applicable
	Laboratory Control Sample	305.1	Not Applicable	—	Not Applicable
	Matrix Spike	305.1	Not Applicable	—	Not Applicable
	Matrix Spike Duplicate	305.1	Not Applicable	—	Not Applicable
	Duplicate	305.1	Frequency: 1 per batch of 10 samples Criteria: ≤ 20 % RPD[3] Corrective Action: Flag data outside of limit.	—	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Alkalinity	Method Blank	310.1 2320B	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	—	Not Applicable
	Laboratory Control Sample	310.1 2320B	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	—	Not Applicable
	Matrix Spike	310.1 2320B	Not Applicable	—	Not Applicable
	Matrix Spike Duplicate	310.1 2320B	Not Applicable	—	Not Applicable
	Duplicate	310.1 2320B	Frequency: 1 per batch of 10 samples Criteria 310.1: ≤ 20 % RPD[3] Criteria 2320B: ≤ 25 % RPD[3] Corrective Action: Flag data outside of limit.	—	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Ammonia	Method Blank	350.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	—	Not Applicable
	Laboratory Control Sample	350.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within control limits, rerun all associated samples	—	Not Applicable
	Matrix Spike	350.1	Frequency: 1 per 10 samples, minimum of one per batch of samples processed Criteria: Percent recovery must be within laboratory control limits Corrective Action: Flag data outside of limit	—	Not Applicable
	Matrix Spike Duplicate	350.1	Not Applicable	—	Not Applicable
	Duplicate	350.1	Not Applicable	—	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Ammonia (TKN)	Method Blank	351.2 351.3	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	—	Not Applicable
	Laboratory Control Sample	351.2 351.3	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	—	Not Applicable
	Matrix Spike	351.2 351.3	Frequency: 1 per 10 samples, minimum of one per batch of samples processed Criteria: Must be within laboratory control limits Corrective Action: Flag data outside of limit	—	Not Applicable
	Matrix Spike Duplicate	351.2 351.3	Not Applicable	—	Not Applicable
	Duplicate	351.2 351.3	Not Applicable	—	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
BOD	Method Blank	405.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	—	Not Applicable
	Laboratory Control Sample	405.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	—	Not Applicable
	Matrix Spike	405.1	Not Applicable	—	Not Applicable
	Matrix Spike Duplicate	405.1	Not Applicable	—	Not Applicable
	Duplicate	405.1	Not Applicable	—	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Bromide	Method Blank	300.0[5] 320.1 D1246	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	9056	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank
	Laboratory Control Sample	300.0[5] 320.1 D1246	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within control limits, rerun all associated samples	9056	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within control limits, rerun all associated samples
	Matrix Spike	300.0[5] 320.1 D1246	Frequency: 1 per 10 samples, minimum of one per batch of samples processed Criteria: Percent recovery must be within laboratory control limits Corrective Action: Flag data outside of limit	9056	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: Flag data associated with MS outside of limit
	Matrix Spike Duplicate	300.0[5] 320.1 D1246	Not Applicable	9056	Not Applicable
	Duplicate	300.0[5] 320.1 D1246	Methods 300.0, 320.1: Not Applicable Frequency: Method D1246: 1 with each batch of samples processed not to exceed 20 samples	9056	Frequency: 1 with each batch of samples processed Criteria: RPD[3] must be within laboratory control limits Corrective Action: Flag data associated with duplicates outside of laboratory RPD[3] limits

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Chemical Oxygen Demand (COD)	Method Blank	410.1 410.2 410.4	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	—	Not Applicable
	Laboratory Control Sample	410.1 410.2 410.4	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	—	Not Applicable
	Matrix Spike	410.1 410.2 410.4	Frequency: 1 per 10 samples, minimum of one per batch of samples processed Criteria: Must be within laboratory control limits Corrective Action: Flag data outside of limit	—	Not Applicable
	Matrix Spike Duplicate	410.1 410.2 410.4	Not Applicable	—	Not Applicable
	Duplicate	410.1 410.2 410.4	Not Applicable	—	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Chloride	Method Blank	300.0[5] 325.1 325.2 325.3 4500-Cl E	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	9056 9251 9253	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank
	Laboratory Control Sample	300.0[5] 325.1 325.2 325.3 4500-Cl E	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within control limits, rerun all associated samples	9056 9251 9253	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples
	Matrix Spike	300.0[5] 325.1 325.2 325.3 4500-Cl E	Frequency: 1 per 10 samples, minimum of one per batch of samples processed Criteria: Percent recovery must be within laboratory control limits Corrective Action: Flag data outside of limit	9056 9251 9253	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Methods 9251Corrective Action: If not within laboratory control limits, rerun all associated samples Method 9056/9253 Corrective Action: Flag data associated with MS outside of limits

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Chloride (continued)	Matrix Spike Duplicate	300.0[5] 325.1 325.2 325.3 4500-Cl E	Not Applicable	9056 9251 9253	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits/< 20 % RPD[3] Corrective Action: Flag data outside of limit Method 9056: MSD is not applicable
	Duplicate	300.0[5] 325.1 325.2 325.3 4500-Cl E	Methods 300.0, 325.1, 325.2, 325.3: Not Applicable Method 4500-Cl E: Frequency: 1 with each batch of samples processed not to exceed 20 samples	9056 9251 9253	Method 9056/9253: Frequency: 1 with each batch of samples processed Criteria: RPD[3] must be within laboratory control limits Corrective Action: Flag data associated with duplicates outside of laboratory RPD[3] limits
Chlorine, Residual	Method Blank	330.3	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	—	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Chlorine, Residual (continued)	Laboratory Control Sample	330.3	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	—	Not Applicable
	Matrix Spike	330.1 330.3	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Must be within laboratory control limits Corrective Action: Flag data outside of limit	—	Not Applicable
	Matrix Spike Duplicate	330.1 330.3	Not Applicable	—	Not Applicable
	Duplicate	330.1 330.3	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: ≤ 20 % RPD[3] Corrective Action: Flag data outside of limit.	—	Water

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846) [2]
Chromium (Cr^{+6})	Method Blank	218.4 3500 Cr-D	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	3060A 7196A	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank
	Laboratory Control Sample	218.4 3500 Cr-D	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	3060A 7196A	Frequency: 1 with each batch of samples processed not to exceed 20 samples prepped Criteria: percent recovery for water must be within ± 15 % and for solids must be within ± 20% Corrective Action: Rerun all samples associated with unacceptable LCS
	Matrix Spike	218.4 3500 Cr-D	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Must be within laboratory QC limits Corrective Action: Flag data outside of limit	3060A 7196A	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Advisory limits are 75% - 125% recovery Corrective Action: Flag data associated with unacceptable Matrix Spike
	Matrix Spike Duplicate	218.4 3500 Cr-D	Not Applicable	3060A 7196A	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Chromium (Cr^{+6}) (continued)	Duplicate	218.4 3500 Cr-D	Not Applicable	3060A 7196A	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: ≤ 20 % RPD[3] limit Corrective Action: Flag data outside of limit.
Color	Method Blank	110.2	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	—	Not Applicable
	Laboratory Control Sample	110.2	Not Applicable	—	Not Applicable
	Matrix Spike	110.2	Not Applicable	—	Not Applicable
	Matrix Spike Duplicate	110.2	Not Applicable	—	Not Applicable
	Duplicate	110.2	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: ≤ 20 % RPD[3] Corrective Action: Flag data outside of limit.	—	Not Applicable
Conductivity	Method Blank	120.1	Not Applicable	9050A	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Conductivity (continued)	Laboratory Control Sample	120.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	9050A	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples
	Matrix Spike	120.1	Not Applicable	9050A	Not Applicable
	Matrix Spike Duplicate	120.1	Not Applicable	9050A	Not Applicable
	Duplicate	120.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: ≤ 20 % RPD[3] Corrective Action: Flag data outside of limit.	9050A	Frequency: 1 with each batch of samples processed not to exceed 10 samples
Cyanide (Amenable)	Method Blank	335.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	9010B 9012A	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Cyanide (Amenable) (continued)	Laboratory Control Sample	335.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	9010B 9012A	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: Rerun all samples associated with unacceptable LCS
	Matrix Spike	335.1	Frequency: 1 per 10 samples, minimum of one per batch of samples processed Criteria: Percent recovery must be within laboratory control limits Corrective Action: Flag data outside of limit	9010B 9012A	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Advisory limits are 75% - 125% recovery Corrective Action: Flag data associated with unacceptable Matrix Spike
	Matrix Spike Duplicate	335.1	Not Applicable	9010B 9012A	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Advisory limits are 75% - 125% recovery Corrective Action: Flag data associated with unacceptable Matrix Spike
	Duplicate	335.1	Not Applicable	9010B 9012A	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Cyanide (Total)	Method Blank	335.2 335.3 4500-CN E	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	9010B 9012A	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank
	Laboratory Control Sample	335.2 335.3 4500-CN E	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	9010B 9012A	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: Rerun all samples associated with unacceptable LCS
	Matrix Spike	335.2 335.3 4500-CN E	Frequency: 1 per 10 samples, minimum of one per batch of samples processed Criteria: Percent recovery must be within laboratory control limits Corrective Action: Flag data outside of limit	9010B 9012A	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Advisory limit is 75% - 125% recovery Corrective Action: Flag data associated with unacceptable Matrix Spike

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Cyanide (Total) (continued)	Matrix Spike Duplicate	335.2 335.3 4500-CN E	Not Applicable	9010B 9012A	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Limit is 75% - 125% recovery Corrective Action: Flag data associated with unacceptable Matrix Spike
	Duplicate	335.2 335.3	Methods 335.2, 335.3: Not Applicable Method 4500-CN E: Frequecny: 1 with each batch of samples processed not to exceed 20 samples Criteria: ≤ 20 % RPD[3] Corrective Action: Flag data outside of limit.	9010B 9012A	Not Applicable
Flashpoint	Method Blank	—	Not Applicable	1010 1020A	Not Applicable
	Laboratory Control Sample	—	Not Applicable	1010 1020A	Not Applicable
	Matrix Spike	—	Not Applicable	1010 1020A	Not Applicable
	Matrix Spike Duplicate	—	Not Applicable	1010 1020A	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846) [2]
Flashpoint (continued)	Duplicate	—	Not Applicable	1010 1020A	Frequency: 1 per batch of ≤20 samples Criteria: RPD[3] must be ≤ 20% Corrective Action: Flag data associated with unacceptable Duplicate
Fluoride	Method Blank	300.0[5] 340.2	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	9056	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable
	Laboratory Control Sample	300.0[5] 340.2	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	9056	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within control limits, rerun all associated samples

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846) [2]
Fluoride (continued)	Matrix Spike	300.0[5] 340.2	Frequency: 1 per 10 samples by IC Criteria: Must be within laboratory QC limits Corrective Action: Flag data outside of limit	9056	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: Flag data associated with outside of limit
	Matrix Spike Duplicate	300.0[5] 340.2	Not Applicable	9056	Not Applicable
	Duplicate	300.0[5] 340.2	Not Applicable	9056	Frequency: 1 with each batch of samples processed Criteria: RPD[3] must be within laboratory control limits Corrective Action: Flag data associated with duplicates outside of laboratory RPD[3] limits
Hardness	Method Blank	130.2 2340B	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	—	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Hardness (continued)	Laboratory Control Sample	130.2 2340B	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	—	Not Applicable
	Matrix Spike	130.2 2340B	Method 130.2, Not Applicable Method 2340B: Frequency , Criteria, and Corrective Action: See ICP Metals Method 200.7 Requirements	—	Not Applicable
	Matrix Spike Duplicate	130.2 2340B	Method 130.2, Not Applicable Method 2340B: Frequency, Criteria, and Corrective Action: See ICP Metals Method 200.7 Requirements	—	Not Applicable
	Duplicate	130.2 2340B	Frequency: 1 per 20 samples, minimum of one per batch of samples processed Criteria: RPD[3] must be within laboratory control limits Corrective Action: Flag data outside of limit	—	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Iodide	Method Blank	345.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	—	Not Applicable
	Laboratory Control Sample	345.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	—	Not Applicable
	Matrix Spike	345.1	Frequency: 1 per batch of 20 samples Criteria: Must be within laboratory QC limits Corrective Action: Flag associated data outside of limit	—	Not Applicable
	Matrix Spike Duplicate	345.1	Not Applicable	—	Not Applicable
	Duplicate	345.1	Not Applicable	—	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Iron	Method Blank	3500-Fe D	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	—	Not Applicable
	Laboratory Control Sample	3500-Fe D	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	—	Not Applicable
	Matrix Spike	3500-Fe D	Frequency: 1 every 10 samples Criteria: Must be within laboratory QC limits Corrective Action: Flag associated data outside of limit	—	Not Applicable
	Matrix Spike Duplicate	3500-Fe D	Not Applicable	—	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Iron (continued)	Duplicate	3500-Fe D	Frequency: 1 per batch of 20 samples Criteria: Must be within laboratory QC limits Corrective Action: Flag associated data outside of limit	—	Not Applicable
Methylene Blue Active Substances (MBAS)	Method Blank	425.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	—	Not Applicable
	Laboratory Control Sample	425.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	—	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Methylene Blue Active Substances (MBAS) (continued)	Matrix Spike	425.1	Frequency: 1 per 10 samples, minimum of one per batch of samples processed Criteria: Percent recovery must be within laboratory control limits Corrective Action: Flag data outside of limit	—	Not Applicable
	Matrix Spike Duplicate	425.1	Not Applicable	—	Not Applicable
	Duplicate	425.1	Not Applicable	—	Not Applicable
Nitrate	Method Blank	300.0[5] 352.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	9056 9210	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Criteria 9210: Concentration must be < 1 mg/L of Nitrate Corrective Action: Rerun all samples associated with unacceptable blank
	Laboratory Control Sample	300.0[5] 352.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	9056 9210	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Criteria 9210: 90-110% Corrective Action: If not within laboratory control limits, rerun all associated samples

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846) [2]
Nitrate (continued)	Matrix Spike	300.0[5] 352.1	Frequency: 1 per 10 samples, minimum of one per batch of samples processed Criteria: Must be within laboratory control limits Corrective Action: Flag data outside of limit	9056 9210	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Criteria 9210: 75-125% Corrective Action: If not within laboratory control limits, flag all associated samples
	Matrix Spike Duplicate	300.0[5] 352.1	Not Applicable	9056 9210	Not applicable
	Duplicate	300.0[5] 352.1	Not Applicable	9056 9210	Method 9056: Frequency: 1 per 10 samples Criteria: RPD[3] must be within laboratory control limits Corrective Action: If not within laboratory control limits, flag all associated samples Method 9210: Not applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Nitrite	Method Blank	300.0[5] 354.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	9056	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank
	Laboratory Control Sample	300.0[5] 354.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	9056	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples
	Matrix Spike	300.0[5] 354.1	Frequency: 1 per 10 samples, minimum of one per batch of samples processed Criteria: Must be within laboratory control limits Corrective Action: Flag data outside of limit	9056	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, flag all associated samples
	Matrix Spike Duplicate	300.0[5] 354.1	Not Applicable	9056	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Nitrite (continued)	Duplicate	300.0[5] 354.1	Not Applicable	9056	Frequency: 1 per 10 samples Criteria: RPD[3] must be within laboratory control limits Corrective Action: If not within laboratory control limits, flag all associated samples
Nitrate-Nitrite	Method Blank	353.1 353.2 353.3	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	—	Not Applicable
	Laboratory Control Sample	353.1 353.2 353.3	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	—	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Nitrate-Nitrite (continued)	Matrix Spike	353.1 353.2 353.3	Frequency: 1 per 20 samples, minimum of one per batch of samples processed Criteria: Percent recovery must be within laboratory control limits Corrective Action: Flag data outside of limit	—	Not Applicable
	Matrix Spike Duplicate	353.1 353.2 353.3	Not Applicable	—	Not Applicable
	Duplicate	353.1 353.2 353.3	Not Applicable	—	Not Applicable
Odor	Method Blank	140.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	—	Not Applicable
	Laboratory Control Sample	140.1	Not Applicable	—	Not Applicable
	Matrix Spike	140.1	Not Applicable	—	Not Applicable
	Matrix Spike Duplicate	140.1	Not Applicable	—	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Odor (continued)	Duplicate	140.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: ≤ 20 % RPD[3] Corrective Action: Flag data outside of limit.	—	Not Applicable
pH	Method Blank	150.1 4500-H^+ B	Not Applicable	9040B 9045C	Not Applicable
	Laboratory Control Sample	150.1 4500-H^+ B	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Sample provided by external source, must be within ± 0.05 pH units Corrective Action: If not within laboratory control limits, rerun all associated samples	9040B 9045C	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Sample provided by external source, must be within ± 0.05 pH units Corrective Action: If not within laboratory control limits, rerun all associated samples
	Matrix Spike	150.1 4500-H^+ B	Not Applicable	9040B 9045C	Not Applicable
	Matrix Spike Duplicate	150.1 4500-H^+ B	Not Applicable	9040B 9045C	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
pH (continued)	Duplicate	150.1 4500-H^+ B	Method 150.1 Frequency: 1 with each batch of samples processed not to exceed 20 samples Method 4500-H^+ B Frequency: 1 with each batch of 10 samples Method 150.1 Criteria: ≤ 20 % RPD[3] limit Method 4500-H^+ B Criteria: ≤ 25 % RPD[3] limit Corrective Action: Flag data outside of limit.	9040B 9045C	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Advisory limits are ≤ 20% RPD[3] Corrective Action: Flag data associated with unacceptable Duplicate
Phenolics	Method Blank	420.1 420.2	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	9065 9066	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank
	Laboratory Control Sample	420.1 420.2	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	9065 9066	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Phenolics (continued)	Matrix Spike	420.1 420.2	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: Flag data associated with unacceptable Matrix Spike	9065 9066	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: Flag associated data
	Matrix Spike Duplicate	420.1 420.2	Not Applicable	9065 9066	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: Flag associated data
	Duplicate	420.1 420.2	Not Applicable	9065 9066	Not Applicable
Phosphate	Method Blank	---	Not Applicable	9056	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank
	Laboratory Control Sample	---	Not Applicable	9056	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Phosphate (continued)	Matrix Spike	---	Not Applicable	9056	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: Flag associated data associated with MS outside of limits
	Matrix Spike Duplicate	---	Not Applicable	9056	Not Applicable
	Duplicate	---	Not Applicable	9056	Frequency: 1 with each batch of samples processed Criteria: RPD[3] must be within laboratory control limits Corrective Action: Flag data associated with duplicates outside of laboratory RPD[3] limits
Phosphorus (Total and Ortho-phosphate)	Method Blank	300.0[4,5] 365.1 365.2 365.3	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	—	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Phosphorus (Total and Ortho-phosphate) (continued)	Laboratory Control Sample	300.0[4,5] 365.1 365.2 365.3	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	—	Not Applicable
	Matrix Spike	300.0[4,5] 365.1 365.2 365.3	Frequency: 1 per 10 samples Criteria: Must be within laboratory QC limits Corrective Action: Flag data outside of limit	—	Not Applicable
	Matrix Spike Duplicate	300.0[4,5] 365.1 365.2 365.3	Not Applicable	—	Not Applicable
	Duplicate	300.0[4,5] 365.1 365.2 365.3	Not Applicable	—	Not Applicable
Reactivity (Cyanide and Sulfide)	Method Blank	---	Not Applicable	Chapter 7[6] Sections 7.3.3.2 and 7.3.4.2	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Reactivity (Cyanide and Sulfide) (continued)	Laboratory Control Sample	---	Not Applicable	Chapter 7[6] Sections 7.3.3.2 and 7.3.4.2	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: Rerun all samples associated with unacceptable LCS
	Matrix Spike	---	Not Applicable	Chapter 7[6] Sections 7.3.3.2 and 7.3.4.2	Follow QC sample requirements of determinative method
	Matrix Spike Duplicate	---	Not Applicable	Chapter 7[6] Sections 7.3.3.2 and 7.3.4.2	Follow QC sample requirements of determinative method
	Duplicate	---	Not Applicable	Chapter 7[6] Sections 7.3.3.2 and 7.3.4.2	Not Applicable
Silica, Dissolved	Method Blank	370.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	—	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Silica, Dissolved (continued)	Laboratory Control Sample	370.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	—	Not Applicable
	Matrix Spike	370.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: Flag data outside of limit	—	Not Applicable
	Matrix Spike Duplicate	370.1	Not Applicable	—	Not Applicable
	Duplicate	370.1	Not Applicable	—	Not Applicable
Solids	Method Blank	160.1 160.2 160.3 160.4	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: If analyte level in method blank is ≥ RL for the analyte of interest in the sample, all associated samples with reportable levels of analyte are reprepared and reanalyzed. SOP No. CORP-WC-0002.	—	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Solids (continued)	Laboratory Control Sample	160.1 160.2 160.3 160.4	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, reprepare and rerun all associated samples	—	Not Applicable
	Matrix Spike	160.1 160.2 160.3 160.4	Not Applicable	—	Not Applicable
	Matrix Spike Duplicate	160.1 160.2 160.3 160.4	Not Applicable	—	Not Applicable
	Duplicate	160.1 160.2 160.3 160.4 160.5	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Sample results should agree within 20% if both the sample and sample duplicate results are > 5 X RL Corrective Action: Flag data outside of limit- Address in the project narrative	—	Not Applicable
Specific Conductance	Method Blank	120.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	9050A	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Specific Conductance (continued)	Laboratory Control Sample	120.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	9050A	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples
	Matrix Spike	120.1	Not Applicable	9050A	Not Applicable
	Matrix Spike Duplicate	120.1	Not Applicable	9050A	Not Applicable
	Duplicate	120.1	Frequency: 1 with each batch of 20 samples processed Criteria: RPD[3] must be within laboratory QC limits Corrective Action: Flag associated data if outside of limits	9050	Frequency: 1 with each batch of 20 samples processed Criteria: RPD[3] must be within laboratory QC limits Corrective Action: Flag associated data if outside of limits
Sulfate	Method Blank	300.0[5] 375.1 375.4	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	9038 9056	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Sulfate (continued)	Laboratory Control Sample	300.0[5] 375.1 375.4	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	9038 9056	Frequency: 1 with each batch of samples processed not to exceed 20 samples Method 9038 Criteria: Percent recovery must be within ± 15 % Method 9056 Criteria: Percent recovery must be within laboratory control limits Corrective Action: Rerun all samples associated with unacceptable LCS (ICV)
	Matrix Spike	300.0[5] 375.1 375.4	Frequency: 1 per 10 samples, minimum of one per batch of samples processed Criteria: Percent recovery must be within laboratory control limits Corrective Action: Flag data outside of limit	9038 9056	Frequency: 1 with each batch of samples processed not to exceed 10 samples (Method 9038) or 20 samples (Method 9056) Method 9038 Criteria: Limits are 75% - 125% recovery Method 9056 Criteria: Percent recovery must be within laboratory control limits Corrective Action: Flag data associated with unacceptable Matrix Spike
	Matrix Spike Duplicate	300.0[5] 375.1 375.4	Not Applicable	9038 9056	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Sulfate (continued)	Duplicate	300.0[5] 375.1 375.4	Not Applicable	9038 9056	Frequency: 1 with each batch of samples processed Criteria: RPD[3] must be within laboratory control limits Corrective Action: Flag data associated with duplicates outside of laboratory RPD[3] limits
Sulfide	Method Blank	376.1 376.2	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	9030B 9034	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank
	Laboratory Control Sample	376.1 376.2	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	9030B 9034	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: Flag associated data

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Sulfide (continued)	Matrix Spike	376.1 376.2	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: Flag data outside of limit	9030B 9034	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: Flag associated data
	Matrix Spike Duplicate	376.1 376.2	Not Applicable	9030B 9034	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: Flag associated data Method 9034: Not Applicable
	Duplicate	376.1 376.2	Not Applicable	9030B 9034	Not Applicable
Sulfite	Method Blank	377.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	—	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Sulfite (continued)	Laboratory Control Sample	377.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	—	Not Applicable
	Matrix Spike	377.1	Frequency: 1 per 20 samples, minimum of one per batch of samples processed Criteria: Percent recovery must be within laboratory control limits Corrective Action: Flag data outside of limit	—	Not Applicable
	Matrix Spike Duplicate	377.1	Not Applicable	—	Not Applicable
	Duplicate	377.1	Not Applicable	—	Not Applicable
Temperature	Method Blank	170.1	Not Applicable	---	Not Applicable
	Laboratory Control Sample	170.1	Not Applicable	---	Not Applicable
	Matrix Spike	170.1	Not Applicable	---	Not Applicable
	Matrix Spike Duplicate	170.1	Not Applicable	---	Not Applicable
	Duplicate	170.1	Not Applicable	---	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Total Organic Carbon (TOC)	Method Blank	415.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	9060	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank
	Laboratory Control Sample	415.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	9060	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: percent recovery must be within laboratory control limits Corrective Action: Rerun all samples associated with unacceptable LCS
	Matrix Spike	415.1	Frequency: 1 per 10 samples, minimum of one per batch of samples processed Criteria: Percent recovery must be within laboratory control limits Corrective Action: Flag data outside of limit	9060	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: Reanalyze if sample remaining. If not, flag data associated with unacceptable Matrix Spike

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Total Organic Carbon (TOC) (continued)	Matrix Spike Duplicate	415.1	Not Applicable	9060	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: Reanalyze if sample remaining. If not, flag data associated with unacceptable Matrix Spike Duplicate
	Duplicate	415.1	Not Applicable	9060	Not Applicable
Total Organic Halides (TOX)	Method Blank	SM 5320B [5] 450.1 [5]	Frequency: 1 with each set of 8 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	9020B	Frequency: Run in duplicate between each group of 8 analytical determinations Criteria: Concentration less than reporting limit or less than 2 X MDL or RL whichever is lower Corrective Action: Rerun all samples associated with unacceptable blank SOP NO. CORP-WC-0001
	Laboratory Control Sample	SM 5320B [5] 450.1 [5]	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery of analyte must be within laboratory control limits Corrective Action: Rerun all samples associated with unacceptable LCS (ICV)	9020B	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery of analyte must be within 90-110% Corrective Action: Rerun all samples associated with unacceptable LCS (ICV) SOP NO. CORP-WC-0001

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Total Organic Halides (TOX) (continued)	Matrix Spike	SM 5320B [5] 450.1 [5]	Frequency: 1 per 10 samples, minimum of one per batch of samples processed Criteria: Must be within laboratory control limits Corrective Action: Reanalyze if sample remaining. If not, flag data with unacceptable Matrix Spike	9020B	Frequency: 1 per batch of 10 samples Criteria: Must be within laboratory control limits Corrective Action: Flag data associated with unacceptable Matrix Spike SOP NO. CORP-WC-0001
	Matrix Spike Duplicate	SM 5320B [5] 450.1 [5]	Not Applicable	9020B	Not Applicable
	Duplicate	SM 5320B [5] 450.1 [5]	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: ≤ 20 % RPD[3] limit Corrective Action: Flag data outside of limit.	9020B	Frequency: All samples will be analyzed in duplicate Criteria: ≤ 20 % RPD[3] limit if both the sample and sample duplicate results are > 10 X MDL. Corrective Action: Flag data outside of limit. SOP NO. CORP-WC-0001
Turbidity	Method Blank	180.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	—	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Turbidity (continued)	Laboratory Control Sample	180.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	—	Not Applicable
	Matrix Spike	180.1	Not applicable	—	Not Applicable
	Matrix Spike Duplicate	180.1	Not Applicable	—	Not Applicable
	Duplicate	180.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Must be within laboratory QC limits Corrective Action: Flag data outside of limit Not Applicable.	—	Not Applicable
Water Content	Method Blank	—	Not Applicable	—	Not Applicable
	Laboratory Control Sample	—	Not Applicable	—	Not Applicable
	Matrix Spike	—	Not Applicable	—	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Water Content (continued)	Matrix Spike Duplicate	—	Not Applicable	—	Not Applicable
	Duplicate	—	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: ≤ 20 % RPD[3] Corrective Action: Flag data outside of limit.	—	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: ≤ 20 % RPD[3] limit Corrective Action: Reanalyze if sample remaining. If not, flag data outside of limit.
GFAA and Flame AA Metals, Mercury by CVAA	Method Blank	200 series	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank SOP NO. CORP-MT-0003	7000A series	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank SOP NO. CORP-MT-0003
	Laboratory Control Sample	200 series	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: percent recovery of analyte must be within ± 20 % Corrective Action: Rerun all samples associated with unacceptable LCS SOP NO. CORP-MT-0003	7000A series	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: percent recovery of analyte must be within ± 20 % Corrective Action: Rerun all samples associated with unacceptable LCS SOP NO. CORP-MT-0003

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
GFAA and Flame AA Metals, Mercury by CVAA (continued)	Matrix Spike	200 series	Frequency: with each batch of samples processed not to exceed 20 samples Criteria: Recovery must be within 75-125 % Corrective Action: Flag data associated with unacceptable MS. (See SOP NO. CORP-MT-0003 for detailed corrective action procedure and for other QC procedures.)	7000A series	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Recovery must be within 75-125 % Corrective Action: Flag data associated with unacceptable MS. (See SOP NO. CORP-MT-0003 for detailed corrective action procedure and for other QC procedures.)
	Matrix Spike Duplicate	200 series	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Recovery must be within 75-125 % , RPD[3] must be within 20 % Corrective Action: Flag data associated with unacceptable MSD SOP NO. CORP-MT-0003	7000A series	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Recovery must be within 75-125 % , RPD[3] must be within 20 % Corrective Action: Flag data associated with unacceptable MSD SOP NO. CORP-MT-0003
	Duplicate	200 series	Not Applicable	7000A series	Not Applicable
	Post Digestion Spikes	200 series	Post Digestion Spike is conducted on all samples	7000A series	Post Digestion Spike is conducted on all samples
ICP Metals	Method Blank	200.7	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank SOP NO. CORP-MT-0001	6010B	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank SOP NO. CORP-MT-0001

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
ICP Metals (continued)	Laboratory Control Sample	200.7	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: percent recovery of analyte must be ± 85-115% Corrective Action: Rerun all samples associated with unacceptable LCS SOP NO. CORP-MT-0001	6010B	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: percent recovery of analyte must be ± 20 % Corrective Action: Rerun all samples associated with unacceptable LCS SOP NO. CORP-MT-0001
	Matrix Spike	200.7	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Limits for percent recovery are 75-125% Corrective Action: Flag data associated with unacceptable Matrix Spike SOP NO. CORP-MT-0001	6010B	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Limits for percent recovery are 75-125% Corrective Action: Flag data associated with unacceptable Matrix Spike SOP NO. CORP-MT-0001
	Matrix Spike Duplicate	200.7	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Limits for percent recovery are 75-125%, RPD[3] must be within 20 % Corrective Action: Flag data associated with unacceptable Matrix Spike SOP NO. CORP-MT-0001	6010B	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Limits for percent recovery are 75-125%, RPD[3] must be within 20 % Corrective Action: Flag data associated with unacceptable Matrix Spike SOP NO. CORP-MT-0001

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
ICP Metals (continued)	Duplicate	200.7	Not Applicable	6010B	Not Applicable
	Serial Dilution	200.7	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: 10 % Difference Corrective Action: Flag data associated with unacceptable Serial Dilution SOP NO. CORP-MT-0001	6010B	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: 10 % Difference Corrective Action: Flag data associated with unacceptable Serial Dilution SOP NO. CORP-MT-0001
ICP/MS Metals	Method Blank	200.8	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	6020	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank
	Laboratory Control Sample	200.8	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Recovery within laboratory control limits Corrective Action: Rerun all samples associated with unacceptable LCS	6020	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Recovery within laboratory control limits Corrective Action: Rerun all samples associated with unacceptable blank
	Matrix Spike	200.8	Frequency: 1 per 10 samples, minimum of one per batch of samples processed Criteria: Recovery within laboratory control limits Corrective Action: Qualify data “suspect/matrix”	6020	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
ICP/MS Metals (continued)	Matrix Spike Duplicate	200.8	Not Applicable	6020	Not Applicable
	Duplicate	200.8	Not Applicable	6020	Frequency: 1 per 20 samples, minimum of one per batch of samples processed Criteria: 20% RPD[3] Corrective Action: Re-analyze samples associated with unacceptable duplicate
	Post Duplicate Spike	200.8	Not Applicable	6020	Frequency: 1 per 20 samples Criteria: 75-125% Corrective Action: Dilute and reanalyze
	Serial 5x Dilution	200.8	Not Applicable	6020	Frequency: 1 per 20 samples Criteria: ± 10% D Corrective Action: Use alternate isotope or quality data "suspect/matrix"

Footnotes

(1) National Pollutant Discharge Elimination System

(2) Resource Conservation and Recovery Act, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, (SW-846), Third Edition, September 1986. Contains Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996).

(3) RPD-Relative Percent Difference

(4) Orthophosphate only

(5) Method not listed in 40 CFR Part 136.

(6) Current promulgated method is a Guidance Method Only, SW-846, Final Update III, Rev.3, 12/96.

TABLE 8.4-6
Organic Laboratory Quality Control Samples

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846) [2]
Aromatic Volatiles by GC	Method Blank	602	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	8021B	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank SOP NO. CORP-GC-0001
	Laboratory Control Sample	602	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: percent recovery must be within acceptance limits given in method for each analyte Corrective Action: Rerun all samples associated with unacceptable LCS	8021B	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: percent recovery for each analyte must be within laboratory acceptance limits Corrective Action: Rerun all samples associated with unacceptable LCS SOP NO. CORP-GC-0001
	Matrix Spike	602	Frequency: 1 per 10 samples from each site or 1 per month, whichever is more frequent Criteria: percent recovery for each analyte should be within advisory limits given in method Corrective Action: Flag data associated with unacceptable Matrix Spike	8021B	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: percent recovery for each analyte should be within laboratory acceptance limits Corrective Action: Flag data associated with unacceptable Matrix Spike SOP NO. CORP-GC-0001

TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846) [2]
Aromatic Volatiles by GC (continued)	Matrix Spike Duplicate	602	Not Applicable	8021B	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: percent recovery for each analyte should be within laboratory acceptance limits Corrective Action: Flag data associated with unacceptable Matrix Spike SOP NO. CORP-GC-0001
	Duplicate	602	Not Applicable	8021B	Not Applicable
	Surrogates	602	Surrogates spiked into method blank and all samples (QC included) Method Blank Criteria and LCS: All surrogates must be within laboratory established control limits before sample analysis may proceed. Sample Criteria: Re-extract samples or flag sample data not meeting surrogate criteria	8021B	Surrogates spiked into method blank and all samples (QC included) Method Blank Criteria and LCS: All surrogates must be within laboratory established control limits before sample analysis may proceed. Sample Criteria: Reprepare and reanlayze samples or flag sample data not meeting surrogate criteria SOP NO. CORP-GC-0001
	Internal Standards	602	Optional: Internal standards are added to the method blank and all samples (QC included). If used, same compounds as used for surrogates may be appropriate.	8021B	Optional: Internal standards are added to the method blank and all samples (QC included). If used, same compounds as used for surrogates may be appropriate. SOP NO. CORP-GC-0001

TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Acrolein &Acrylonitrile by GC	Method Blank	603	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	8031 (Acrylo-nitrile only)	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank
	Laboratory Control Sample	603	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: percent recovery must be within acceptance limits given in method for each analyte Corrective Action: Rerun all samples associated with unacceptable LCS	8031 (Acrylo-nitrile only)	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: percent recovery for each analyte must be within laboratory acceptance limits Corrective Action: Rerun all samples associated with unacceptable LCS
	Matrix Spike	603	Frequency: 1 per 10 samples from each site or 1 per month, whichever is more frequent Criteria: percent recovery for each analyte should be within advisory limits given in method Corrective Action: Flag data associated with unacceptable Matrix Spike	8031 (Acrylo-nitrile only)	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: percent recovery for each analyte should be within laboratory acceptance limits Corrective Action: Flag data associated with unacceptable Matrix Spike

TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846) [2]
Acrolein & Acrylonitrile by GC (continued)	Matrix Spike Duplicate	603	Not Applicable	8031 (Acrylo-nitrile only)	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: percent recovery for each analyte should be within laboratory acceptance limits Corrective Action: Flag data associated with unacceptable Matrix Spike
	Duplicate	603	Not Applicable	8031 (Acrylo-nitrile only)	Not Applicable
	Surrogates	603	Surrogates spiked into method blank and all samples (QC included) Method Blank Criteria and LCS: All surrogates must be within laboratory established control limits before sample analysis may proceed. Sample Criteria: Re-extract samples or flag sample data not meeting surrogate criteria	8031 (Acrylo-nitrile only)	Surrogates spiked into method blank and all samples (QC included) Method Blank Criteria and LCS: All surrogates must be within laboratory established control limits before sample analysis may proceed. Sample Criteria: Re-extract and reanalyze samples or flag sample data not meeting surrogate criteria
	Internal Standards	603	Optional: Internal standards are added to the method blank and all samples (QC included). If used, same compounds as used for surrogates may be appropriate.	8031 (Acrylo-nitrile only)	Optional: Internal standards are added to the method blank and all samples (QC included). If used, same compounds as used for surrogates may be appropriate.

TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Dioxins/ Dibenzo-furans (LRMS)	Method Blank	613	Frequency: 1 per batch of ≤ 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all positive samples associated with unacceptable blank	8280A	Frequency: 1 per batch of ≤ 20 samples extracted Criteria: Concentration less than reporting limit Corrective Action: Rerun all positive samples associated with unacceptable blank
	Laboratory Control Sample	613	Frequency: 1 per batch of ≤ 20 samples extracted Criteria: percent recovery must be within acceptance limits given in method for each analyte Corrective Action: Rerun all samples associated with unacceptable LCS	8280A	Frequency: 1 per batch of ≤ 20 samples extracted Criteria: percent recovery for each analyte must be within laboratory acceptance limits Corrective Action: Rerun all samples associated with unacceptable LCS
	Matrix Spike	613	Frequency: 1 per analytical batch of ≤ 20 samples Criteria: percent recovery for each analyte should be within advisory limits given in method Corrective Action: Flag data associated with unacceptable Matrix Spike	8280A	Frequency: 1 per analytical batch of ≤ 20 samples Criteria: percent recovery for each analyte should be within laboratory acceptance limits Corrective Action: Flag data associated with unacceptable Matrix Spike
	Matrix Spike Duplicate	613	Frequency: 1 per analytical batch of ≤ 20 samples Criteria: percent recovery for each analyte should be within advisory limits given in method Corrective Action: Flag data associated with unacceptable matrix spike Duplicate	8280A	Frequency: 1 per analytical batch of ≤ 20 samples Criteria: percent recovery for each analyte should be within laboratory acceptance limits Corrective Action: Flag data associated with unacceptable matrix spike duplicate

TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Dioxins/ Dibenzo-furans (LRMS) (continued)	Duplicate	613	Not Applicable	8280A	Not Applicable
	Surrogates	613	Not Applicable	8280A	Not Applicable
	Internal Standards	613	Internal standards are added to all samples (QC samples included). Internal standard recovery should be between 40 % to 120 %.	8280A	Internal standards are added to all samples (QC samples included). Internal standard recovery should be between 40 % - 120 % for Method 8280A. Use limits in laboratory SOP.
Dioxins/ Dibenzo-furans (HRGC/HR MS)	Method Blank	1613B[5]	Frequency: 1 per batch ≤ 20 samples extracted Criteria: Concentration less than reporting level or one third regulatory level whichever is greater Corrective Action: Rerun all positive samples associated with unacceptable blank	8290	Frequency: 1 per batch of ≤ 20 samples extracted Criteria: Concentration less than reporting limit Corrective Action: Rerun all positive samples associated with unacceptable blank
	Laboratory Control Sample (Ongoing Precision and Recovery - OPR)	1613B[5]	Frequency: 1 per batch ≤ 20 samples extracted Criteria: percent recovery must be within acceptance limits given in method for each analyte Corrective Action: Rerun all samples associated with unacceptable LCS (OPR)	8290	Frequency: 1 per batch of ≤ 20 samples extracted Criteria: percent recovery for each analyte must be within laboratory acceptance limits Corrective Action: Rerun all samples associated with unacceptable LCS

TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846) [2]
Dioxins/ Dibenzo-furans (HRGC/HRMS) (continued)	Matrix Spike	1613B[5]	Not Applicable	8290	Frequency: 1 per analytical batch of ≤ 20 samples Criteria: percent recovery for each analyte should be within laboratory acceptance limits Corrective Action: Flag data associated with unacceptable Matrix Spike
	Matrix Spike Duplicate	1613B[5]	Not Applicable	8290	Frequency: 1 per analytical batch of ≤ 20 samples Criteria: percent recovery for each analyte should be within laboratory acceptance limits Corrective Action: Flag data associated with unacceptable matrix spike duplicate
	Duplicate	1613B[5]	Not Applicable	8290	Not Applicable
	Surrogates	1613B[5]	Not Applicable	8290	Not Applicable
	Internal Standards (Labeled Compounds and Cleanup Standards)	1613B[5]	Labeled internal standards and cleanup standards are added to all samples (QC samples included). Recovery of each labeled standard should be within the method limits.	8290	Internal standards are added to all samples (QC samples included). Internal standard recovery should be between 40 % - 135 % for Method 8290. Use limits in laboratory SOP.

TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
PCBs (HRGC/HRMS)	Method Blank	1668[5]	Frequency: 1 per batch ≤ 20 samples extracted Criteria: Concentration less than reporting level or one third regulatory level whichever is greater Corrective Action: Rerun all positive samples associated with unacceptable blank	--	Not Applicable
	Laboratory Control Sample (Ongoing Precision and Recovery - OPR)	1668[5]	Frequency: 1 per batch ≤ 20 samples extracted Criteria: percent recovery must be within acceptance limits given in method for each analyte Corrective Action: Rerun all samples associated with unacceptable LCS (OPR)	--	Not Applicable
	Matrix Spike	1668[5]	Not Applicable	--	Not Applicable
	Matrix Spike Duplicate	1668[5]	Not Applicable		Not Applicable
	Duplicate	1668[5]	Not Applicable	--	Not Applicable
	Surrogates	1668[5]	Not Applicable	--	Not Applicable

TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846) [2]
PCBs (HRGC/HRMS) (continued)	Internal Standards (Labeled Compounds and Cleanup Standards)	1668[5]	Labeled internal standards and cleanup standards are added to all samples (QC samples included). Recovery of each labeled standard should be within the method limits.	--	Not Applicable
Halogenated Volatiles Volatiles by GC	Method Blank	--	Not Applicable	8021B	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank SOP NO. CORP-GC-0001
	Laboratory Control Sample	--	Not Applicable	8021B	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: percent recovery for each analyte must be within laboratory acceptance limits Corrective Action: Rerun all samples associated with unacceptable LCS SOP NO. CORP-GC-0001

TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846) [2]
Halogenated Volatiles by GC (continued)	Matrix Spike	--	Not Applicable	8021B	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: percent recovery for each analyte should be within laboratory acceptance limits Corrective Action: Flag data associated with unacceptable Matrix Spike SOP NO. CORP-GC-0001
	Matrix Spike Duplicate	--	Not Applicable	8021B	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: percent recovery for each analyte should be within laboratory acceptance limits Corrective Action: Flag data associated with unacceptable Matrix Spike SOP NO. CORP-GC-0001
	Duplicate	--	Not Applicable	8021B	Not Applicable
	Surrogates	--	Not Applicable	8021B	Surrogates spiked into method blank and all samples (QC included) Method Blank Criteria and LCS: All surrogates must be within laboratory established control limits before sample analysis may proceed. Sample Criteria: Reprepare and reanalyze samples or flag sample data not meeting surrogate criteria. SOP NO. CORP-GC-0001

TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Halogenated Volatiles by GC (continued)	Internal Standards	--	Not Applicable	8021B	Optional: Internal standards are added to the method blank and all samples (QC included). If used, same compounds as used for surrogates may be appropriate. SOP NO. CORP-GC-0001
Herbicides	Method Blank	615 [3]	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Re-extract all samples associated with unacceptable blank	8151A	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Re-extract all samples associated with unacceptable blank SOP NO. CORP-GC-0001
	Laboratory Control Sample	615 [3]	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Percent recovery must be within acceptance limits given in method for each analyte Corrective Action: Re-extract all samples associated with unacceptable LCS	8151A	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Percent recovery for each analyte must be within laboratory acceptance limits Corrective Action: Re-extract and reanalyze all samples associated with unacceptable LCS SOP NO. CORP-GC-0001
	Matrix Spike	615 [3]	Frequency: 1 per 10 samples from each site or 1 per month, whichever is more frequent Criteria: Percent recovery for each analyte should be within advisory limits given in method Corrective Action: Flag data associated with unacceptable Matrix Spike	8151A	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Percent recovery for each analyte should be within laboratory acceptance limits Corrective Action: Flag data associated with unacceptable Matrix Spike SOP NO. CORP-GC-0001

TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846) [2]
Herbicides (continued)	Matrix Spike Duplicate	615 [3]	Not Applicable	8151A	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery for each analyte should be within laboratory control limits Corrective Action: Flag data associated with unacceptable matrix spike sample SOP NO. CORP-GC-0001
	Duplicate	615 [3]	Not Applicable	8151A	Not Applicable
	Surrogates	615 [3]	Not Applicable	8151A	Surrogates spiked into method blank and all samples (QC included) Method Blank Criteria and LCS: All surrogates must fall within laboratory established control limits before sample analysis may proceed. Sample Criteria: Re-extract and reanalyze samples or flag sample data not meeting surrogate criteria SOP NO. CORP-GC-0001
	Internal Standards	615 [3]	Not Applicable	8151A	Optional
Nitro-aromatics by HPLC	Method Blank	--	Not Applicable	8330	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank

TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846) [2]
Nitro-aromatics by HPLC (continued)	Laboratory Control Sample	--	Not Applicable	8330	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Percent recovery for each analyte must be within laboratory acceptance limits Corrective Action: Rerun all samples associated with unacceptable LCS
	Matrix Spike	--	Not Applicable	8330	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Percent recovery for each analyte should be within laboratory acceptance limits Corrective Action: Flag data associated with unacceptable Matrix Spike
	Matrix Spike Duplicate	--	Not Applicable	8330	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Percent recovery for each analyte should be within laboratory acceptance limits Corrective Action: Flag data associated with unacceptable Matrix Spike
	Duplicate	--	Not Applicable	8330	Not Applicable
	Surrogates	--	Not Applicable	8330	Surrogates spiked into method blank and all samples (QC included) Method Blank Criteria and LCS: All surrogates must fall within laboratory established control limits before sample analysis may proceed. Sample Criteria: Re-extract and reanalyze samples or flag sample data not meeting surrogate criteria
	Internal Standards	--	Not Applicable	8330	Not Applicable

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QAMP Change Form

DOCUMENT: Quality Assurance Management Plan, Revision No. 3
SECTION(S) AFFECTED BY CHANGE: Table 8.4-6, pages 79, 80, 92, 94
REASON FOR ADDITION OR CHANGE: To revise the QAMP tables to include information regarding surrogates (8330), matrix spike duplicates (8141A), and internal standard retention times (8270C and 8260B).
CHANGE EFFECTIVE FROM: 05/14/99
CHANGE: See attached pages.
SUBMITTED BY/DATE: Chris Rigell, 5/11/99
APPROVED BY:

Mark A. Matthews
Chief Operating Officer
5/12/99
Date

Chris M. Lee
Vice President of Operations Services
5/12/99
Date

Jack R. Hall
Corporate Director of Quality Assurance
5/12/99
Date

Entire Page
Revised 5/14/99

TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Nitro-aromatics by HPLC (continued)	Laboratory Control Sample	--	Not Applicable	8330	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Percent recovery for each analyte must be within laboratory acceptance limits Corrective Action: Rerun all samples associated with unacceptable LCS
	Matrix Spike	--	Not Applicable	8330	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Percent recovery for each analyte should be within laboratory acceptance limits Corrective Action: Flag data associated with unacceptable Matrix Spike
	Matrix Spike Duplicate	--	Not Applicable	8330	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Percent recovery for each analyte should be within laboratory acceptance limits Corrective Action: Flag data associated with unacceptable Matrix Spike
	Duplicate	--	Not Applicable	8330	Not Applicable
	Surrogates	--	Not Applicable	8330	Surrogates spiked into method blank and all samples (QC included) Method Blank Criteria and LCS: All surrogates must fall within laboratory established control limits before sample analysis may proceed. Sample Criteria: Re-extract and reanalyze samples or flag sample data not meeting surrogate criteria
	Internal Standards	--	Not Applicable	8330	Not Applicable

TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846) [2]
Organo-phosphorus Pesticides	Method Blank	--	Not Applicable	8141A	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank
	Laboratory Control Sample	--	Not Applicable	8141A	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Percent recovery for each analyte should be within laboratory acceptance limits Corrective Action: Rerun all samples associated with unacceptable LCS
	Matrix Spike	--	Not Applicable	8141A	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Percent recovery for each analyte should be within laboratory acceptance limits Corrective Action: Flag data associated with unacceptable MS
	Matrix Spike Duplicate	--	Not Applicable	8141A	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Percent recovery for each analyte should be within laboratory acceptance limits Corrective Action: Flag data associated with unacceptable MS
	Duplicate	--	Not Applicable	8141A	Not Applicable

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QAMP Change Form

DOCUMENT: Quality Assurance Management Plan, Revision No. 3
SECTION(S) AFFECTED BY CHANGE: Table 8.4-6, pages 79, 80, 92, 94
REASON FOR ADDITION OR CHANGE: To revise the QAMP tables to include information regarding surrogates (8330), matrix spike duplicates (8141A), and internal standard retention times (8270C and 8260B).
CHANGE EFFECTIVE FROM: 05/14/99
CHANGE: See attached pages.
SUBMITTED BY/DATE: Chris Rigell, 5/11/99
APPROVED BY:

Mark A. Matthews
Chief Operating Officer
5/12/99
Date

Chris M. Lee
Vice President of Operations Services
5/12/99
Date

Jack R. Hall
Corporate Director of Quality Assurance
5/12/99
Date

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TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Organo-phosphorus Pesticides	Method Blank	--	Not Applicable	8141A	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank
	Laboratory Control Sample	--	Not Applicable	8141A	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Percent recovery for each analyte should be within laboratory acceptance limits Corrective Action: Rerun all samples associated with unacceptable LCS
	Matrix Spike	--	Not Applicable	8141A	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Percent recovery for each analyte should be within laboratory acceptance limits Corrective Action: Flag data associated with unacceptable MS
	Matrix Spike Duplicate	--	Not Applicable	8141A	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Percent recovery for each analyte should be within laboratory acceptance limits Corrective Action: Flag data associated with unacceptable MS
	Duplicate	--	Not Applicable	8141A	Not Applicable

TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846) [2]
Organo-phosphorus Pesticides (continued)	Surrogates	--	Not Applicable	8141A	Surrogates spiked into method blank and all samples (QC included) Method Blank and LCS Criteria: Results must fall within laboratory-established control limits Sample Criteria: Re-extract and reanalyze samples or flag sample data not meeting surrogate criteria
PAHs by GC and HPLC	Method Blank	610	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	8100 8310	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank
	Laboratory Control Sample	610	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery must be within acceptance limits given in method for each analyte Corrective Action: Rerun all samples associated with unacceptable LCS	8100 8310	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery for each analyte must be within laboratory acceptance limits Corrective Action: Rerun all samples associated with unacceptable LCS

TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846) [2]
PAHs by GC and HPLC (continued)	Matrix Spike	610	Frequency: 1 per 10 samples from each site or 1 per month, whichever is more frequent Criteria: percent recovery for each analyte should be within advisory limits given in method Corrective Action: Flag data associated with unacceptable Matrix Spike	8100 8310	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery for each analyte should be within laboratory acceptance limits Corrective Action: Flag data associated with unacceptable Matrix Spike
	Matrix Spike Duplicate	610	Not Applicable	8100 8310	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery for each analyte should be within laboratory acceptance limits Corrective Action: Flag data associated with unacceptable Matrix Spike
	Duplicate	610	Not Applicable	8100 8310	Not Applicable
	Surrogates	610	Not specified in method	8100 8310	Surrogates spiked into method blank and all samples (QC included) Method Blank Criteria and LCS: Results must fall within laboratory established control limits Sample Criteria: Re-extract and reanalyze samples or flag sample data not meeting surrogate criteria
	Internal Standards	610	Optional	8100 8310	Optional

TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846) [2]
Pesticides/ PCBs	Method Blank	608	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	8081A 8082	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Reprepare and reanalyze all samples associated with unacceptable blank, see SOP CORP-GC-0001
	Laboratory Control Sample	608	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery must be within acceptance limits given in method for each analyte Corrective Action: Rerun all samples associated with unacceptable LCS	8081A 8082	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery for each analyte must be within laboratory acceptance limits Corrective Action: Rerun all samples associated with unacceptable LCS SOP NO. CORP-GC-0001
	Matrix Spike	608	Frequency: 1 per 10 samples from each site or 1 per month, whichever is more frequent Criteria: percent recovery for each analyte should be within advisory limits given in method Corrective Action: Flag data associated with unacceptable Matrix Spike	8081A 8082	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery for each analyte should be within laboratory acceptance limits Corrective Action: Flag data associated with unacceptable Matrix Spike, see SOP CORP-GC-0001

TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846) [2]
Pesticides/ PCBs (continued)	Matrix Spike Duplicate	608	Not Applicable	8081A 80882	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery for each analyte should be within laboratory acceptance limits Corrective Action: Flag data associated with unacceptable Matrix Spike, see SOP CORP-GC-0001
	Duplicate	608	Not Applicable	8081A 8082	Not Applicable
	Surrogates	608	Not specified in method	8081A 8082	Surrogates spiked into method blank and all samples (QC included) Method Blank Criteria and LCS: Results must fall within laboratory established control limits Sample Criteria: Re-extract and reanalyze samples or flag sample data not meeting surrogate criteria, see SOP CORP-GC-0001
	Internal Standards	608	Optional	8081A 8082	Optional

TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846) [2]
Petroleum Hydro-carbons/Oil and Grease	Method Blank	413.1 413.2 418.1	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank Method 413.1: Not Applicable	9070 9071A	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank

TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846) [2]
Petroleum Hydro-carbons/Oil and Grease (continued)	Laboratory Control Sample	413.1 413.2 418.1	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples Method 413.1: Not Applicable	9070 9071A	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Percent recovery must be within ± 20% Corrective Action: Rerun all samples associated with unacceptable LCS
	Matrix Spike	413.1 413.2 418.1	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: Flag associated data Method 413.1: Not Applicable	9070 9071A	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: Flag associated data
	Matrix Spike Duplicate	413.1 413.2 418.1	Not Applicable	9070 9071A	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: Flag associated Method 9071: Not Applicable

TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846) [2]
Petroleum Hydro-carbons/Oil and Grease (continued)	Duplicate	413.1 413.2 418.1	Not Applicable	9070 9071A	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: Flag associated Method 9070: Not Applicable
	Surrogates	413.1 413.2 418.1	Not Applicable	9070 9071A	Not Applicable
	Internal Standards	413.1 413.2 418.1	Not Applicable	9070 9071A	Not Applicable
Petroleum Hydro-carbons	Method Blank	1664[4]	Frequency: 1 with each preparation batch Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank SOP NO. CORP-WC-0003	---	---

TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846) [2]
Petroleum Hydro-carbons (continued)	Laboratory Control Sample	1664[4]	Frequency: 1 with each analytical batch Criteria: Waters - See limits in Table 2 of SOP No.: CORP-WC-0003 Soils - Percent recovery must be within laboratory control limits Corrective Action: Rerun all samples associated with unacceptable LCS SOP NO. CORP-WC-0003	---	---
	Matrix Spike	1664[4]	Frequency: 1 with every 10 samples per site Criteria: See percent recovery limits in Table 2 of SOP No. CORP-WC-0003 Corrective Action: See Section 9.6.1 of SOP No. CORP-WC-0003	---	---
	Matrix Spike Duplicate	1664[4]	Frequency: 1 with every 10 samples per site Criteria: See percent recovery and RPD limits in Table 2 of SOP No. CORP-WC-0003 Corrective Action: See Section 9.6.1 of SOP No. CORP-WC-0003	---	---
	Duplicate	1664[4]	Not Applicable	---	---

TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846) [2]
Purgeable Halocarbons by GC	Method Blank	601	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	8021B	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank SOP NO. CORP-GC-0001
	Laboratory Control Sample	601	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery must be within acceptance limits given in method for each analyte Corrective Action: Rerun all samples associated with unacceptable LCS	8021B	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery for each analyte must be within laboratory acceptance limits Corrective Action: Rerun all samples associated with unacceptable LCS, see Section 9.7, SOP No. CORP-GC-0001
	Matrix Spike	601	Frequency: 1 per 10 samples from each site or 1 per month, whichever is more frequent Criteria: percent recovery for each analyte should be within advisory limits given in method Corrective Action: Flag data associated with unacceptable Matrix Spike	8021B	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery for each analyte should be within laboratory acceptance limits Corrective Action: Flag data associated with unacceptable Matrix Spike, see Section 9.8, SOP No. CORP-GC-0001

TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Purgeable Halocarbons by GC (continued)	Matrix Spike Duplicate	601	Not Applicable	8021B	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery for each analyte should be within laboratory acceptance limits Corrective Action: Flag data associated with unacceptable Matrix Spike, see Section 9.7, SOP No. CORP-GC-0001
	Duplicate	601	Not Applicable	8021B	Not Applicable
	Surrogates	601	Surrogates spiked into method blank and all samples (QC included) Method Blank Criteria and LCS: All surrogates must be within laboratory established control limits before sample analysis may proceed. Sample Criteria: Re-extract samples or flag sample data not meeting surrogate criteria	8021B	Surrogates spiked into method blank and all samples (QC included) Method Blank Criteria and LCS: All surrogates must be within laboratory established control limits before sample analysis may proceed. Sample Criteria: Re-extract and reanalyze samples or flag sample data not meeting surrogate criteria, see Section 9.4, SOP No. CORP-GC-0001
	Internal Standards	601	Optional: Internal standards are added to the method blank and all samples (QC included). If used, same compounds as used for surrogates may be appropriate.	8021B	Optional: Internal standards are added to the method blank and all samples (QC included). If used, same compounds as used for surrogates may be appropriate.

TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Semivolatiles	Method Blank	625	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	8270C	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Reextract and reanalyze all samples associated with unacceptable blank, see Section 9.3, SOP No. CORP-MS-0001
	Laboratory Control Sample	625	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery must be within acceptance limits given in method for each analyte Corrective Action: Rerun all samples associated with unacceptable LCS	8270C	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery for each analyte must be within laboratory acceptance limits Corrective Action: Reextract and reanalyze all samples associated with unacceptable LCS, see Section 9.5.2, SOP No. CORP-MS-0001
	Matrix Spike	625	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery for each analyte should be within advisory limits given in method Corrective Action: Flag data associated with unacceptable Matrix Spike	8270C	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery for each analyte should be within laboratory acceptance limits Corrective Action: Flag data associated with unacceptable Matrix Spike, see Section 9.6, SOP No. CORP-MS-0001

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SECTION(S) AFFECTED BY CHANGE: Table 8.4-6, pages 79, 80, 92, 94
REASON FOR ADDITION OR CHANGE: To revise the QAMP tables to include information regarding surrogates (8330), matrix spike duplicates (8141A), and internal standard retention times (8270C and 8260B).
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APPROVED BY:

Mark A. Matthews
Chief Operating Officer
5/12/99
Date

Chris M. Lee
Vice President of Operations Services
5/12/99
Date

Jack R. Hall
Corporate Director of Quality Assurance
5/12/99
Date

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TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Semivolatiles	Method Blank	625	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	8270C	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Reextract and reanalyze all samples associated with unacceptable blank, see Section 9.3, SOP No. CORP-MS-0001
	Laboratory Control Sample	625	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery must be within acceptance limits given in method for each analyte Corrective Action: Rerun all samples associated with unacceptable LCS	8270C	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery for each analyte must be within laboratory acceptance limits Corrective Action: Reextract and reanalyze all samples associated with unacceptable LCS, see Section 9.5.2, SOP No. CORP-MS-0001
	Matrix Spike	625	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery for each analyte should be within advisory limits given in method Corrective Action: Flag data associated with unacceptable Matrix Spike	8270C	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery for each analyte should be within laboratory acceptance limits Corrective Action: Flag data associated with unacceptable Matrix Spike, see Section 9.6, SOP No. CORP-MS-0001

TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846) [2]
Semivolatiles (continued)	Matrix Spike Duplicate	625	Not Applicable	8270C	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery for each analyte should be within laboratory acceptance limits Corrective Action: Flag data associated with unacceptable Matrix Spike, see Section 9.6, SOP No. CORP-MS-0001
	Duplicate	625	Not Applicable	8270C	Not Applicable
	Surrogates	625	Surrogates spiked into method blank and all samples (QC included) Method Blank and LCS Criteria: All surrogates must be in control before sample analysis may proceed Sample Criteria: Re-extract samples or flag sample data not meeting surrogate criteria	8270C	Surrogates spiked into method blank and all samples (QC included) Method Blank and LCS Criteria: All surrogates must be in control before sample analysis may proceed Sample Criteria: Re-extract and reanalyze samples or flag sample data not meeting surrogate criteria, see Section 9.7.2, SOP No. CORP-MS-0001
	Internal Standards	625	Frequency: Internal standards spiked into method blank and all samples (QC included) Criteria: All internal standard recoveries must be within laboratory control limits Corrective Action: Flag sample data not meeting internal standard recovery requirements	8270C	Internal Standards are added to all samples (QC samples included). Internal standard area of daily standard must be within 50% to 200% of the response in the mid level of the initial calibration standard. The retention time (RT) for any internal standard (IS) in the continuing calibration must not exceed ± 0.5 minutes from mid level initial calibration standard IS RT.

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TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Semivolatiles (continued)	Matrix Spike Duplicate	625	Not Applicable	8270C	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery for each analyte should be within laboratory acceptance limits Corrective Action: Flag data associated with unacceptable Matrix Spike, see Section 9.6, SOP No. CORP-MS-0001
	Duplicate	625	Not Applicable	8270C	Not Applicable
	Surrogates	625	Surrogates spiked into method blank and all samples (QC included) Method Blank and LCS Criteria: All surrogates must be in control before sample analysis may proceed Sample Criteria: Re-extract samples or flag sample data not meeting surrogate criteria	8270C	Surrogates spiked into method blank and all samples (QC included) Method Blank and LCS Criteria: All surrogates must be in control before sample analysis may proceed Sample Criteria: Re-extract and reanalyze samples or flag sample data not meeting surrogate criteria, see Section 9.7.2, SOP No. CORP-MS-0001
	Internal Standards	625	Frequency: Internal standards spiked into method blank and all samples (QC included) Criteria: All internal standard recoveries must be within laboratory control limits Corrective Action: Flag sample data not meeting internal standard recovery requirements	8270C	Internal Standards are added to all samples (QC samples included). Internal standard area of daily standard must be within 50% to 200% of the response in the mid level of the initial calibration standard. The retention time (RT) for any internal standard (IS) in the continuing calibration must not exceed $\pm$ 0.5 minutes from mid level initial calibration standard IS RT.

TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Volatiles by GC/MS	Method Blank	624	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	8260B	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank, see Section 9.4, SOP No. CORP-MS-0002
	Laboratory Control Sample	624	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: percent recovery for each analyte should be within advisory limits given in method Corrective Action: Flag data associated with unacceptable Matrix Spike	8260B	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: percent recovery for each analyte must be within laboratory acceptance limits Corrective Action: Rerun all samples associated with unacceptable LCS, see Section 9.5, SOP No. CORP-MS-0002
	Matrix Spike	624	Frequency: 1 per ≤ 20 samples from each site or 1 per month, whichever is more frequent Criteria: percent recovery for each analyte should be within advisory limits given in method Corrective Action: Flag data associated with unacceptable Matrix Spike	8260B	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: percent recovery for each analyte should be within laboratory acceptance limits Corrective Action: Flag data associated with unacceptable Matrix Spike, see Section 9.6, SOP No. CORP-MS-0002

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TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Volatiles by GC/MS	Method Blank	624	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	8260B	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank, see Section 9.4, SOP No. CORP-MS-0002
	Laboratory Control Sample	624	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: percent recovery for each analyte should be within advisory limits given in method Corrective Action: Flag data associated with unacceptable Matrix Spike	8260B	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: percent recovery for each analyte must be within laboratory acceptance limits Corrective Action: Rerun all samples associated with unacceptable LCS, see Section 9.5, SOP No. CORP-MS-0002
	Matrix Spike	624	Frequency: 1 per $\leq$ 20 samples from each site or 1 per month, whichever is more frequent Criteria: percent recovery for each analyte should be within advisory limits given in method Corrective Action: Flag data associated with unacceptable Matrix Spike	8260B	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: percent recovery for each analyte should be within laboratory acceptance limits Corrective Action: Flag data associated with unacceptable Matrix Spike, see Section 9.6, SOP No. CORP-MS-0002

TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846) [2]
Volatiles by GC/MS (continued)	Matrix Spike Duplicate	624	Not Applicable	8260B	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: percent recovery for each analyte should be within laboratory acceptance limits Corrective Action: Flag data associated with unacceptable Matrix Spike, see Section 9.6, SOP No. CORP-MS-0002
	Duplicate	624	Not Applicable	8260B	Not Applicable
	Surrogates	624	Surrogates spiked into Method Blank and all samples (QC included) Method Blank Criteria: All surrogates must be in control before sample analysis may proceed. Sample Criteria: Re-extract samples or flag sample data not meeting surrogate criteria	8260B	Surrogates spiked into Method Blank and all samples (QC included) Method Blank Criteria and LCS: All surrogates must be in control before sample analysis may proceed. Sample Criteria: Re-extract and reanalyze samples or flag sample data not meeting surrogate criteria, see Section 9.3, SOP No. CORP-MS-0002
	Internal Standards	624	Frequency: Internal standards spiked into method blank and all samples (QC included) Criteria: All internal standard recoveries must be within laboratory control limits Corrective Action: Flag sample data not meeting internal standard recovery requirements	8260B	Internal Standards are added to all samples (QC samples included). Internal standard area of daily standard must be within 50% to 200% of the response in the mid level of the initial calibration standard. The retention time (RT) for any internal standard (IS) in the continuing calibration must not exceed ± 0.5 minutes from mid level initial calibration standard IS RT.

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Corporate Director of Quality Assurance
Date: 5/12/99

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TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA (SW846)[2]
Volatiles by GC/MS (continued)	Matrix Spike Duplicate	624	Not Applicable	8260B	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: percent recovery for each analyte should be within laboratory acceptance limits Corrective Action: Flag data associated with unacceptable Matrix Spike, see Section 9.6, SOP No. CORP-MS-0002
	Duplicate	624	Not Applicable	8260B	Not Applicable
	Surrogates	624	Surrogates spiked into Method Blank and all samples (QC included) Method Blank Criteria: All surrogates must be in control before sample analysis may proceed. Sample Criteria: Re-extract samples or flag sample data not meeting surrogate criteria	8260B	Surrogates spiked into Method Blank and all samples (QC included) Method Blank Criteria and LCS: All surrogates must be in control before sample analysis may proceed. Sample Criteria: Re-extract and reanalyze samples or flag sample data not meeting surrogate criteria, see Section 9.3, SOP No. CORP-MS-0002
	Internal Standards	624	Frequency: Internal standards spiked into method blank and all samples (QC included) Criteria: All internal standard recoveries must be within laboratory control limits Corrective Action: Flag sample data not meeting internal standard recovery requirements	8260B	Internal Standards are added to all samples (QC samples included). Internal standard area of daily standard must be within 50% to 200% of the response in the mid level of the initial calibration standard. The retention time (RT) for any internal standard (IS) in the continuing calibration must not exceed $\pm$ 0.5 minutes from mid level initial calibration standard IS RT.

TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Footnotes

(1) National Pollutant Discharge Elimination System

(2) Resource Conservation and Recovery Act, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, (SW-846), Third Edition, September 1986. Contains Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996).

(3) Method not listed in 40 CFR Part 136.

(4) Method 1664 is a proposed method only, and has not been promulgated by the EPA. These requirements are from Quanterra® SOP Number CORP-WC-0003, "HEM/SGT-HEM by Method 1664".

(5) Method 1613, Rev B, October 1994, EPA 821-B-94-005, "Tetra-Through Octa-Chlorinated Dioxins and Furans by Isotope Dilution HRGC/HRMS". Method 1668, Draft, October 4, 1995, "Toxic PCBs by Isotope Dilution HRGC/HRMS".

TABLE 8.4-7
USEPA Contract Laboratory Program Statement of Work Quality Control Samples

Analysis	QC Sample	Method	Requirement
Cyanide, Total	Method Blank	ILM03.0 ILMO4.0	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria ILMO3.0: Concentration less than CRDL or less than 10x sample concentration Criteria ILMO4.0: If method blank is > CRDL, sample results are acceptable if they are ≥ 10-times method blank level. Corrective Action: Reprepare all samples associated with unacceptable blank
	Laboratory Control Sample	ILM03.0 ILMO4.0	Frequency: 1 with each batch of samples processed or for each SDG, whichever is more frequent Criteria: Water - 80-120% Solid - Meet control limits established for solid reference material Corrective Action: Reprepare all samples associated with unacceptable LCS
	Matrix Spike	ILM03.0 ILMO4.0	Frequency: 1 with each group of samples of a similar matrix type and concentration or for each SDG, whichever is more frequent Criteria: 75-125% unless sample result > 4x spike amount Corrective Action: Flag data associated with unacceptable Matrix Spike, perform post distillation spike at 2 x CRDL or 2x sample concentration whichever is greater
	Matrix Spike Duplicate	ILM03.0 ILMO4.0	Not Applicable
	Duplicate	ILM03.0 ILMO4.0	Frequency: 1 with each group of samples of a similar matrix type and concentration or for each SDG whichever is more frequent Criteria: RPD ≤ 20% or ± CRDL if sample or duplicate value < 5x CRDL Corrective Action: Flag all associated data associated if duplicate results outside control limits
	Surrogates	ILM03.0 ILMO4.0	Not Applicable
	Internal Standards	ILM03.0 ILMO4.0	Not Applicable

TABLE 8.4-7
USEPA Contract Laboratory Program Statement of Work Quality Control Samples (Continued)

Analysis	QC Sample	Method	Requirement
ICAP (excludes mercury)	Method Blank	ILM03.0 ILMO4.0	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria ILMO3.0: Concentration less than CRDL or less than 10x sample concentration Criteria ILMO4.0: If method blank is > CRDL, sample results are acceptable if they are ≥ 10-times method blank level. Corrective Action: Reprepare all samples associated with unacceptable blank
	Laboratory Control Sample	ILM03.0 ILMO4.0	Frequency: 1 with each batch of samples processed or for each SDG, whichever is more frequent Criteria: Water - 80-120% except silver and antimony Solid - Meet control limits established for solid reference material Corrective Action: Reprepare all samples associated with unacceptable LCS
	Matrix Spike	ILM03.0 ILMO4.0	Frequency: 1 with each group of samples of a similar matrix type and concentration or for each SDG whichever is more frequent Criteria: 75-125% unless sample result > 4x spike amount Corrective Action: Flag data associated with unacceptable Matrix perform post digestion spike at 2xCRDL or 2x sample concentration whichever is greater
	Matrix Spike Duplicate	ILM03.0 ILMO4.0	Not Applicable
	Duplicate	ILM03.0 ILMO4.0	Frequency: 1 with each group of samples of a similar matrix type and concentration or for each SDG whichever is more frequent Criteria: RPD ≤ 20% or ± CRDL if sample or duplicate value < 5x CRDL Corrective Action: Flag all data associated with duplicate results outside control limits

TABLE 8.4-7
USEPA Contract Laboratory Program Statement of Work Quality Control Samples (Continued)

Analysis	QC Sample	Method	Requirement
ICAP (excludes mercury) (continued)	Serial Dilution	ILM03.0 ILMO4.0	Frequency: 1 with each group of samples of a similar matrix type and concentration or for each SDG whichever is more frequent Criteria: <10% D when sample concentration > 50x IDL Corrective Action: Flag all data associated with results outside control limits
	Surrogates	ILM03.0 ILMO4.0	Not Applicable
	Internal Standards	ILM03.0 ILMO4.0	Not Applicable.
GFAA (excludes mercury)	Method Blank	ILM03.0 ILMO4.0	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria ILMO3.0: Concentration less than CRDL or less than 10x sample concentration Criteria ILMO4.0: If method blank is > CRDL, sample results are acceptable if they are ≥ 10-times method blank level. Corrective Action: Reprepare all samples associated with unacceptable blank
	Laboratory Control Sample	ILM03.0 ILMO4.0	Frequency: 1 with each batch of samples processed or for each SDG, whichever is more frequent Criteria: Water - 80-120% except silver and antimony Solid - Meet control limits established for solid reference material Corrective Action: Reprepare all samples associated with unacceptable LCS
	Matrix Spike	ILM03.0 ILMO4.0	Frequency: 1 with each group of samples of a similar matrix type and concentration or for each SDG whichever is more frequent Criteria: 75-125% unless sample result > 4x spike amount Corrective Action: Flag data associated with unacceptable Matrix
	Matrix Spike Duplicate	ILM03.0 ILMO4.0	Not Applicable

TABLE 8.4-7
USEPA Contract Laboratory Program Statement of Work Quality Control Samples (Continued)

Analysis	QC Sample	Method	Requirement
GFAA (excludes mercury) (continued)	Duplicate	ILM03.0 ILMO4.0	Frequency: 1 with each group of samples of a similar matrix type and concentration or for each SDG whichever is more frequent Criteria: RPD ≤ 20% or ± CRDL if sample or duplicate value < 5x CRDL Corrective Action: Flag all associated data associated if duplicate results outside control limits
	Analytical Spike	ILM03.0 ILMO4.0	Frequency: 1 with each sample except matrix spike Criteria: Evaluate per method requirements Corrective action: Perform per method requirements
	Surrogates	ILM03.0 ILMO4.0	Not Applicable
	Internal Standards	ILM03.0 ILMO4.0	Not Applicable.
Mercury (CVAA)	Method Blank	ILM03.0 ILMO4.0	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria ILMO3.0: Concentration less than CRDL Criteria ILMO4.0: If method blank is > CRDL, sample results are acceptable if they are ≥ 10-times method blank level. Corrective Action: Reprepare all samples associated with unacceptable blank
	Laboratory Control Sample	ILM03.0 ILMO4.0	Frequency: 1 with each batch of samples processed or for each SDG, whichever is more frequent Criteria: Water - 80-120% Solid - Meet control limits established for solid reference material Corrective Action: Reprepare all samples associated with unacceptable LCS
	Matrix Spike	ILM03.0 ILMO4.0	Frequency: 1 with each group of samples of a similar matrix type and concentration or for each SDG Criteria: 75-125% unless sample result > 4x spike amount Corrective Action: Flag data associated with unacceptable Matrix Spike

TABLE 8.4-7
USEPA Contract Laboratory Program Statement of Work Quality Control Samples (Continued)

Analysis	QC Sample	Method	Requirement
Mercury (CVAA) (continued)	Matrix Spike Duplicate	ILM03.0 ILMO4.0	Not Applicable
	Duplicate	ILM03.0 ILMO4.0	Frequency: 1 with each group of samples of a similar matrix type and concentration or for each SDG whichever is more frequent Criteria: RPD ≤ 20% or ± CRDL if sample or duplicate value < 5x CRDL Corrective Action: Flag all associated data associated if duplicate results outside control limits
	Surrogates	ILM03.0 ILMO4.0	Not Applicable
	Internal Standards	ILM03.0 ILMO4.0	Not Applicable.
PCDD, PCDF	Method Blank	DFLM01.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Chemical interference or electronic noise must be less than 5% of the appropriate internal standard ion A peak that meets identification criteria must be less than 2% of the signal of the appropriate internal standard ion Corrective Action: Reprepare all samples with positive results or those not meeting all identification criteria associated with unacceptable blank
	Laboratory Control Sample	DFLM01.1	Not Applicable
	Matrix Spike	DFLM01.1	Frequency: 1 for each matrix analyzed for each SDG Criteria: 50-150% Corrective Action: Verify all calculations and spiking; no further action required
	Matrix Spike Duplicate	DFLM01.1	Not Applicable

TABLE 8.4-7
USEPA Contract Laboratory Program Statement of Work Quality Control Samples (Continued)

Analysis	QC Sample	Method	Requirement
PCDD, PCDF (continued)	Duplicate	DFLM01.1	Frequency: 1 for each matrix analyzed for each SDG Criteria: RPD ≤ 50% Corrective Action: Verify all calculations and spiking; no further action required
	Surrogates	DFLM01.1	Not Applicable
	Internal Standards	DFLM01.1	Frequency: Internal standards are spiked into all samples and QC samples Criteria: 25 - 150% Corrective Action: Re-extract and reanalyze all samples with unacceptable surrogate recoveries
Pesticides/PCBs	Method Blank	OLM03.1	Frequency: 1 with each case of samples received (up to 20 samples), for each extraction procedure within each SDG, whichever is most frequent or whenever samples are extracted Criteria: Concentration < CRQL Corrective Action: Re-extract and reanalyze all samples associated with unacceptable blank
	Laboratory Control Sample	OLM03.1	Not Applicable.
	Matrix Spike	OLM03.1	Frequency: 1 with each case of samples received (up to 20 samples), for each extraction procedure or for each SDG, whichever is most frequent Criteria: Percent recovery for each analyte should be within advisory limits given in method Corrective Action: Flag data associated with Matrix Spike recoveries outside of advisory limits

TABLE 8.4-7
USEPA Contract Laboratory Program Statement of Work Quality Control Samples (Continued)

Analysis	QC Sample	Method	Requirement
Pesticides/PCBs (continued)	Matrix Spike Duplicate	OLM03.1	Frequency: 1 with each case of samples received (up to 20 samples), for each concentration level (soils) or for each SDG, whichever is most frequent Criteria: Percent recovery for each analyte should be within advisory limits given in method RPD between MS/MSD should be within advisory limits given in method Corrective Action: Flag data associated with Matrix Spike recoveries or RPD outside of advisory limits
	Duplicate	OLM03.1	Not Applicable
	Surrogates	OLM03.1	Frequency: Surrogates spiked onto all samples and QC samples Criteria: Percent recovery for each surrogate in samples should be within 30-150% Percent recovery for each surrogate in the method blank must be 30-150% Corrective Action: Flag unacceptable surrogate recoveries in samples Re-extract all samples associated with unacceptable surrogate recoveries in the method blank
	Internal Standards	OLM03.1	Not Applicable.
	Method Blank	OLM01.8	Frequency: 1 with each case of samples received (up to 20 samples and including matrix spikes and reanalyses) that are of similar matrix (water or soil) or similar concentration (soil), or 1 with each 14 calendar day period (7 calendar day for 14-day data turnaround contracts) during which samples in a case are received), or 1 whenever samples are extracted by the same procedure (continuous liquid - liquid extraction or sonication) Criteria: Concentration < CRQL Corrective Action: Re-extract and re-analyze all samples associated with unacceptable blank

TABLE 8.4-7
USEPA Contract Laboratory Program Statement of Work Quality Control Samples (Continued)

Analysis	QC Sample	Method	Requirement
Pesticides/PCBs (continued)	Laboratory Control Sample	OLM01.8	Not Applicable
	Matrix Spike	OLM01.8	Frequency: 1 with every 20 samples of each matrix Criteria: Percent recovery should be within advisory limits given in method Corrective Action: Flag data associated with matrix spike recoveries outside of advisory limits
	Matrix Spike Duplicate	OLM01.8	Frequency: 1 with every 20 samples of each matrix Criteria: Percent recovery and RPD should be within advisory limits given in method Corrective Action: Flag data associated with percent recovery or RPD outside of advisory limits
	Duplicate	OLM01.8	Not Applicable
	Surrogates	OLM01.8	Frequency: Spiked onto all samples and QC samples Criteria: Advisory limits are 60% - 150% Corrective Action: Flag surrogate recoveries outside of advisory limits
	Internal Standards	OLM01.8	Not Applicable
Semivolatiles by GC/MS	Method Blank	OLM03.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration less than CRQL except phthalates which must be ≤ 5x CRQL Corrective Action: Re-extract and re-analyze all samples associated with unacceptable blank
	Laboratory Control Sample	OLM03.1	Not Applicable.

TABLE 8.4-7
USEPA Contract Laboratory Program Statement of Work Quality Control Samples (Continued)

Analysis	QC Sample	Method	Requirement
Semivolatiles by GC/MS (continued)	Matrix Spike	OLM03.1	Frequency: 1 with each case of samples received (up to 20 samples), for each concentration level (soils) or for each SDG, whichever is most frequent Criteria: Percent recovery for each analyte should be within advisory limits given in method Corrective Action: Flag data associated with Matrix Spike outside of advisory limits
	Matrix Spike Duplicate	OLM03.1	Frequency: 1 with each case of samples received (up to 20 samples), for each concentration level (soils) or for each SDG, whichever is most frequent Criteria: Percent recovery for each analyte should be within advisory limits given in method RPD between MS/MSD should be within advisory limits given in method Corrective Action: Flag data associated with Matrix Spike recoveries or RPD outside of advisory limits
	Duplicate	OLM03.1	Not Applicable
	Surrogates	OLM03.1	Frequency: Surrogates spiked onto all samples and QC samples Criteria: Percent recovery for each surrogate must be within limits given in method (one base/neutral and/or one acid surrogate may be outside of limits but not below 10%) Corrective Action: Flag data associated with unacceptable recoveries or reanalyze all samples with unacceptable surrogate recoveries as required in method
	Internal Standards	OLM03.1	Frequency: Internal Standards are spiked onto all samples and QC samples Criteria: Internal Standard areas must be within -50% to + 100% from the last daily calibration check standard Corrective Action: Reanalyze all samples with unacceptable areas

TABLE 8.4-7
USEPA Contract Laboratory Program Statement of Work Quality Control Samples (Continued)

Analysis	QC Sample	Method	Requirement
Semivolatiles by GC/MS (continued)	Method Blank	OLM01.8	Frequency: 1 with each case of samples received (up to 20 samples) and including matrix spikes and reanalyses) that are of similar matrix (water or soil) or similar concentration (soil), or 1 with each 14 calendar day period (7 calendar day for 14-day data turnaround contracts) during which samples in a case are received, or 1 whenever samples are extracted by the same procedure (continuous liquid-liquid extraction or sonication) Criteria: Concentration ≤ CRQL except phthalates which must be < 5 x CRQL Corrective Action: Re-extract and re-analyze all samples associated with unacceptable blank
	Laboratory Control Sample	OLM01.8	Not Applicable
	Matrix Spike	OLM01.8	Frequency: 1 with each case of samples received (up to 20 samples), for each concentration level (soils) or for each 14 day calendar period (7 calendar day period for 14 day data turnaround contracts) during which field samples in a case were received, whichever is most frequent Criteria: Percent recovery for each analyte should be within advisory limits given in method Corrective Action: Flag data associated with Matrix Spike recoveries outside of advisory limits
	Matrix Spike Duplicate	OLM01.8	Frequency: 1 with each case of samples received (up to 20 samples), for each concentration level (soils) or for each 14 day calendar period (7 calendar day period for 14 day data turnaround contracts) during which field samples in a case were received, whichever is most frequent Criteria: Percent recovery for each analyte should be within advisory limits given in method. RPD between MS/MSD should be within advisory limits given in method. Corrective Action: Flag data associated with Matrix Spike recoveries or RPD outside of advisory limits

TABLE 8.4-7
USEPA Contract Laboratory Program Statement of Work Quality Control Samples (Continued)

Analysis	QC Sample	Method	Requirement
Semivolatiles by GC/MS (continued)	Duplicate	OLM01.8	Not Applicable
	Surrogates	OLM01.8	Frequency: Surrogates spiked onto all samples and QC samples Criteria: Percent recovery for each surrogate must be within limits given in method (one base/neutral and/or one acid surrogate may be outside of limits, but not below 10%) Corrective Action: Flag data associated with unacceptable recoveries or reanalyze all samples with unacceptable surrogate recoveries as required in method
	Internal Standards	OLM01.8	Frequency: Internal Standards are spiked onto all samples and QC samples Criteria: Internal Standard areas must be within -50% to + 100% from the last daily calibration check standard Corrective Action: Reanalyze all samples with unacceptable areas
Volatiles by GC/MS	Method Blank	OLM03.1	Frequency: 1 per 12 hours Criteria: Concentration less than CRQL except methylene chloride, acetone, 2-butanone must be ≤ 5x CRQL Corrective Action: Reanalyze all samples associated with unacceptable blank
	Laboratory Control Sample	OLM03.1	Not Applicable
	Matrix Spike	OLM03.1	Frequency: 1 with each case of samples received (up to 20 samples), for each concentration level (soils) or for each SDG, whichever is most frequent Criteria: Percent recovery for each analyte should be within advisory limits given in method Corrective Action: Flag data associated with Matrix Spike outside of advisory limits

TABLE 8.4-7
USEPA Contract Laboratory Program Statement of Work Quality Control Samples (Continued)

Analysis	QC Sample	Method	Requirement
Volatiles by GC/MS (continued)	Matrix Spike Duplicate	OLM03.1	Frequency: 1 with each case of samples received (up to 20 samples), for each concentration level (soils) or for each SDG, whichever is most frequent Criteria: Percent recovery for each analyte should be within advisory limits given in method RPD between MS/MSD should be within advisory limits given in method Corrective Action: Flag data associated with Matrix Spike recoveries or RPD outside of advisory limits
	Duplicate	OLM03.1	Not Applicable
	Surrogates	OLM03.1	Frequency: Surrogates spiked onto all samples and QC samples Criteria: Percent recovery for each surrogate must be within limits given in method Corrective Action: Reanalyze all samples with unacceptable surrogate recoveries
	Internal Standards	OLM03.1	Frequency: Internal Standards are spiked onto all samples and QC samples Criteria: Internal Standard areas must be within -50% to + 100% from the last daily calibration check standard Corrective Action: Reanalyze all samples with unacceptable Internal Standard areas
	Storage Blank	OLM03.1	Frequency: 1 per SDG Criteria: Concentration less than CRQL except methylene chloride, acetone, 2-butanone must be ≤ 5x CRQL Corrective Action: Narrate with corrective action plan

TABLE 8.4-7
USEPA Contract Laboratory Program Statement of Work Quality Control Samples (Continued)

Analysis	QC Sample	Method	Requirement
Volatiles by GC/MS (continued)	Method Blank	OLM01.8	Frequency: 1 per 12 hours Criteria: Concentration less than CRQL except methylene chloride, acetone, and 2-butanone must be ≤ 5x CRQL Corrective Action: Re-purge and re-analyze all associated samples
	Laboratory Control Sample	OLM01.8	Not Applicable
	Matrix Spike	OLM01.8	Frequency: 1 with each case of samples received (up to 20 samples), for each concentration level (soils) or for each 14 day calendar period (7 calendar day period for 14 day data turnaround contracts) during which field samples in a case were received, whichever is most frequent Criteria: Percent recovery for each analyte should be within advisory limits given in method Corrective Action: Flag data associated with Matrix Spike recoveries outside of advisory limits
	Matrix Spike Duplicate	OLM01.8	Frequency: 1 with each case of samples received (up to 20 samples), for each concentration level (soils) or for each 14 day calendar period (7 calendar day period for 14 day data turnaround contracts) during which field samples in a case were received, whichever is most frequent Criteria: Percent recovery for each analyte should be within advisory limits given in method. RPD between MS/MSD should be within advisory limits given in method. Corrective Action: Flag data associated with Matrix Spike recoveries or RPD outside of advisory limits
	Duplicate	OLM01.8	Not Applicable
	Surrogates	OLM01.8	Frequency: Surrogates spiked onto all samples and QC samples Criteria: Percent recovery for each analyte should be within advisory limits given in method Corrective Action: Re-analyze all samples with unacceptable surrogate recoveries

TABLE 8.4-7
USEPA Contract Laboratory Program Statement of Work Quality Control Samples (Continued)

Analysis	QC Sample	Method	Requirement
Volatiles by GC/MS (continued)	Internal Standards	OLM01.8	Frequency: Internal Standards are spiked onto all samples and QC samples Criteria: Internal Standard areas must be within -50% to + 100% from the last daily calibration check standard Corrective Action: Re-analyze all samples with unacceptable Internal Standard areas
	Storage Blank	OLM01.8	Not Applicable

Notes:

SDG = Sample Delivery Group

TABLE 8.5-1
Inorganic Sample Containers, Preservatives, and Holding Times

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2], [3], [7]		RCRA (SW846)[3], [4]	
			Method	Requirements	Method	Requirements
Acidity	Water	100 mL	305.1	250 mL plastic or glass, Cool, 4°C, 14 days	---	Not Applicable
	Solid[5]	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Alkalinity	Water	100 mL	310.1 2320B	250 mL plastic or glass, Cool, 4°C, 14 days	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Ammonia	Water	400 mL	350.1	500 mL plastic or glass, Cool, 4°C H_2SO_4 to pH < 2, 28 days	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Biochemical Oxygen Demand (BOD)	Water	200 mL	405.1	1000 mL plastic or glass, Cool, 4°C 48 hours	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Bromide	Water	100 mL	300.0[7] 320.1 ASTM D1246-88	250 mL plastic or glass, No preservative required, 28 days	9056	Cool, 4°C, analyze ASAP after collection
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Chemical Oxygen Demand (COD)	Water	100 mL	410.1 410.2 410.4	250 mL glass or plastic, Cool, 4°C, H_2SO_4 to pH < 2, 28 days	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable

TABLE 8.5-1
Inorganic Sample Containers, Preservatives, and Holding Times (Continued)

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2, 3, 7]		RCRA (SW846)[3, 4]	
			Method	Requirements	Method	Requirements
Chloride	Water	50 mL	300.0[7] 325.1 325.2 325.3 4500 Cl E	250 mL plastic or glass, No preservative required, 28 days	9056 9251 9253	Method 9056: Cool, 4°C, analyze ASAP after collection. Method 9251/9253: 250ml plastic or glass, no preservative required, 28 days
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Chlorine, Residual	Water	100 mL	330.1 330.3	250 mL glass or plastic, Cool, 4°C, analyze immediately	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Chromium (Cr^{+6})	Water	100 mL	218.4 3500 Cr-D	Method 218.4: 200 mL plastic or glass, Cool, 4°C, 24 hours Method 3500 Cr-D: 200 mL quartz, TFE, or polypropylene HNO_3 to pH <2 Cool, 4°C Analyze ASAP after collection	7196A	200 mL plastic or glass, Cool, 4°C, 24 hours
	Solid	Not Applicable	---	Not Applicable	3060A/ 7196A	250 mL plastic or glass, 30 days to digestion, 96 hours after digestion
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable

TABLE 8.5-1
Inorganic Sample Containers, Preservatives, and Holding Times (Continued)

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2, 3, 7]		RCRA (SW846)[3, 4]	
			Method	Requirements	Method	Requirements
Color	Water	100 mL	110.2	250 mL plastic or glass, Cool, 4°C, 48 hours	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Conductivity	Water	100 mL	120.1	200 mL glass or plastic, Cool, 4°C, 28 days	9050A	200 mL glass or plastic, Cool, 4°C, 24 hours
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Cyanide (Amenable)	Water	IL	335.1	1 liter plastic or glass, NaOH to pH >12 0.6g ascorbic acid[6] Cool, 4°C, 14 days unless sulfide is present. Then maximum holding time is 24 hours	9010B 9012A	1 liter plastic or glass, NaOH to pH >12 0.6g ascorbic acid[6] Cool, 4°C, 14 days
	Solid	50g	---	Not Applicable	9010B 9012A	Not Specified
	Waste	50g	---	Not Applicable	9010B 9012A	Not Specified
Cyanide (Total)	Water	IL	335.1 335.2 335.3 4500 CN^- D	1 liter plastic or glass, NaOH to pH >12 0.6g ascorbic acid[6] Cool, 4°C, 14 days unless sulfide is present. Then maximum holding time is 24 hours	9010B 9012A	1 liter plastic or glass, NaOH to pH >12 0.6g ascorbic acid[6] Cool, 4°C, 14 days
	Solid	50g	--	Not Applicable	9010B 9012A	8 or 16 oz glass Teflon-lined lids, Cool, 4°C, 14 days

TABLE 8.5-1
Inorganic Sample Containers, Preservatives, and Holding Times (Continued)

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2], [3], [7]		RCRA (SW846)[3], [4]	
			Method	Requirements	Method	Requirements
Cyanide (Total) (continued)	Waste	50g	--	Not Applicable	9010B 9012A	8 or 16 oz glass Teflon-lined lids, Cool, 4°C
Flashpoint (Ignitability)	Liquid	Not Applicable	---	Not Applicable	1010	No requirements, 250 mL amber glass, Cool, 4°C is recommended
	Solid	Not Applicable	--	Not Applicable	---	Not Applicable
	Waste	Not Applicable	--	Not Applicable	---	Not Applicable
Fluoride	Water	300 mL	300.0[7] 340.2	500 mL plastic, No preservation required, 28 days	9056	Cool, 4°C, analyze ASAP after collection
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Hardness (Total)	Water	50 mL	130.2 2340B	250 mL glass or plastic, HNO_3 to pH < 2, 6 months	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Iodide	Water	100 mL	345.1 Dionex	100 mL plastic or glass, Cool, 4°C, 24 hours		Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Iron (Ferrous)	Water	100 mL	3500-Fe D	1 liter glass or polyethylene container, 6 months **This test should be performed in the field.**	-	Not Applicable
	Solid	Not Applicable	-	Not Applicable	-	Not Applicable
	Waste	Not Applicable	-	Not Applicable	-	Not Applicable

TABLE 8.5-1
Inorganic Sample Containers, Preservatives, and Holding Times
(Continued)

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2], [3], [7]		RCRA (SW846)[3], [4]	
			Method	Requirements	Method	Requirements
Methylene Blue Active Substances (MBAS) (Surfactant)	Water	100 mL	425.1	250 mL plastic or glass, Cool, 4°C, 48 hours	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Nitrate	Water	100 mL	300.0[7] 352.1	Method 300.0: 250 mL plastic or glass, Cool, 4°C, 48 hours. Method 352.1: 250 mL plastic or glass, Cool, 4°C, 48 hours.	9056 9210	Method 9056: Cool, 4°C, analyze ASAP after collection Method 9210: Cool, 4°C Preserve by adding 1 mL of 1M boric acid solution per 100 mL of sample
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	9210	Not Specified
Nitrite	Water	50 mL	300.0[7] 354.1	250 mL plastic or glass Cool, 4°C, 48 hours	9056	Cool, 4°C, analyze ASAP after collection
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable

TABLE 8.5-1
Inorganic Sample Containers, Preservatives, and Holding Times (Continued)

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2, 3, 7]		RCRA (SW846)[3, 4]	
			Method	Requirements	Method	Requirements
Nitrate-Nitrite	Water	100 mL	353.1 353.2 353.3	250 mL plastic or glass, H_2SO_4 to pH < 2, 28 days	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Ortho-phosphate	Water	50 mL	300.0[7] 365.1 365.2 365.3 365.4	100 mL plastic or glass, Filter on site Cool, 4°C, 48 hours	9056	Cool, 4°C, analyze ASAP collection
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
pH	Water	50 mL	150.1 4500-H^+ B	100 mL plastic or glass. Analyze immediately. **This test should be performed in the field.**	9040B	100 mL plastic or glass. Analyze immediately. **This test should be performed in the field.**
	Solid	Not Applicable	---	Not Applicable	9045C	4 oz glass or plastic, Cool, 4°C, Analyze as soon as possible.
	Waste	Not Applicable	---	Not Applicable	9045C	4 oz glass or plastic, Cool, 4°C, Analyze as soon as possible.
Phenolics	Water	100 mL	420.1 420.2	500 mL glass, Cool, 4°C, H_2SO_4 to pH < 2, 28 days	9065 9066	1 liter glass recommended, Cool, 4°C, H_2SO_4 to pH < 4, 28 days
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	9065	Not Specified
Phosphate	Water	50 mL	---	Not Applicable	9056	Cool, 4°C, analyze ASAP collection
	Solid	Not Applicable	---	Not Applicable	9056	Not Applicable
	Waste	Not Applicable	---	Not Applicable	9056	Not Applicable

TABLE 8.5-1
Inorganic Sample Containers, Preservatives, and Holding Times (Continued)

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2, 3, 7]		RCRA (SW846)[3, 4]	
			Method	Requirements	Method	Requirements
Phosphorus (Total)	Water	50 mL	365.1 365.2 365.3 365.4	100 mL plastic or glass, H_2SO_4 to pH < 2, 28 days	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Odor	Water	IL	140.1	200 mL glass only, Cool, 4°C, 24 hours		Not Applicable
	Solid	Not Applicable	--	Not Applicable	---	Not Applicable
	Waste	Not Applicable	--	Not Applicable	---	Not Applicable
Reactivity (Cyanide and Sulfide)	Liquid	10 g	---	Not Applicable	Chapter 7 Sections 7.3.3.2 and 7.3.4.2	10 oz amber glass, Cool, 4°C, no headspace, analyze as soon as possible.
	Solid	10 g	---	Not Applicable	Chapter 7 Sections 7.3.3.2 and 7.3.4.2	10 oz amber glass, Cool, 4°C, no headspace, analyze as soon as possible.
	Waste	10 g	---	Not Applicable	Chapter 7 Sections 7.3.3.2 and 7.3.4.2	10 oz amber glass, Cool, 4°C, no headspace, analyze as soon as possible.
Settleable Solids	Water	1000 mL	160.5	1000 mL plastic or glass, Cool, 4°C, 48 hours	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Silica, Dissolved	Water	50 mL	370.1	Plastic only, 100 mL, Cool, 4°C, 28 days	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable

TABLE 8.5-1
Inorganic Sample Containers, Preservatives, and Holding Times (Continued)

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2, 3, 7]		RCRA (SW846)[3, 4]	
			Method	Requirements	Method	Requirements
Specific Conductance	Water	50 mL	120.1	250 mL plastic or glass, Cool, 4°C, 24 hours	9050A	250 mL plastic or glass, Cool, 4°C, 28 days
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Sulfate (SO_4)	Water	100 mL	300.0[7] 375.1 375.4	100 mL plastic or glass, Cool, 4°C, 28 days	9056 9038	Method 9056: Cool, 4°C, analyze ASAP collection Method 9038: 200 mL plastic or glass, Cool, 4°C, 28 days
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	100 mL	---	Not Applicable	9038	200 mL plastic or glass, Cool, 4°C, 28 days
Sulfide	Water	100 mL	376.1 376.2	500 mL plastic or glass, Cool, 4°C, Add 2 mL zinc acetate plus NaOH to pH > 9, 7 days	9030B 9034	500 mL plastic, no headspace, Cool, 4°C, Add 4 drops of 2N zinc acetate per 100 mL of sample, adjust the pH to > 9 with 6 N NaOH solution, 7 days
	Solid	50 g	---	Not Applicable	9030B 9034	Cool, 4°C, fill surface of solid with 2N Zinc acetate until moistened, store headspace-free
	Waste	50 g	---	Not Applicable	9030B 9034	Cool, 4°C, fill surface of solid with 2N Zinc acetate until moistened, store headspace-free

TABLE 8.5-1
Inorganic Sample Containers, Preservatives, and Holding Times (Continued)

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2], [3], [7]		RCRA (SW846)[3], [4]	
			Method	Requirements	Method	Requirements
Sulfite (SO_3)	Water	100 mL	377.1	100 mL plastic or glass, No preservative required, analyze immediately **This test should be performed in the field.**	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Temperature	Water	200 mL	170.1	1 liter plastic or glass, analyze immediately in the field	---	Not Applicable
	Solid	Not Applicable	--	Not Applicable	--	Not Applicable
	Waste	Not Applicable	--	Not Applicable	--	Not Applicable
Total Dissolved Solids (Filterable)	Water	100 mL	160.1	250 mL plastic or glass, Cool, 4°C, 7 days	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Total Kjeldahl Nitrogen (TKN)	Water	500 mL	351.2 351.3	500 mL plastic or glass, Cool, 4°C, H_2SO_4 to pH < 2, 28 days	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Total Organic Carbon (TOC)	Water	100 mL	415.1	100 mL plastic or glass, Cool, 4°C, H_2SO_4 to pH < 2, 28 days	9060	100 mL glass or 40 mL VOA vials, Cool, 4°C, H_2SO_4 or HCl to pH < 2, 28 days
	Solid	Not Applicable	---	Not Applicable	9060	Not Specified
	Waste	Not Applicable	---	Not Applicable	9060	Not Specified

TABLE 8.5-1
Inorganic Sample Containers, Preservatives, and Holding Times (Continued)

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2], [3], [7]		RCRA (SW846)[3], [4]	
			Method	Requirements	Method	Requirements
Total Organic Halides (TOX)	Water	100 mL	5320B [7] 450.1 [7]	Method 5320B: 500 mL amber glass, Teflon®-lined lid, Cool, 4°C, HNO_3 to pH <2, no headspace, 14 days Method 450.1: 500 mL amber glass, Teflon®-lined lid, Cool, 4°C, HNO_3 to pH <2, no headspace, 28 days	9020B	500 mL amber glass, Teflon®-lined lid, Cool, 4°C, H_2SO_4 to pH < 2, no headspace, 28 days
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Total Solids	Water	100 mL	160.3	250 mL plastic or glass, Cool, 4°C, 7 days	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Total Suspended Solids (Nonfilterable)	Water	100 mL	160.2	250 mL plastic or glass, Cool, 4°C, 7 days	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Turbidity	Water	50 mL	180.1	250 mL plastic or glass, Cool, 4°C, 48 hours	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Volatile Solids	Water	100 mL	160.4	250 mL plastic or glass, Cool, 4°C, 7 days	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable

TABLE 8.5-1
Inorganic Sample Containers, Preservatives, and Holding Times (Continued)

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2], [3], [7]		RCRA (SW846)[3], [4]	
			Method	Requirements	Method	Requirements
Water Content	Water	Not Applicable	---	Not Applicable	---	Not Applicable
	Solid	10 g	---	Refer to specific method used	---	Refer to specific method used
	Waste	10 g	---	Refer to specific method used	---	Refer to specific method used
Metals (excludes Hg)	Water	100 mL	200 series	1 liter glass or polyethylene container, HNO_3 to pH $\leq$ 2, 6 months	6010B, 6020, 7000A series	1 liter glass or polyethylene container, HNO_3 to pH $\leq$ 2, 6 months
	Solid	200 g	200 series	8 or 16 oz glass or polyethylene container storage at 4 °C	6010B, 6020, 7000A series	8 or 16 oz glass or polyethylene container, storage at 4°C, 6 months
	Waste	200 g	200 series	Not Applicable	6010B, 6020, 7000A series	8 or 16 oz glass or polyethylene container, storage at 4°C, 6 months
Mercury (CVAA)	Water	100 mL	245.1	1 liter glass or polyethylene container, HNO_3 to pH $\leq$ 2, 28 days	7470A	1 liter glass or polyethylene container, HNO_3 to pH $\leq$ 2, 28 days
	Solid	200 g	245.5	8 or 16 oz glass or polyethylene container, Cool, 4°C, 28 days	7471A	8 or 16 oz glass or polyethylene container, Cool, 4°C, 28 days (CORP-MT-0007)
	Waste	200 g	--	Not Applicable	7471A	8 or 16 oz glass or polyethylene container, Cool, 4°C, 28 days (CORP-MT-0007)

TABLE 8.5-1
Inorganic Sample Containers, Preservatives, and Holding Times
(Continued)

Footnotes

(1) Minimum sample size indicates sample amount needed for a single analysis. Matrix spikes or duplicates will require an additional sample amount of at least this amount for each additional QC sample aliquot required.
(2) National Pollutant Discharge Elimination System - MCAWW, March 1983.
(3) Holding times are calculated from date of collection.
(4) Resource Conservation and Recovery Act, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, (SW-846), Third Edition, September 1986. Contains Final Update I (July 1992), Final Update IIA, (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996).
(5) Solid matrix type includes soil, sediment, sludge and other solid materials not classified as waste.
(6) Samples to be analyzed for cyanide should be field-tested for residual chlorine. If residual chlorine is detected, ascorbic acid should be added.
(7) Method not listed in 40 CFR Part 136.

TABLE 8.5-2
Organic Sample Containers, Preservatives, and Holding Times

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2], [3]		RCRA (SW846)[3], [4]	
			Method	Requirements	Method[6]	Requirements
Aromatic Volatiles	Water	40 mL	602	40 mL glass, VOA vial (in triplicate) with Teflon®-lined septa without headspace, Cool, 4°C, Add sodium thiosulfate if residual chlorine, 7 days with pH > 2, 14 days with pH ≤ 2	8021B	40 mL glass, VOA vial (in triplicate) with Teflon®-lined septa without headspace, Cool, 4°C, Add sodium thiosulfate if residual chlorine, 1:1 HCl to pH ≤ 2, 14 days with pH ≤ 2
	Solid[5]	5 g or 25 g	--	Not Applicable	8021B	4 or 8 oz glass with Teflon®-lined lid, Cool 4 °C, 14 days. Field preserved with sodium bisulfate solution for low level analysis, or with methanol for medium level analysis. Soil sample can also be taken by using the EnCore™ sampler and preserved in the lab within 48 hours of sampling. Maximum holding time for Encore Sampler is 48 hours (before the sample is added to methanol or sodium bisulfate).Cool, 4°C (Preservation and holding times are subject to client specifications)[12]
	Waste	5 g or 25 g	--	Not Applicable	8021B	4 or 8 oz glass with Teflon®-lined lid, Cool 4 °C, 14 days. Field preserved with sodium bisulfate solution for low level analysis, or with methanol for medium level analysis.

TABLE 8.5-2
Organic Sample Containers, Preservatives, and Holding Times (Continued)

Analytical Parameters	Matrix	Minimum Sample Size[1]	Method	NPDES[2], [3]		RCRA (SW846)[3], [4]
				Requirements	Method[6]	Requirements
Aromatic Volatiles (continued)	Waste	5 g or 25 g	--	Not Applicable	8021B	Soil sample can also be taken by using the EnCore™ sampler and preserved in the lab within 48 hours of sampling. Maximum holding time for Encore Sampler is 48 hours (before the sample is added to methanol or sodium bisulfate). Cool, 4°C (Preservation and holding times are subject to client specifications) [12]
Acrolein & Acrylonitrile by GC	Water	40 mL	603	Glass with Teflon®-lined septum, Cool, 4 °C (± 2°C), 0.008% $Na_2S_2O_3$[11], Adjust pH 4-5[8] 14 days	8031 (Acrylo-nitrile only)	Glass with Teflon®-lined septum, Cool, 4 °C (± 2°C), 0.008% $Na_2S_2O_3$[11], Adjust pH 4-5[8] 14 days
	Solid	-	-	Not Applicble	-	Not Applicable
	Waste	-	-	Not Applicble	-	Not Applicable
Dioxins/ Dibenzo-furans (LRMS)	Water	1L	613	1 liter amber glass with Teflon®-lined lid, Cool, 4°C, Extraction, 7 days Analysis, 40 days	8280A	1 liter glass amber with Teflon®-lined lid, Cool 4°C, if residual chlorine is present in aqueous samples, add 80 mg of sodium thiosulfate per liter of sample, if sample pH >9, adjust to pH 7-9 with H_2SO_4, Extract within 30 days Analyze within 45 days of extraction
	Solid	10 g	--	Not Applicable	8280A	8 or 16 oz glass amber wide mouth with Teflon®-lined lid, Cool 4°C, Extract within 30 days Analyze within 45 days of extraction

TABLE 8.5-2
Organic Sample Containers, Preservatives, and Holding Times (Continued)

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2, 3]		RCRA (SW846)[3, 4]	
			Method	Requirements	Method[6]	Requirements
Dioxins/ Dibenzo-furans (LRMS) (continued)	Waste	10 g	--	Not Applicable	8280A	8 or 16 oz glass amber wide mouth with Teflon®-lined lid, Cool 4°C, Extract within 30 days and Analyze within 45 days of extraction
	Water	1L	613	1 liter amber glass with Teflon®-lined lid, Cool, 4°C, Extraction, 7 days Analysis, 40 days	--	Not Applicable
	Solid	10 g	--	Not Applicable	--	Not Applicable
	Waste	10 g	--	Not Applicable	--	Not Applicable
Dioxins/Dibenzo -furans (HRGC/HRMS)	Water	I L	1613B	1.1 liter amber glass w/fluoropolymer-lined screw cap. Add sodium thiosulfate if residual chlorine. If pH > 9, H_2SO_4 to pH 7-9. Cool, 0-4°C in the dark. Extraction , 1 year. Analysis, 1 year.	8290	1 liter glass amber with Teflon®-lined lid, Cool, 4°C, Extraction, 30 days Analysis, 45 days from date of extraction

TABLE 8.5-2
Organic Sample Containers, Preservatives, and Holding Times (Continued)

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2], [3]		RCRA (SW846)[3], [4]	
			Method	Requirements	Method[6]	Requirements
Dioxins/Dibenzo -furans (HRGC/HRMS) (continued)	Solid	10g	1613B	500 mL amber wide, mouth, glass w/fluoropolymer-lined screw cap. Cool, <4°C in the dark until receipt in Lab, then <-10°C in the dark. Extraction , 1 year. Analysis, 1 year.	8290	8 or 16 oz glass amber wide mouth with Teflon®-lined lid, Cool, 4°C, Extraction, 30 days Analysis, 45 days from date of extraction
	Waste	10g	1613B	500 mL amber wide, mouth, glass w/fluoropolymer-lined screw cap. Cool, <4°C in the dark until receipt in Lab, then <-10°C in the dark. Extraction , 1 year. Analysis, 1 year.	8290	8 or 16 oz glass amber wide mouth with Teflon®-lined lid, Cool, 4°C, Extraction, 30 days Analysis, 45 days from date of extraction
PCBS By HRGC/HRMS	Water	1 L	1668	1.1 liter amber glass w/fluoropolymer-lined screw cap. Add sodium thiosulfate if residual chlorine. H_2SO_4 to pH 2-3. Cool, 0-4°C in the dark. Extraction , 1 year. Analysis, 1 year.	--	Not Applicable
	Solid	10g	1668	500 mL amber wide, mouth, glass w/fluoropolymer-lined screw cap. Cool, <4°C in the dark until receipt in Lab, then <-10°C in the dark. Extraction , 1 year. Analysis, 1 year.	--	Not Applicable

TABLE 8.5-2
Organic Sample Containers, Preservatives, and Holding Times (Continued)

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2], [3]		RCRA (SW846)[3], [4]	
			Method	Requirements	Method[6]	Requirements
PCBS By HRGC/HRMS (continued)	Waste	10g	1668	500 mL amber wide, mouth, glass w/fluoropolymer-lined screw cap. Cool, <4°C in the dark until receipt in Lab, then <-10°C in the dark. Extraction , 1 year. Analysis, 1 year.	--	Not Applicable
Halogenated Volatiles By GC	Water	40 mL	--	Not Applicable	8021B	40 mL glass, VOA vial (in triplicate) with Teflon®-lined septa without headspace, Cool, 4°C, Add sodium thiosulfate if residual chlorine, 1:1 HCl to pH $\leq$ 2, 14 days
	Solid[5]	5 g or 25 g	--		8021B	4 or 8 oz glass with Teflon®-lined lid, Cool 4 °C, 14 days. Field preserved with sodium bisulfate solution for low level analysis, or with methanol for medium level analysis. Soil sample can also be taken by using the EnCore™ sampler and preserved in the lab within 48 hours of sampling. Maximum holding time for Encore Sampler is 48 hours (before the sample is added to methanol or sodium bisulfate). Cool, 4°C (Preservation and holding times are subject to client specifications) [12]

TABLE 8.5-2
Organic Sample Containers, Preservatives, and Holding Times (Continued)

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2], [3]		RCRA (SW846)[3], [4]	
			Method	Requirements	Method[6]	Requirements
Halogenated Volatiles (continued)	Waste	5 g or 25 g	--	Not Applicable	8021B	4 or 8 oz glass with Teflon®-lined lid, Cool 4 °C, 14 days. Field preserved with sodium bisulfate solution for low level analysis, or with methanol for medium level analysis. Soil sample can also be taken by using the EnCore™ sampler and preserved in the lab within 48 hours of sampling. Maximum holding time for Encore Sampler is 48 hours (before the sample is added to methanol or sodium bisulfate). Cool, 4°C (Preservation and holding times are subject to client specifications) [12]
Herbicides	Water	1L	615 [10]	1 liter amber glass with Teflon®-lined lid, Sodium thiosulfate or ascorbic acid if residual chlorine present, Cool, 4°C, Extraction, 7 days Analysis, 40 days after extraction	8151A	1 liter amber glass with Teflon®-lined lid. If residual chlorine present, add 3 mL sodium thiosulfate per gallon. Cool, 4°C, Extraction, 7 days Analysis, 40 days of the start of the extraction
	Solid	50 g	--	Not Applicable	8151A	4 or 8 oz glass widemouth with Teflon®-lined lid, Cool 4 °C, Extraction, 14 days Analysis, 40 days of the start of the extraction

TABLE 8.5-2
Organic Sample Containers, Preservatives, and Holding Times (Continued)

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2], [3]		RCRA (SW846)[3], [4]	
			Method	Requirements	Method[6]	Requirements
Herbicides (continued)	Waste	50 g	--	Not Applicable	8151A	4 or 8 oz glass widemouth with Teflon®-lined lid. Cool 4 °C Extraction, 14 days Analysis, 40 days of the start of the extraction
Nitroaromatics	Water	1L	--	Not Applicable	8330	1 liter amber glass with Teflon®-lined lid. If residual chlorine present, add 3 mL sodium thiosulfate per gallon. Cool, 4°C, Extraction, 7 days Analysis, 40 days of the start of the extraction
	Solid	50 g	---	Not Applicable	8330	4 or 8 oz glass widemouth with Teflon®-lined lid Cool, 4°C, Extraction, 14 days Analysis, 40 days of the start of the extraction

TABLE 8.5-2
Organic Sample Containers, Preservatives, and Holding Times (Continued)

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2, 3]		RCRA (SW846)[3, 4]	
			Method	Requirements	Method[6]	Requirements
Nitroaromatics (continued)	Waste	50 g	---	Not Applicable	8330	4 or 8 oz glass widemouth with Teflon®-lined lid Cool, 4 °C, Extraction, 14 days Analysis, 40 days of the start of the extraction
Organo-phosphorus Pesticides	Water	1L	---	Not Applicable	8141A	1 liter amber glass with Teflon®-lined lid. If residual chlorine present, add 3 mL sodium thiosulfate per gallon. Cool, 4°C, Extraction, 7 days Analysis, 40 days of the start of the extraction
	Solid	50 g	---	Not Applicable	8141A	4 or 8 oz glass widemouth with Teflon®-lined lid Cool, 4°C, Extraction, 14 days Analysis, 40 days of the start of the extraction
	Waste	50 g	---	Not Applicable	8141A	4 or 8 oz glass widemouth with Teflon®-lined lid, Cool, 4°C, Extraction, 14 days Analysis, 40 days of the start of the extraction
PAHs by GC and HPLC	Water	1L	610	1 liter amber glass with Teflon®-lined lid, Adjust pH to 5-9 if extraction not to be done within 72 hours of sampling. Add sodium thiosulfate if residual chlorine present. Cool, 4°C, Extraction, 7 days Analysis, 40 days after extraction	8100 8310	1 liter amber glass with Teflon®-lined lid, If residual chlorine present, add 3 mL sodium thiosulfate per gallon, Cool, 4°C, Extraction, 7 days Analysis, 40 days of the start of the extraction

TABLE 8.5-2
Organic Sample Containers, Preservatives, and Holding Times (Continued)

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2], [3]		RCRA (SW846)[3], [4]	
			Method	Requirements	Method[6]	Requirements
PAHs by GC and HPLC (continued)	Solid	50 g	---	Not Applicable	8100 8310	4 or 8 oz glass wide mouth with Teflon®-lined lid, Cool, 4°C, Extraction, 14 days Analysis, 40 days of the start of the extraction
	Waste	50 g	---	Not Applicable	8100 8310	4 or 8 oz glass wide mouth with Teflon®-lined lid, Cool, 4°C Extraction, 14 days Analysis, 40 days of the start of the extraction
Pesticides/ PCBs	Water	1L	608	1 liter amber glass with Teflon®-lined lid, Adjust pH to 5-9 if extraction not to be done within 72 hours of sampling. Add sodium thiosulfate if residual chlorine present and aldrin is being determined. Cool, 4°C, Extraction, 7 days Analysis, 40 days after extraction	8081A 8082	1 liter amber glass with Teflon®-lined lid, If residual chlorine present, add 3 mL 10% sodium thiosulfate per gallon, Cool, 4°C, Extraction, 7 days Analysis, 40 days of the start of the extraction
	Solid	50 g	---	Not Applicable	8081A 8082	4 or 8 oz glass wide mouth with Teflon®-lined lid, Cool, 4°C, Extraction, 14 days Analysis, 40 days of the start of the extraction
	Waste	50 g	---	Not Applicable	8081A 8082	4 or 8 oz glass wide mouth with Teflon®-lined lid, Cool, 4°C Extraction, 14 days Analysis, 40 days of the start of the extraction

TABLE 8.5-2
Organic Sample Containers, Preservatives, and Holding Times (Continued)

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2, 3]		RCRA (SW846)[3, 4]	
			Method	Requirements	Method[6]	Requirements
Petroleum Hydrocarbons/ Oil and Grease	Water	1L	413.1 413.2 418.1	1 liter glass, Cool, 4°C, HCl to pH <2, 28 days	9070	1 liter glass with Cool, 4°C, HCl to pH <2, 28 days
	Solid	---	---	Not Applicable	9071A	8 oz. glass with Teflon®-lined lid, Holding Time not specified
	Waste	---	---	Not Applicable	9071A	8 oz. glass with Teflon®-lined lid, Holding Time not specified
	Water	1 L	1664[7]	1 liter glass, Cool, 0-4°C HCl or H_2SO_4 to pH <2 28 days	---	---
	Solid	30 g	1664[7]	8 or 16 oz. wide mouth glass jar, Cool, 0-4°C, 28 days	---	---
	Waste	---	---	Not Applicable	---	---
Purgeable Halocarbons By GC	Water	40 mL	601	40 mL glass VOA vial (in triplicate) with Teflon®-lined septa with no headspace, Cool, 4°C, Add sodium thiosulfate if residual chlorine present, 14 days	8021B	40 mL glass VOA vial (in triplicate) with Teflon®-lined septa with no headspace, Cool, 4°C, 1:1 HCl to pH ≤ 2, sodium thiosulfate if residual chlorine present, 14 days
	Solid	5 g or 25 g	---	Not Applicable	8021B	4 or 8 oz glass with Teflon®-lined lid, Cool 4 °C, 14 days. Field preserved with sodium bisulfate solution for low level analysis, or with methanol for medium level analysis.

TABLE 8.5-2
Organic Sample Containers, Preservatives, and Holding Times (Continued)

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2, 3]		RCRA (SW846)[3, 4]	
			Method	Requirements	Method[6]	Requirements
Purgeable Halocarbons By GC (continued)	Solid	5 g or 25 g	---	Not Applicable	8021B	Soil sample can also be taken by using the EnCore™ sampler and preserved in the lab within 48 hours of sampling. Maximum holding time for Encore Sampler is 48 hours (before the sample is added to methanol or sodium bisulfate). Cool, 4°C (Preservation and holding times are subject to client specifications) [12]
	Waste	5 g or 25 g	---	Not Applicable	8021B	4 or 8 oz glass with Teflon®-lined lid, Cool 4 °C, 14 days. Field preserved with sodium bisulfate solution for low level analysis, or with methanol for medium level analysis. Soil sample can also be taken by using the EnCore™ sampler and preserved in the lab within 48 hours of sampling. Maximum holding time for Encore Sampler is 48 hours (before the sample is added to methanol or sodium bisulfate).Cool, 4°C (Preservation and holding times are subject to client specifications) [12]

TABLE 8.5-2
Organic Sample Containers, Preservatives, and Holding Times (Continued)

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2], [3]		RCRA (SW846)[3], [4]	
			Method	Requirements	Method[6]	Requirements
Semivolatiles	Water	1L	625	1 liter amber glass with Teflon®-lined lid, Cool, 4°C, Extraction, 7 days Analysis, 40 days	8270C	1 liter amber glass with Teflon®-lined lid, If residual chlorine present, add 3 mL sodium thiosulfate per gallon, Cool, 4°C, Extraction, 7 days Analysis, within 40 days of extraction
	Solid	50 g	---	Not Applicable	8270C	8 or 16 oz glass wide mouth with Teflon-lined lid, Cool, 4°C, Extraction, 14 days Analysis, within 40 days of extraction
	Waste	50 g	---	Not Applicable	8270C	8 or 16 oz glass wide mouth with Teflon®-lined lid, Cool, 4°C, Extraction, 14 days Analysis, within 40 days of extraction
Volatile Organics	Water	40 mL	624	40 mL glass, VOA vial (in triplicate) with Teflon®-lined septa without headspace, Cool, 4°C, Add sodium thiosulfate if residual chlorine, 7 days with pH > 2, 14 days with pH ≤ 2[8]	8260B	40 mL glass, VOA vial (in triplicate) with Teflon®-lined septa without headspace, Cool, 4°C, Add sodium thiosulfate if residual chlorine, 1:1 HCl to pH ≤ 2, 14 days with pH ≤ 2[9]

TABLE 8.5-2
Organic Sample Containers, Preservatives, and Holding Times (Continued)

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2, 3]		RCRA (SW846)[3, 4]	
			Method	Requirements	Method[6]	Requirements
Volatile Organics (continued)	Solid[5]	5 g or 25 g	--	Not Applicable	8260B	4 or 8 oz glass with Teflon®-lined lid, Cool 4 °C, 14 days. Field preserved with sodium bisulfate solution for low level analysis, or with methanol for medium level analysis. Soil sample can also be taken by using the EnCore™ sampler and preserved in the lab within 48 hours of sampling. Maximum holding time for Encore Sampler is 48 hours (before the sample is added to methanol or sodium bisulfate). Cool, 4°C (Preservation and holding times are subject to client specifications)
	Waste	5 g or 25 g	--	Not Applicable	8260B	4 or 8 oz glass with Teflon®-lined lid, Cool 4 °C, 14 days. Field preserved with sodium bisulfate solution for low level analysis, or with methanol for medium level analysis. Soil sample can also be taken by using the EnCore™ sampler and preserved in the lab within 48 hours of sampling. Maximum holding time for Encore Sampler is 48 hours (before the sample is added to methanol or sodium bisulfate). Cool, 4°C (Preservation and holding times are subject to client specifications)

TABLE 8.5-2
Organic Sample Containers, Preservatives, and Holding Times
(Continued)

Footnotes

(1) Minimum sample size indicates sample amount needed for a single analysis. Matrix spikes or duplicates will require an additional sample amount of at least this amount for each additional QC sample aliquot required.
(2) National Pollutant Discharge Elimination System - 40 CFR Part 136, Appendix A.
(3) Holding times are calculated from the date of collection.
(4) Resource Conservation and Recovery Act, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Third Edition, September 1986. Contains Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996).
(5) Solid matrix type includes soil, sediment, sludge or other solids not classified as waste.
(6) Only one determination method is listed when separate methods are required for preparation and analysis.
(7) Method 1664 is a proposed only method and has not been promulgated by the EPA.
(8) For acrolein and acrylonitrile the pH should be adjusted to 4-5. This pH adjustment is not required if acrolein is not measured. Samples requiring analysis of acrolein that received no pH adjustment must be analyzed within three days of sampling.
(9) For acrolein and acrylonitrile the pH should be adjusted to 4-5.
(10) Method not listed in 40 CFR Part 136.
(11) Should only be used in the presence of residual chlorine.
(12) Data from Encore shows that with freezing, the sample in an Encore may be held for up to 7 days. Until formal EPA approval, this holding time must be approved by the client.

TABLE 8.5-3
Radiological Sample Containers, Preservatives, and Holding Times

Analytical Parameters	Matrix	Recommended Containers[1]	Preservative	Maximum Holding Time	Minimum Volume Required for Analysis[2]
Gross Alpha/Beta	Water	P, G	Field acidified to pH < 2 with HNO_3	180 days after collection	500 mls
	Soil	P, G	None		50[4] gms
Americium-241	Water	P, G	Field acidified to pH < 2 with HNO_3	180 days after collection	1000[5] mls
	Soil	P, G	None		50[4] gms
Carbon-14	Water	P, G	Field adjusted to pH > 9 with NaOH[3]	180 days after collection	100 mls
	Soil	P, G	None		50[4] gms
Calcium-45	Water	P, G	Field acidified to pH < 2 with HNO_3	180 days after collection	100 mls
Curium-242	Water	P, G	Field acidified to pH < 2 with HNO_3	180 days after collection	1000[5] mls
	Soil	P, G	None		50[4] gms
Gamma Emitters Actinides, as applicable, Co-60, Cs-137, K-40, Mn-54, and other fission/activation products	Water	P, G	Field acidified to pH < 2 with HNO_3	180 days after collection	1000[5] mls
	Soil	P, G	None		650[7] gms
Iron-55	Water	P, G	Field acidified to pH < 2 with HNO_3	180 days after collection	50 mls
Lead-210	Water	P, G	Field acidified to pH < 2 with HNO_3	180 days after collection	500 mls
	Soil	P, G	None		50[4] gms
Neptunium-237	Water	P, G	Field acidified to pH < 2 with HNO_3	180 days after collection	1000[5] mls
	Soil	P, G	None		50[4] gms
Promethium-147	Water	P, G	Field acidified to pH < 2 with HNO_3	180 days after collection	250 mls

TABLE 8.5-3
Radiological Sample Containers, Preservatives, and Holding Times (Continued)

Analytical Parameters	Matrix	Recommended Containers[1]	Preservative	Maximum Holding Time	Minimum Volume Required for Analysis[2]
Plutonium-238, 239/240	Water	P, G	Field acidified to pH < 2 with HNO_3	180 days after collection	1000[5] mls
	Soil	P, G	None		50[4] gms
Radium-226	Water	P, G	Field acidified to pH < 2 with HNO_3	180 days after collection	1000[5] mls
	Soil	P, G	None		50[4] gms
Radium-228	Water	P, G	Field acidified to pH < 2 with HNO_3	180 days after collection	1000[5] mls
	Soil	P, G	None		50[4] gms
Strontium-89, 90 and Total Strontium	Water	P, G	Field acidified to pH < 2 with HNO_3	180 days after collection	1000[5] mls
	Soil	P, G	None		50[4] gms
Technetium-99	Water	P, G	Field acidified to pH < 2 with HNO_3	180 days after collection	100 mls
	Soil	P, G	None		50[4] gms
Thorium-227, 228, 230, 232	Water	P, G	Field acidified to pH < 2 with HNO_3	180 days after collection	1000[5] mls
	Soil	P, G	None		50[4] gms
Total Uranium	Water	P,G	Field acidified to pH < 2 with HNO_3	180 days after collection	50 mls
	Soil	P, G	None		50[4] gms
Tritium	Water	P, G[6]	None	180 days after collection	100 mls
	Soil	P, G[6]	None		100 gms
Uranium-233/234, 235/236	Water	P, G	Field acidified to pH < 2 with HNO_3	180 days after collection	1000[5] mls
	Soil	P, G	None		50[4] gms
Uranium-238	Soil	P, G	None	180 days after collection	50[4] gms

TABLE 8.5-3
Radiological Sample Containers, Preservatives, and Holding Times
(Continued)

Footnotes

(1) Plastic (polyethylene), Glass

(2) Assumes that quality control samples have been assigned in the field. If duplicates, matrix spikes and/or matrix spike duplicates are to be assigned by the laboratory, additional multiple sample volumes are required. Volumes listed are for standard aliquot size. Detection limit requirements may necessitate larger volumes.

(3) Assumes that carbon is in the form of CO_3^{--}.

(4) May be aliquoted or sequentially determined from the same volume.

(5) May be aliquoted or sequentially determined from the same volume.

(6) Tritium is very volatile. Sample containers must be air tight to eliminate tritium loss.

(7) Dry weight.

TABLE 8.5-4
Sample Containers, Preservatives, and Holding Times for USEPA Contract Laboratory Program Statement of Work

Analytical Parameters	Matrix	Minimum Sample Size	Requirements[1]
Cyanide, Total and Amenable to Chlorination	Water	500 mL	500 mL, glass or polyethylene container, 0.6 g ascorbic acid (only in presence of residual chlorine) NaOH to pH > 12, Cool, 4°C, 12 days
	Soil/Sediment	25 g	8 or 16 oz glass with Teflon-lined lids, Cool, 4°C, 12 days
ICAP and GFAA (excludes mercury)	Water	100 mL	1 liter glass or polyethylene container, HNO_3 to pH =2, 180 days
	Soil/Sediment	25 g	4 or 8 oz glass or polyethylene container, Cool, 4°C, 180 days
Mercury (CVAA)	Water	100 mL	1 liter glass or polyethylene container, HNO_3 to pH =2, 26 days
	Soil/Sediment	25 g	8 or 16 oz glass with Teflon®-lined lids, Cool, 4°C, 26 days
Pesticides/PCBs	Water	1 L	1 liter amber glass with Teflon®-lined lid, Cool, 4°C, Extraction within 5 days of sample receipt Analysis within 40 days after start of extraction
	Soil/Sediment	50 g	8 or 16 oz glass wide mouth with Teflon®-lined lid, protect from light, Cool, 4°C, Extraction within 10 days of sample receipt Analysis within 40 days after start of extraction
PCDD, PCDF[2]	Water	1 L	1 liter amber glass with Teflon®-lined lid, Cool, 4°C, No holding time requirements specified
	Soil/Sediment/ Fly Ash/ Chemical Waste	25 g	4 or 8 oz glass wide mouth with Teflon®-lined lid, protect from light, room temperature, No holding time requirements specified

TABLE 8.5-4
Sample Containers, Preservatives, and Holding Times for USEPA Contract Laboratory Program Statement of Work (Continued)

Analytical Parameters	Matrix	Minimum Sample Size	Requirements[1]
Semivolatiles	Water	1L	1 liter amber glass with Teflon®-lined lid, Cool, 4°C, Extraction within 5 days of sample receipt Analysis within 40 days after start of extraction
	Soil/Sediment	50 g	8 or 16 oz glass wide mouth with Teflon®-lined lid, Cool, 4°C, Extraction within 10 days of sample receipt Analysis within 40 days after start of extraction
Volatiles	Water	40 mL	40 mL glass with Teflon®-lined lid, no entrapped air bubbles pH <2[3], Cool, 4°C, 10 days
	Soil/Sediment	25 g	4 or 8 oz glass with Teflon®-lined lids, Cool, 4°C, 10 days

Footnotes

(1) Holding times are calculated from verified time of sample receipt.

(2) PCDD: Polychlorinated Dibenzo-p-dioxins
PCDF: Polychlorinated Dibenzofurans

(3) The OLM03.0 requirement is to acidify the sample to pH<2. The OLM01.8 requirement is to determine and report the pH of the sample to check that the sample was acidified in the field.

TABLE 8.5-5
Sample Containers, Preservatives, and Holding Times for TCLP[(1)] and SPLP[(2)]

Analytical Parameters	Matrix	Minimum Sample Size[(3)]	TCLP Method 1311 and SPLP Method 1312 Requirements	
			From Field Collection to TCLP/SPLP Extraction	From TCLP/SPLP Extraction to Analysis
Mercury	Liquid Solid Waste	1L	1L glass, Cool, 4°C, 28 days	Glass or polyethylene 28 days
Metals (except mercury)	Liquid Solid Waste	1L	1L glass, Cool, 4°C, 180 days	Glass or polyethylene 180 days
Semivolatiles	Liquid Solid Waste	1L	1L glass, Cool 4°C, 14 days	1L glass Extraction of leachate within 7 days of TCLP extraction, Analyze extract within 40 days
Volatiles	Liquid Solid Waste	6 oz	4 oz glass, Cool 4°C, 14 days	40 mL glass, 14 days

Footnotes

(1) TCLP = Toxicity Characteristic Leaching Procedure

(2) SPLP = Synthetic Precipitation Leaching Procedure

(3) Smaller sample size is adequate for solid samples or individual fractions. A combined volume of 32 oz. is recommended for semivolatiles and metals. A separate 4 oz. container should always be used for the volatile fraction. Volatile fractions should be stored with minimal headspace.

TABLE 8.5-6
Periodic Equipment Calibrations

Type of Equipment	Calibration Requirements
Balances	• Must be serviced and calibrated annually by an approved vendor • Calibration must be checked daily or before use by analyst with weight(s) classified as Class "S" (or Class "S" traceable) by NIST per operation-specific SOPs. Acceptance criteria vary according to weight used and accuracy of balance. Acceptance criteria must be documented in log. • All Class "S" weights must be certified by an outside vendor every three years.
Thermometers	• Working glass thermometers must be calibrated against a certified NIST thermometer at least annually as described in operation-specific SOPs. • Working non-glass thermometers must be calibrated against a certified NIST thermometer quarterly as described in operation-specific SOPs. • The NIST thermometer must be recertified every three years.
Refrigerators/Freezers	• Thermometers must be immersed in a liquid such as mineral oil or glycol • Temperature of units used for sample or standard storage must be checked daily as described in operation-specific SOPs. Refrigerator acceptance limits: 4°C ± 2°C Freezer acceptance limits: < - 10°C
Ovens	• Temperature of units must be checked daily or before use. • Acceptance limits vary according to use as described in operation-specific SOPs and must be documented in the temperature log.
Micropipettors	• Calibrations are checked gravimetrically as required by the operation-specific SOP. • Must be calibrated at the frequency (normally quarterly) required by the manufacturer at a minimum.
Syringes, Volumetric Glassware and Graduated Glassware	• All syringes and volumetric glassware are purchased as Class A items. • Class A items are certified by the manufacturer to be within ± 1% of the measured volume, therefore, calibration of these items by Quanterra® laboratories is not required. • All analysts are trained in the proper use and maintenance of measuring devices to ensure the measurement of standards, reagents and sample volumes are within method tolerances.

TABLE 8.5-7
Summary of Inorganic Method Calibrations

Analysis	Calibration	NPDES[1]		RCRA (SW846)[2]	
		Method	Requirement	Method	Requirement
Acidity	Initial	305.1	2 point calibration of pH meter (± 0.05 pH units of true value)	--	Not Applicable
	Continuing	305.1	Not Applicable	--	Not Applicable
	Ending	305.1	Not Applicable	--	Not Applicable
Alkalinity	Initial	310.1 2320B	2 point calibration of pH meter (± 0.05 pH units of true value)	--	Not Applicable
	Continuing	310.1 2320B	Not Applicable	--	Not Applicable
	Ending	310.1 2320B	Not Applicable	--	Not Applicable
Ammonia	Initial	350.1	6 levels including blank, "r"[3] ≥ 0.995	--	Not Applicable
	Continuing	350.1	1 level or LCS every 10 samples ± 10% of true value	--	Not Applicable
	Ending	350.1	1 level or LCS every 10 samples ± 10% of true value	--	Not Applicable
Biochemical Oxygen Demand (BOD)	Initial	405.1	a. Winkler titration: Iodometric with standard thiosulfate b. Membrane electrode: Read in air and in water with zero dissolved oxygen	--	Not Applicable
	Continuing	405.1	Not Applicable	--	Not Applicable
	Ending	405.1	Not Applicable	--	Not Applicable

TABLE 8.5-7
Summary of Inorganic Method Calibrations
(Continued)

Analysis	Calibration	NPDES[1]		RCRA (SW846)[2]	
		Method	Requirement	Method	Requirement
Bromide	Initial	300.0[4] 320.1 ASTM D1246-88	Method 300.0 & ASTM D1246-88: 5 levels plus a blank, "r"[3] ≥ 0.995 Method 320.1: Not Applicable	9056	Method 300.0: 5 levels plus a blank, "r"[3] ≥ 0.995
	Continuing	300.0[4] 320.1 ASTM D1246-88	Method 300.0 & ASTM D1246-88:1 level every 10 samples ± 10% of true value Method 320.1 Not Applicable	9056	Method 300.0: Not Applicable
	Ending	300.0[4] 320.1 ASTM D1246-88	Not Applicable	9056	Not Applicable
Chemical Oxygen Demand (COD)	Initial	410.4 410.1 410.2	Method 410.4: 5 levels plus a blank"r"[3] ≥ 0.995 Methods 410.1 & 410.2: Standardize titrant.	--	Not Applicable
	Continuing	410.4 410.1 410.2	Method 410.4: 1 level every 10 samples ± 10% of true value Methods 410.1 & 410.2: Not Applicable	--	Not Applicable
	Ending	410.4	Method 410.4: 1 level ± 10% of true value Methods 410.1 & 410.2: Not Applicable	--	Not Applicable

TABLE 8.5-7
Summary of Inorganic Method Calibrations
(Continued)

Analysis	Calibration	NPDES[1]		RCRA (SW846)[2]	
		Method	Requirement	Method	Requirement
Chloride	Initial	300.0[4] 325.1 325.2 325.3 4500-Cl E	Method 300.0, 325.1, and 325.2, 4500 Cl E: 5 levels plus blank "r"[3] ≥ 0.995 Method 325.3: Standardize titrant	9056 9251 9253	Method 9056: 3 levels plus a blank Method 9251: 5 levels plus blank "r"[3] ≥ 0.995 Method 9253: Standardize titrant
	Continuing	300.0[4] 325.1 325.2 325.3 4500-Cl E	Method 300.0, 325.1, and 325.2, 4500-Cl E: 1 level every 10 samples ± 10% of true value Method 325.3: Not Applicable	9056 9251 9253	Method 9056: 1 per batch of 20 samples, ± 10% of true value Method 9251: 1 level every 10 samples ± 10% of true value Method 9253: Not Applicable
	Ending	300.0[4] 325.1 325.2 325.3 4500-Cl E	Method 300.0, 325.1, and 325.2, 4500-Cl E: 1 level every 10 samples ± 10% of true value Method 325.3: Not Applicable	9056 9251 9253	Method 9056 and 9253: Not Applicable Method 9251: 1 level ± 10% of true value
Chromium Cr^{+6}	Initial	218.4 3500 Cr-D	Method 218.4: 5 levels plus blank "r"[3] ≥ 0.995 Method 3500 Cr-D: 3 levels plus blank	7196A	5 levels plus blank "r"[3] ≥ 0.995
	Continuing	218.4 3500 Cr-D	1 level every 10 samples ± 10% of true value	7196A	1 level every 10 samples ± 15%
	Ending	218.4 3500 Cr-D	1 level ± 10% of true value	7196A	1 level ± 15%

TABLE 8.5-7
Summary of Inorganic Method Calibrations
(Continued)

Analysis	Calibration	NPDES[1]		RCRA (SW846)[2]	
		Method	Requirement	Method	Requirement
Chlorine, Residual	Initial	330.1 330.3	Standardize titrant	--	Not Applicable
	Continuing	330.1 330.3	Not Applicable	--	Not Applicable
	Ending	330.1 330.3	Not Applicable	--	Not Applicable
Color	Initial	110.2	3 levels plus blank	--	Not Applicable
	Continuing	110.2	1 level every 10 samples	--	Not Applicable
	Ending	110.2	1 level	--	Not Applicable
Conductivity	Initial	120.1	Standard KCl solution	9050A	1 level to determine cell constant
	Continuing	120.1	Not Applicable	9050A	Not Applicable
	Ending	120.1	Not Applicable	9050A	Not Applicable
Cyanide (Amenable)	Initial	335.1	7 levels plus blank "r"[3] ≥ 0.995	9010B 9012A	7 levels plus blank "r"[3] ≥ 0.995
	Continuing	335.1	1 level every 10 samples ± 10% of true	9010B 9012A	1 mid-level every 10 samples ± 15% of true value
	Ending	335.1	1 level ± 10 % of true value	9010B 9012A	± 15% of true value
Cyanide (Total)	Initial	335.1 335.2 335.3 4500-CN E	7 levels plus blank "r"[3] ≥ 0.995	9010B 9012A	7 levels plus blank "r"[3] ≥ 0.995
	Continuing	335.1 335.2 335.3 4500-CN E	1 mid-level every 10 samples ± 10 % of true value	9010B 9012A	1 mid-level every 10 samples ± 15% of true value
	Ending	335.1 335.2 335.3 4500-CN E	1 mid-level ± 10 % of true value	9010B 9012A	± 15% of true value

TABLE 8.5-7
Summary of Inorganic Method Calibrations
(Continued)

Analysis	Calibration	NPDES[1]		RCRA (SW846)[2]	
		Method	Requirement	Method	Requirement
Flashpoint	Initial	--	Not Applicable	1010	p-Xylene reference standard must have flashpoint of 27.2°C ± 1.1°C
	Continuing	--	Not Applicable	1010	Not Applicable
	Ending	--	Not Applicable	1010	Not Applicable
Fluoride	Initial	300.0[4] 340.2	Method 300.0: 5 levels plus a blank, "r"[3] ≥ 0.995 Method 340.2: 6 levels "r"[3] ≥ 0.995	9056	3 levels plus a blank
	Continuing	300.0[4] 340.2	1 mid-level every 10 samples ± 10% of true value	9056	1 per batch of 20 samples ± 10% of true value
	Ending	300.0[4] 340.2	1 mid-level ± 10% of true value	9056	Not Applicable
Hardness	Initial	130.2 2340B	Method 130.2: Standardize titrant Method 2340B: See ICP Metals 200.7	--	Not Applicable
	Continuing	130.2 2340B	Method 130.2: Not Applicable Method 2340B: See ICP Metals 200.7	--	Not Applicable
	Ending	130.2 2340B	Method 130.2: Not Applicable Method 2340B: See ICP Metals 200.7	--	Not Applicable
Iodide	Initial	345.1 Dionex[3]	Method 345.1: Standardize titrant Dionex: 4 levels plus blank "r"[3] ≥ 0.995	--	Not Applicable

TABLE 8.5-7
Summary of Inorganic Method Calibrations
(Continued)

Analysis	Calibration	NPDES[1]		RCRA (SW846)[2]	
		Method	Requirement	Method	Requirement
Iodide (continued)	Continuing	345.1 Dionex[3]	Method 345.1: Not Applicable Dionex: 1 mid-level every 10 samples ± 10 % of true value	--	Not Applicable
	Ending	345.1 Dionex[3]	Method 345.1: Not Applicable Dionex: 1 mid-level ± 10% of true value	--	Not Applicable
Iron (Ferrous)	Initial	3500-Fe D	3 levels plus a blank, "r"[3] ≥ 0.995	-	Not Applicable
	Continuing	3500-Fe D	1 mid-level every 10 samples ± 10% of true value	-	Not Applicable
	Ending	3500-Fe D	1 mid-level ± 10% of true value	-	Not Applicable
Methylene Blue Active Substances (MBAS)	Initial	425.1	4 levels plus blank "r"[3] ≥ 0.995	--	Not Applicable
	Continuing	425.1	1 level every 10 samples ± 10 % of true value	--	Not Applicable
	Ending	425.1	1 level ± 10 % of true value	--	Not Applicable

TABLE 8.5-7
Summary of Inorganic Method Calibrations
(Continued)

Analysis	Calibration	NPDES[1]		RCRA (SW846)[2]	
		Method	Requirement	Method	Requirement
Nitrate	Initial	300.0[4] 352.1	5 levels plus a blank "r"[3] ≥ 0.995	9056 9210	Method 9056: 3 levels plus a blank Method 9210: 2 levels plus a blank must be analyzed with each batch of 20 samples (ICV ± 10%)
	Continuing	300.0[4] 352.1	1 mid-level every 10 samples ± 10% of true value	9056 — 9210	Method 9056: 1 per batch of 20 samples, ± 10% of true value Method 9210: Independently - prepared check standard every 10 samples
	Ending	300.0[4] 352.1	1 mid-level ± 10% of true value	9056 — 9210	Method 9056: Not Applicable Method 9210: After final sample CCV must be analyzed
Nitrite	Initial	300.0[4] 354.1	5 levels plus a blank "r"[3] ≥ 0.995	9056	3 levels plus a blank
	Continuing	300.0[4] 354.1	1 mid-level every 10 samples ± 10% of true value	9056	1 per batch of 20 samples, ± 10% of true value
	Ending	300.0[4] 354.1	1 mid-level ± 10% of true value	9056	Not Applicable
Nitrate-Nitrite	Initial	353.1 353.2 353.3	5 levels plus blank "r"[3] ≥ 0.995	--	Not Applicable
	Continuing	353.1 353.2 353.3	1 level every 10 samples ± 10% of true value	--	Not Applicable
	Ending	353.1 353.2 353.3	1 mid-level ± 10% of true value	--	Not Applicable

TABLE 8.5-7
Summary of Inorganic Method Calibrations
(Continued)

Analysis	Calibration	NPDES[1]		RCRA (SW846)[2]	
		Method	Requirement	Method	Requirement
Odor	Initial	140.1	No calibration	--	Not Applicable
	Continuing	140.1	Not Applicable	--	Not Applicable
	Ending	140.1	Not Applicable	--	Not Applicable
Phosphorus (total and Ortho-phosphate)	Initial	300.0[4] 365.1 365.2 365.3 365.4	Method 300.0/365.3/365.4: 3 levels plus a blank Method 365.2: 8 levels plus a blank	--	Not Applicable
	Continuing	300.0[4] 365.1 365.2 365.3 365.4	Method 300.0/365.3/365.4: 1 level every 10 samples ± 10% of true value Method 365.2: Blank and 2 standards with each series of samples, ± 2% of true value or recalibrate	--	Not Applicable
	Ending	300.0[4] 365.1 365.2 365.3 365.4	Method 300.0/365.3/365.4: ± 10% of true value Method 365.2: Not Applicable	--	Not Applicable
pH	Initial	150.1 4500-H^+ B	2 level calibration that bracket the expected pH of the sample (± 0.05 pH units of true value)	9040B 9045C	2 point calibration (± 0.05 pH units of true value)
	Continuing	150.1 4500-H^+ B	1 buffer check every 10 samples ± 5% of true value	9040B 9045C	Not Applicable
	Other	150.1 4500-H^+ B	Third point check	9040B 9045C	Third point check

TABLE 8.5-7
Summary of Inorganic Method Calibrations
(Continued)

Analysis	Calibration	NPDES[1]		RCRA (SW846)[2]	
		Method	Requirement	Method	Requirement
pH (continued)	Ending	150.1 4500-H^+ B	1 buffer check ± 5% of true value	9040B 9045C	Not Applicable
Phenolics	Initial	420.1 420.2	5 levels plus a blank "r"[3] ≥ 0.995	9065 9066	5 levels plus a blank "r"[3] 0.995
	Continuing	420.1 420.2	1 mid-level every 10 samples ± 10% true value	9065 9066	1 mid-level ± 15% true value
	Ending	420.1 420.2	1 mid-level ± 10% true value	9065 9066	1 mid-level ± 15% true value
Phosphate	Initial	---	Not Applicable	9056	3 levels plus a blank
	Continuing	---	Not Applicable	9056	1 per batch of 20 samples, ± 15% of true value
	Ending	---	Not Applicable	9056	Not Applicable
Reactivity	Initial	--	Not Applicable	Chap 7	See Total Cyanide and Sulfide
	Continuing	--	Not Applicable		
	Ending	--	Not Applicable		
Settleable Solids	Initial	160.5	Not Applicable	--	Not Applicable
	Continuing	160.5		--	Not Applicable
	Ending	160.5		--	Not Applicable
Silica, Dissolved	Initial	370.1	Approximately 6 levels plus blank "r"[3] ≥ 0.995	--	Not Applicable
	Continuing	370.1	1 level ± 15% of true value	--	Not Applicable
	Ending	370.1	1 level ± 15% of true value	--	Not Applicable

TABLE 8.5-7
Summary of Inorganic Method Calibrations
(Continued)

Analysis	Calibration	NPDES[1]		RCRA (SW846)[2]	
		Method	Requirement	Method	Requirement
Specific Conductance	Initial	120.1	Standardize meter with 0.01 M KCl	9050A	Not Applicable
	Continuing	120.1	1 level every 10 samples ± 10% of true value	9050A	Not Applicable
	Ending	120.1	1 level ± 10% of true value	9050A	Not Applicable
Sulfate	Initial	300.0[4] 375.1 375.4	Method 300.0/375.1: 5 levels plus blank "r"[3] ≥ 0.995 Method 375.4: 3 levels plus blank "r"[3] ≥ 0.995	9038 9056	Method 9038: 3 levels plus a blank for every hour of continuous sample analysis. Method 9056: 3 levels plus a blank
	Continuing	300.0[4] 375.1 375.4	Method 300.0/375.1: 1 mid-level after every 10 samples ± 10% of true value Method 375.4: 1 level every 3 or 4 samples ± 10% of true value	9038 9056	Method 9038: Independent-prepared check standard every 15 samples Method 9056: 1 per batch of 20 samples, ± 10% of true value
	Ending	300.0[4] 375.1 375.4	± 10% of true value	9038 9056	Not Applicable
Sulfide	Initial	376.1 376.2	Method 376.1: This is a titration method. Therefore, calibrations are not applicable. Method 376.2: 5 levels plus a blank "r" [3] ≥ 0.995	9030B 9034	This is a colorimetric titration. Therefore, calibration is not applicable.

TABLE 8.5-7
Summary of Inorganic Method Calibrations
(Continued)

Analysis	Calibration	NPDES[1]		RCRA (SW846)[2]	
		Method	Requirement	Method	Requirement
Sulfide (continued)	Continuing	376.1 376.2	Method 376.1: Not Applicable Method 376.2: 1 level every 10 samples ± 10% of true value	9030B 9034	This is a colorimetric titration. Therefore, calibration is not applicable.
	Ending	376.1 376.2	Method 376.1: Not Applicable Method 376.2: ± 10% of true value	9030B 9034	This is a colorimetric titration. Therefore, calibration is not applicable.
Sulfite	Initial	377.1	This is a colorimetric titration. Therefore, calibration is not applicable.	--	Not Applicable
	Continuing	377.1		--	Not Applicable
	Ending	377.1		--	Not Applicable
Temperature	Initial	170.1	Not Applicable	--	Not Applicable
	Continuing	170.1	Not Applicable	--	Not Applicable
	Ending	170.1	Not Applicable	--	Not Applicable
Total Dissolved Solids	Initial	160.1	This is a gravimetric determination. Calibrate balance prior to analysis	--	Not Applicable
	Continuing	160.1		--	Not Applicable
	Ending	160.1		--	Not Applicable

TABLE 8.5-7
Summary of Inorganic Method Calibrations
(Continued)

Analysis	Calibration	NPDES[1]		RCRA (SW846)[2]	
		Method	Requirement	Method	Requirement
Total Kjeldahl Nitrogen (TKN)	Initial	351.2 351.3	Method 351.2: 5 levels plus blank "r"[3] ≥ 0.995 Method 351.3: Titrimetric: Standardize titrant Colorimetric: 7 levels plus blank	--	Not Applicable
	Continuing	351.2 351.3	Method 351.2: 1 mid- level every 10 samples ± 10% of true value Method 351.3: Not Applicable	--	Not Applicable
	Ending	351.2 351.3	Method 351.2: ± 10% of true value Method 351.3: Not Applicable	--	Not Applicable
Total Organic Carbon (TOC)	Initial	415.1	3 levels plus blank	9060	3 levels plus blank "r"[3] ≥ 0.995
	Continuing	415.1	1 mid-level every 10 samples ± 15% of true value	9060	1 mid-level every 10 samples ± 15% of true value
	Ending	415.1	± 15% of true value	9060	± 15% of true value

TABLE 8.5-7
Summary of Inorganic Method Calibrations
(Continued)

Analysis	Calibration	NPDES[1]		RCRA (SW846)[2]	
		Method	Requirement	Method	Requirement
Total Organic Halides (TOX)	Initial	SM 5320B [4] 450.1 [4]	Method 5320B: 7 levels plus a blank ± 10% of true value Method 450.1: Daily instrument calibration standard and blank in duplicate ± 10% of true value (calibration std.) Verify with independently-prepared check standard	9020B	Daily instrument calibration standard and blank in duplicate ± 10% of true value (calibration std.) Verify with independently-prepared check standard – ICV ± 10% SOP NO. CORP-WC-0001
	Continuing	SM 5320B [4] 450.1 [4]	± 10% of true value	9020B	CCV ± 10% of true value SOP NO. CORP-WC-0001
	Ending	SM 5320B [4] 450.1 [4]	± 10% of true value	9020B	CCV ± 10% of true value SOP NO. CORP-WC-0001
Total Solids	Initial	160.3	This is a gravimetric determination. Calibrate balance before use.	--	Not Applicable
	Continuing	160.3		--	Not Applicable
	Ending	160.3		--	Not Applicable
Total Suspended Solids (Nonfilterable)	Initial	160.2	This is a gravimetric determination. Calibrate balance before use.	--	Not Applicable
	Continuing	160.2		--	Not Applicable
	Ending	160.2		--	Not Applicable

TABLE 8.5-7
Summary of Inorganic Method Calibrations
(Continued)

		NPDES[1]		RCRA (SW846)[2]	
Analysis	**Calibration**	**Method**	**Requirement**	**Method**	**Requirement**
Turbidity	Initial	180.1	Minimum of 1 level in each instrument range Follow manufacturer's instructions	--	Not Applicable
	Continuing	180.1	Not Applicable	--	Not Applicable
	Ending	180.1	Not Applicable	--	Not Applicable
Volatile Solids	Initial	160.4	This is a gravimetric determination. Calibrate balance before use.	--	Not Applicable
	Continuing	160.4		--	Not Applicable
	Ending	160.4		--	Not Applicable
Water Content	Initial	--	Calibrate Balance	--	Calibrate Balance
	Continuing	--	Not Applicable	--	Not Applicable
	Ending	--	Not Applicable	--	Not Applicable
GFAA Metals (excludes Hg)	Initial	200 series	3 levels plus blank ICV ± 10% of true value "r"[3] ≥ 0.995 SOP NO. CORP-MT-0003	7000A series	3 levels plus blank ICV ± 10% of true value "r"[3] ≥ 0.995 SOP NO. CORP-MT-0003
	Continuing	200 series	Every 10 samples ± 10% of true value SOP NO. CORP-MT-0003	7000A series	Every 10 samples ± 20% of true value SOP NO. CORP-MT-0003
	Ending	200 series	± 10% of true value SOP NO. CORP-MT-0003	7000A series	± 20% of true value SOP NO. CORP-MT-0003
	Other	200 series	Annually - Instrument detection limits SOP NO. CORP-MT-0003	7000A	Annually - Instrument detection limits SOP NO. CORP-MT-0003

TABLE 8.5-7
Summary of Inorganic Method Calibrations
(Continued)

Analysis	Calibration	NPDES[1]		RCRA (SW846)[2]	
		Method	Requirement	Method	Requirement
ICAP Metals (excludes Hg)	Initial	200.7	1 level and blank Rerun high calibration standard: verify quantitation at ± 5% of true value,ICV RSD < 3% from replicate (SOP No. CORP-MT-0001)	6010B	1 level and blank Rerun high calibration standard: verify quantitation at ± 5% of true value, ICV RSD < 5% from replicate (SOP No. CORP-MT-0001)
	Continuing	200.7	Every 10 samples ± 5% of true value CCV RSD < 5% from replicate (SOP No. CORP-MT-0001)	6010B	Mid-level calibration standard Every 10 samples ± 10% of true value CCV RSD < 5% from replicate (SOP No. CORP-MT-0001)
	Ending	200.7	± 5% of true value CCV RSD < 5% from replicate (SOP No. CORP-MT-0001)	6010B	Mid-level calibration standard ± 10% of true value CCV RSD < 5% from replicate (SOP No. CORP-MT-0001)
	Other	200.7	ICSA, ICSAB: Analyze at beginning of run. For ICSA, AB criteria see Section 9.8, SOP No. CORP-MT-0001. Annually: ICP interelement correction factors Instrument detection limits	6010B	ICSA, ICSAB: Analyze at beginning of run. For ICSA, AB criteria see Section 9.8, SOP No. CORP-MT-0001. Annually: ICP interelement correction factors Instrument detection limits
ICP/MS Metals	Initial	200.8	1 level and blank, ICV: ± 10% of true	6020	1 level and blank, ICV: ± 10% of true
	Continuing	200.8	Mid-level calibration standard Every 10 samples, ± 10% of true value	6020	Mid-level calibration standard Every 10 samples, ± 10% of true value
	Ending	200.8	Not specified	6020	Mid-level calibration standard, ± 10% of true value
	Other	200.8	Initial tuning standard deviation ≤ 5% for five replicates; Mass calibration ≤ 0.1 amu from true; Resolution ≤ 0.75 amu full width at 5% peak height; Analyze ICSA and ICSAB at the beginning of each run and every 12 hours	6020	Initial tuning standard deviation ≤ 5% for four replicates; Mass calibration ≤ 0.1 amu from true; Resolution ≤ 0.9 amu full width at 10% peak height; Analyze ICSA and ICSAB at the beginning of each run and every 12 hours

TABLE 8.5-7
Summary of Inorganic Method Calibrations
(Continued)

Analysis	Calibration	NPDES[1]		RCRA (SW846)[2]	
		Method	Requirement	Method	Requirement
Mercury by CVAA	Initial	245.1 245.5	5 levels plus blank ICV ± 10% of true value "r"[3] ≥ 0.995 SOP NO. CORP-MT-0005/0007	7470A 7471A	5 levels plus blank ICV ± 10% of true value "r"[3] ≥ 0.995 SOP NO. CORP-MT-0005/0007
	Continuing	245.1 245.5	Daily or every 10 samples, whichever is more frequent ± 20% of true value SOP NO. CORP-MT-0005/0007	7470A 7471A	Every 10 samples ± 20% of true value SOP NO. CORP-MT-0005/0007
	Ending	245.1 245.5	± 20% of true value SOP NO. CORP-MT-0005/0007	7470A 7471A	± 20% of original prepared standard SOP NO. CORP-MT-0005/0007
	Other	245.1 245.5	Annually: - Instrument detection limits	7470A 7471A	Annually - Instrument detection limits

Footnotes

(1) National Pollutant Discharge Elimination System

(2) Resource Conservation and Recovery Act, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, (SW-846), Third Edition, September 1986. Contains Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December, 1996).

(3) "r" = correlation coefficient

(4) Method not listed in 40 CFR Part 136.

TABLE 8.5-8
Summary of Organic Method Calibrations

Analytical Parameter	Calibration	NPDES[1]		RCRA (SW846)[2]	
		Method	Requirement	Method	Requirement
Aromatic Volatiles by GC	Initial	602	Minimum of 3 levels If % RSD < 10%, use avg RF. Otherwise, calibration curve employed	8021B	Minimum of 5 levels If % RSD < 20%, use avg RF. Otherwise, calibration curve employed. SOP No. CORP-GC-0001
	Continuing	602	Analyze QC check sample and evaluate per method requirements	8021B	Mid-level calibration standard analyzed every 10 samples. % D ≤ 15%, gases 20% D. Evaluate per SOP No. CORP-GC-0001 requirements.
	Ending	602	Not Applicable	8021B	Mid-level calibration standard % D ≤ 15%. Evaluate per SOP No. CORP-GC-0001 requirements.
	Other	602	Not Applicable	8021B	Not Applicable
Acrolein &Acrylonitrile by GC	Initial	603	Minimum of 3 levels If % RSD < 10%, use avg RF. Otherwise, calibration curve employed	8031 (Acrylo-nitrile only)	Minimum of 5 levels If % RSD < 20%, use avg RF. Otherwise, calibration curve employed.
	Continuing	603	Analyze QC check sample and evaluate per method requirements	8031 (Acrylo-nitrile only)	Mid-level calibration standard analyzed every 10 samples. Evaluate per method requirements.8
	Ending	603	Not Applicable	8031 (Acrylo-nitrile only)	Mid-level calibration standard Evaluate per method requirements.
	Other	603	Not Applicable	8031 (Acrylo-nitrile only)	Not Applicable

TABLE 8.5-8
Summary of Organic Method Calibrations
(Continued)

Analytical Parameter	Calibration	NPDES[1]		RCRA (SW846)[2]	
		Method	Requirement	Method	Requirement
Dioxins/ Dibenzofurans (LRMS)	Initial	613	3 levels If % RSD <10%, use mean RF. Otherwise calibration curve employed	8280A	5 levels in triplicate % RSD ≤ 15%
	Continuing	613	1 level each working day. % D must be ≤ 15%.	8280A	1 level every 12 hours after window performance mix Standard must have RFs with %D ≤ 30% from initial
	Ending	613	Not Applicable	8280A	Window performance mix
	Other	613	Establish Single Ion Monitoring conditions described in method	8280A	Window mix to set congener windows every 12 hours at beginning of sequence. Isotope ratios in standard must meet criteria in method. Valley between 2,3,7,8-TCDD[3] and 1,2,3,4-TCDD must be ≤ 25% of the 2,3,7,8-TCDD[3] peak height.

TABLE 8.5-8
Summary of Organic Method Calibrations
(Continued)

Analytical Parameter	Calibration	NPDES[1]		RCRA (SW846)[2]	
		Method	Requirement	Method	Requirement
Dioxins/ Dibenzofurans (HRGC/HRMS)	Initial	1613B	5 levels plus window defining solution. %RSD for compounds calibrated by isotope dilution < 20%. %RSD for compounds calibrated by internal standard < 35%.	8290	1 level every 12 hours after window defining solution. RFs with %D ≤ 20% for natives; %D ≤ 30% for labeled compounds from initial
	Continuing	1613B	1 level every 12 hours after window defining solution. Calculated concentrations must be within method acceptance criteria. (1613 Table 6)	8290	1 level: RFs with %D ≤ 20% for natives; %D ≤ 30% for labeled compounds from initial
	Ending	1613B	Not Applicable	--	Not Applicable
	Other	1613B	Isotope ratios in calibration standards must meet criteria in method. Valley between 2,3,7,8-TCDD and all other TCDDs must be ≤ 25% of the 2,3,7,8-TCDD height.	8290	Isotope ratios in standard must meet criteria in method. Valley between 2,3,7,8-TCDD [3] and all other TCDDs must be ≤ 25% of the 2,3,7,8-TCDD height
PCBs by HRGC/HRMS	Initial	1668	5 levels plus window defining solution. %RSD for compounds calibrated by isotope dilution < 20%. %RSD for compounds calibrated by internal standard < 35%.	--	Not Applicable
	Continuing	1668	1 level every 12 hours after window defining solution. Calculated concentrations must be within method acceptance criteria. (1668 Table 6)	--	Not Applicable
	Ending	1668	Not Applicable	--	Not Applicable
	Other	1668	Isotope ratios in calibration standards must meet criteria in method.	--	Not Applicable

TABLE 8.5-8
Summary of Organic Method Calibrations
(Continued)

Analytical Parameter	Calibration	NPDES[1]		RCRA (SW846) [2]	
		Method	Requirement	Method	Requirement
Herbicides by GC	Initial	615 [9]	Minimum of 3 levels If % RSD < 10%, use avg RF. Otherwise, calibration curve employed	8151A	Minimum of 5 levels If % RSD < 20%, use avg RF. Otherwise, calibration curve employed. SOP No. CORP-GC-0001
	Continuing	615 [9]	1 or more calibration standards analyzed daily % D ± 15% of predicted response	8151A	Mid-level calibration standard analyzed every 10 samples. % D < 15% of predicted response for any analyte quantitated and reported. SOP No. CORP-GC-0001
	Ending	615 [9]	Not Applicable	8151A	Mid-level calibration standard. % D < 15% of predicted response for any analyte quantitated and reported. SOP No. CORP-GC-0001
	Other	615 [9]	Not Applicable	8151A	Not Applicable
Nitroaromatics by HPLC	Initial	--	Not Applicable	8330	Minimum of 5 levels. Curve should be linear with zero intercept.
	Continuing	--	Not Applicable	8330	Midpoint calibration standard at beginning and after the midpoint of sample run. %D < 15% of predicted response for any analyte quantitated and reported.

TABLE 8.5-8
Summary of Organic Method Calibrations
(Continued)

Analytical Parameter	Calibration	NPDES[1]		RCRA (SW846)[2]	
		Method	Requirement	Method	Requirement
Nitroaromatics by HPLC (continued)	Ending	--	Not Applicable	8330	Midpoint calibration standard. %D: < 15% of predicted response for any analyte quantitated and reported.
	Other	--	Not Applicable	8330	Not Applicable
Polyaromatic Hydrocarbons by GC or HPLC	Initial	610	Minimum of 3 levels If % RSD < 10%, use avg RF. Otherwise, calibration curve employed	8100 8310	Minimum of 5 levels If % RSD < 20%, use avg RF. Otherwise, calibration curve employed.
	Continuing	610	1 or more calibration standards analyzed daily % D ± 15% of predicted response	8100 8310	Mid-level calibration standard analyzed every 10 samples. % D < 15% of predicted response for any analyte quantitated and reported.
	Ending	610	Not Applicable	8100 8310	Mid-level calibration standard. % D ± 15% of predicted response for any analyte quantitated and reported.
	Other	610	Not Applicable	8100 8310	Not Applicable
Pesticides/ PCBs by GC	Initial	608	Minimum of 3 levels If % RSD < 10%, use avg RF. Otherwise, calibration curve employed	8081A 8082	Minimum of 5 levels. If % RSD < 20%, use avg RF. Otherwise, calibration curve employed. (See SOP No. CORP-GC-0001)
	Continuing	608	1 or more calibration standards analyzed daily % D ± 15% of predicted response	8081A 8082	Mid-level calibration standard analyzed every 10 samples. % D < 15% of predicted response for any analyte quantitated and reported. (See SOP No. CORP-GC-0001)

TABLE 8.5-8
Summary of Organic Method Calibrations
(Continued)

Analytical Parameter	Calibration	NPDES[1]		RCRA (SW846)[2]	
		Method	Requirement	Method	Requirement
Pesticides/ PCBs by GC (continued)	Ending	608	Not Applicable	8081A 8082	Mid-level calibration standard. % D < 15% of predicted response for any analyte quantitated and reported. (See SOP No. CORP-GC-0001)
	Other	608	Not Applicable	8081A 8082	Not Applicable
Petroleum Hydrocarbons/ Oil and Grease	Initial	413.1 413.2 418.1	Method 413.1: This is a gravimetric determination. Calibrate balance before use. Method 413.2/418.1: 3 levels plus a blank "r" ≥ 0.995	9070 9071A	This is a gravimetric determination. Calibrate balance before use
	Continuing	413.1 413.2 418.1	Not Applicable	9070 9071A	Not Applicable
	Ending	413.1 413.2 418.1	Not Applicable	9070 9071A	Not Applicable
	Initial	1664[8]	Calibrate analytical balance at 2 mg and 1000 mg Calibration must be ± 10% at 2 mg and ± 0.5% at 1000 mg or recalibrate balance SOP No. CORP-WC-0003	--	--
	Continuing	1664[8]	Not Applicable	--	--
	Ending	1664[8]	Not Applicable	--	--
Organophos-phorous Pesticides by GC	Initial	--	Not Applicable	8141A	Minimum of 5 levels If % RSD < 20%, use avg RF. Otherwise, calibration curve employed.

TABLE 8.5-8
Summary of Organic Method Calibrations
(Continued)

Analytical Parameter	Calibration	NPDES[1]		RCRA (SW846)[2]	
		Method	Requirement	Method	Requirement
Organophos-phorous Pesticides by GC (continued)	Continuing	--	Not Applicable	8141A	Mid-level calibration standard analyzed every 10 samples. % D < 15% of predicted response for any analyte quantitated and reported.
	Ending	--	Not Applicable	8141A	Mid-level calibration standard % D < 15% of predicted response for any analyte quantitated and reported.
	Other	--	Not Applicable	8141A	Not Applicable
Purgeable Halocarbons by GC	Initial	601	Minimum of 3 levels If % RSD < 10%, use avg RF. Otherwise, calibration curve employed	8021B	Minimum of 5 levels If % RSD < 20%, use avg RF. Otherwise, calibration curve employed. (See SOP No. CORP-GC-0001)
	Continuing	601	Analyze QC check sample and evaluate per method requirements	8021B	Mid-level calibration standard analyzed every 10 samples. % D < 15%, gases 20% D Evaluate per SOP No. CORP-GC-0001 requirements.
	Ending	601	Not Applicable	8021B	Mid-level calibration standard % D <15% Evaluate per SOP No. CORP-GC-0001 requirements.
	Other	601	Not Applicable	8021B	Not Applicable

TABLE 8.5-8
Summary of Organic Method Calibrations
(Continued)

Analytical Parameter	Calibration	NPDES[1]		RCRA (SW846)[2]	
		Method	Requirement	Method	Requirement
Halogenated Volatiles by GC	Initial	--	Not Applicable	8021B	Minimum of 5 levels If % RSD < 20%, use avg RF. Otherwise, calibration curve employed. (See SOP No. CORP-GC-0001)
	Continuing	--	Not Applicable	8021B	Mid-level calibration standard analyzed every 10 samples. % D < 15% of predicted response for any analyte quantitated and reported. (See SOP No. CORP-GC-0001)
	Ending	--	Not Applicable	8021B	Mid-level calibration standard % D < 15% of predicted response for any analyte quantitated and reported. (See SOP No. CORP-GC-0001)
	Other	--	Not Applicable	8021B	Not Applicable
Semivolatiles	Initial	625	Minimum of 3 levels, lowest near but above MDL If % RSD ≤ 35%, use avg RF Otherwise calibration curve employed. SOP No. CORP-MS-0001	8270C	Minimum of 5 levels, % RSD for RF for CCCs[4] < 30% SPCCs[5]: RF > 0.050 SOP No. CORP-MS-0001
	Continuing	625	1 level every 24 hours Aceeptance criteria are found in the metnod and SOP No. CORP-MS-0001	8270C	Mid-level standard every 12 hours (after tuning) %D for CCCs[4] < 20 % between RF from standard and avg RF from initial SPCCs[5]: RF > 0.050 SOP No. CORP-MS-0001

TABLE 8.5-8
Summary of Organic Method Calibrations
(Continued)

Analytical Parameter	Calibration	NPDES[1]		RCRA (SW846)[2]	
		Method	Requirement	Method	Requirement
Semivolatiles (continued)	Ending	625	Not Applicable	8270C	Not Applicable
	Other	625	DFTPP[7] tuning every 24 hours before standard or sample runs. SOP No. CORP-MS-0001	8270C	DFTPP[7] tuning at the beginning of every 12 hour shift. SOP No. CORP-MS-0001
Volatiles	Initial	--	Not Applicable	8260B	Minimum of 5 levels, %RSD for RF for CCCs[4] < 30.0% SPCCs[5]: RF ≥ 0.300 for Chlorobenzene and 1,1,2,2-tetrachloroethane, Chloromethane and 1,1-dichloroethane, and RF > 0.100 for Bromoform (See Table 11, SOP No. CORP-MS-0002)

TABLE 8.5-8
Summary of Organic Method Calibrations
(Continued)

Analytical Parameter	Calibration	NPDES[1]		RCRA (SW846)[2]	
		Method	Requirement	Method	Requirement
Volatiles (continued)	Continuing	--	Not Applicable	8260B	Mid-level standard every 12 hours (after tuning) %Drift for CCCs[4] < 20.0% between RF from standard and avg RF from initial SPCCs[5]: RF ≥ 0.300 for Chlorobenzene and 1,1,2,2-tetrachloroethane, Chloromethane and 1,1-dichloroethane, and RF > 0.100 for Bromoform SOP No. CORP-MS-0002
	Ending	--	Not Applicable	8260B	Not Applicable
	Other	--	Not Applicable	8260B	BFB[6]tuning at the beginning of every 12 hour shift. SOP No. CORP-MS-0002

Footnotes

(1) National Pollutant Discharge Elimination System
(2) Resource Conservation and Recovery Act, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, (SW-846), Third Edition, September 1986. Contains Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996).
(3) TCDD - 2,3,7,8-Tetrachlorodibenzo-p-dioxin
(4) CCC - Continuing Calibration Compounds
(5) SPCC - System Performance Check Compound
(6) BFB - Bromofluorobenzene
(7) DFTPP - Decafluorotriphenylphosphine
(8) Method 1664 is a proposed only method and has not been promulgated by the EPA.
(9) Method not listed in 40 CFR Part 136.

TABLE 8.5-9
Summary of USEPA Contract Laboratory Program Statement of Work
Method Calibrations

Analytical Parameter	Calibration	Method	Requirement
Cyanide, Total	Initial	ILM03.0 ILMO4.0	Minimum 5 levels plus blank "r" ≥ 0.995
	Continuing	ILM03.0 ILMO4.0	1 mid-level every 10 samples ± 15 % of true value
	Ending	ILM03.0 ILMO4.0	± 15 % of true value
	Other	ILM03.0 ILMO4.0	Not Applicable
ICAP (excludes mercury)	Initial	ILM03.0 ILMO4.0	1 level and blank ICV: ± 10% of true
	Continuing	ILM03.0 ILMO4.0	Mid-level calibration standard Every 10 samples ± 10% of true value
	Ending	ILM03.0 ILMO4.0	Mid-level calibration standard ± 10% of true value
	Other	ILM03.0 ILMO4.0	ILMO3.0: ICSA, ICSAB: Analyze at beginning and end or every 8 hours whichever is more frequent ILMO3.0: CRI: Beginning and end of each run, and every 8 hours for all analytes at 2x CRDL or 2x IDL whichever is greater, except for Al, Ba, Ca, Fe, Mg, Na, K ILMO4.0: ICSA, ICSAB: Analyze at beginning and end of run, but not before ICV. Must be analyzed every 20 analytical samples per ICP run. ILMO4.0: CRI: Beginning and end of each run and every 20 analytical samples per ICP run. CRI must be immediately followed by ICS analysis. Quarterly: Instrument detection limits Linear Range Verification Annually: ICP interelement correction factors

TABLE 8.5-9
Summary of USEPA Contract Laboratory Program Statement of Work
Method Calibrations
(Continued)

Analytical Parameter	Calibration	Method	Requirement
GFAA (excludes Hg)	Initial	ILM03.0 ILMO4.0	Minimum 3 levels plus blank ICV: ± 10%
	Continuing	ILM03.0 ILMO4.0	Every 10 samples ± 10% of true value
	Ending	ILM03.0 ILMO4.0	± 10% of true value
	Other	ILM03.0 ILMO4.0	CRA: Beginning of every analytical run (no acceptance criteria) Quarterly - Instrument detection limits
Mercury (CVAA)	Initial	ILM03.0 ILMO4.0	Minimum 3 levels plus blank "r"(4) ≥ 0.995 ICV: ± 20%
	Continuing	ILM03.0 ILMO4.0	Every 10 samples ± 20% of true value
	Ending	ILM03.0 ILMO4.0	± 20% of true value
	Other	ILM03.0 ILMO4.0	Quarterly - Instrument detection limits ILMO3.0: CRA not required. ILMO4.0: CRA: Beginning of every analytical run (no acceptance criteria)
Pesticides/PCBs	Initial	OLM03.1	3 levels for single component analytes, 1 level for multicomponent analytes RSD must be ≤ 20% except α-BHC and δ-BHC at 25% (allow up to 2 target analytes to be 20% ≤ 30%)
	Continuing	OLM03.1	Instrument Blank and midpoint calibration or PEM every 12 hours % D: ± 25% of predicted response

TABLE 8.5-9
Summary of USEPA Contract Laboratory Program Statement of Work
Method Calibrations
(Continued)

Analytical Parameter	Calibration	Method	Requirement
Pesticides/PCBs (continued)	Ending	OLM03.1	Instrument Blank and midpoint calibration or PEM
	Other	OLM03.1	Resolution Check Mixture ≥ 60% PEM: ≥ 90% DDT, Endrin breakdown must each be ≤ 20% (≤ 30% combined)
	Initial	OLM01.8	3 levels for single component analytes, 1 level for multicomponent analytes RSD must be ≤20% for each single component target compounds (up to two single components target compounds per column may be > 20.0% but those compounds must have an RSD ≤30.0%.
	Continuing	OLM01.8	Instrument Blank and mid-point calibration standard or PEM every 12 hours Must meet resolution, retention time window, and RPD requirements in method
	Ending	OLM01.8	Instrument Blank and mid-point calibration standard or PEM Must meet resolution retention time window, and RPD requirements in method
PCDD, PCDF	Initial	DFLM01.1	Minimum 5 levels Resolution: 13C12-2378-TCDD and 13C12-1234-TCDD < 25% 123478-HxCDD and 123678-HxCDD ≤ 50% %RSD unlabeled PCDDs/PCDFs and internal standards ≤ 15%
	Continuing	DFLM01.1	Analyze CC3 or CPS solution every 12 hours Must meet ion abundance, S/N, and %D criteria in method
	Ending	DFLM01.1	Analyze CC1 solution at end of 12 hour period Must meet ion abundance and S/N criteria in method
	Other	DFLM01.1	Window Defining Mix: verify switching times

TABLE 8.5-9
Summary of USEPA Contract Laboratory Program Statement of Work
Method Calibrations
(Continued)

Analytical Parameter	Calibration	Method	Requirement
Semivolatiles by GC/MS	Initial	OLM03.1	5 levels RRF and RSD must meet method criteria
	Continuing	OLM03.1	Mid-level every 12 hours after tuning check %D and RRF must meet minimum criteria
	Ending	OLM03.1	Not Applicable
	Other	OLM03.1	DFTPP tuning at the beginning of every 12 hour shift
	Initial	OLM01.8	5 levels RRF and RSD must meet method criteria
	Continuing	OLM01.8	1 level every 12 hours %D and RRF must meet minimum method criteria
	Ending	OLM01.8	Not Applicable
Volatiles by GC/MS	Initial	OLM03.1	5 levels RRF and RSD must meet method criteria
	Continuing	OLM03.1	Mid-level every 12 hours after tuning check %D and RRF must meet minimum criteria
	Ending	OLM03.1	Not Applicable
	Other	OLM03.1	BFB tuning at the beginning of every 12 hour shift
	Initial	OLM01.8	5 levels RRF and RSD must meet method criteria
	Continuing	OLM01.8	1 level every 12 hours %D and RRF must meet minimum method criteria
	Ending	OLM01.8	Not Applicable
	Other	OLM01.8	BFB tuning at the beginning of every 12 hour shift

TABLE 8.6-1
Precision and Accuracy Measurements

Measurement	Definition
Accuracy	The degree of agreement of a measurement with an accepted reference or true value. The only true or known values in the laboratory are spiked samples. Expressed as laboratory control sample (LCS) percent recovery (% R): $$LCS\ \%\ Recovery = \frac{X}{t} x\ 100$$ where: X = observed concentration t = concentration of spike added Expressed as matrix spike/matrix spike duplicate (MS/MSD) sample percent recovery (% R): $$MS\ /\ MSD\ \%\ Recovery = \frac{X_s - X}{t} x\ 100$$ where: X_s = observed concentration in spiked sample X = observed concentration in unspiked sample t = concentration of spike added
Precision	The measure of analytical reproducibility of two values. Expressed as the relative percent difference (RPD) of two values. $$RPD = \left[\frac{|X_1 - X_2|}{\left(\frac{X_1 + X_2}{2} \right)} \right] x\ 100$$ where: X_1 = first observed concentration X_2 = second observed concentration

TABLE 8.6-1
Precision and Accuracy Measurements
(Continued)

Measurement	Definition
Arithmetic mean	The average of a set of values. $\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$ where: $\bar{x}$ = the mean x_i = the i^{th} data value n = number of data values
Standard Deviation	A measure of the random (probable) error associated with a single measurement within a data set. $s = \sqrt{\frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n-1}}$ where: s = sample standard deviation $\bar{x}$ = the mean x_i = the i^{th} data value n = number of data values
Quality Control Chart	A graphical representation of analytical accuracy. Displays the arithmetic mean of a data set, the upper and lower warning limits and the upper and lower control limits.
ACCURACY	
Upper Control Limit (UCL)	$UCL = \bar{x} + 3s$
Upper Warning Limit (UWL)	$UWL = \bar{x} + 2s$
Lower Warning Limit (LWL)	$LWL = \bar{x} - 2s$
Lower Control Limit (LCL)	$LCL = \bar{x} - 3s$
PRECISION	
RPD	Zero to (mean RPD + 3s)

TABLE 8.11-1
Instrument Maintenance Schedule
Ion Chromatograph[1]

As Needed	Daily	Weekly	Monthly	Semi-annually
Clean micromembrane suppressor when decreases in sensitivity are observed.	Check plumbing/leaks.	Check pump heads for leaks.	Check all air and liquid lines for discoloration and crimping, if indicated.	Lubricate left hand piston.
Check fuses when power problems occur.	Check gases.	Check filter (inlet)	Check/change bed supports guard and analytical columns, if indicated.	Clean conductivity cell.
Reactivate or change column when peak shape and resolution deteriorate or when retention time shortening indicates that exchange sites have become deactivated.	Check pump pressure.			Check conductivity cell for calibration.
De-gas pump head when flow is erratic.	Check conductivity meter.			

TABLE 8.11-2
Instrument Maintenance Schedule
LACHAT Auto Analyzer[1]

As Needed	Daily	Monthly	Semi-annually	Annually
Prepare fresh reagents.	Check detector. Clean detector cell and make sure there are no trapped bubbles in detector cell. Check Valves Check Reference source	Replace tubing.	Lubricate pump roller.	Clean pump rollers with steel wool and lubricate.
	Check peristaltic tubing. Check sampler Check auto diluter	Clean pump, diluter, and XYZ Sampler.		
	Clean sample probe shaft.			

TABLE 8.11-3
Instrument Maintenance Schedule
Total Organic Halide Analyzer(1)

Daily	As Needed
Check electrodes for damage, polish the electrodes.	Examine and clean or replace pyrolysis tube.
Replace dehydrating fluid and electrolyte fluid.	Clean titration cell.
Clean quartz boat.	Observe gas flow.
Observe check valves during use for backfeed.	Replace reference electrode fluid.
At end of each day of use, wash out absorption module, empty electrolyte and fill cell with DI water. Empty dehydrator tube	Change quartz wool.
Perform cell performance check.	Replace o-rings and seals.

TABLE 8.11-4
Instrument Maintenance Schedule
High Pressure Liquid Chromatograph(1)

Daily	As Needed
Check level of solution in reservoirs. If adding, verify that solvent is from the same source. If changing, rinse gas and delivery lines to prevent contamination of the new solvent.	Replace columns when peak shape and resolution indicate that chromatographic performance of column is below method requirements.
Check gas supply.	Oil autosampler slides when sample does not advance.
Flush with an appropriate solvent to remove all bubbles.	Rinse flow cell with 1N nitric acid if sensitivity low.
Pre-filter all samples.	Change pump seals when flow becomes inconsistent.
	Repack front end of column Backflush column.

TABLE 8.11-5
Instrument Maintenance Schedule
Flame Atomic Absorption Spectroscopy[1]

Daily	Monthly	As Needed
Verify proper safety precautions are working.	Clean all filters and fans.	Check drain receptacle.
Verify gas box operates properly and safely.	Change capillary tubing	Check background corrector for alignment.
Verify sensitivity using elements in UV/VIS spectrum.	Clean optical windows	Clean burner head.
		Clean nebulizer.
		Clean spray chamber.
		Check sample introduction O-rings.

TABLE 8.11-6
Instrument Maintenance Schedule
Inductively Coupled Argon Plasma/Mass Spectrometry (ICAP/MS)[1]

Daily	Weekly	Monthly	Quarterly	Annually	As Needed
Check sample waste container level.	Check peristaltic pump: proper roller pressure, sample introduction tubing, correct pump rotation, condition of drain tubing.	Clean all filters and fans.	Replace oil in roughing pumps.	Replace oil in turbo-molecular pump.	Check electronic settings for optimum sensitivity: resolution, mass calibration, ion optics, CEM, deflector voltage.
Check quartz torch condition.	Check condition of sampler and skimmer cones.	Check recirculator water level.			
Measure quartz torch for proper alignment.	Check and drain oil mist eliminator on roughing pumps.				
Clean spray chamber and nebulizer.					
Check oil level of roughing pumps.					

TABLE 8.11-7
Instrument Maintenance Schedule
ICP[1]

Daily	Monthly or As Needed	Semi-annually	Annually
Check gases Check that argon tank pressure is 50-60 psi and that a spare tank is available. Check aspiration tubing	Clean plasma torch assembly to remove accumulated deposits.	Change vacuum pump oil.	Notify manufacturer service engineer for scheduled preventive maintenance service.
Check vacuum pump gage. (<10 millitorr)	Clean nebulizer and drain chamber; keep free flowing to maintain optimum performance.	Replace coolant water filter. (may require more or less frequently depending on the quality of water)	
Check that cooling water supply system is full and drain bottle is not full. Also that drain tubing is clear, tight fitting and has few bends.	Clean filters on back of power unit to remove dust.		
Check that nebulizer is not clogged.	Replace when needed: peristaltic pump tubing sample capillary tubing autosampler sipper probe		
Check that capillary tubing is clean and in good condition.	Check yttrium position. Check O-rings Clean/lubricate pump rollers.		
Check that peristaltic pump windings are secure.			
Check that high voltage switch is on.			
Check that exhaust screens are clean.			
Check that torch, glassware, aerosol injector tube, bonnet are clean.			

TABLE 8.11-8
Instrument Maintenance Schedule
Graphite Furnace Atomic Absorption[1]

Daily	Weekly	Monthly	Semi-annually	Annually
Check gas lines and gas supply.	Clean optical windows.	Check coolant level in cooling unit. Add coolant if error message appears.	Change graphite contacts	Notify manufacturer service engineer to clean optics.
Clean contact cylinders.				Check optics
Check tubes and platform; replace if corroded, faking, or if low absorbance results. Check autosampler tubing and alignment. Flush autosampler tubing				
PE4100ZL: clean fume extraction tip, replace fume extraction filter and H_2O trap.				
As needed, trim sampling capillary.				
Check drain lines and waste containers; empty as needed.				
Check acid rinse containers; fill as needed.				

TABLE 8.11-9
Instrument Maintenance Schedule
Cold Vapor Atomic Absorption (Leeman PS 200) [1]

Daily	As Needed	Annually
Change drying tube	Change pump tubing	Change Hg lamp.
Check pump tubing/drain tubing	Check/change Hg lamp	
Check gas pressure	Clean optical cell	
Check aperture reading Check tubing	Lubricate pump	

TABLE 8.11-10
Instrument Maintenance Schedule
Cold Vapor Atomic Absorption (PE 5000) (1)

Daily	As Needed	Monthly
Clean aspirator by flushing with DI water.	Change source lamp	Clean cell in aqua regia.
Check tubing and replace if needed.		Clean aspirator in aqua regia.
Change silica gel in drying tube.		Clean windows with methanol.
Check argon gas supply.		
Adjust lamp.		

TABLE 8.11-11
Instrument Maintenance Schedule
Gas Chromatograph[(1)]

Daily	As Needed	Quarterly/Semi-annually/Annually
Check for sufficient supply of carrier and detector gases. Check for correct column flow and/or inlet pressures.	Replace front portion of column packing or break off front portion of capillary columns. Replace column if this fails to restore column performance or when column performance (e.g. peak tailing, poor resolution, high backgrounds, etc.) indicates it is required.	Quarterly ELCD: change-roughing resin, clean cell assembly. Quarterly FID: clean detector
Check temperatures of injectors and detectors. Verify temperature programs.	Change glass wool plug in injection port and/or replace injection port liner when front portion of column packing is changed or front portion of capillary column is removed.	Semi-annually ECD: perform wipe test.
Check inlets, septa. Replace septum Clean injector port		Annually ELCD: change finishing resin, clean solvent filter. Annually FID: Replace flame tip ECD: detector cleaning and re-foiling, every five years or whenever loss of sensitivity, or erratic response or failing resolution is observed.
Check baseline level.	Perform gas purity check (if high baseline indicates that impure carrier gas may be in use).	
Check reactor temperature of electrolytic conductivity detector.	Replace or repair flow controller if constant gas flow cannot be maintained.	
	Replace fuse.	
Inspect chromatogram to verify symmetrical peak shape and adequate resolution between closely eluting peaks.	Reactivate external carrier gas dryers.	
Clip column leader	Detectors: clean when baseline indicates contamination or when response is low. FID: clean/replace jet, replace ignitor. NPD: clean/replace collector assembly. PID: clean lamp window monthly or replace as needed, replace seals. ELCD: check solvent flow weekly, change reaction tube, replace solvent, change reaction gas, clean/replace Teflon® transfer line. ECD: follow manufacturers suggested maintenance schedule	
	Reactivate flow controller filter dryers when presence of moisture is suspected.	

TABLE 8.11-11
Maintenance Schedule
Gas Chromatograph[(1)]
(Continued)

Daily	As Needed	Quarterly/Semi-annually/Annually
GC (continued)	HP 7673 Autosampler: replace syringe, fill wash bottle, dispose of waste bottle contents.	
	Purge & trap devices: periodic leak checks quarterly, replace/condition traps (when poor response or disappearance of reactive or poorly trapped compounds), clean sample lines, valves (if they become contaminated), clean glassware. Clean sparger weekly. Check purge flow monthly. Bake trap as needed to correct for high background. Change trap annually, or as needed whenever loss of sensitivity, or erratic response or failing resolution is observed.	
	Purge & trap autosamplers: leak check system, clean sample lines, valves. PTA-30 autosampler also requires cleaning the syringes, frits, valves, and probe needles, adjustment of micro switches, replacement of Teflon® valve, and lubrication of components.	

TABLE 8.11-12
Instrument Maintenance Schedule
Mass Spectrometer[1]

Daily	Weekly	As Needed[2]	Quarterly	Semi-Annually	Annually
Check for sufficient gas supply. Check for correct column flow and/or inlet pressure.	Check mass calibration (PFTBA or FC-43)	Check level of oil in mechanical pumps and diffusion pump if vacuum is insufficient. Add oil if needed between service contract maintenance.	Check ion source and analyzer (clean, replace parts as needed)		Replace the exhaust filters on the mechanical rough pump every 1-2 years.
Check temperatures of injector, detector. Verify temperature programs.		Replace electron multiplier when the tuning voltage approaches the maximum and/or when sensitivity falls below required levels.	Check vacuum, relays, gas pressures and flows	Clean rods	
Check inlets, septa.		Clean Source, including all ceramics and lenses - the source cleaning is indicated by a variety of symptoms including inability of the analyst to tune the instrument to specifications, poor response, and high background contamination.	Change oil in the mechanical rough pump. Relubricate the turbomolecular pump-bearing wick.		
Check baseline level.		Repair/replace jet separator.			
Check values of lens voltages, electron multiplier, and relative abundance and mass assignments of the calibration compounds.		Replace filaments when both filaments burn out or performance indicates need for replacement.			

TABLE 8.11-13
Instrument Maintenance Schedule
TRAACS 800 Auto Analyzer (1)

As Needed	Daily	Monthly	Semi-annually	Annually
Replaces air filter when progressive loss of air pressure is observed.	Check air pressure gauge (22 ± 2 psi)	Change all pump tubes (or after 200 hours of pumping time)	(or after 1000 hours of pumping time)	Lightly lubricate the Linear Sample Rails (use semi-fluid lubricant)
Replace air valve tubing when occlusion in tubing is observed	Use recommended washout procedure (at end of analysis operations)	Clean sample probe shaft	Replace pump platens	Replace colorimeter lamp (or after 2500 hours of use)

TABLE 8.11-14
Instrument Maintenance Schedule
Sonicator (1)

Daily	As Needed
Daily when used: Inspect probe tips for inconsistencies (etching/pitting).	Replace probe tip.
	Disassemble and clean sonicator probe tips.
	Tune sonicator assembly.

TABLE 8.11-15
Instrument Maintenance Schedule
Analytical/Top Loading Balances(1)

Daily	Annually
Check using Class S-verified weights once daily or before use Clean pan and weighing compartment	Manufacturer cleaning and calibration.

TABLE 8.11-16
Instrument Maintenance Schedule
Refrigerators/Walk-in Coolers(1)

Daily	As Needed
Temperatures checked and logged.	Refrigerant system and electronics serviced.

TABLE 8.11-17
Instrument Maintenance Schedule
Ovens[(1)]

Daily	As Needed
Temperatures checked and logged.	Electronics serviced.

TABLE 8.11-18
Instrument Maintenance Schedule
Specific Digital Ion Analyzer[(1)]

Daily	As Needed
Daily when used: Calibrate with check standards. Inspect electrode daily, clean as needed. Inspect electrode proper levels of filling solutions daily, fill as needed. Clean probe, each use.	Electronics serviced.

TABLE 8.11-19
Instrument Maintenance Schedule
Turbidimeter[(1)]

Daily	Monthly	As Needed
Daily when used: Adjust linearity on varying levels of NTU standards. Standardize with NTU standards. Inspect cells.	Clean instrument housing	Electronics serviced.

TABLE 8.11-20
Instrument Maintenance Schedule
Dissolved Oxygen Meter[(1)]

Daily	As Needed
Daily when used: Calibrate with check standards. Check probe membrane for deterioration Clean and replace membrane with HCl solution.	Electronics serviced.

TABLE 8.11-21
Instrument Maintenance Schedule
Conductance Meter[(1)]

Daily	As Needed
Daily when used: Check probe and cables. Standardize with KCl. Inspect conductivity cell	Electronics serviced.

TABLE 8.11-22
Instrument Maintenance Schedule
Chemical Oxygen Demand (COD) Reactor[(1)]

Daily	As Needed
Daily when used: Calibrate with check standards.	Electronics serviced.

TABLE 8.11-23
Instrument Maintenance Schedule
Spectrophotometer[(1)]

As Needed	Daily	Monthly	Annually
Dust the lamp and front of the front lens.	Check the zero %A adjustment.	Clean windows	Check instrument manual.
	Clean sample compartment		Perform wavelength calibration.
	Clean cuvettes		Replace lamp annually or when erratic response is observed.
			Clean and align optics.

TABLE 8.11-24
Instrument Maintenance Schedule
pH Meter[(1)]

As Needed	Daily
Clean electrode.	Inspect electrode. Verify electrodes are properly connected and filled.
Refill reference electrode.	Inspect electrode proper levels of filling solutions. Make sure electrode is stored in buffer.

TABLE 8.11-25
Instrument Maintenance Schedule
Fourier Transform Infrared Spectrometry (FTIR)[(1)]

Check desiccant every 3 months.
Check KBr window every 3 months.

TABLE 8.11-26
Instrument Maintenance Schedule
Radiological Analysis Equipment[(1)]

Instrument	Items Checked/Service	Minimum Frequency
Alpha Proportional	Check gas flow	Daily
	Clean sample tray	Weekly
	Check bubbler oil level	Monthly
Beta Proportional	Check gas flow	Daily
	Clean sample holders	Weekly
Liquid Scintillation	Clean sample changer	Weekly
	Check condensate trays	Weekly
	Check air filters	Monthly
Quad aß Proportional	Check gas flow	Daily
	Clean sample holders	Weekly
Gamma Spectroscopy	Check LN_2 level	Bi-weekly
	Replace plastic liner	Weekly
Alpha Spectroscopy	Clean sample holder	As needed
	Change vacuum pump oil	Every six months
LIPA	Clean sample changer	Weekly
	Check laser dye performance	Weekly
Benzene Synthesizer	Check gas tubes	Weekly
	Clean instrument	Monthly
Electrolytic Enrichment	Check electrical leads	Monthly
	Clean system	Monthly
Fluorometer	Clean sample holder	Weekly

TABLE 8.11-27
Instrument Maintenance Schedule
Total Organic Carbon Analyzer (OI 7000)

Daily	As Needed	Weekly	Monthly	Semi-Annually
Check: Oxygen supply Persulfate supply Acid supply Carrier gas flow rate (~ 150 cc/min) IR millivolts for stability (after 30 min. warm-up) Reagent reservoirs	Check injection port septum after 50-200 runs. Tube end-fitting connections after 100 hours or use. Indicating drying tube. NDIR zero, after 100 hours of use. Sample pump, after 2000 hours for use. Digestion vessel/condensation chamber, after 2000 hours of use. Permeation tube, after 2000 hours of use. NDIR cell, after 2000 hours of use.	Check liquid-flow-rate-pump-tubing conditions on autosampler Check injection port septum	Clean digestion vessel Clean condenser column Do the leak test	Change pump tubing

Footnotes to Preventive Maintenance Tables

(1) Refer to manufacturer's instructions for each instrument to identify and perform maintenance operations.
(2) Also see Table 8.11-11 for applicable "As Needed" GC maintenance.

TABLE 8.11-28
Instrument Maintenance Schedule
APCI/ESI LC/MS/MS

Daily	As Needed	Semi-annually	Annually
Check helium sparge supply for adequate pressure	Oil autosampler when it is noisy or picking up the tray	Replace rough-pump oil	Replace turbo-pump oil
Check solvent reservoirs for sufficient level of solvent	Change pump seals		Vacuum system components including fans and fan covers
Verify that pump is primed, operating pulse free	Change filters in autosampler		
Check needle wash reservoir for sufficient solvent	Replace column if excessive pressure or poor performance		
Verify capillary heater temperature	Rinse capillary with MeOH		
Verify vaporizer heater temperature	Clear capillary if clogged		
Verify manifold heater temperature	Rinse and clean corona needle		
Verify manifold pressure (~5 x 10-6)	Replace sample inlet tube in APCI (10.1 cm)		
Verify fore-pump pressure (~30 to 200mtorr)	Replace fused silica tube in ESI interface		
Verify rough pump and turbo-pump oil levels	Clean lenses		
Verify nitrogen pressure for auxiliary and sheath gasses	Clean skimmer		
Verify that corona and multiplier are functioning			

TABLE 8.11-29
Instrument Maintenance Schedule
Digestion Block

Annually
Check temperature with NIST thermometer

TABLE 8.11-30
Instrument Maintenance Schedule
Flash Point Tester

Daily	As Needed
Check tubing. Clean sample cup each use.	Check thermometer against NIST thermometer, when used.
Check gas.	
Clean flash assembly	
Check stirrer	

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Appendix A

Quanterra®
Quality Assurance Management Plan

Corporate Key Personnel List and Quanterra® Operations Organizational Chart

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Quanterra®
Corporate Key Personnel List

Associate Name	Title	Degree	Years of Experience
Gerhard F. König	President and CEO	MBA	33
Enos Tracey	Chief Financial Officer	BS, Accounting MBA, Accountancy	14
Elizabeth Counts	Human Resources Manager	MS, Human Resources	9
Mark Matthews	Chief Operating Officer	BA, Accounting	19
Chris M. Lee	Vice President Operations Services	Business/Biology	14
Donnie Heinrich	Senior Vice President of Sales	BS, Chemistry	23
Brad S. Figley	Senior Vice President Legal and Strategy	JD in Law	17
Bill Henning	Director of Information Technology	BA, Sociology MBA, Quantitative Studies	15
Jack Hall	Corporate Director of Quality Assurance	BS, Chemistry	34
Don Dihel	Corporate Director of Environmental Health and Safety	BA, Chemistry	24
Richard Burrows	Technology/Principal Scientist	BS, Chemistry Ph.D., Analytical Chemistry	13

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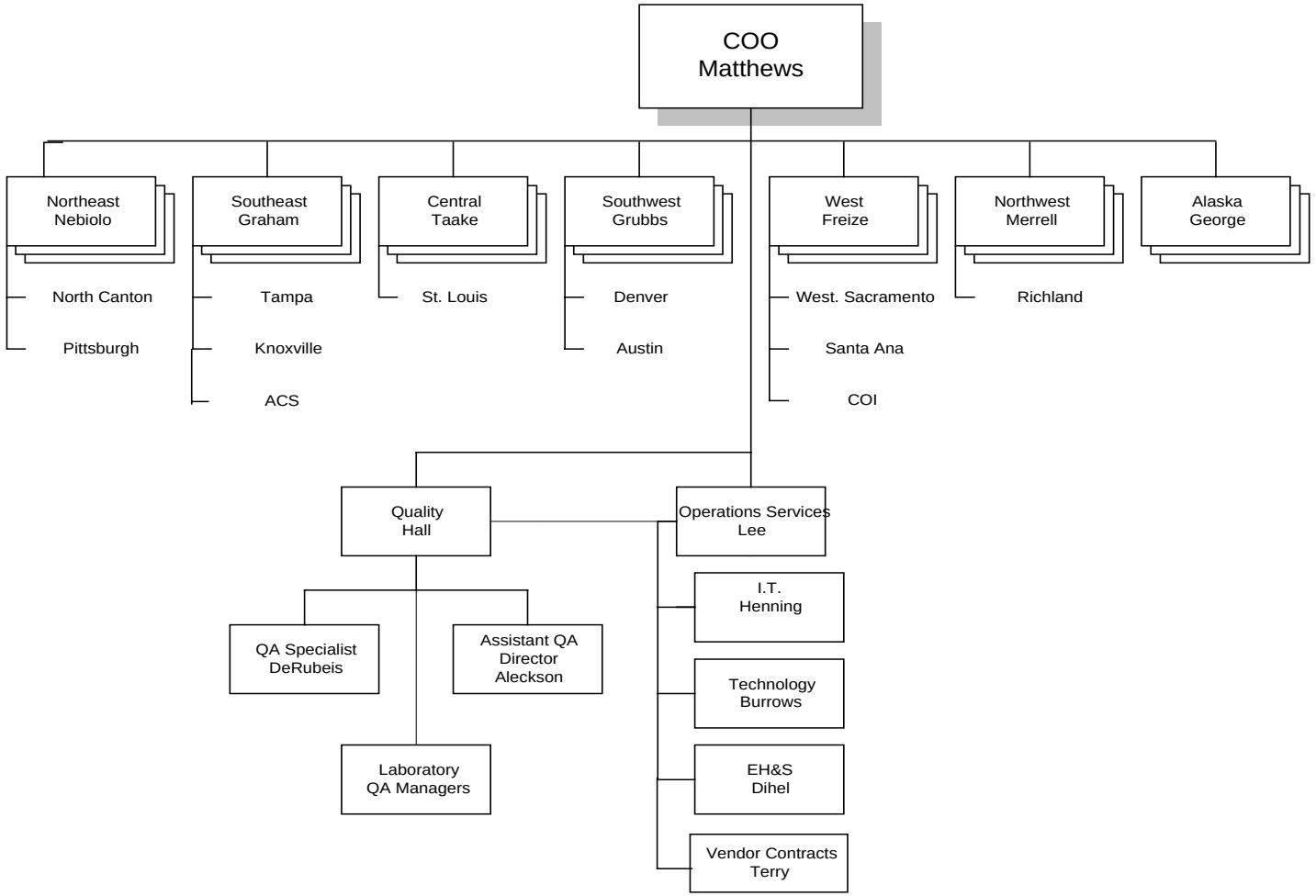
QUANTERRA OPERATIONS ORGANIZATIONAL CHART



as of 10/1/98

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Appendix B

Quanterra®
Quality Assurance Management Plan

Addresses of Quanterra® Locations

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APPENDIX B

ADDRESSES OF Quanterra® LOCATIONS

LABORATORIES

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QAMP Change Form

DOCUMENT: Quality Assurance Management Plan, Revision No. 3
SECTION(S) AFFECTED BY CHANGE: Section 8.5.2, page 58; Appendix B, page 3.
REASON FOR ADDITION OR CHANGE: Section 8.5.2: To clarify the HT requirements and make consistent with Quanterra® Terms and Conditions. Appendix B: To correct area code for North Canton location.
CHANGE EFFECTIVE FROM: February 1, 1999
CHANGE: See attached pages.
SUBMITTED BY/DATE: Chris Rigell, 01/26/99
APPROVED BY:

Mark A. Matthews
Chief Operating Officer

2/1/99
Date

Chris M. Lee
Vice President **of Operations Services**

1/28/99
Date

Jack R. Hall
Corporate **Director of Quality Assurance**

1/26/99
Date

Entire Page
Revised 2/1/99

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CHANGE: See attached pages.
SUBMITTED BY/DATE: Chris Rigell, 01/26/99
APPROVED BY:

Mark A. Matthews
Chief Operating Officer
Date 2/1/99

Chris M. Lee
Vice President **of Operations Services**
Date 1/28/99

Jack R. Hall
Corporate **Director of Quality Assurance**
Date 1/26/99

Revised 2/1/99

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Appendix C

Quanterra®
Quality Assurance Management Plan

Facility-Specific Appendix

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List of Laboratory Locations

This appendix contains facility-specific, quality-related information and requirements for Quanterra® laboratories. These laboratories are located in the following cities:

- Anchorage, Alaska
- Austin, Texas
- City of Industry, California
- Denver, Colorado
- Knoxville, Tennessee
- North Canton, Ohio
- Pittsburgh, Pennsylvania
- Richland, Washington
- Sacramento, California
- Santa Ana, California
- St. Louis, Missouri
- Tampa, Florida

Each laboratory section in this appendix contains information specific to that laboratory only and contains the following basic outline:

Section	Contents
0	Table of Contents
1	Organizational Chart
2	Instrument List
3	Standard Operating Procedures List
4	Analytical Methods
5	MDLs, RLs, and CRDLs
6	Performance Evaluation Studies
7	Additional Operation-Specific Information

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Index

Index (continued)

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Index (continued)

Page/Location

Index (continued)

Page/Location

Index (continued)

Page/Location

Index (continued)

Page/Location

Index (continued)

Page/Location

Index (continued)

Page/Location

Index (continued)

Page/Location

Index (continued)

Page/Location

Index (continued)

Page/Location

Index (continued)

Page/Location

Index (continued)

Page/Location

Index (continued)

Page/Location

Index (continued)

Page/Location

Index (continued)

Page/Location

Index (continued)

Page/Location

Index (continued)

Page/Location

Index (continued)

Page/Location

Index (continued)

Page/Location

Glossary

Glossary (continued)

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Glossary (continued)

acceptance limits

Data quality limits specified for analytical method performance.

accuracy

Accuracy is the degree of agreement between a measurement and the true or expected value, or between the average of a number of measurements and the true or expected value. Systematic errors affect accuracy. For chemical properties, accuracy is expressed either as a percent recovery (R) or as a percent bias (R - 100).

aliquot, aliquant

A measured portion of a sample taken for analysis.

analytical spike

A sample created by spiking target analytes into a prepared portion of a sample just prior to analysis. (Also see matrix spike.)

anomaly

See nonconformance.

areas needing improvement

Represent isolated instances of noncompliance or issues that are judged to have a less immediate impact on data quality. Laboratory management must correct the situation or otherwise ensure that the condition does not recur. This term replaces the previous term used “Observations.”

arithmetic mean

The arithmetic mean ($\bar{x}$) is the average of a set of values. It is equal to the sum of the observed values divided by the number of observations. Also called "average".

where: $\bar{x}$ = the mean

x_i = the i^{th} data value

n = number of data values

$$\bar{x} = \frac{\sum_{i=1}^{n} x}{n}$$

Glossary (continued)

assessment
The evaluation process used to measure the performance or effectiveness of a system and its elements. Assessment is used as an all-inclusive term to denote any of the following: performance, systems, data and compliance audits, management systems reviews, peer reviews, inspections, or spot assessments.

associate
Employee.

audit
A planned and documented investigative evaluation of an item or process to determine its adequacy and effectiveness as well as compliance with established procedures, instructions, drawings, quality management plans, and other applicable documents.

benchmarking
A step-by-step method of improving performance by identifying and studying best practices and comparing them to industry practices.

bias
A systematic (consistent) error in test results. Bias is expressed as the difference between the population mean and the true or reference value, or as estimated from sample statistics, the difference between the sample average and the reference value.

blind performance evaluation sample
A sample either submitted to the laboratory or prepared in the laboratory whereby the concentrations of parameters of concern are known by the preparer and not by the laboratory.

calibration
Establishment of a relationship between various calibration standards and the measurements of them obtained by a measurement system, or portions thereof. The levels of the calibration standard should bracket the range of levels at which actual measurements are to be made. Calibration is also the act of making a scheduled comparison of instrument performance against national standards for

Glossary (continued)

instruments which measure physical parameters such as mass, time, and temperature. This type of calibration is independent of use in specific analyses and projects.

calibration curve
The graphical relationship between the known values for a series of calibration standards and instrument responses.

calibration factor (CF)
The ratio of the instrument response of an analyte to the amount injected. CFs are used in external standard calibrations.

$$CF = \frac{Total\ Area\ of\ Peak}{Mass\ Injected}$$

calibration standard
A standard used to quantitate the relationship between the output of a sensor and a property to be measured. Calibration standards should be traceable to standard reference materials (provided by NIST, or other recognized standards agencies) or a primary standard.

Certificate of Analysis
The standard Quanterra® format for reporting analytical results.

certified reference material
A reference material accompanied by a certificate issued by an organization certifying the contents and concentration(s) of the material. (See also standard reference material.)

chain-of-custody (COC)
A system of documentation demonstrating the physical custody and traceability of samples.

Glossary (continued)

check standard analyses

A standard (often a midpoint standard) analyzed at a frequency specified in the method or in a SOP to verify the continuing calibration of the standard curve.

client

Any individual or organization for whom items or services are furnished or work is performed in response to defined requirements and expectations.

client sample

The material or collection media submitted to the laboratory for analysis. Field QC samples are considered client samples but laboratory QC samples are not counted as client samples when counting samples for QC batches.

coefficient of variation (relative standard deviation)

A measure of precision (relative dispersion). It is equal to the standard deviation (s) divided by the mean ($\bar{x}$) and multiplied by 100 to give a percentage value.

$$CV\ (RSD) = \left(\frac{s}{\bar{x}}\right) x\ 100$$

collocated samples

Independent samples collected in such a manner that they are equally representative of the variable(s) of interest at a given point in space and time. The results will indicate sampling as well as analytical variability.

comparability

Comparability is a measure of the confidence with which one data set can be compared to another. To ensure comparability, all laboratory analysts are required to use uniform procedures (i.e., SOPs) and a uniform set of units and calculations for analyzing and reporting environmental data.

Glossary (continued)

completeness

Completeness is a measure of the percentage of measurements that are judged to be valid measurements. At a minimum, the objective for completeness of data is 90% for each constituent analyzed. It is usually expressed as a percentage:

$$\% \ Completeness = \frac{V}{n} \ x \ 100$$

where: V = number of measurements judged valid
n = total number of measurements

composite

A sample composed of two or more increments.

control chart

A graphical representation of analytical accuracy. Displays the arithmetic mean of a data set, the upper and lower warning limits and the upper and lower control limits.

control table

A tabular presentation of test results with respect to time or sequence of measurement, together with limits within which the results are expected to lie when the analytical process is in a state of control.

controlled document

A document for which the distribution is known. Updates of the document are sent to the original recipients, unless the copy distributed is an uncontrolled copy.

corrective action

A measure taken to rectify conditions adverse to quality and, where necessary, to preclude their recurrence.

Glossary (continued)

correlation coefficient

The correlation coefficient (r) is a determination of how closely data "fits" a straight line. It is a number between -1 and 1 that indicates the degree of linear relationship between two sets of numbers. A correlation coefficient of +1 (usually calculated to three decimal places or 1.000) means the data falls exactly on a straight line with positive slope. A correlation coefficient of -1 (or -1.000) means the data falls exactly on a straight line with negative slope.

customer

See client.

data quality objective (DQO)

Data quality objectives (DQOs) are qualitative and quantitative statements used to ensure the generation of the type, quantity, and quality of environmental data that will be appropriate for the intended application (EPA 1994). Typically, DQOs are identified during project scope and development of sampling and analysis plans. In this QA manual, however, we refer to only the analytical DQOs because laboratories generally do not have any authority over sample collection, shipment, or other field-related activities that may affect the data quality of the environmental sample before the sample is received in the laboratory. EPA has established six primary analytical DQOs for environmental studies: precision, accuracy, representativeness, completeness, comparability, and detectability.

The components of analytical variability (uncertainty) can be estimated when QA and QC samples of the right types and quantities are incorporated into measurement procedures at the analytical laboratory. Quanterra incorporates numerous QA and QC samples to obtain data for comparison with the analytical DQOs and to ensure that the measurement system is functioning properly. The QA and QC samples and their applications, described in Section 8.4 and are selected on the basis of method- or client-specific requirements. Field blanks, field duplicates, and performance evaluation (PE) samples are received from the client as unknown samples. Analytical laboratory QC samples for inorganic, organic, and radionuclide analyses may include calibration or instrument blanks, method blanks, background, duplicates, replicates, laboratory control samples (LCSs), calibration standards, matrix spikes (MSs), matrix spike duplicates (MSDs), surrogate spikes, and yield tracers.

Glossary (continued)

data validation
See validation - data.

data verification
See verification - data.

deficiency
See nonconformance or finding.

degrees of freedom
The number of independent deviations used in calculating an estimate of the standard deviation.

double blind performance evaluation sample
A sample that contains select parameters at defined levels. The levels are unknown to the laboratory. The laboratory is also unaware that the sample is a performance evaluation sample.

duplicate sample analyses
Different aliquots of the same sample are analyzed to evaluate the precision of an analysis.

error
The difference between an observed or measured value and its true value.

field blank
A blank that is prepared and handled in the field and analyzed in the same manner as its corresponding client samples.

field matrix spike
A sample created by spiking target analytes into a sample in the field at the point of sample acquisition.

Glossary (continued)

finding

Noncompliant practices or policies which have significant adverse impact on data quality, technical defensibility, or regulatory acceptance of data. Findings require immediate attention by the laboratory management and must be resolved to comply with Quanterra®'s quality documents and laboratory-established procedures often called deficiencies by auditors.

geometric mean

The n^{th} root of the product of all values in a set of n values or the antilogarithm of the arithmetic mean of the logarithms of all the values of a set of n values. The geometric mean is generally used when the logarithms of a set of values are nearly normally (Gaussian) distributed, such as is the case of much population data.

initial calibration

Analysis of a series of analytical standards at different specified concentrations; used to define the linearity and dynamic range of the response of an instrument to the target compounds prior to the analysis of samples.

inspection

Examination or measurement of an item or activity to verify conformance to specific requirements.

instrument detection limit (IDL)

The smallest concentration or amount an instrument can reliably detect.

internal standard (IS)

A compound added to every standard, QC sample, client sample, or sample extract at a known concentration prior to analysis for the purpose of quantitation. For example, internal standards are used as the basis for quantitation of the target compounds by GC/MS.

linear regression

A statistical method for finding a straight line that best fits a set of two or more data points, thus providing a relationship between two or more variables.

Glossary (continued)

matrix
The component or substrate which contains the analyte(s) of interest. Examples of matrices are water, soil or sediment, and air. Matrix is not synonymous with phase (liquid or solid).

matrix effect
An interference in the measurement of analyte(s) in a sample that is caused by materials in the sample. Matrix effects may cause elevated reporting limits or may prevent the acquisition of acceptable results.

matrix spike (MS)
An aliquot of a matrix fortified (spiked) with known quantities of specific compounds and subjected to an entire analytical procedure in order to indicate the appropriateness of the method for a particular matrix. The percent recovery for the respective compound(s) is then calculated.

matrix spike duplicate (MSD)
A second aliquot of the same matrix as the matrix spike (above) that is spiked in order to determine the precision of the method.

may
Denotes permission but not a requirement.

mean
See arithmetic mean.

measurement
The process or operation of ascertaining the extent, degree, quantity, dimensions, or capability with respect to a standard.

median
The middle value of a set of data when the data set is ranked in increasing or decreasing order.

Glossary (continued)

method
An assemblage of techniques.

method blank (MB)
An analytical control consisting of all reagents, which may include internal standards and surrogate standards, that is carried through the entire analytical procedure. The method blank is used to define the level of laboratory background contamination. Examples of method blanks are a volume of deionized or distilled laboratory water for water samples, a purified solid matrix for soil/sediment samples, or a generated zero air.

method detection limit (MDL)
The minimum concentration of an analyte that, in a given matrix and with a specific method, can be identified, measured, and reported with 99% confidence that the analyte concentration is greater than zero. The MDL is operationally defined as:

$$MDL = st_{(n-1,\ \alpha=0.99)}$$

where:

s = the standard deviation of a number of measurements of a blind or sample matrix containing the analyte at a concentration near the lowest standard recommended in the method and

$t_{(n-1,\ \alpha=0.99)}$ = the student's value for a one-sided t-statistic appropriate for the number of samples used to determine (s), at the 99% confidence level and n-1 degrees of freedom.

modified method
A standard or reference method which has been changed to meet project or matrix requirements.

must
Denotes a requirement is mandatory and has to be met.

Glossary (continued)

notable practices

Laboratory practices that increase effectiveness and quality and represent improvements with respect to conventional laboratory operations.

nonconformance

An unplanned deviation from an established protocol or plan. The deviation may be the result of Quanterra's® actions, then termed a deficiency. If the deviation is the result of events beyond the control of Quanterra®, it is termed an anomaly.

operational calibration

Routinely performed as part of instrument usage, such as the development of a standard calibration curve. Operational calibration is generally performed for instrument systems.

outlier

A result excluded from the statistical calculations due to being deemed "suspicious" when applying the "Grubbs Test" (or equivalent).

parameter

A constant or coefficient that describes some characteristic of a population (e.g., standard deviation, mean, regression coefficients). Also, a chemical being measured, i.e., an analyte.

percent difference

When two independent measurements of the same characteristics are available, it is possible to use the percent difference instead of the coefficient of variation to measure precision.

$$\%D = \left| \frac{X_1 - X_2}{X_1} \right| x\ 100\%$$

where: $\%D$ = percent difference
X_1 = first value
X_2 = second value

Glossary (continued)

percent recovery
A measure of accuracy determined from the comparison of a reported spike value to its true spike concentration.

$$\%R = \frac{\textit{observed conc. - sample conc.}}{\textit{true spike conc.}} \textit{ x 100\%}$$

performance audit
See performance evaluation.

performance evaluation (PE)
A type of audit in which a known or characterized value is compared to the result obtained through the routine analysis of the sample in the laboratory to evaluate the proficiency of an analyst or laboratory.

periodic calibration
A calibration that is performed at prescribed intervals for equipment such as balances, thermometers, and balance weights. In general, they are performed on equipment that are distinct, singular purpose units, and are relatively stable in performance.

population
A generic term denoting any finite or infinite collection of individual things, objects, or events.

practical quantitation limit (PQL)
The lowest concentration a method can reliably achieve within limits of precision and accuracy and is derived from empirical, matrix-free method performance studies.

precision
Precision is an estimate of variability, that is, it is an estimate of agreement among individual measurements of the same physical or chemical property, under prescribed similar conditions. The precision of a measurement system is affected by random errors. Precision is expressed either as

Glossary (continued)

relative standard deviation (RSD) for replicate measurements greater than two or as relative percent difference (RPD) for duplicate measurements. Table 8.6-1 illustrates the formulae used to calculate units of precision (i.e., RSD and RPD).

preventive maintenance
An organized program within Quanterra® laboratories of actions (such as equipment cleaning, lubricating, reconditioning, adjustment and/or testing) taken to maintain proper instrument and equipment performance and to prevent instruments and equipment from failing during use.

primary standard
A material having a known, stable property that can be accurately measured or derived from established physical or chemical constants. It is readily reproducible and can be accepted (within stated limits) and used to establish the same value of another substance or item.

procedure
Detailed instructions to permit replication of a method. (See standard operating procedure.)

proficiency testing
A series of planned tests which will determine the ability of field technicians or laboratory analysts to perform routine analyses. The results from this testing may be used for comparison against established criteria or for relative comparisons among the data from a group of technicians or analysts.

project-specific reporting limit (PSRL)
See reporting limit.

protocol
Methodology specified in regulatory, authoritative, or contractual situations.

QC batch
The QC batch consists of a set of up to 20 field samples that behave similarly (i.e., same matrix) and are processed using the same procedures, reagents, and standards within the same time period.

Glossary (continued)

QC check sample
A reference matrix containing known concentrations of parameters of interest. If prepared in the laboratory, it is made using stock standard solutions independent of those used for calibration. If the results of these parameters do not meet acceptance criteria, corrective actions are taken.

qualification (personnel)
The characteristics of abilities gained through education, training, or experience, as measured against established requirements, such as standards or tests, that qualify an individual to perform a required function.

quality
The sum of features and properties/characteristics of a process, item, or service that bears on its ability to meet the stated needs of the user. Quanterra® has defined quality as meeting the needs of our clients, both internal and external.

quality assurance (QA)
An integrated system of management activities involving planning, implementation, assessment, reporting, and quality improvement to ensure that a process, item, or service is of the type and quality needed and expected by the customer.

Quality Assurance Directive
QA directives are memos issued by the QA Director (or the QA Managers for their facility) to clarify policies, Procedures, and the QAMP; or to give direction for an immediate action to ensure or maintain quality.

Quality Assurance Management Plan (QAMP)
The Quality Assurance Management Plan for Environmental Analyses (QAMP) is a formal document that describes quality systems in terms of organizational structure, functional responsibilities of management, and staff, and lines of authority. The QAMP documents the QMS and describes both the organizational and project-specific principles, goals, controls, and tools of

Glossary (continued)

the QMS. The QAMP provides the criteria and specifications for the generation of environmental analytical data.

Quality Assurance Project or Program Plan (QAPP)

A formal document describing in comprehensive detail the necessary QA, QC, and other technical activities that must be implemented to ensure the results of the work performed will satisfy the stated performance criteria.

quality control (QC)

The overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that it meets the stated requirements established by the client or by Quanterra®.

quality improvement

The process of improving the quality of operations. This process encourages worker recommendations for improvement of work processes and requires timely management evaluation and feedback or implementation.

quality management

That aspect of the overall management system of the organization that determines and implements the quality policy. Quality management includes strategic planning, allocation of resources, and other systematic activities (e.g., planning, implementation, and assessment) pertaining to the quality management system.

quality management system (QMS)

A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, and implementation plan of an organization for ensuring quality in its work processes, products, and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA and QC.

random error

Variations of repeated measurements that are random in nature and individually not predictable.

Glossary (continued)

range
The difference between the largest and smallest numbers in a set of numbers.

raw data
All documentation associated with the original recording of analytical results pertinent to a specific sample or set of samples. This may include laboratory worksheets, calculation forms, instrument-generated output, analyst notes, etc., from sample receipt through final reporting.

reagent water
Water in which an interferant is not observed at or above the minimum quantitation limit of the parameters of interest. The reagent water's purity and acceptability is verified by analysis with each set of samples.

recovery
See percent recovery.

reference method
A method of known and demonstrated accuracy.

regression coefficients
The quantities describing the slope and intercept of a regression line.

relative error
An error expressed as a percentage of the true value or accepted reference value.

relative percent different (RPD)
Statistic for evaluating the precision of a replicate set. For replicate results:

Glossary (continued)

$$RPD = \left[\frac{|X_1 - X_2|}{\left(\frac{X_1 + X_2}{2} \right)} \right] x\ 100$$

where: X_1 = first observed concentration
X_2 = second observed concentration

relative response factor (RRF)
A measure of the relative mass spectral response of a compound compared to its internal standard. RRFs are determined by analysis of standards and are used in the calculation of concentrations of analytes in samples. Because a RRF is the comparison of two responses, it is a unitless number. RRFs are determined by the following equation:

$$RRF = \frac{A_x}{A_{IS}} x \frac{C_{IS}}{C_x}$$

where: A = area of the characteristic ion measured
C = concentration
IS = internal standard
x = analyte of interest

relative standard deviation (RSD)
See coefficient of variation.

reporting limit (RL)
One of two types of reporting limit conventions within Quanterra®. The Reporting Limit (RL) is a uniform, Quanterra® -wide reporting limit based on an evaluation of the PQLs at Quanterra® laboratories and the expected method performance in routine water and soil matrices. Project Specific Reporting Limits (PSRLs) are reporting limits that are defined by project requirements.

Glossary (continued)

representative sample
A sample taken to represent a lot or population as accurately and precisely as possible.

representativeness
Representativeness is the degree to which data accurately and precisely represent a characteristic of a population, a variation in a physical or chemical property at a sampling point, or an environmental condition. Data representativeness is primarily a function of sampling strategy; therefore, the sampling scheme must be designed to maximize representativeness. Representativeness also relates to ensuring that, through sample homogeneity, the sample analysis result (concentration) is representative of the constituent concentration in the sample matrix. At each Quanterra laboratory, every effort must be made to analyze an aliquot that is representative of the original sample, and to ensure the homogeneity of the sample before subsampling.

reproducibility
The precision, usually expressed as a standard deviation, measuring the variability among results of measurements of the same sample at different laboratories.

response factor (RF)
A factor derived from the calibration of a compound that is used in the quantitation calculation of sample analytes. A response factor may be derived from an external standard calibration (then called a Calibration Factor) or from an internal standard calibration (then called a Relative Response Factor).

secondary standard
A material having a property that is calibrated against a primary standard.

self assessment
Assessments of work conducted by individuals, groups, or organizations directly responsible for overseeing or performing the work.

shall

Glossary (continued)

Denotes a requirement that is mandatory and has to be met.

should

Denotes a guideline or recommendation.

standard addition

The procedure of adding known increments of the analyte of interest to a sample to cause increases in detection response to subsequently establish, by extrapolation of the plotted responses, the level of the analyte of interest present in the original sample.

standard deviation

A measure of the dispersion about the mean of the elements in a population. The square root of the variance of a set of values:

$$s = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}}$$

where: s = standard deviation
Σ = sum of
X = observed values
n = number of observations

standardization

The establishment of the value of a potential standard with respect to an established or known standard.

standard method

A method of known and demonstrated precision issued by an organization generally recognized as competent to do so.

standard operating procedure (SOP)

Glossary (continued)

A written document that details an operation, analysis, or action, with prescribed techniques and steps, that is officially approved as the method for performing certain routine or repetitive tasks.

standard reference material (SRM)
A material produced in quantity, of which certain properties have been certified by the National Institute of Standards and Technology (NIST), formerly NBS, or other agencies to the extent possible to satisfy its intended use.

standard verification
Standard is checked by Quanterra® or the vendor versus a known specification. See Section 8.5.4.3.

statistic
A constant or coefficient that describes some characteristic of a sample. Statistics are used to estimate parameters of populations.

stock solution
A concentrated solution of analyte(s) or reagent(s) prepared and verified by prescribed procedure(s), and used for preparing working standards or standard solutions.

subsample
A portion taken from a sample. A laboratory sample may be a subsample of a gross sample; similarly, a test portion may be a subsample of a laboratory sample.

supplier
See vendor.

surrogate (surrogate standard)
Compounds, when required by a method, that are used added to every blank, sample, LCS, matrix spike, matrix spike duplicate, and standard. They are used to evaluate analytical efficiency by

Glossary (continued)

measuring recovery. Surrogates include brominated, fluorinated, or isotopically-labeled compounds that are not expected to be detected in environmental media.

systematic error

The condition of a consistent deviation of the results of a measurement process from the reference or known level.

systems audit or evaluation

A systematic on-site qualitative review of facilities, procedures, equipment, training, record keeping, data verification, and reporting aspects of a quality assurance system to arrive at a measure of the capability of the system. Within Quanterra®, system audits or evaluations are performed on a periodic basis under the direction of the Quanterra® Corporate Director of Quality Assurance.

technique

Physical or chemical principle for characterizing materials of chemical systems.

traceability of data

The entire documented chain of acquired data from the original acquisition effort through to the final tabulation, synthesis, reduction, and storage activities. The documentation will allow complete reconstruction of the data.

traceability of samples

During all environmental monitoring field efforts, acquired samples will be assigned specific and unique identification numbers. These sample numbers shall be accompanied by documentation (chain-of-custody form) which clearly identifies all parameters associated with sample acquisition. All additional sample numbering systems applied to the sample must be clearly cross-referenced to the field sample number to provide for traceability of samples from acquisition to reporting of sample results.

traceability of standards

The ability of an analytical standard material used for calibration purposes to be traced to its source. The standards used by Quanterra® must be traceable via written documentation to sources which

Glossary (continued)

produce or sell verified or certified standards, i.e., National Institute for Standards and Technology, or vendors preparing standards from those sources which they have certified.

validation - computer software
The process of establishing documented evidence which provides a high degree of assurance that a specific process will consistently produce a product meeting predetermined specifications and quality attributes. This process demonstrates and documents that the software performs correctly and meets all specified requirements.

validation - data
The process of a second party performing a systematic review of the raw and final data produced by a laboratory using predetermined criteria to ascertain the validity of the data with respect to the criteria (e.g., HAZWRAP data validation).

vendor
Any individual or organization furnishing items or services or performing work according to a procurement document. This is an all-inclusive term used in place of any of the following: supplier, seller, contractor, subcontractor, or consultant.

verification - computer software
The process of checking the accuracy of manually entered or automatically (electronically) calculated information.

verification - data
The process of reviewing data to ensure that data reduction has been correctly performed and that analytical results to be reported correspond to the data acquired and processed.