SITE-SPECIFIC SAMPLING AND ANALYSIS PLAN
PHASE II ENVIRONMENTAL PROPERTY ASSESSMENT
EAST LIBERTY PETROLEUM
812 PENN CIRCLE NORTH
PITTSBURGH, PENNSYLVANIA 15206

Prepared for:

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Site-Specific Sampling and Analysis Plan
Phase II Environmental Property Assessment
East Liberty Petroleum
812 Penn Circle North
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INTRODUCTION

This Site-specific Sampling and Analysis Plan (SAP) has been prepared on behalf of North Side Industrial Development Company (NSIDC) to define the scope of a Phase II Environmental Site Assessment (ESA) for the East Liberty Petroleum parcel ("Property") located at 812 Penn Circle North in Pittsburgh, Allegheny County, Pennsylvania. The Property encompasses a total of approximately 0.81 acre of vacant land. Figure 1 identifies the Property location on a U.S. Geological Survey Quadrangle map.

This Site-specific SAP serves as a companion document to the *Northside Industrial Development Company, Inc. Programmatic Quality Assurance Project Plan (QAPP), Phase I and Phase II Environmental Property Assessments, Multiple Properties, Allegheny and Beaver Counties, Pennsylvania,* (KU Resources, Inc., December 2014) previously approved by the U.S. Environmental Protection Agency (U.S. EPA). This Site-specific SAP identifies the specific procedures to be followed during the implementation of the Phase II ESA activities to facilitate the production of representative and valid data.

In accordance with the programmatic QAPP, the format of this Site-specific SAP is consistent with the *U.S. EPA Region III Site-Specific Sampling and Analysis Plan Template, Draft Interim Final,* dated August 1999. Pursuant to this guidance document, the following technical elements are included within this SAP:

- Project Management (Sections A.1 through A.4);
- Measurement/Data Acquisition (Sections B.1 through B.4);
- Assessment and Oversight (Sections C.1 through C.2); and
- Data Validation and Usability (Section D).

Standard Operating Procedures (SOPs) for Phase II ESA field investigations are presented as Attachment A, and are reproduced from the previously approved programmatic QAPP. The Phase II activities will be conducted in accordance with a Site-specific health and safety plan (HASP) and will follow in general accordance with the ASTM International (ASTM) Standards (ASTM, 2011).

A. PROJECT MANAGEMENT

A.1 Property Information/Background

A.1.1 Background/Objectives

The Property was identified by NSIDC as a brownfields site with both viable redevelopment potential and some degree of potential environmental concerns, which warranted assessment. The Property is being taken through Pennsylvania's Land Recycling and Environmental Remediation Standards Act Liability Release (Act 2) program in anticipation of future development.

In September 2015, KU Resources, Inc. (KU Resources) performed a Phase I ESA on the Property as the first step in investigating the Property. As discussed further in Section A.1.2, the Phase I ESA report identified several recognized environmental conditions (RECs) and potential areas of environmental concern associated with the Property which warrant further evaluation.

The objective of this SAP is to characterize the soil, groundwater, and soil gas on the Property, via an intrusive sampling and analysis program.

A.1.2 Relevant Property Characteristics

A.1.2.1 Current Uses of the Property

The Property is recorded in the Allegheny County Tax Assessment as Parcel Number 83-P-60. The Property is currently vacant and is situated on the northwest corner of Penn Circle in a commercial area. The Property is relatively flat, sloping slightly southeast toward a vacant parking lot. The Property is bordered to the north and west by Penn Circle, to the east and southeast by a parking lot, and to the south by a vacant office building and its associated parking lot.

Figure 2 provides a map of the Property layout. No structures are located on the Property and it is covered by paved asphalt. A sidewalk and stone wall, approximately two feet in height, border the property on the north and west sides. Access to the Property is available through two entrances on Penn Circle North, one entrance on Penn Circle West, and through the south adjacent parking lot accessible via Penn Circle West and Ansley Street. The nearest surface water (Negley Run) is approximately ½ mile to the northeast of the Property.

A.1.2.2 Past Uses of the Property

Review of historical maps indicates that the Property was used for residential purposes from circa 1872 to circa 1969. From circa 1968 to circa 1989, a gasoline filling station was present on the property (Figures 3 and 4). From circa 1988 to the present, the Property has been used as a parking lot or vacant land. It is currently unknown whether any USTs were closed or removed from the Property.

A.1.2.3 Current and Past Uses of Adjoining Properties

The below table represents a summary of the historical uses of the adjoining properties through a review of the historical maps:

Year	Property (Parcel 83-P-60)	North Adjacent (Multiple Parcels)	East & South Adjacent (Parcel 83-P-225)	South Adjacent (Parcel 83-P-165)	West Adjacent (Parcel 83-P-297)
Current	Vacant Parking Lot	Residential Structures	Parking Lot	Office Building & Parking Lot	Public Park
1995	Parking Lot	Similar	Similar	Similar	Similar
1988	Gasoline Filling Station	Similar	Similar	Similar	Similar
1979	Similar	Residential & Light Commercial Structures	Similar	Similar	Similar
1969	Similar	Similar	Similar	Vacant Lot	Similar
1967	Vacant Lot	Similar	Similar	Similar	Similar
1956	Residential Structures	Similar	Residential Structures	Church and Residential Structures	Residential Structures
1950	Similar	Similar	Similar	Similar	Similar
1927	Similar	Similar	Similar	Church, Residential and Light Commercial Structures	Similar
1905	Similar	Residential Structures	Similar	Similar	Similar
1893	Similar	Similar	Similar	Similar	Similar
1884	N/A	N/A	N/A	Lumberyard and Planing Mill	N/A
1882	Vacant Lot	Vacant Lot	Vacant Lot	Similar	Similar

A.1.2.4 Past Remediation of the Property

2001 Phase I ESA Report by Michael Baker Jr., Inc.

A Phase I ESA was performed in 2001 for the entirety of Penn Circle, which encompasses the Property (Baker, 2001). This Phase I revealed that the Property was previously a service station, constructed in 1968 and closed on either November 4, 1988 or March 30, 1989. According to information from the Urban Redevelopment Authority (URA), the service station was a Gulf Oil Corporation facility in 1967 and an out-of-service Boron service station in 1986. According to the database search, the service station was owned by Sohio Oil Company, listed as Site #57656, and identified as a small-quantity generator of RCRA hazardous waste. A formal request for information to the appropriate departments within BP was submitted, but a response was not received before completion of the ESA.

2015 Phase I ESA Report by KU Resources, Inc.

KU Resources noted the presence of the following RECs in connection with the East Liberty Petroleum property (portions of the Property):

- The past automotive filling and service use of the Property from circa 1968 to circa 1989 represents a REC on the Property.
- The historical use of upgradient, nearby property to the south as a lumberyard and planing mill represents a REC on the Property.
- The historical presence of 16 automotive stations on nearby, upgradient properties represents RECs on the Property.
- The historical presence of 14 dry cleaning facilities on nearby, upgradient properties represents RECs on the Property.

A Phase II ESA was recommended to determine if any of the RECs identified had resulted in significant impacts to these properties. There is no available information indicating that any remediation activities have been completed at the Property to date.

A.1.2.5 Physical Setting Sources

Please refer to Figure 1 that illustrates the location of the Property on a U.S. Geological Survey (USGS) 7.5-minute topographic map. The Property is situated at an elevation of approximately 912 feet above mean sea level.

Property Geology

The Pittsburgh area is located physiographically within the Appalachian Plateau Province. Bedrock underlying the site area belongs to the Casselman Formation of the Conemaugh Group and is Pennsylvanian in age. This formation consists of cyclic sequences of sandstone, shale, limestone, and thin, non-persistent coal. The Highland Park area is situated at higher elevations than surrounding areas. The contrast in topography between East Liberty and the Highland Park area is characteristic of ancient river terrace deposits. A preglacial Monongahela River channel has been mapped in the East Liberty area. Layers of silt and sand were deposited within the abandoned river channel. Geologic maps reviewed indicate that the Property is underlain by terrace deposits resting on top of the bedrock. The terrace deposits can attain thicknesses of 20-25 feet in some locations; however, the average thickness is much less – on the order of several feet or not present at all.

Soils and Unconsolidated Materials

According to the U.S. Soil Survey map published for Allegheny County, only the Urban land-Rainsboro complex, gently sloping (URB) soil type was identified at the Property. Urban land includes soil that has been disturbed or reworked to develop a parcel and may consist of on-site material or fill material brought onto the parcels for construction purposes.

Groundwater

Groundwater beneath the Property is most likely present in a shallow zone defined at the soil/bedrock interface, and in deeper zone(s) situated in the underlying bedrock units. The first water-bearing zone most likely is a result of the downward percolation of surface water. Precipitation migrates vertically through the permeable soil zone and, upon reaching the relatively impermeable layers, begins to move laterally. In this area, the first water-bearing zone is typically located at the soil-bedrock interface and the flow direction typically mimics the surface topography. Fluctuations in precipitation, depth to bedrock, and buried man-made structures can influence the depth and flow direction of the shallow zone.

Bedrock beneath the Property may also be a source of groundwater. The dip of the bedrock, localized fractures, heterogeneous composition of bedrock, and lateral/vertical variability of bedrock can influence groundwater flow and characteristics. The actual characteristics of groundwater flow can only be determined through the installation of monitoring wells.

Based on area topography and the vicinity of the Site in relation to the Allegheny River, the inferred direction of a sustained groundwater flow is north. The EDR AQUIFLOW Information System identified a depth to the water table greater than 5 feet within a half mile of the Property.

A.1.2.6 Conclusions of the Past Activities

The 2001 Phase I ESA revealed that the Property was previously a service station, constructed in 1968 and closed on either November 4, 1988 or March 30, 1989. According to information from the URA, the service station was a Gulf Oil Corporation facility in 1967 and an out-of-service Boron service station in 1986. According to the database search, the service station was owned by Sohio Oil Company, listed as Site #57656, and identified as a small-quantity generator of RCRA hazardous waste. A formal request for information to the appropriate departments within BP was submitted, but a response was not received before completion of the ESA.

The 2015 Phase I ESA report by KU Resources identified the following RECs in connection with the Property parcels:

- The past automotive filling and service use of the Property from circa 1968 to circa 1989 represents a REC on the Property.

- The historical use of upgradient, nearby property to the south as a lumberyard and planing mill represents a REC on the Property.

- The historical presence of 16 automotive stations on nearby, upgradient properties represent RECs on the Property.

- The historical presence of 14 dry cleaning facilities on nearby, upgradient properties represent RECs on the Property.

A Phase II ESA was recommended to determine if any of the RECs identified had resulted in significant impacts to these properties.

Section A.2 of this SAP provides the general description of the overall Phase II ESA activities proposed to assess the environmental status of the Property. Specific sample design and methodology is provided in Section B, Measurement/Data Acquisition.

A.2 Project Description

A.2.1 Description of Work to be Performed

Based on the findings of the 2001 and 2015 Phase I ESA reports, the Phase II ESA SAP activities will include the following primary components:

- Three test trenches will be excavated in an attempt to determine if USTs and associated piping are present at the Property.

- A soil quality assessment will be performed at various locations through soil sampling conducted during installation of soil borings, and the collection of surface and subsurface soil samples.

- A groundwater quality assessment will be performed through the installation, development, and sampling of permanent groundwater monitoring wells situated at strategic locations throughout the Property. The monitoring wells will be located to assess specific RECs, as well as the environmental quality conditions of the overall Property.

- A soil gas survey will be performed through the installation of vapor extraction wells to collect soil gas samples to assess possible vapor intrusion pathways.

Specific sample design and methodology is provided within Section B of this Site-specific SAP.

A.2.2 Applicable or Relevant and Appropriate Requirements

The primary Applicable or Relevant and Appropriate Requirement for brownfield site assessments in Pennsylvania is the Pennsylvania Land Recycling and Environmental Remediation Standards Act. This voluntary state regulatory program, commonly referred to as Pennsylvania's Act 2, was developed to address the environmental problems associated with unused and abandoned industrial properties within the Commonwealth. Act 2 was enacted in May of 1995 and provides for the following:

- The Recycling of Existing Industrial and Commercial Properties
  - Minimizes Greenfield Development
  - Promotes the Reuse of Properties in Economically Impacted Areas
- Defines Cleanup Liability
  - Sets Obtainable Standards Protective of the Environment
  - Promotes Voluntary Cleanup Activity
- Establishes a Framework for Remediation Standards
  - Property Cleanup Based on Actual Risk
  - Development of Numeric Requirements
  - Provides Clear Predictable Standards
- Establishes the Industrial Properties Cleanup Fund
  - An Aid to Redevelopment Interests
- Provides a Mechanism to Obtain a Release of Liability for Environmental Conditions on Real Estate

The Act 2 regulations were enacted in August 1997 and were updated in 2011. The regulations provide the regulatory framework under which the procurement of Act 2 liability protection can be obtained. The Act 2 Technical Guidance Manual was issued in December 1997 and updated in December 2001 to assist in the interpretation of the rules and regulations, and to establish Pennsylvania Department of Environmental Protection (PADEP) policy regarding subjective issues. As a result of these documents, a formal process of submittals, notices, and procedures has been established. A summary of the primary elements of the Act 2 process are as follows:

1. Public Notice
   - Publish a Notice of Intent to Remediate in local newspaper.
   - Notify local government of Intent to Remediate.

2. Remedial Investigation
   - Includes an environmental assessment that may be detailed in a Work Plan submitted to and approved by the PADEP.
   - Intended to determine the nature and extent of contamination.
   - Used to determine which one of three available Act 2 standards will be achieved:
     - Site-Specific Standard
     - Statewide Health Standard
     - Background Standard
   - Results in a report that documents the findings of the Remedial Investigation.

3. Cleanup Activities/Risk Assessment (as applicable)

- As warranted, cleanup and/or risk assessment activities may be warranted to attain the selected Act 2 standard. Cleanup and/or risk assessment activities are then documented in a report submitted to the PADEP.

4. Final Report
   - Report intended to document the attainment of an Act 2 Standard.
   - Attainment of an Act 2 Standard provides the cleanup liability protection. A letter from the PADEP is issued documenting its concurrence with the attainment demonstration in the Final Report.

Act 2 is a voluntary program which is utilized by property owners and other stakeholders in cases where they seek to obtain the liability protection available under the Act 2 program. The decision whether to enter the property into the Act 2 program will be made at a future date, in consultation with the various stakeholders.

The sampling and analysis program identified within this SAP has been prepared based upon the general Act 2 program requirements, to facilitate possible entry of the Property into the Act 2 program at a future date. However, depending on the results of the proposed sampling program contained herein, additional sampling and analysis of certain environmental media may be needed to satisfy the Property characterization requirements of Act 2.

A.2.3 Proposed Action Levels

The analytical results of the sampling and analysis programs for groundwater and soil will be compared against the tabulated Pennsylvania Act 2 medium-specific concentrations (MSCs) for preliminary screening purposes. The Act 2 MSC tables consider multiple site characteristics and end-use scenarios (e.g., used aquifer versus non-use aquifer, residential site versus non-residential site, etc.). The analytical data will be compared to the residential scenario MSCs. For soil, the lower of the Act 2 residential direct contact MSC or the Act 2 residential, used aquifer (TDS≤2500) soil to groundwater MSC for each of the constituents will be used. For groundwater, the Act 2 residential, used aquifer (TDS≤2500) groundwater MSC for each of the constituents will be used. These MSCs are the most conservative screening values used by the PADEP within the Act 2 program. Analytical data may be additionally screened against U.S. EPA regional screening levels and/or U.S. EPA maximum contaminant levels, if they are more conservative and deemed necessary or relevant. The proposed action levels (MSCs) for the investigation are included on Table 3.

Soil gas analytical results will be compared to indoor air quality screening values from Table 3 of the PADEP Land Recycling Program Technical Guidance Manual – Section IV.A.4, and calculated soil gas screening values derived from these values. The soil gas screening values used for the investigation are included on Table 3.

A.2.4 Data Quality Objectives Process

This section provides a brief summary of the data quality objectives (DQO) process, which incorporates the following information:

- State the problem;
- Identify the decision(s) to be made;
- Identify what information is needed to make informed, defensible decisions;
- Define the boundaries of the investigation;
- Develop a decision rule; and
- Specify the limits on decision error.

The DQOs are summarized in Table 1.

A.3 Project Timeline

The scope of work activities identified within this SAP will require approximately 27 weeks to complete; per the following anticipated project timeline:

ACTIVITY	START DATE	APPROX. COMPLETION DATE
1) Planning/Preparatory Activities	November 30, 2015 (Approval)	December 18, 2015
2) First Phase of Field Work (Test trenches, installation of wells/borings, and collection of soil)	December 21, 2015	January 1, 2016
3) Groundwater and Soil Gas Sampling - Round 1	January 4, 2016	January 8, 2016
4) Groundwater and Soil Gas Sampling - Round 2	March 28, 2016	April 1, 2016
5) Analytical Data Analysis and Data Validation	December 28, 2015	May 2, 2016
6) Phase II ESA Report	December 28, 2015	May 30, 2016

It should be noted that a different approval date will result in relative, but different start and completion dates.

A.4 Measurement Quality Indicators

The approved programmatic QAPP establishes the program-wide Measurement Quality Objectives (Section A.3 of the QAPP). See Table 3, Measurement Quality Indicators.

B. MEASUREMENT/DATA ACQUISITION

B.1 Conceptual Site Model

The potential for adverse risks to arise from contact with constituents in an environmental medium is based on the following four factors: 1) chemicals must be present at sufficient levels, 2) an environmental medium must be present to receive or transport the chemicals, 3) receptors must be present, and 4) exposure pathways must exist between the source of the chemicals and receptors. In the absence of any one of the four components, risks do not exist. The presence of all four elements indicates a potential for risks to human health, but does not necessarily indicate an unacceptable risk.

Development of a conceptual site model (CSM) is a critical step in the Phase II ESA process to identify the potential sources of constituents, the release mechanisms into environmental media, and potential exposure pathways and receptors.

Target Analytes

The past uses of the Property parcel include a mixture of residential structures (houses, flats, and apartments), automotive filling and service stations, and a parking lot. Automotive filling and service stations often utilize/store various chemical substances. Because minimal historical data exist for the Property related to constituents that may have been released into the environment due to the automotive filling station activities, target compound list (TCL) volatile organic compounds (VOCs), TCL semi-volatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), and lead will be considered the target analytes for soils and groundwater at the Property. TCL VOCs will be the target analytes for soil gas at the Property.

Pathways of Interest

The likely movement of these constituents into the environment from historical releases/spills would be initially to soil. The highest concentrations of the constituents would be expected to be near historical fuel pumps at the filling station(s) and near the historical service building.

As a result of leaching due to precipitation infiltration, the constituents could ultimately migrate through the unsaturated soil column and into groundwater. Once in groundwater, the constituents would migrate with groundwater flow. Fate-and-transport mechanisms such as dilution, dispersion, and/or adsorption would tend to reduce constituent concentrations along the groundwater flow path. Groundwater flow at the Property is expected to be northward towards the Allegheny River.

B.2 Sampling Design

A comprehensive sampling design program has been developed to assess both the individual RECs identified through the Phase I ESA process, and the environmental quality conditions of the overall Property in general. Figure 5 identifies the Property boundaries proposed test trenches, and sampling

locations on an aerial photograph of the Property. SOPs for implementing this SAP are included in Attachment A.

The future use of the Property is anticipated to be residential use. In order to assess the overall Property condition and RECs, and to compare data collected to Pennsylvania's Act 2 MSCs, the following will be incorporated into the sample design:

- Three test trenches will be excavated in an attempt to determine if USTs and associated piping are present at the Property.

- Soil samples will be selected from the 0-2 foot depth interval (surface soil) and the 2-15 foot depth interval (subsurface soil); with six borings (KU-SB/MW-01, KU-SB/VEW-02, KU-SB/ VEW 03, KU-SB/MW-04, KU-SB/MW-05, and KU-SB-06) analyzed for VOCs via Method 8260C, SVOCs via Method 8270D LL, PCBs via Method 8082A, and lead via Method 6020A.

- Two rounds of groundwater samples will be collected from three installed wells (KU-SB/MW-01, KU-SB/MW-04, and KU-SB/MW-05) for VOCs via Method 8260C, SVOCs via Method 8270D LL, PCBs via Method 8082A, and lead via Method 6020A.

- Soil gas samples (KU-VEW-01, KU-SB/VEW-02, and KU-SB/VEW-03) will be collected and analyzed for TCL VOCs via U.S. EPA Method TO-15.

MSCs identified for comparison include residential soil direct contact, soil to groundwater, and used aquifer scenarios. Soil gas concentrations will be compared to indoor air quality screening values from Table 3 of the PADEP Land Recycling Program Technical Guidance Manual – Section IV.A.4, and calculated soil gas screening values derived from these values.

Field quality control/quality assurance samples will be collected as specified in Table 2 of the programmatic QAPP. This includes one field replicate and one equipment blank for the soil sampling event, one field replicate and one equipment blank for each groundwater sampling event, and one field replicate and one equipment blank for each soil gas sampling event. Additionally, one trip blank will be included per each cooler shipped to the laboratory.

A Proposed Sampling Location Map is provided as Figure 5. Proposed boring/well KU-SB/MW-01 is located at the southern border of the Property in the direction that groundwater is anticipated to enter the Property. Proposed boring/well KU-SB/VEW-02 and boring KU-SB-06 are located in the vicinity of the former gasoline filling station present at the Property from circa 1968 to circa 1989. Proposed boring KU-SB/VEW-03 is located in the vicinity of the former filling island and the northern border of the Property. Proposed boring/well KU-SB/MW-04 is located in the vicinity of the former service building and at the northeastern border of the Property. Proposed boring/well KU-SB/MW-05 is located in the vicinity

of a former filling island and the northwestern border of the Property in the direction that groundwater is anticipated to exit the Property. Proposed well KU-VEW-01 is located near the former filling island on the western side of the Property.

All sampling locations will be located via a handheld global positioning system (GPS), or by measuring their locations from known points. Site-specific vertical datum for the groundwater monitoring wells will be obtained via survey transit.

The following investigation activities address the various RECs presented in Section A.1.2.6.

B.2.1 UST Investigation

To determine if USTs and associated piping are present, three test trenches will be excavated with a hydraulic backhoe to depths of approximately 5 feet. The test trenches will be approximately 30 feet in length and of sufficient width to attain the desired depth. Excavated materials will be stockpiled on plastic adjacent to the trench.

If a UST or associated piping is encountered, digging will cease and the tank will be exposed for further evaluation of its contents, diameter, length, and capacity. A modification to the scope of work and an addendum to the SAP will subsequently be issued before resuming any activities on the site.

Upon completion of the trenching operation, the excavated materials will be returned to the open trench. If an insufficient volume of fill material is available, KU Resources proposes to use drill cuttings generated from the soil boring program to complete the trench backfilling. As specified by URA, a top layer of gravel will cover the test trenches and the parking lot will be returned to a condition that approximates that of pre-trenching.

B.2.2 Soil Investigation

Six soil borings will be advanced to groundwater or to equipment refusal/bedrock, whichever occurs first. Surface and subsurface soil samples will be collected from the soil borings. The surface and subsurface soil samples will be analyzed for the parameters discussed in Section B.2.

B.2.3 Groundwater Investigation

Three of the six soil borings (KU-SB/MW-01, KU-SB/MW-04, and KU-SB/MW-05) will be converted into monitoring wells. Two rounds of groundwater sampling will be performed using low-flow methodology and collected from the three monitoring wells. The groundwater samples will be analyzed for the parameters discussed in Section B.2.

B.2.4 Soil Gas Investigation

Two of the six soil borings (KU-SB-02/VEW-02 and KU-SB-03/VEW-03) will be converted into soil vapor extraction wells. A third soil vapor extraction well (VEW-01) will be installed on the western side of the

site. Two rounds of soil gas samples will be collected from each of the newly installed soil vapor extraction wells and analyzed for the parameters discussed in Section B.2.

B.3 Sampling Methods Requirements

The program-wide sampling methodologies and SOPs for the NSIDC Cooperative Agreement have been provided within the programmatic QAPP, as well as Attachment A, and will be followed during the implementation of this SAP. A summary of the sampling techniques for the various environmental media to be investigated at the Property follows. See Table 2 for sampling and analytical methods requirements.

B.3.1 Soil Boring Sampling Method

The three soil borings (KU-SB/MW-01, KU-SB/MW-04, and KU-SB/MW-05) to be converted into monitoring wells will be advanced to groundwater or to equipment refusal/bedrock, whichever occurs first. The remaining three soil borings (KU-SB/VEW-02, KU-SB/VEW-03, and KU-SB-06) will be advanced to 15 feet below ground surface (bgs) or equipment refusal/bedrock, whichever occurs first. Borings will be advanced using direct-push equipment, and soil samples will be collected continuously from ground surface to the termination depth. In accordance with the Pennsylvania Act 2 program, residential soils are classified as either surface soils (0-2 feet bgs) or subsurface soils (2-15 feet bgs) for exposure pathway and risk analysis. In Act 2 (25 Pa Section 250.305), the ingestion and inhalation of soil pathways are only complete to depths of 15 feet from the existing ground surface. Therefore, collection of soil samples at a depth greater than 15 feet bgs is not required.

All samples will be examined in the field, and field logs noting soil and lithologic descriptions, environmental quality observations, and other pertinent information will be maintained. Based on field observations (i.e., visible and/or odorous indications of soil quality impacts), selected aliquots of subsurface samples will be field screened (every 2-foot interval). The soil samples will be field screened with a photoionization detector (PID) equipped with a 10.6-electron volt (eV) lamp. The soil samples will be screened on a minimum of 2-foot intervals. The screening will occur immediately after the opening of the acetate liners. Once the acetate liners have been opened, a dedicated or decontaminated instrument will be used to disturb the soil sample and release potential organic vapors from the selected interval to be screened by the PID. The results of the field screening will be recorded as a parts-per-million concentration in the field logbook.

These results, along with sample location and depth considerations, will be used to select the subsurface soil samplings to be submitted for laboratory analysis. One surface soil sample (from within the 0- to 2-foot depth interval) and one subsurface soil sample (from within the 2- to 15-foot depth interval) will be submitted for laboratory analysis from each soil boring. If there are no impacts (visual, olfactory, or PID) observed throughout the depth of the entire soil boring, a default sampling interval of 2 to 4 feet bgs will be used for the subsurface sample. This sampling depth interval will be used due to the likelihood of historical contaminants being released at or near ground surface. This depth interval is the most likely

subsurface interval to contain contamination from the downward migration of constituents of concern, if no other observations of contamination are noted.

An alternative sample or additional samples may be collected from within the 2- to 15-foot interval based on observed field observations of the boring. Samples selected for laboratory analysis will be transferred to sample containers. Boreholes will be backfilled with bentonite upon completion of the boring.

Soil samples analyzed for VOC concentrations will be collected in accordance with SOP No.: 007 (Attachment A). According to SOP No.: 007, the samples may be collected directly with the EnCore™ syringe, or with conventional sampling equipment. If using the syringes, the sample must be immediately placed in the sample container (40-ml pre-prepared vial) to reduce volatilization losses. The 40-ml vials should contain 10 ml of organic free water for an unpreserved sample or approximately 10 ml of organic free water and a preservative. The 40-ml vials should be prepared and weighed by the laboratory (commercial sources are available which supply preserved and tared vials). A sample collected with conventional sampling equipment must either immediately be placed in the final sample container (EnCore™ or 40-ml pre-prepared vial) or an intermediate sample container with no head space. If an intermediate container (usually 2-oz. soil jar) is used, the sample should be transferred to the final sample container (EnCore™ or 40-ml pre-prepared vial) as soon as possible not to exceed 30 minutes.

As detailed within the programmatic QAPP, a record of daily field activities at the Property as they pertain to the subsurface investigation will be maintained, and boring logs will be prepared.

B.3.2 Groundwater Sampling Method

Three of the soil borings (KU-SB/MW-01, KU-SB/MW-04, and KU-SB/MW-05) will be converted into monitoring wells. Monitoring wells will be constructed using 2-inch diameter, manufactured, pre-packed well screens and manufactured bentonite seals/foam bridges.

Groundwater monitoring screens will be installed in accordance with SOP No.: 005 (Attachment A). In cases where the "aquifer" or zone of interest may be only 6 inches to a few feet thick, screen length should be limited to 5 feet or less to minimize siltation problems from surrounding fine-grained materials and possible dilution effects from water contributed by uncontaminated zones. The screen length and position must accommodate the magnitude and depth of variations in water table elevation. Well screens will be set so that approximately 2 feet of screen will be above the observed zone of saturation so that lighter-density substances can enter the well. However, the screened interval may be adjusted in the field so that more or less of it is above the zone of saturation, based on observed subsurface conditions.

The drilling and sampling will be supervised by a Pennsylvania-licensed geologist. A record of daily field activities at the Property as they pertain to the subsurface investigation will be maintained, and boring logs/well construction logs will be prepared.

Two rounds of groundwater sampling will be performed twelve weeks apart as this accounts for seasonal change and is standard industry practice in accordance with Act 2. Both rounds of groundwater sampling will be performed using low-flow methodology and analyzed for the parameters discussed in the sample design section above. The order of collection for groundwater samples is to be VOCs first, followed by SVOCs. Lead samples will be collected last, and filtered in the field with a 0.45-micron filter. SOP No.: 009 provides further details for well development, purging, and groundwater sampling methods.

B.3.3 Soil Gas Monitoring Point Installation and Soil Gas Sampling Methods

Soil gas wells will be installed with a core drill and hand auger techniques. The soil gas wells will be constructed using 1-inch diameter screen and riser. The anticipated length of the well screens is 1 foot. The target depth of the wells will be 5 feet bgs. The remainder of the well will be completed with a riser, and the soil gas well will be completed with a flush-mount protective cover. The wells will be constructed so that the silica sand filter pack will be extended to approximately 1 foot above the top of the screened area. The screened and riser interval may be adjusted in the field based upon the conditions.

Prior to collecting the soil gas sample, one to three volumes of atmospheric air will be purged to allow the subsurface soil gas to enter the screen and sample tubing. Once the tubing has been satisfactorily purged to enable collection of a representative soil gas sample, a 1-liter to 6-liter pre-evacuated, SUMMA® canister is attached to the end of the tubing for sample collection.

B.3.4 Investigation-Derived Waste Sampling Method

During the course of the field investigation, disposable/single-use equipment, personal protective equipment, and investigation-derived waste (IDW) samples (e.g., soil boring cuttings, well development and purge water) can be generated. Well development and purge water generated during investigation activities will be collected and retained pending receipt of the laboratory analytical results from the subsequent groundwater monitoring event(s). Following receipt of analytical results, the collected development/purge water will be managed, as appropriate. Excess soil generated as a result of soil boring and well installation activities will be containerized in sealed, labeled 55-gallon drums, pending review of the laboratory data and waste disposition considerations. All other IDW will be segregated and containerized, as needed, for proper disposal.

The programmatic QAPP should be referenced for additional information regarding the sampling protocols and methodologies to be used during the implementation of this Site-specific SAP.

B.4 Analytical Methods Requirements

The analytical methods to be used during the implementation of this Site-specific SAP are identified in Section B.2, Sampling Design. Analytical method requirements are provided on Table 3, and the laboratory qualifications package is included as Attachment B. The programmatic QAPP also addresses the analytical parameters of NSIDC's overall Cooperative Agreement.

C. ASSESSMENT AND OVERSIGHT

C.1 Performance and System Audits

During field activities, the Quality Control Manager of the project will determine whether the field activities are following protocols delineated in the QAPP and SAP. If the protocols are not being followed, the procedures described in Section C.1 of the programmatic QAPP will be implemented to address how these issues will be handled and resolved.

Only laboratories that have defined QA protocol will be selected.

C.2 Reports to Managements

Status reports will not be necessary since the duration of this project is only 27 weeks.

D. DATA VALIDATION AND USABILITY

D.1 Reconciliation with User Requirements

The programmatic QAPP (Section D of the QAPP) provides the data validation and usability protocols and how the overall DQOs for this project will be met by verifying the methods and results to collect, develop, and report the data. These details of the QAPP are listed below.

D.1.1 Field Data

The field data package will be reviewed by the sampling personnel. To adequately assess the data package, the following items will be reviewed:

- Field data contained in sampling logs for completeness;
- Preparation, identification, and analysis of equipment blanks, field blanks, and trip blanks;
- Field analyses and equipment calibration and general condition; and
- Chain-of-custody forms, i.e., for proper completion, signatures of field personnel, and the laboratory sample custodian.

D.1.2 Laboratory Data

The analytical data package will be verified for completeness, correctness, and conformance of the data. Validation of the data will be performed if the verification process warrants it. Validation of data, when necessary, will be performed in accordance with the U.S. EPA Region III National Functional Guidelines.

The analytical data package validation procedure may include a review of the following:

- Data reduction procedures specified in 40 Code of Federal Regulations §136 and SW-846, as they apply to individual analytical methods.

- The data package by the analytical laboratory relative to the reporting requirements specified in the Data Reporting section of this Plan, to ensure completeness in the analytical data package and compliance with U.S. EPA-approved procedures.

- Sampling dates, sample extraction dates, and analysis dates to check that samples were extracted and/or analyzed within proper holding times.

- Analytical methods and suggested detection limits.

- Field and laboratory blanks to evaluate possible contamination sources. The preparation techniques and frequencies, and the analytical results (if appropriate) will be considered. Blanks will be evaluated in accordance with U.S. EPA Functional Guidelines for Validation of Laboratory Data.

- Field duplicates to check the precision of chemical analyses and field sample collection techniques. If available, field duplicates and laboratory duplicates for water matrices will be reviewed.

- Surrogate spikes relative to allowable control limits specified for the method.

- Matrix spike recoveries for organic analyses (considered advisory by the U.S. EPA) for evaluation of the presence of matrix interferences that may affect recovery of a particular analyte. Control limits will be reported when matrix spike data are reported. When matrix spike duplicates are performed and/or reported, the relative percent difference will be calculated and RPD control limits reported.

- Matrix spike recoveries for inorganic analyses (considered definitive). If matrix spike recoveries are outside control limits, the data will be flagged as a quantitatively suspect or an estimated value.

Any issues associated with data usability will be resolved through the consultant's experience with the protocols and limitations associated with Pennsylvania's Act 2 program. Any limitations on the use of the data will be conveyed to the decision makers through periodic program updates, as well as within the Phase II ESA report which will document the implementation of this SAP.

E. REFERENCES

ASTM International. (2011) "Standard Practice for Environmental Property Assessments: Phase II Environmental Property Assessment Process." Designation: E1903-11. July 2011.

Michael Baker Jr., Inc. (2001) Phase I Environmental Site Assessment. East Liberty, Penn Circle, Pittsburgh, Pennsylvania. November 2001.

KU Resources, Inc. (2014) "North Side Industrial Development Company, Inc. Programmatic Quality Assurance Project Plan, Phase I and Phase II Environmental Site Assessments, Multiple Properties, Allegheny and Beaver Counties, Pennsylvania." December 2014.

KU Resources, Inc. (2015) "Phase I Environmental Property Assessment, East Liberty Petroleum, Pittsburgh, Allegheny County, Pennsylvania." September 2015.

Pennsylvania Department of Environmental Protection (PADEP; 2008) Technical Guidance Manual. Section IV – General Guidance. Table IV-9. March 18, 2008.

U.S. Environmental Protection Agency Region III. (1999) "U.S. EPA – Region III Site-Specific Sampling and Analysis Plan Template, Draft Interim Final." August 1999.

Table 1
Data Quality Objectives

State Problem	Identify the Decision(s)	Identify the Inputs to the Decision(s)	Define the Study Boundaries	Develop Decision Rules	Tolerable Limits on Errors
The soil and groundwater beneath the Site from past historical activities on site and off site may have been contaminated with volatiles (VOCs), semi-volatiles (SVOCs), polychlorinated biphenyls (PCBs), and/or lead.	Investigation is proposed to determine soil, groundwater, and soil gas concentrations at the Site. Plans are to redevelop property for future residential use. Based on the results of the investigation, it will be determined if remediation strategies are needed or redevelopment can proceed.	The primary type of information that needs to be obtained in order to resolve the decision statement is laboratory analyses of soil, groundwater, and soil gas samples from proposed soil borings, monitoring wells, and vapor extraction wells. Soil and groundwater samples will be analyzed for VOCs, SVOCs, PCBs, and lead. Soil gas samples will be analyzed for VOCs.	Soil borings, monitoring wells, and vapor extraction wells will be installed within the boundaries of the Site. It is estimated that the SAP will require approximately 27 weeks to complete.	Provide the chemical concentrations and aerial extent of VOCs, SVOCs, PCBs, and lead in the soil and groundwater on Site. Provide the chemical concentrations and aerial extent of VOCs in the soil gas on Site. The data collected will be compared to the most applicable Act 2 screening values or other screening values which may be applicable, to the extent possible, based on the available Site information. If screening values are exceeded, then it will be ascertained if there is a threat to pubic health or the environment and if remediation strategies need to be formulated.	Data validation will be performed in accordance with the programmatic QAPP if required.

Table 2
Sampling and Analytical Methods Requirements

Matrix	Parameter	Number of Samples (1)	Sampling Procedure (2)	Analytical Method
Soil	Volatile Organic Compounds (VOCs)	12	SOP No. 007	8260C (5035)
Soil	Semi-volatile Organic Compouds (SVOCs)	12	SOP No. 007	8270D LL (3541)
Soil	Polychlorinated Biphenyls (PCBs)	12	SOP No. 007	8082A (3541-3665A-3660B)
Soil	Lead	12	SOP No. 007	6020A (3050B)
Groundwater	Volatile Organic Compounds (VOCs)	6	SOP No. 009	8260C (5030C)
Groundwater	Semi-volatile Organic Compounds (SVOCs)	6	SOP No. 009	8270D LL (3520C)
Groundwater	Polychlorinated Biphenyls (PCBs)	6	SOP No. 009	8082A (3510C)
Groundwater	Lead	6	SOP No. 009	6020A (3005A)
Soil Gas	Volatile Organic Compounds (VOCs)	6	SOP No. 010	TO-15

(1) Sample number does not include QA/QC samples. Soil sample number is derived from collecting two samples from each of six borings. Groundwater and soil gas samples include two rounds of sampling from three wells.

(2) Standard Operating Procedures are from the North Side Industrial Development Company, Inc. Programmatic Quality Assurance Project Plan, Phase I and Phase II Environmental Site Assessments, Multiple Properties, Allegheny and Beaver Counties, Pennsylvania (KU Resources, 2014) previously approved by the U.S. Environmental Protection Agency.

Table 3
Measurement Quality Indicators

Analyte	Matrix	Action Limit[1] (µg/l)	Precision	Accuracy	Completeness
VOCs – Method 8260C					
Acetone	Aqueous	33,000	35	22-150	Equal to or greater than 95%
Benzene	Aqueous	5	32	80-120	Equal to or greater than 95%
Bromodichloromethane	Aqueous	80	35	66-130	Equal to or greater than 95%
Bromoform	Aqueous	80	35	46-150	Equal to or greater than 95%
Bromomethane	Aqueous	10	35	33-150	Equal to or greater than 95%
2-Butanone (MEK)	Aqueous	4,000	35	39-138	Equal to or greater than 95%
Carbon disulfide	Aqueous	1,500	35	54-132	Equal to or greater than 95%
Carbon tetrachloride	Aqueous	5	35	55-150	Equal to or greater than 95%
Chlorobenzene	Aqueous	100	29	80-120	Equal to or greater than 95%
Chloroethane	Aqueous	230	35	36-142	Equal to or greater than 95%
Chloroform	Aqueous	80	35	72-127	Equal to or greater than 95%
Chloromethane	Aqueous	30	35	50-139	Equal to or greater than 95%
Cyclohexane	Aqueous	13,000	35	45-142	Equal to or greater than 95%
Dibromochloromethane	Aqueous	80	35	60-140	Equal to or greater than 95%
1,2-Dibromo-3-Chloropropane	Aqueous	0.2	35	37-133	Equal to or greater than 95%
1,2-Dibromoethane	Aqueous	0.05	35	74-123	Equal to or greater than 95%
1,2-Dichlorobenzene	Aqueous	600	24	77-120	Equal to or greater than 95%
1,3 Dichlorobenzene	Aqueous	600	24	76-120	Equal to or greater than 95%
1,4 Dichlorobenzene	Aqueous	75	24	77-120	Equal to or greater than 95%
Dichlorodifluoromethane	Aqueous	1,000	35	13-150	Equal to or greater than 95%
1,1-Dichloroethane	Aqueous	31	35	73-126	Equal to or greater than 95%
1,2-Dichloroethane	Aqueous	5	32	68-132	Equal to or greater than 95%
1,1-Dichloroethene	Aqueous	7	35	65-136	Equal to or greater than 95%
1,2-Dichloroethene	Aqueous	70	35	70-126	Equal to or greater than 95%
1,2-Dichloropropane	Aqueous	5	34	76-124	Equal to or greater than 95%
cis-1,3-Dichloropropene	Aqueous	6.6	35	66-120	Equal to or greater than 95%
trans-1,3-Dichloropropene	Aqueous	6.6	35	65-125	Equal to or greater than 95%
Ethylbenzene	Aqueous	700	33	72-126	Equal to or greater than 95%
2-Hexanone	Aqueous	11	35	25-132	Equal to or greater than 95%
Isopropylbenzene	Aqueous	840	35	58-130	Equal to or greater than 95%
Methyl acetate	Aqueous	37,000	35	47-142	Equal to or greater than 95%
Methylcyclohexane	Aqueous	---	35	45-145	Equal to or greater than 95%
Methylene Chloride	Aqueous	5	35	63-129	Equal to or greater than 95%
4-Methyl-2-pentanone (MIBK)	Aqueous	2,900	35	45-145	Equal to or greater than 95%
Methyl-tert-butyl ether	Aqueous	20	35	64-123	Equal to or greater than 95%
Styrene	Aqueous	100	34	71-127	Equal to or greater than 95%
1,1,2,2-Tetrachloroethane	Aqueous	0.84	35	62-125	Equal to or greater than 95%
Tetrachloroethene	Aqueous	5	35	70-135	Equal to or greater than 95%
Toluene	Aqueous	1,000	35	80-123	Equal to or greater than 95%
1,1,2-Trichloro-1,2,2-trifluoroethane	Aqueous	63,000	35	46-148	Equal to or greater than 95%
1,2,4-Trichlorobenzene	Aqueous	70	35	60-127	Equal to or greater than 95%
1,1,1-Trichloroethane	Aqueous	200	35	63-133	Equal to or greater than 95%
1,1,2-Trichloroethane	Aqueous	5	35	77-127	Equal to or greater than 95%
Trichloroethene	Aqueous	5	35	73-120	Equal to or greater than 95%
Trichlorofluoromethane	Aqueous	63,000	35	44-150	Equal to or greater than 95%
Vinyl chloride	Aqueous	2	35	53-138	Equal to or greater than 95%
Xylenes, Total	Aqueous	10,000	32	76-128	Equal to or greater than 95%

Table 3
Measurement Quality Indicator

Analyte	Matrix	Action Limit[1] (µg/l)	Precision	Accuracy	Completeness
SVOCs – Method 8270D LL					
Acenaphthene	Aqueous	2,200	25	47-100	Equal to or greater than 95%
Acenaphthylene	Aqueous	2,200	26	47-100	Equal to or greater than 95%
Acetophenone	Aqueous	3,700	30	42-100	
Anthracene	Aqueous	66	20	49-100	Equal to or greater than 95%
Atrazine	Aqueous	3	15	46-100	
Benzaldehyde	Aqueous	---	35	10-125	
Benzo(a)anthracene	Aqueous	0.29	20	50-100	Equal to or greater than 95%
Benzo(a)pyrene	Aqueous	0.2	22	47-100	Equal to or greater than 95%
Benzo(b)fluoranthene	Aqueous	0.29	22	43-100	Equal to or greater than 95%
Benzo(g,h,i)perylene	Aqueous	0.26	21	48-100	Equal to or greater than 95%
Benzo(k)fluoranthene	Aqueous	0.55	24	47-100	Equal to or greater than 95%
1,1'-Biphenyl	Aqueous	1,800	26	45-100	
2,2'-oxybis[1-chloropropane]	Aqueous	---	28	38-100	
4-Bromophenyphenyl ether	Aqueous	---	22	46-100	Equal to or greater than 95%
Butylbenzylphthalate	Aqueous	350	23	45-105	Equal to or greater than 95%
Caprolactam	Aqueous	---	25	45-102	
Carbazole	Aqueous	33	20	48-100	Equal to or greater than 95%
4-Chloro-3-methylphenol	Aqueous	180	27	47-100	Equal to or greater than 95%
4-Chloroaniline	Aqueous	3.3	28	43-100	Equal to or greater than 95%
bis(2-Chloroethoxy) methane	Aqueous	110	28	45-100	Equal to or greater than 95%
bis(2-Chloroethyl) ether	Aqueous	0.15	28	42-100	Equal to or greater than 95%
2-Chloronaphthalene	Aqueous	2,900	26	42-100	Equal to or greater than 95%
2-Chlorophenol	Aqueous	40	28	41-100	Equal to or greater than 95%
4-Chlorophenylphenyl ether	Aqueous	---	25	48-100	Equal to or greater than 95%
Chrysene	Aqueous	1.9	20	49-100	Equal to or greater than 95%
Dibenzo(a,h)anthracene	Aqueous	0.029	21	48-100	Equal to or greater than 95%
Dibenzofuran	Aqueous	37	24	47-100	Equal to or greater than 95%
3,3'-Dichlorobenzidine	Aqueous	1.5	28	41-100	Equal to or greater than 95%
2,4-Dichlorophenol	Aqueous	20	29	45-100	Equal to or greater than 95%
Diethylphthalate	Aqueous	29,000	20	48-100	Equal to or greater than 95%
2,4-Dimethylphenol	Aqueous	730	25	45-100	Equal to or greater than 95%
Dimethylphthalate	Aqueous	---	24	49-100	Equal to or greater than 95%
Di-n-butylphthalate	Aqueous	3,700	21	49-101	Equal to or greater than 95%
4,6-Dinitro-2-methylphenol	Aqueous	---	19	46-100	Equal to or greater than 95%
2,4-Dinitrophenol	Aqueous	73	18	36-100	Equal to or greater than 95%
2,4-Dinitrotoluene	Aqueous	2.1	21	49-100	Equal to or greater than 95%
2,6-Dinitrotoluene	Aqueous	37	23	50-100	Equal to or greater than 95%
Di-n-octylphthalate	Aqueous	1,500	23	40-105	Equal to or greater than 95%
bis(2-Ethylhexyl)phthalate	Aqueous	6	35	35-118	Equal to or greater than 95%
Fluoranthene	Aqueous	260	20	48-100	Equal to or greater than 95%
Fluorene	Aqueous	1,500	22	48-100	Equal to or greater than 95%
Hexachlorobenzene	Aqueous	1	19	45-100	Equal to or greater than 95%
Hexachlorobutadine	Aqueous	8.5	18	42-100	
Hexachlorocyclopentadiene	Aqueous	50	16	37-109	Equal to or greater than 95%
Hexachloroethane	Aqueous	1	16	39-100	Equal to or greater than 95%
Indeno(1,2,3-cd)pyrene	Aqueous	0.29	21	47-100	Equal to or greater than 95%
Isophorone	Aqueous	100	30	48-100	Equal to or greater than 95%
2-Methynaphthalene	Aqueous	150	27	44-100	Equal to or greater than 95%

Table 3
Measurement Quality Indicator

Analyte	Matrix	Action Limit[1] (µg/l)	Precision	Accuracy	Completeness
SVOCs – Method 8270D LL					
2-Methylphenol(o-cresol)	Aqueous	1,800	28	43-100	Equal to or greater than 95%
3,4-Methyphenol(m&p cresol)	Aqueous	180	28	41-100	Equal to or greater than 95%
Naphthalene	Aqueous	100	25	44-100	Equal to or greater than 95%
2-Nitroaniline	Aqueous	110	26	52-105	Equal to or greater than 95%
3-Nitroaniline	Aqueous	11	24	44-100	Equal to or greater than 95%
4-Nitroaniline	Aqueous	33	21	44-104	Equal to or greater than 95%
Nitrobenzene	Aqueous	73	27	47-100	Equal to or greater than 95%
2-Nitrophenol	Aqueous	290	31	45-100	Equal to or greater than 95%
4-Nitrophenol	Aqueous	60	21	44-129	Equal to or greater than 95%
N-Nitroso-di-n-propylamine	Aqueous	0.094	27	42-100	Equal to or greater than 95%
N-Nitrosodiphenylamine	Aqueous	130	21	48-100	Equal to or greater than 95%
Pentachlorophenol	Aqueous	1	15	36-105	Equal to or greater than 95%
Phenanthrene	Aqueous	1,100	20	48-100	Equal to or greater than 95%
Phenol	Aqueous	2,000	25	43-100	Equal to or greater than 95%
Pyrene	Aqueous	130	20	44-100	Equal to or greater than 95%
2,4,5-Trichlorophenol	Aqueous	3,700	26	49-100	Equal to or greater than 95%
2,4,6-Trichlorophenol	Aqueous	37	28	47-101	Equal to or greater than 95%
PCBs – Method 8082A					
PCB-1016	Aqueous	2.6	25	55-120	Equal to or greater than 95%
PCB-1221	Aqueous	0.33	25	55-120	Equal to or greater than 95%
PCB-1232	Aqueous	0.33	25	55-120	Equal to or greater than 95%
PCB-1242	Aqueous	0.33	25	55-120	Equal to or greater than 95%
PCB-1248	Aqueous	0.33	25	55-120	Equal to or greater than 95%
PCB-1254	Aqueous	0.33	25	55-120	Equal to or greater than 95%
PCB-1260	Aqueous	0.33	25	55-120	Equal to or greater than 95%
Metals – Method 6020A					
Lead	Aqueous	5	20	80-120	Equal to or greater than 95%

Note:
[1]Pennsylvania Act 2 Residential, Used Aquifer, TDS ≤ 2500, Medium-Specific Concentrations (MSCs).

Table 3
Measurement Quality Indicators

Analyte	Matrix	Action Limit[1] (mg/kg)	Precision	Accuracy	Completeness
Acetone	Soil	3,300	40	20-150	Equal to or greater than 95%
Benzene	Soil	0.5	20	77-120	Equal to or greater than 95%
Bromodichloromethane	Soil	8	21	70-125	Equal to or greater than 95%
Bromoform	Soil	8	23	53-140	Equal to or greater than 95%
Bromomethane	Soil	1	40	25-150	Equal to or greater than 95%
2-Butanone (MEK)	Soil	400	36	35-149	Equal to or greater than 95%
Carbon disulfide	Soil	150	23	50-127	Equal to or greater than 95%
Carbon tetrachloride	Soil	0.5	22	69-122	Equal to or greater than 95%
Chlorobenzene	Soil	10	20	79-120	Equal to or greater than 95%
Chloroethane	Soil	23	40	22-150	Equal to or greater than 95%
Chloroform	Soil	8	25	72-120	Equal to or greater than 95%
Chloromethane	Soil	3	27	44-131	Equal to or greater than 95%
Dibromochloromethane	Soil	8	20	70-132	Equal to or greater than 95%
1,2-Dibromo-3-Chloropropane	Soil	0.02	40	35-136	Equal to or greater than 95%
1,2-Dichlorobenzene	Soil	60	22	71-124	Equal to or greater than 95%
1,3 Dichlorobenzene	Soil	61	20	75-118	Equal to or greater than 95%
1,4 Dichlorobenzene	Soil	3	20	77-116	Equal to or greater than 95%
1,1-Dichloroethane	Soil	3.1	23	66-124	Equal to or greater than 95%
1,2-Dichloroethane	Soil	0.5	23	61-127	Equal to or greater than 95%
1,2-Dichloroethene	Soil	7	20	77-121	Equal to or greater than 95%
1,1-Dichloroethene	Soil	0.7	25	59-129	Equal to or greater than 95%
1,2-Dichloropropane	Soil	0.5	20	72-122	Equal to or greater than 95%
1,2,4-Trichlorobenzene	Soil	27	40	51-136	Equal to or greater than 95%
cis-1,3-Dichloropropene	Soil	0.66	20	73-120	Equal to or greater than 95%
trans-1,3-Dichloropropene	Soil	0.66	20	74-129	Equal to or greater than 95%
Dichlorodifluoromethane	Soil	100	34	25-150	Equal to or greater than 95%
Ethylbenzene	Soil	70	21	78-125	Equal to or greater than 95%
1,2-Dibromoethane	Soil	0.005	20	70-131	Equal to or greater than 95%
Cyclohexane	Soil	1,700	21	64-130	Equal to or greater than 95%
2-Hexanone	Soil	1.1	32	32-150	Equal to or greater than 95%
Isopropylbenzene	Soil	0.1	22	70-133	Equal to or greater than 95%
Methyl acetate	Soil	3,700	40	27-142	Equal to or greater than 95%
Methylene Chloride	Soil	0.5	28	58-127	Equal to or greater than 95%
4-Methyl-2-pentanone (MIBK)	Soil	290	30	44-148	Equal to or greater than 95%
Methyl-tert-butyl ether	Soil	2	36	48-132	Equal to or greater than 95%
Methylcyclohexane	Soil	----	23	66-135	Equal to or greater than 95%
Styrene	Soil	24	20	83-129	Equal to or greater than 95%
1,1,2,2-Tetrachloroethane	Soil	0.08	24	60-139	Equal to or greater than 95%
Tetrachloroethene	Soil	0.5	20	78-129	Equal to or greater than 95%
Toluene	Soil	100	21	78-124	Equal to or greater than 95%
1,1,1-Trichloroethane	Soil	20	31	67-126	Equal to or greater than 95%
1,1,2-Trichloro-1,2,2-trifluoroethane	Soil	10,000	37	55-130	Equal to or greater than 95%
1,1,2-Trichloroethane	Soil	0.5	22	70-128	Equal to or greater than 95%
Trichloroethene	Soil	0.5	21	76-119	Equal to or greater than 95%
Trichlorofluoromethane	Soil	200	40	20-150	

Table 3
Measurement Quality Indicators

Analyte	Matrix	Action Limit[1] (mg/kg)	Precision	Accuracy	Completeness
VOCs – Method 8260C					
Vinyl chloride	Soil	0.2	27	63-124	Equal to or greater than 95%
Xylenes, Total	Soil	1,000	20	83-126	Equal to or greater than 95%
SVOCs – Method 8270D LL					
Acenaphthene	Soil	2,700	23	34-100	Equal to or greater than 95%
Acenaphthylene	Soil	2,500	23	34-100	Equal to or greater than 95%
Anthracene	Soil	350	20	35-100	Equal to or greater than 95%
Benzo(a)anthracene	Soil	25	20	37-100	Equal to or greater than 95%
Benzo(a)pyrene	Soil	46	21	36-100	Equal to or greater than 95%
Benzo(b)fluoranthene	Soil	40	22	31-100	Equal to or greater than 95%
Benzo(g,h,i)perylene	Soil	180	20	29-106	Equal to or greater than 95%
Benzo(k)fluoranthene	Soil	610	21	34-100	Equal to or greater than 95%
4-Bromophenyphenyl ether	Soil	---	20	33-100	Equal to or greater than 95%
Butylbenzylphthalate	Soil	3,000	20	33-105	Equal to or greater than 95%
4-Chloro-3-methylphenol	Soil	---	20	37-100	Equal to or greater than 95%
4-Chloroaniline	Soil	0.42	20	33-100	Equal to or greater than 95%
bis(2-Chloroethoxy) methane	Soil	11	20	31-100	Equal to or greater than 95%
bis(2-Chloroethyl) ether	Soil	0.015	20	31-100	Equal to or greater than 95%
2-Chloronaphthalene	Soil	6,200	25	29-100	Equal to or greater than 95%
Chrysene	Soil	230	20	37-100	Equal to or greater than 95%
Dibenzo(a,h)anthracene	Soil	13	26	31-106	Equal to or greater than 95%
Dibenzofuran	Soil	95	23	35-100	Equal to or greater than 95%
2,2'-oxybis[1-chloropropane]	Soil	---	20	29-100	Equal to or greater than 95%
Bis(2-ethylhexyl) phthalate	Soil	130	20	32-106	Equal to or greater than 95%
4-Chlorophenyl phenyl ether	Soil	---	22	35-100	Equal to or greater than 95%
Di-n-butyl phthalate	Soil	1,500	20	36-102	Equal to or greater than 95%
3,3'-Dichlorobenzidine	Soil	8.3	21	29-100	Equal to or greater than 95%
2,4-Dichlorophenol	Soil	2	20	34-100	Equal to or greater than 95%
Diethylphthalate	Soil	2,900	20	36-103	Equal to or greater than 95%
2,4-Dimethylphenol	Soil	73	20	34-100	Equal to or greater than 95%
Dimethylphthalate	Soil	---	23	36-100	Equal to or greater than 95%
2,4-Dinitrophenol	Soil	7.3	23	30-100	Equal to or greater than 95%
2,4-Dinitrotoluene	Soil	0.21	21	36-102	Equal to or greater than 95%
2,6-Dinitrotoluene	Soil	3.7	20	37-100	Equal to or greater than 95%
Di-n-octylphthalate	Soil	10,000	20	26-112	Equal to or greater than 95%
Fluoranthene	Soil	3,200	20	36-100	Equal to or greater than 95%
Fluorene	Soil	3,000	21	35-100	Equal to or greater than 95%
Hexachloro-1,3-butadiene	Soil	10	20	30-104	Equal to or greater than 95%
Hexachlorobenzene	Soil	0.96	21	30-104	Equal to or greater than 95%
Hexachlorocyclopentadiene	Soil	91	30	21-113	Equal to or greater than 95%
Hexachloroethane	Soil	0.56	20	31-100	Equal to or greater than 95%
Indeno(1,2,3-cd)pyrene	Soil	2,200	25	31-103	Equal to or greater than 95%
Isophorone	Soil	10	20	34-100	Equal to or greater than 95%
2-Methynaphthalene	Soil	600	21	33-100	Equal to or greater than 95%
2-Methylphenol(o-cresol)	Soil	180	20	33-100	Equal to or greater than 95%
Naphthalene	Soil	25	23	32-100	Equal to or greater than 95%

Table 3
Measurement Quality Indicators

Analyte	Matrix	Action Limit[1] (mg/kg)	Precision	Accuracy	Completeness
SVOCs – Method 8270D LL					
2-Nitroaniline	Soil	11	20	34-108	Equal to or greater than 95%
3-Nitroaniline	Soil	1.1	20	35-100	Equal to or greater than 95%
4-Nitroaniline	Soil	3.3	20	34-104	Equal to or greater than 95%
Nitrobenzene	Soil	7.3	20	30-100	Equal to or greater than 95%
2-Nitrophenol	Soil	29	22	33-100	Equal to or greater than 95%
4-Nitrophenol	Soil	6	20	23-138	Equal to or greater than 95%
N-Nitroso-di-n-propylamine	Soil	0.0094	20	33-100	Equal to or greater than 95%
N-Nitrosodiphenylamine	Soil	20	20	32-100	Equal to or greater than 95%
Pentachlorophenol	Soil	5	20	24-106	Equal to or greater than 95%
Phenanthrene	Soil	10,000	20	33-100	Equal to or greater than 95%
Phenol	Soil	200	20	34-100	Equal to or greater than 95%
Pyrene	Soil	2,200	21	32-100	Equal to or greater than 95%
2,4,5-Trichlorophenol	Soil	2,300	22	34-103	Equal to or greater than 95%
2,4,6-Trichlorophenol	Soil	11	25	34-103	Equal to or greater than 95%
Carbazole	Soil	21	20	34-100	Equal to or greater than 95%
Acetophenone	Soil	370	20	31-100	Equal to or greater than 95%
Atrazine	Soil	0.3	20	30-130	Equal to or greater than 95%
Benzaldehyde	Soil	---	20	30-130	Equal to or greater than 95%
1,1'-Biphenyl	Soil	790	24	32-100	Equal to or greater than 95%
Caprolactam	Soil	---	20	37-103	Equal to or greater than 95%
2-Chlorophenol	Soil	4.4	20	31-100	Equal to or greater than 95%
Methylphenol, 3 & 4	Soil	18	20	33-100	Equal to or greater than 95%
4,6-Dinitro-2-methylphenol	Soil	0.37	20	36-100	Equal to or greater than 95%
PCBs – Method 8082A					
PCB-1016	Soil	72	30	50-120	Equal to or greater than 95%
PCB-1221	Soil	0.16	30	50-120	Equal to or greater than 95%
PCB-1232	Soil	0.13	30	50-120	Equal to or greater than 95%
PCB-1242	Soil	4	30	50-120	Equal to or greater than 95%
PCB-1248	Soil	16	30	50-120	Equal to or greater than 95%
PCB-1254	Soil	67	30	50-120	Equal to or greater than 95%
PCB-1260	Soil	150	30	50-120	Equal to or greater than 95%
Metals – Method 6020A					
Lead	Soil	450	20	80-120	Equal to or greater than 95%

Note:
[1]Pennsylvania Act 2 Residential, Used Aquifer, TDS ≤2500, Medium-Specific Concentrations (MSCs). The MSCs listed for soil represent the lower of the direct contact or soil to groundwater MSC for each of the analytes.

Table 3
Measurement Quality Indicators

Analyte	Matrix	Action Limit[1] (mg/m^3) Indoor Air Screening Value	Action Limit[1] (mg/m^3) Soil Gas Screening Value	Precision	Accuracy	Completeness
VOCs – Method TO-15						
1,1,1-Trichloroethane	Soil Gas	2.9	290	25	70-130	Equal to or greater than 95%
1,1,2,2-Tetrachloroethane	Soil Gas	0.00036	0.036	25	70-130	Equal to or greater than 95%
1,1,2-Trichloro-1,2,2-trifluoroethane	Soil Gas	42	4200	25	70-130	Equal to or greater than 95%
1,1,2-Trichloroethane	Soil Gas	0.0013	0.13	25	70-130	Equal to or greater than 95%
1,1-Dichloroethane	Soil Gas	0.013	1.3	25	70-130	Equal to or greater than 95%
1,1-Dichloroethene	Soil Gas	0.28	28	25	70-130	Equal to or greater than 95%
1,2,4-Trichlorobenzene	Soil Gas	0.02	2	25	60-140	Equal to or greater than 95%
1,2,4-Trimethylbenzene	Soil Gas	0.0083	0.83	25	70-130	Equal to or greater than 95%
1,2-Dichloro-1,1,2,2-tetrafluoroethane	Soil Gas	---	---	25	60-140	Equal to or greater than 95%
1,2-Dichlorobenzene	Soil Gas	0.19	19	25	70-130	Equal to or greater than 95%
1,2-Dichloroethane	Soil Gas	0.00081	0.081	25	70-130	Equal to or greater than 95%
1,2-Dichloropropane	Soil Gas	0.002	0.2	25	70-130	Equal to or greater than 95%
1,3,5-Trimethylbenzene	Soil Gas	0.0083	0.83	25	70-130	Equal to or greater than 95%
1,3-Dichlorobenzene	Soil Gas	NA	NA	25	70-130	Equal to or greater than 95%
1,4-Dichlorobenzene	Soil Gas	0.0033	0.33	25	70-130	Equal to or greater than 95%
1,4-Dioxane	Soil Gas	0.0027	0.27	25	60-140	Equal to or greater than 95%
2-Butanone (MEK)	Soil Gas	1.4	140	25	60-140	Equal to or greater than 95%
4-Methyl-2-pentanone (MIBK)	Soil Gas	0.097	9.7	25	60-140	Equal to or greater than 95%
Acetone	Soil Gas	43	4300	25	60-140	Equal to or greater than 95%
Benzene	Soil Gas	0.0027	0.27	25	70-130	Equal to or greater than 95%
Benzyl chloride	Soil Gas	0.00043	0.043	25	70-130	Equal to or greater than 95%
Bromoform	Soil Gas	0.019	1.9	25	60-140	Equal to or greater than 95%
Bromomethane	Soil Gas	0.0068	0.68	25	70-130	Equal to or greater than 95%
Carbon disulfide	Soil Gas	0.97	97	25	70-130	Equal to or greater than 95%
Carbon tetrachloride	Soil Gas	0.0014	0.14	25	70-130	Equal to or greater than 95%
Chlorobenzene	Soil Gas	0.024	2.4	25	70-130	Equal to or greater than 95%
Dibromochloromethane	Soil Gas	0.00078	0.078	25	70-130	Equal to or greater than 95%
Chloroethane	Soil Gas	0.025	2.5	25	70-130	Equal to or greater than 95%
Chloroform	Soil Gas	0.00044	0.044	25	70-130	Equal to or greater than 95%
Chloromethane	Soil Gas	0.012	1.2	25	60-140	Equal to or greater than 95%
cis-1,2-Dichloroethene	Soil Gas	0.049	4.9	25	70-130	Equal to or greater than 95%
cis-1,3-Dichloropropene	Soil Gas	0.0052	0.52	25	70-130	Equal to or greater than 95%
Cyclohexane	Soil Gas	24	2400	25	70-130	Equal to or greater than 95%
Bromodichloromethane	Soil Gas	0.00057	0.057	25	70-130	Equal to or greater than 95%
Dichlorodifluoromethane	Soil Gas	0.24	24	25	60-140	Equal to or greater than 95%
Ethylbenzene	Soil Gas	0.019	1.9	25	70-130	Equal to or greater than 95%
1,2-Dibromoethane (EDB)	Soil Gas	0.049	4.9	25	70-130	Equal to or greater than 95%
Hexachlorobutadiene	Soil Gas	---	---	25	60-140	Equal to or greater than 95%
Hexane	Soil Gas	0.28	28	25	70-130	Equal to or greater than 95%
Isopropyl alcohol	Soil Gas	---	---	25	60-140	Equal to or greater than 95%
Isopropylbenzene	Soil Gas	0.54	54	25	70-130	Equal to or greater than 95%
m-Xylene & p-Xylene	Soil Gas	0.14	14	25	70-130	Equal to or greater than 95%
Methyl tert-butyl ether	Soil Gas	0.081	8.1	25	60-140	Equal to or greater than 95%
Methylene Chloride	Soil Gas	0.044	4.4	25	70-130	Equal to or greater than 95%
Naphthalene	Soil Gas	0.0042	0.42	25	60-140	Equal to or greater than 95%

Table 3
Measurement Quality Indicators

Analyte	Matrix	Action Limit[1] (mg/m^3)		Precision	Accuracy	Completeness
		Indoor Air Screening Value	Soil Gas Screening Value			
VOCs – Method TO-15						
o-Xylene	Soil Gas	0.14	14	25	70-130	Equal to or greater than 95%
Styrene	Soil Gas	1.4	140	25	70-130	Equal to or greater than 95%
Tetrachloroethene	Soil Gas	0.036	3.6	25	70-130	Equal to or greater than 95%
Tetrahydrofuran	Soil Gas	---	---	25	60-140	Equal to or greater than 95%
Toluene	Soil Gas	0.56	56	25	70-130	Equal to or greater than 95%
trans-1,2-Dichloroethene	Soil Gas	0.097	9.7	25	70-130	Equal to or greater than 95%
trans-1,3-Dichloropropene	Soil Gas	0.0052	0.52	25	70-130	Equal to or greater than 95%
Trichloroethene	Soil Gas	0.012	1.2	25	70-130	Equal to or greater than 95%
Trichlorofluoromethane	Soil Gas	0.97	97	25	60-140	Equal to or greater than 95%
Vinyl acetate	Soil Gas	0.28	28	25	60-140	Equal to or greater than 95%
Vinyl bromide	Soil Gas	0.00067	0.067	25	60-140	Equal to or greater than 95%

Note:
[1]Pennsylvania Act 2 Residential Indoor Air Screening Value. The Soil Gas Screening Value is the Indoor Air Screening Value multiplied by a transfer factor of 100.

KEY

- Site Boundary
- Soil Boring
- Monitoring Well
- Vapor Extraction Well
- Test Trench

NORTH

NOT TO SCALE

KU Resources, Inc.

PROPOSED SAMPLING LOCATION MAP

EAST LIBERTY PETROLEUM
812 PENN CIRCLE NORTH
PITTSBURGH, PA 15206

Prepared for: **NORTH SIDE INDUSTRIAL DEVELOPMENT COMPANY**

DRAWN BY:	SAG	10/22/15
CHECKED BY:		
APPROVED BY:		
DRAWING NO.		

FIGURE 5

Quality Assurance Manual

TestAmerica Pittsburgh
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The previous revision of this document was referenced as PT-LQAM revision 4

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Title Page:

Quality Assurance Manual
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SECTION 2

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REFERENCED CORPORATE SOPs AND POLICIES

SOP / Policy Reference	Title
CA-Q-S-001	Solvent and Acid Lot Testing and Approval
CA-Q-S-002	Acceptable Manual Integration Practices
CA-Q-S-004	Method Compliance & Data Authenticity Audits
CA-Q-S-006	Detection Limits
CA-Q-S-008	Management Systems Review
CW-Q-S-001	Corporate Document Control and Archiving
CW-Q-S-002	Writing a Standard Operating Procedure (SOPs)
CW-L-S-002	Internal Investigation of Potential Data Discrepancies and Determination for Data Recall
CA-L-S-002	Subcontracting Procedures
CW-L-P-004	Ethics Policy
CA-L-P-002	Contract Compliance Policy
CW-F-P-002	Authorization Matrix
CW-F-P-004	Procurement and Contracts Policy
CA-C-S-001	Work Sharing Process
CA-T-P-001	Qualified Products List
CW-F-S-007	Controlled Purchases Policy

SOP / Policy Reference	Title
CW-F-S-018	Vendor Selection
CA-Q-M-002	Corporate Quality Management Plan
CW-E-M-001	Corporate Environmental Health & Safety Manual

REFERENCED LABORATORY DOCUMENTS

SOP Reference	Title
PT-QA-001	Employee Orientation and Training (DOCs)
PT-QA-002	Internal Auditing
PT-QA-005	Uncertainty Measurement
PT-QA-006	Procurement of Standards and Materials; Labeling and Traceability
PT-QA-007	Detection Limits
PT-QA-008	Thermometer Calibration and Temperature Monitoring
PT-QA-010	Preparation and Management of Standard Operating Procedures (SOPs) and Other Controlled Documents
PT-QA-012	Selection and Calibration of Balances and Weights
PT-QA-013	Independent QA Data Review
PT-QA-016	Nonconformance and Corrective Action System
PT-QA-017	Aqueous Pipette / Dispenser Calibration – Gravimetric Method
PT-QA-018	Technical Data Review Requirements
PT-QA-019	Records Information Management
PT-QA-020	Report Production
PT-QA-021	Quality Control Requirements
PT-QA-022	Equipment Maintenance
PT-QA-024	Subsampling
PT-QA-027	Sample Receiving and Chain of Custody
PT-QA-028	Bottle and Cooler Preparation
PT-QA-029	DoD QSM Version 4.2 Requirements
PT-QA-W-002	SOP List
PT-QA-WI-028	Management of Change Request Form

SECTION 3. INTRODUCTION , SCOPE AND APPLICABILITY

3.1 INTRODUCTION AND COMPLIANCE REFERENCES

TestAmerica Pittsburgh's Quality Assurance Manual (QAM) is a document prepared to define the overall policies, organization objectives and functional responsibilities for achieving TestAmerica's data quality goals. The laboratory maintains a local perspective in its scope of services and client relations and maintains a national perspective in terms of quality.

The QAM has been prepared to assure compliance with The NELAC Institute (TNI) Standard, dated 2009, Volume 1 Modules 2 and 4, and ISO/IEC Guide 17025:2005(E) (TNI). In addition, the policies and procedures outlined in this manual are compliant with TestAmerica's Corporate Quality Management Plan (CQMP – CA-Q-M-002) and the various accreditation and certification programs listed in Appendix 3. The CQMP provides a summary of TestAmerica's quality and data integrity system. It contains requirements and general guidelines under which all TestAmerica facilities shall conduct their operations.

The QAM has been prepared to be consistent with the requirements of the following documents:

- EPA 600/4-88/039, *Methods for the Determination of Organic Compounds in Drinking Water,* EPA, Revised July 1991
- EPA 600/R-95/131, *Methods for the Determination of Organic Compounds in Drinking Water,* Supplement III, EPA, August 1995.
- EPA 600/4-79-019, *Handbook for Analytical Quality Control in Water and Wastewater Laboratories,* EPA, March 1979.
- *Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846), Third Edition, September 1986, Final Update I, July 1992, Final Update IIA, August 1993, Final Update II, September 1994; Final Update IIB, January 1995; Final Update III, December 1996; Final Update IV, January 2008.*
- *U.S. Department of Defense, Quality Systems Manual for Environmental Laboratories, Version 4.2, October 2010.*
- *Federal Register, 40 CFR Parts 136, 141, 172, 173, 178, 179 and 261.*
- *Statement of Work for Inorganics & Organics Analysis, SOM and ISM, current versions, USEPA Contract Laboratory Program Multi-media, Multi-concentration.*
- APHA, *Standard Methods for the Examination of Water and Wastewater,* 18th Edition, 19th, 20th, 21st, 22nd and on-line Editions.
- *U.S. Department of Energy* Order 414.1C, *Quality Assurance*, June 17, 2005.
- *U.S. Department of Energy*, *Quality Systems for Analytical Services*, Revision 3.6, November 2010.
- U.S. Department of Defense, *Air Force Center for Environmental Excellence Quality Assurance Project Plan (QAPP),* Version 4.0.02, May 2006.
- Nuclear Regulatory Commission (NRC) quality assurance requirements.
- Marine Protection, Research, and Sanctuaries Act (MPRSA).
- Toxic Substances Control Act (TSCA).

3.2 TERMS AND DEFINITIONS

A Quality Assurance Program is a company-wide system designed to ensure that data produced by the laboratory conforms to the standards set by state and/or federal regulations. The program functions at the management level through company goals and management policies, and at the analytical level through Standard Operating Procedures (SOPs) and quality control. The TestAmerica program is designed to minimize systematic error, encourage

constructive, documented problem solving, and provide a framework for continuous improvement within the organization.

Refer to Appendix 2 for the Glossary/Acronyms.

3.3 SCOPE / FIELDS OF TESTING

The laboratory analyzes a broad range of environmental and industrial samples every month. Sample matrices vary among effluent water, groundwater, hazardous waste, sludge, soils and tissue. The Quality Assurance Program contains specific procedures and methods to test samples of differing matrices for chemical, physical and biological parameters. The Program also contains guidelines on maintaining documentation of analytical processes, reviewing results, servicing clients and tracking samples through the laboratory. The technical and service requirements of all analytical requests are thoroughly evaluated before commitments are made to accept the work. Measurements are made using published reference methods or methods developed and validated by the laboratory.

The methods covered by this manual include the most frequently requested methodologies needed to provide analytical services in the United States and its territories. The specific list of test methods used by the laboratory can be found in the Statement of Qualifications (SOQ) The current list of accredited methods is maintained in Total Access.The approach of this manual is to define the minimum level of quality assurance and quality control necessary to meet these requirements. All methods performed by the laboratory shall meet these criteria as appropriate. In some instances, quality assurance project plans (QAPPs), project specific data quality objectives (DQOs) or local regulations may require criteria other than those contained in this manual. In these cases, the laboratory will abide by the requested criteria following review and acceptance of the requirements by the Laboratory Director and the Quality Assurance (QA) Manager. In some cases, QAPPs and DQOs may specify less stringent requirements. The Laboratory Director and the QA Manager must determine if it is in the lab's best interest to follow the less stringent requirements.

3.3.1 Specialty Analyses

3.3.1.1 Dredged Material Evaluations

TestAmerica Pittsburgh offers trace level testing of waters (site-waters and elutriates), sediments, and tissues in support of Dredged Material Evaluations for in-water (ocean and inland waters) and upland (Confined Disposal Facilities (CDFs), beneficial use, etc.) disposal options. In-house capabilities for commonly requested sediment program parameters include:

- Organochlorine Pesticides
- Organophosphorus Pesticides
- PCBs (as Aroclors)
- Volatile Organics
- Semivolatile Organics
- Metals
- Cyanide
- Total Sulfides
- Acid Volatile Sulfide (AVS) and Simultaneously Extracted Metals (SEM)
- Nitrogen, Ammonia
- Nitrogen, Nitrate + Nitrite

- Biochemical Oxygen Demand (BOD)
- Chemical Oxygen Demand (COD)
- Total Organic Carbon (combustion procedure for sediments)
- Total Solids/Moisture Content
- Total Volatile Solids
- Lipids
- With teaming arrangements with other TestAmerica facilities, additional sediment program capabilities include:
- Polychlorinated Dibenzo-Dioxins and Furans (PCDDs/PCDFs)
- Butyl Tins (mono – tetra)
- Total Kjeldahl Nitrogen
- Total Phosphorus
- Grain Size
- Specific Gravity
- Atterberg Limits
- PCBs (as Congeners)

TestAmerica Pittsburgh also generates elutriate samples following appropriate U.S. Army Corps of Engineers procedures. These include:

- Standard Elutriate Test (SET) for in-water disposal evaluations, and
- Modified Elutriate Test (MET) or Effluent Elutriate Test (EET) for CDF disposal evaluations.
- Illinois Resuspension Tests (Supernatant and Elutriate Tests).
- Dredge Elutriate Test (DRET)

TestAmerica Pittsburgh currently supports dredge material evaluation projects following several state specific programs, as well as, under the following guidance documents:

- Ocean Testing Manual or OTM (USACE, 1991).
- New Jersey's Tidal Waters Technical Manual (NJDEP, 1997).
- Inland Testing Manual or ITM (USACE, 1998).
- Upland Testing Manual or UTM (USACE, 2003).

3.3.1.2 Tissue Analyses

TestAmerica Pittsburgh has extensive experience in supporting projects requiring tissue analyses. These include analyses of laboratory cultured reference species from bioaccumulation tests associated with dredged material evaluations to a variety of field collected species (aquatic and terrestrial). TestAmerica Pittsburgh has developed modifications to the standard solid methodologies (where possible) to allow for the use of smaller sample weights and achieve lower quantitation limits. In-house capabilities for commonly requested tissue parameters include:

- Organochlorine Pesticides
- PCBs (as Aroclors)
- Semivolatile Organics
- Metals
- Lipids
- Moisture Content

With teaming arrangements with other TestAmerica facilities, additional tissue capabilities include:

- Polychlorinated Dibenzo-Dioxins and Furans (PCDDs/PCDFs)
- Butyl Tins (mono – tetra)
- PCBs (as Congeners)

3.4 MANAGEMENT OF THE MANUAL

3.4.1 Review Process

The template on which this manual is based is reviewed annually by Corporate Quality Management Personnel to assure that it remains in compliance with Section 3.1. This manual itself is reviewed annually by senior laboratory management to assure that it reflects current practices and meets the requirements of the laboratory's clients and regulators as well as the CQMP. Occasionally, the manual may need changes in order to meet new or changing regulations and operations. The QA Manager will review the changes in the normal course of business and incorporate changes into revised sections of the document. All updates will be reviewed by the senior laboratory management staff. The laboratory updates and approves such changes according to our Document Control & Updating procedures (refer to SOP No. PT-QA-010, Preparation and Management of Standard Operating Procedures (SOPs) and Other Controlled Documents).

SECTION 4.

MANAGEMENT REQUIREMENTS

4.1 Overview

TestAmerica Pittsburgh is a local operating unit of TestAmerica Laboratories, Inc.. The organizational structure, responsibilities and authorities of the corporate staff of TestAmerica Laboratories, Inc. are presented in the CQMP. The laboratory has day-to-day independent operational authority overseen by corporate officers (e.g., President, Chief Executive Officer, Chief Financial Officer, Corporate Quality etc.). The laboratory operational and support staff work under the direction of the Laboratory Director. The organizational structure for both Corporate & TestAmerica Pittsburgh is presented in Figure 4-1.

4.2 Roles And Responsibilities

In order for the Quality Assurance Program to function properly, all members of the staff must clearly understand and meet their individual responsibilities as they relate to the quality program. The following descriptions briefly define each role in its relationship to the Quality Assurance Program.

4.2.1 Additional Requirements for Laboratories

The responsibility for quality resides with every employee of the laboratory. All employees have access to the QAM, are trained to this manual, and are responsible for upholding the standards therein. Each person carries out his/her daily tasks in a manner consistent with the goals and in accordance with the procedures in this manual and the laboratory's SOPs. Role descriptions for Corporate personnel are defined in the CQMP. This manual is specific to the operations of TestAmerica's Pittsburgh laboratory.

4.2.2 General Manager (GM)

Each GM reports directly to the CEO. Each GM has full responsibility for the overall administrative and operational management of their respective laboratories. The GM's responsibilities include allocation of personnel and resources, long-term planning, setting goals, and achieving the financial, business, and quality objectives of TestAmerica. The GM ensures timely compliance with corporate management directives, policies, and management systems reviews. The GM is also responsible for restricting any laboratory from performing analyses that cannot be consistently and successfully performed to meet the standards set forth in this manual.

4.2.3 Laboratory Director

Pittsburgh's Laboratory Director is responsible for the overall quality, safety, financial, technical, human resource and service performance of the whole laboratory and reports to their respective GM. The Laboratory Director provides the resources necessary to implement and maintain an effective and comprehensive Quality Assurance and Data Integrity Program. The Laboratory Director can also serve as the Technical Manager.

Specific responsibilities include, but are not limited to:

- Provides one or more technical directors for the appropriate fields of testing. If the Technical Manager is absent for a period of time exceeding 15 consecutive calendar days, the

Laboratory Director must designate another full time staff member meeting the qualifications of the Technical Manager to temporarily perform this function. If the absence exceeds 35 consecutive calendar days, the primary accrediting authority must be notified in writing.

- Ensures that all analysts and supervisors have the appropriate education and training to properly carry out the duties assigned to them and ensures that this training has been documented.
- Ensures that personnel are free from any commercial, financial and other undue pressures which might adversely affect the quality of their work.
- Ensures TestAmerica's human resource policies are adhered to and maintained.
- Ensures that sufficient numbers of qualified personnel are employed to supervise and perform the work of the laboratory.
- Ensures that appropriate corrective actions are taken to address analyses identified as requiring such actions by internal and external performance or procedural audits. Procedures that do not meet the standards set forth in the QAM or laboratory SOPs may be temporarily suspended by the Laboratory Director.
- Reviews and approves all SOPs prior to their implementation and ensures all approved SOPs are implemented and adhered to.
- Pursues and maintains appropriate laboratory certification and contract approvals. Supports ISO 17025 requirements.
- Ensures client specific reporting and quality control requirements are met.
- Captains the management team, consisting of the QA Manager, the Technical Managers and the Department Managers.
- Monitoring the validity of the analyses performed and data generated in the laboratory. This activity begins with reviewing and supporting all new business contracts, insuring data quality, analyzing internal and external non-conformances to identify root cause issues and implementing the resulting corrective and preventive actions, facilitating the data review process (training, development, and accountability at the bench), and providing technical and troubleshooting expertise on routine and unusual or complex problems. Interfaces with management on solving day-to-day technical issues.
- Providing training and development programs to applicable laboratory staff as new hires and, subsequently, on a scheduled basis. Training includes instruction on calculations, instrumentation management to include troubleshooting and preventive maintenance.
- The Technical Manager meets the requirements specified in the Section 5.2.6.1 of the TNI standards.

4.2.4 Quality Assurance (QA) Manager or Designee

The QA Manager has responsibility and authority to ensure the continuous implementation of the quality system based on TNI Standard and DoD QSM. The QA Manager reports directly to the Laboratory Director and to the Corporate Quality Systems Director. This position is able to evaluate data objectively and perform assessments without outside (e.g., managerial) influence. Corporate QA may be used as a resource in dealing with regulatory requirements, certifications and other quality assurance related items. The QA Manager directs the activities of the QA Specialists to accomplish specific responsibilities, which include, but are not limited to:

- Serves as the focal point for QA/QC in the laboratory.
- Ensuring Communication & monitoring standards of performance to ensure that systems are in place to produce the level of quality as defined in this document.

- Notifying laboratory management of deficiencies in the quality system and ensuring corrective action is taken. Procedures that do not meet the standards set forth in the QAM or laboratory SOPs are temporarily suspended following the procedures outlined in Section 12.
- Evaluation of the thoroughness and effectiveness of training.
- QA Manager has the authority and responsibility for ensuring that all personnel understand their contributions to the quality system; evaluates the effectiveness of training; or uses available tools, such as audit and surveillance results, control charts, proficiency testing results, data analysis, corrective and preventive actions, customer feedback, and management reviews in efforts to monitor trends and continually improve the quality system.
- Maintains, approves, and updates the QAM.
- Has joint signature authority, with the Laboratory Director and Technical Managers for approval of quality documents.
- Directs controlled distribution laboratory quality documents.
- Provides Quality System training to all new personnel.
- Reviews and approves documentation of analyst training records.
- Serves as a focal point for QA and QC issues, reviews corrective actions and recommends resolution for recurring nonconformances within the laboratory.
- Monitoring and communicating regulatory changes that may affect the laboratory to management.
- Monitoring and evaluating laboratory certifications; scheduling proficiency testing samples. Maintaining certifications.
- Monitors data quality measures via statistical methods to verify that the laboratory routinely meets stated quality goals.
- Hosts external audits conducted by outside agencies.
- Responsible for approving quality control reference data changes in the LIMS.
- Oversees the selection, review, and approval of analytical subcontractors.
- Prepares monthly QA Reports to management describing significant quality events to Laboratory Director and/or Corporate QA.
- Has the final authority to accept or reject data and to stop work in progress in the event that procedures or practices compromise the validity and integrity of analytical data.
- Coordinating, writing, and reviewing preparation of all test methods SOPs, with regard to quality, integrity, regulatory He/she insures that the SOPs are properly managed and adhered to at the bench.
- Have documented training and/or experience in QA/QC procedures and the laboratory's Quality System.
- Having a general knowledge of the analytical test methods for which data audit/review is performed (and/or having the means of getting this information when needed).
- Arranging for or conducting internal audits on quality systems and the technical operation.
- The laboratory QA Manager will maintain records of all ethics-related training, including the type and proof of attendance.
- Maintain, improve, and evaluate the corrective action database and the corrective and preventive action systems.
- Notifying laboratory management of deficiencies in the quality system and ensuring corrective action is taken. Procedures that do not meet the standards set forth in the QAM or laboratory SOPs shall be investigated following procedures outlined in Section 12 and if deemed necessary may be temporarily suspended during the investigation.

- Objectively monitor standards of performance in quality control and quality assurance without outside (e.g., managerial) influence.
- Coordinating of document control of SOPs, MDLs and control limits.
- Follow-up with audits to ensure client QAPP requirements are met.
- Development of suggestions and recommendations to improve quality systems.
- Research of current state and federal requirements and guidelines.
- Compliance with ISO 17025.
- Compliance with DoD ELAP

4.2.5 Technical Director

The Technical Director serves as a technical resource for TestAmerica's personnel and clients in their field of expertise. Researches, develops, and implements new analytical methods and recommends process improvements to existing analyses. Manages technical projects and conducts evaluation of technologies. Writes and reviews laboratory SOPs and trains employees on methods and procedures. Performs sample analysis and final data review, and maintains and troubleshoots laboratory instruments.

- Solves technical problems in the laboratory including troubleshooting instruments and develops or modifies methods as needed to meet customer requirements.
- Performs sample analyses, data write up, and final data review.
- Maintains and repairs analytical instruments to reduce downtime.
- Consults with clients, regulators, and others regarding technical aspects of analyses.
- Suggests and implements process improvements to maximize productivity, save costs, and decrease turn around time.
- Develops or amends department SOP's.
- Participates in TestAmerica's best practice process to spread best technical practices and develop TestAmerica Standard Operating Procedures (SOPs). Leads the implementation and follow-up of the best practices and SOPs in the laboratory.
- Evaluates and adapts new technologies and methodologies. Performs non-routine analysis as required to meet the needs of current long-term clients or as a means to capture new clients in support of business development efforts.
- Manages technical projects. Prepares reports and recommendations for senior laboratory management.
- Sets up and conducts training for analyst and technicians in area of expertise.
- Mentors associates in the laboratory.
- Assists in the development of health and safety protocols.
- Consults with Project Managers and sales staff regarding analytical techniques and capabilities.
- Investigates issues raised by clients, QA, sales, and other departments to find root cause and implement corrective action and proper response.
- Contributes technical information and evaluation for deciding major new equipment purchases and capital expenditures.
- Carries out technical and business tasks as assigned by the Laboratory

- Manages technical projects. Prepares reports and recommendations for senior laboratory management.

4.2.6 Quality Assurance Specialist

The QA Specialist is responsible for QA documentation and involvement in the following activities:

- Assist the QA Manager in performing the annual internal laboratory audits, compiling the evaluation, and coordinating the development of an action plan to address any deficiency identified.
- Facilitate external audits, coordinating with the QA Manager and Laboratory Staff to address any deficiencies noted at the time of the audit and subsequently presented in the final audit report.
- Assist the QA Manager in the preparation of new SOP's and in the maintenance of existing SOPs, coordinating annual reviews and updates.
- Manages the performance testing (PT) studies, coordinates follow up studies for failed analytes and works with QA Manager and Laboratory Staff to complete needed corrective action reports.
- Personnel training records review and maintenance.
- Document control maintenance.
- Assists the Quality Manager and Project Management Group in the review of program plans for consistency with organizational and contractual requirements. Summarize and convey to appropriate personnel anomalies or inconsistencies observed in the review process.
- Manages certifications and accreditations.
- Monitors for compliance the following QA Metrics: Temperature Monitoring of refrigeration units and incubators; thermometer calibrations; balance calibrations; eppendorf/pipette calibrations; and proper standard/reagent storage.
- Periodic checks on the proper use and review of instrument logs.
- Initiate Analyst/Data audits and the Mint-miner data file review process for organic instrumentation. Maintain tracking of reviews.
- Assist in the technical review of data packages which require QA review.

4.2.7 Technical Manager or Designee

The Technical Manager(s) report(s) directly to the Laboratory Director. The scope of responsibility ranges from the new-hire training and existing technology through the ongoing training and development programs for existing analysts and new instrumentation and for compliance with the ISO 17025 Standard. Specific responsibilities include, but are not limited to:

- Reviewing and approving, with input from the QA Manager, proposals from marketing, in accordance with an established procedure for the review of requests and contracts. This procedure addresses the adequate definition of methods to be used for analysis and any limitations, the laboratory's capability and resources, the client's expectations. Differences are resolved before the contract is signed and work begins. A system documenting any significant changes is maintained, as well as pertinent discussions with the client regarding their requirements or the results of the analyses during the performance of the contract. All work subcontracted by the laboratory must be approved by the client. Any deviations from the contract must be disclosed to the client. Once the work has begun, any amendments to the contract must be discussed with the client and so documented.

- Monitoring the validity of the analyses performed and data generated in the laboratory. This activity begins with reviewing and supporting all new business contracts, insuring data quality, analyzing internal and external non-conformances to identify root cause issues and implementing the resulting corrective and preventive actions, facilitating the data review process (training, development, and accountability at the bench), and providing technical and troubleshooting expertise on routine and unusual or complex problems.
- Providing training and development programs to applicable laboratory staff as new hires and, subsequently, on a scheduled basis. Training includes instruction on calculations, instrumentation management to include troubleshooting and preventive maintenance.
- Enhancing efficiency and improving quality through technical advances and improved LIMS utilization. Capital forecasting and instrument life cycle planning for second generation methods and instruments as well as asset inventory management.
- Compliance with ISO 17025.
- Compliance with DoD ELAP

4.2.8 Customer Service Manager (CSM)

- Reports directly to the Client Services Director with dotted line reporting to the Laboratory Director
- Has signature authority for contracts for laboratory services, as detailed in TestAmerica policy, and for laboratory reports.
- 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.

4.2.9 Project Manager

- Reports directly to the Client Services Director with dotted line reporting to the Laboratory Director
- Monitors analytical and QA project requirements for a specified project.
- Ensures appropriate reporting of certification status for work performed at the laboratory as well as for workshare and subcontracted work.
- 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.
- Has signature authority for final reports.
- 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.

- Prepares reissue requests for project data.
- Responsible for meeting quality requirements.

4.2.10 Office Manager

- Reports directly to the Laboratory Director or designee.
- Supervises and manages the activities of all administrative and clerical support staff.
- Provides recommendations to the Laboratory Director on staffing needs within the administrative department.
- Schedules facility maintenance and repair to ensure laboratory is operating within operational, security and safety requirements.
- Provides assistance with accounting, accounts payable, accounts receivable, and invoicing activities to ensure appropriate financial reporting.
- Coordinates purchasing activities for administrative items and may also support purchasing for laboratory areas to provide departments with the proper supplies in a timely manner.
- Maintains petty cash fund and distributes funds as needed for the purchase of items for the laboratory.
- Assists in management of EH&S policies and procedures to ensure a safe and secure workplace for employees.
- Provides administrative support to the Laboratory Director and other laboratory as needed to facilitate operational requirements.

4.2.11 Project Manager Assistant (PMA)

- Collates data reports, expanded deliverables and CLP data packages for delivery to clients and reviews for accuracy.
- Assists the CSMs and PMs in the reporting process.
- Enters field data in TALS LIMS.
- Prints reports as needed for Project Managers.
- Monitors report due dates for timely delivery.
- Provides clerical support to the CSMs, PMs and other laboratory staff as needed
- Generates credit or debit invoices to ensure proper payment in compliance with client requirements as established and communicated.
- Sends final data to clients via email or courier.

4.2.12 Organics Department Manager

Manages the GC and GCMS and Organic Preparation groups. Reports directly to the Laboratory Director or designee.

- Ensure that analysts in their department adhere to applicable SOPs and the QA Manual. He/she performs frequent SOP and QA Manual review to determine if analysts are in compliance and if new, modified, and optimized measures are feasible and should be added to these documents. Responsible for review and approval of SOPs for their section.
- With regard to analysts, participates in the selection, training, development of performance objectives and standards of performance, appraisal (measurement of objectives), scheduling, counseling, discipline, and motivation of analysts and documents these activities in accordance with systems developed by the QA and Personnel Departments. They

evaluate staffing sufficiency and overtime needs. Training consists of familiarization with SOP, QC, Safety, and computer systems.

- Encourage the development of analysts to become cross-trained in various methods and/or operate multiple instruments efficiently while performing maintenance and documentation, self-supervise, and function as a department team.
- Provide guidance to analysts in resolving problems encountered daily during sample prep/analysis in conjunction with the Technical Managers and/or QA Manager. Each is responsible ensuring 100% implementation of the data review and documentation, non-conformance and corrective action issues, the timely and accurate completion of performance evaluation samples and MDLs, for his/her department.
- Ensure all logbooks are maintained, current, and properly labeled or archived.
- Report all non-conformance conditions to the QA Manager, Technical Managers and/or Laboratory Director.
- Ensure that preventive maintenance is performed on instrumentation as detailed in the QA Manual or SOPs. He/she is responsible for developing and implementing a system for preventive maintenance, troubleshooting, and repairing or arranging for repair of instruments.
- Maintain adequate and valid inventory of reagents, standards, spare parts, and other relevant resources required to perform daily analysis.
- Achieve optimum turnaround time on analyses and compliance with holding times.
- Conduct efficiency and cost control evaluations on an ongoing basis to determine optimization of labor, supplies, overtime, first-run yield, capacity (designed vs. demonstrated), second- and third-generation production techniques/instruments, and long-term needs for budgetary planning.
- Develop, implement, and enhance calibration programs.
- Provide written responses to external and internal audit issues.

4.2.13 Inorganics Department Manager

Manages the Metals and Wet Chemistry groups. Reports directly to the Laboratory Director or designee.

- Ensure that analysts in their department adhere to applicable SOPs and the QA Manual. He/she performs frequent SOP and QA Manual review to determine if analysts are in compliance and if new, modified, and optimized measures are feasible and should be added to these documents. Responsible for review and approval of SOPs for their section.
- With regard to analysts, participates in the selection, training, development of performance objectives and standards of performance, appraisal (measurement of objectives), scheduling, counseling, discipline, and motivation of analysts and documents these activities in accordance with systems developed by the QA and Personnel Departments. They evaluate staffing sufficiency and overtime needs. Training consists of familiarization with SOP, QC, Safety, and computer systems.
- Encourage the development of analysts to become cross-trained in various methods and/or operate multiple instruments efficiently while performing maintenance and documentation, self-supervise, and function as a department team.
- Provide guidance to analysts in resolving problems encountered daily during sample prep/analysis in conjunction with the Technical Managers and/or QA Manager. Each is responsible ensuring 100% implementation of the data review and documentation, non-

conformance and corrective action issues, the timely and accurate completion of performance evaluation samples and MDLs, for his/her department.

- Ensure all logbooks are maintained, current, and properly labeled or archived.
- Report all non-conformance conditions to the QA Manager, Technical Managers and/or Laboratory Director.
- Ensure that preventive maintenance is performed on instrumentation as detailed in the QA Manual or SOPs. He/she is responsible for developing and implementing a system for preventive maintenance, troubleshooting, and repairing or arranging for repair of instruments.
- Maintain adequate and valid inventory of reagents, standards, spare parts, and other relevant resources required to perform daily analysis.
- Achieve optimum turnaround time on analyses and compliance with holding times.
- Conduct efficiency and cost control evaluations on an ongoing basis to determine optimization of labor, supplies, overtime, first-run yield, capacity (designed vs. demonstrated), second- and third-generation production techniques/instruments, and long-term needs for budgetary planning.
- Develop, implement, and enhance calibration programs.
- Provide written responses to external and internal audit issues.

4.2.14 Team Leader/Supervisor

Reports directly to the Organics or Inorganics Manager and/or Laboratory Director or designee.

- Ensure that analysts in their department adhere to applicable SOPs and the QA Manual. He/she performs frequent SOP and QA Manual review to determine if analysts are in compliance and if new, modified, and optimized measures are feasible and should be added to these documents. Responsible for review and approval of SOPs for their section.
- With regard to analysts, participates in the selection, training, development of performance objectives and standards of performance, appraisal (measurement of objectives), scheduling, counseling, discipline, and motivation of analysts and documents these activities in accordance with systems developed by the QA and Personnel Departments. They evaluate staffing sufficiency and overtime needs. Training consists of familiarization with SOP, QC, Safety, and computer systems.
- Encourage the development of analysts to become cross-trained in various methods and/or operate multiple instruments efficiently while performing maintenance and documentation, self-supervise, and function as a department team.
- Provide guidance to analysts in resolving problems encountered daily during sample prep/analysis in conjunction with the Technical Manager(s) and/or QA Manager. Each is responsible ensuring 100% implementation of the data review and documentation, non-conformance and corrective action issues, the timely and accurate completion of performance evaluation samples and MDLs, for his/her department.
- Ensure all logbooks are maintained, current, and properly labeled or archived.
- Report all non-conformance conditions to the QA Manager, Technical Manager (s) and/or Laboratory Director.
- Ensure that preventive maintenance is performed on instrumentation as detailed in the QA Manual or SOPs. He/she is responsible for developing and implementing a system for preventive maintenance, troubleshooting, and repairing or arranging for repair of instruments.

- Maintain adequate and valid inventory of reagents, standards, spare parts, and other relevant resources required to perform daily analysis.
- Achieve optimum turnaround time on analyses and compliance with holding times.
- Conduct efficiency and cost control evaluations on an ongoing basis to determine optimization of labor, supplies, overtime, first-run yield, capacity (designed vs. demonstrated), second- and third-generation production techniques/instruments, and long-term needs for budgetary planning.
- Develop, implement, and enhance calibration programs.
- Provide written responses to external and internal audit issues.

4.2.15 Laboratory Analyst

Laboratory analysts are responsible for conducting analysis and performing all tasks assigned to them by the team leader or supervisor. The responsibilities of the analysts are listed below:

- Perform analyses by adhering to analytical and quality control protocols prescribed by current SOPs, this QA Manual, and project-specific plans honestly, accurately, timely, safely, and in the most cost-effective manner.
- Ensures sample and data integrity by adhering to internal chain-of-custody procedures.
- Document standard and sample preparation, instrument calibration and maintenance, data calculations, sample matrix effects, and any observed non-conformance on bench sheets, lab notebooks, run logs, and/or the Non-Conformance Database.
- Report all non-conformance situations, instrument problems, matrix problems and QC failures, which might affect the reliability of the data, to their supervisor or Technical Manager (s), and/or the QA Manager or member of QA staff.
- Perform 100% review of the data generated prior to entering and submitting for secondary level review. Performs data processing using available tools/software.
- Suggest method improvements to their supervisor, the Technical Manager (s), and the QA Manager. These improvements, if approved, will be incorporated. Ideas for the optimum performance of their assigned area, for example, through the proper cleaning and maintenance of the assigned instruments and equipment, are encouraged.
- Work cohesively as a team in their department to achieve the goals of accurate results, optimum turnaround time, cost effectiveness, cleanliness, complete documentation, and personal knowledge of environmental analysis.

4.2.16 Sample Custodian/Sample Receiving Team Leader

- Ensures implementation of proper sample receipt procedures, including maintenance of chain-of-custody.
- Reports nonconformances associated with condition-upon-receipt of samples.
- 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.

4.2.17 Field Service Technician

The Field Service Technicians report to the Sample Management Department Manager. The responsibilities of the Field Service Technicians are outlined below:

- Perform sample collection and sample pick-up
- Ensures sample containers are prepared for sampling
- Performs field tests and measurements and operates and maintains equipment used for those purposes.

4.2.18 Environmental Health and Safety Coordinator

The Health and Safety Coordinator reports to the Laboratory Director and ensures that systems are maintained for the safe operation of the laboratory. The EH&S Coordinator is responsible to:

- Conduct ongoing, necessary safety training and conduct new employee safety orientation.
- Assist in developing and maintaining the Chemical Hygiene/Safety Manual.
- Administer dispersal of all Material Safety Data Sheet (MSDS) information.
- Perform regular chemical hygiene and housekeeping instruction.
- Give instruction on proper labeling and practice.
- Serve as chairman of the laboratory safety committee.
- Provide and train personnel on protective equipment.
- Oversee the inspection and maintenance of general safety equipment – fire extinguishers, safety showers, eyewash fountains, etc. and ensure prompt repairs as needed.
- Supervise and schedule fire drills and emergency evacuation drills.
- Determine what initial and subsequent exposure monitoring, if necessary to determine potential employee exposure to chemicals used in the laboratory.
- When determined necessary, conduct exposure monitoring assessments.
- Determine when a complaint of possible over-exposure is “reasonable” and should be referred for medical consultation.
- Assist in the internal and external coordination of the medical consultation/monitoring program conducted by TestAmerica’s medical consultants.

4.3 DEPUTIES

The following table defines who assumes the responsibilities of key personnel in their absence:

Key Personnel	Deputy	Comment
Laboratory Director: Deborah Lowe	Project Technical Manager – Dave Dunlap	NELAP Technical Manager (entire laboratory)
Quality Assurance Manager: Violet Fanning	Quality Assurance Specialist: Pam Dudeck	
Technical Manager: Larry Matko	Laboratory Director: Deborah Lowe	NELAP Technical Manager (Lipids & 8141)
Organics Department Manager: Sharon Bacha	Designated GC and GCMS Analyst	NELAP Technical Manager (Organics)
Inorganics Department Manager: Roseann Ruyechan	Designated Metals and Wet Chemistry Supervisors	
Metals Supervisor: Bill Reinheimer	Designated Senior Metals Analyst	

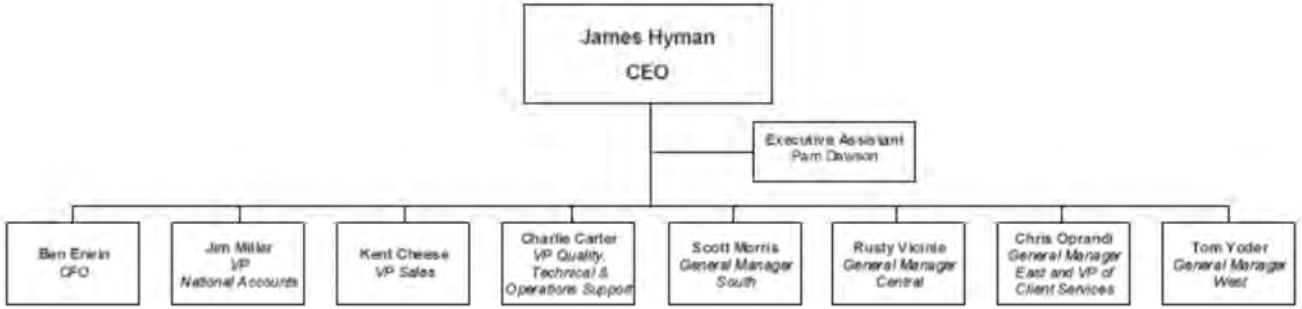
Key Personnel	Deputy	Comment
Wet Chemistry Supervisor: Mike Wesoloski	Designated Senior Wet Chemistry Analyst	NELAP Technical Manager (Wet Chemistry)
Organic Prep Team Leader: Brian Pino	Designated Senior Organic Prep Analyst	
Sample Receiving Department Manager: Christine Kovitch	Lab Director or Designated person in the group	

If the NELAP Technical Manager is absent for a period of time exceeding 15 consecutive calendar days, the Laboratory Director must designate another full time staff member meeting the qualifications of the Technical Manager to temporarily perform this function. If the absence exceeds 35 consecutive calendar days, the primary accrediting authority must be notified in writing.

Figure 4-1.

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

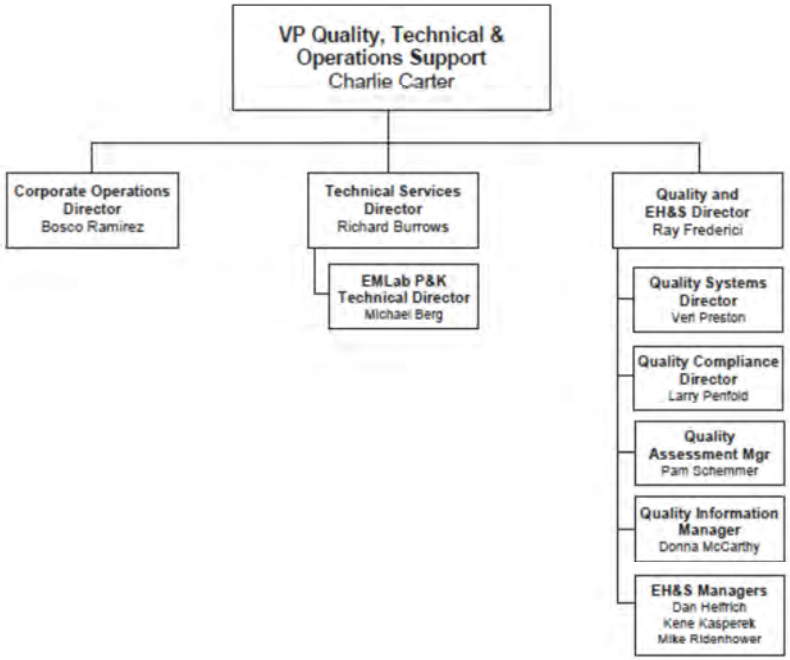
Executive Committee



30 Nov 2012

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Quality, Technical, EH&S & Operations Support



30 Oct 2012

Note: QA Managers and EH&S Coordinators have direct reporting relationship to both operations leadership and corporate functional leadership.

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Pittsburgh Laboratory Organization

Rusty Vicinie
General Manager

Debbie Lowe
Laboratory Director

Steve Tarosky
Director of Financial Operations, East

Verl Preston
Corporate QA Director

Ray Frederici
Corporate EHS Officer

Tara Schlenker
Client Services Director

Project Technical Director
Dave Dunlap

Pittsburgh Customer Service
Kathryn Bort, CSM
Carrie Gamber, CSM
Ryan Hall, CSM

Project Managers
Veronica Bortot
Deb Bowen
Jill Colussy
John Danek
John Poremba

Darla Skowronek
PA Group Leader

Project Administrators
Megan Hall
Kathy Myers
Vacant

Larry Matko
Technical Director

Sediments/ TCLP Dept. Mgr.
Lauren McGrath
Sean Payton

Baltimore Washington DC Svc Center
Ken Ives, CSM

Paul Gayleard, Courier

VA Beach Svc Center
Emily Bauer, CSM

Steve Gross, Courier

Organics
Sharon Bacha
Dept Mgr

GC SVOA
Jim DeRubeis
Dave Eppinger
Ashok Gupta
Matt Hartman
John Oravec
Linx Waclaski

GCMS SVOA
Craig Addison
Frank Bungard
Vince Piccolino

MS VOA
Don Ferguson
Kathy Gordon
Patrick Journet
Jessica Ryan
Mike Zukowski
Vacant

Org Prep
Brian Pino
Supervisor

Kevin Geehring
Jeremy Merriman
Chuck Miller
Brandon O'Donnell
Bill Trout
Chuck Yushinski

Inorganic
Roseann Ruyechan
Dept Mgr

Metals
Bill Reinheimier
Supervisor

Rob Good
Caitlyn Haluck
Bill A. Hoyle
Mary Beth Miller (PT)
Ron Rosenbaum
Caitlin Ferguson
Jim Swanson
Stephanie Testa

Wet Chemistry
Mike Wesoloski
Supervisor

Erin Bozik
Paul Johnson
Chuck Kieda
Sarah Kunkle
Cheryl Loheyde
Jeremiah McLaughlin
Janea Patterson
Carl Reagle

Violet Fanning
QA Manager

Pam Dudeck, QA Specialist

Steve Jackson
Regional EHSC

Lisa Haueter
Regional HR Generalist

Sample Management
Chris Kovitch
Dept. Mgr

Vacant
Vacant
Bill T. Hoyle
Elyse Skowronek
Debbie Watson

Field Service
Eric Kubit

On Call Couriers:
Steve Drexel (P)
Tom Meyers (P)

Temporary Employees
Haley Bacha (T)
Emily Skowronek (T)
Zach Dunlap (T)
Rachael Hartman (T)

Note:
QA Manager and EH&S Manager have a direct reporting relationship to both operations leadership and corporate functional leadership.

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PT 3

* Listed more than once
(PT) Part Time

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SECTION 5

QUALITY SYSTEM

5.1 Quality Policy Statement

It is TestAmerica's Policy to:

- Provide data of known quality to its clients by adhering to approved methodologies, regulatory requirements and the QA/QC protocols.
- Effectively manage all aspects of the laboratory and business operations by the highest ethical standards.
- Continually improve systems and provide support to quality improvement efforts in laboratory, administrative and managerial activities. TestAmerica recognizes that the implementation of a quality assurance program requires management's commitment and support as well as the involvement of the entire staff.
- Provide clients with the highest level of professionalism and the best service practices in the industry.
- To comply with the ISO/IEC 17025:2005(E) International Standard, the 2009 TNI Standard and to continually improve the effectiveness of the management system.

Every staff member at the laboratory plays an integral part in quality assurance and is held responsible and accountable for the quality of their work. It is, therefore, required that all laboratory personnel are trained and agree to comply with applicable procedures and requirements established by this document.

5.2 Ethics And Data Integrity

TestAmerica is committed to ensuring the integrity of its data and meeting the quality needs of its clients. The elements of TestAmerica's Ethics and Data Integrity Program include:

- Ethics Policy (Corporate Policy No. CW-L-P-004) and Employee Ethics Statements.
- Ethics and Compliance Officers (ECOs).
- A Training Program.
- Self-governance through disciplinary action for violations.
- A Confidential mechanism for anonymously reporting alleged misconduct and a means for conducting internal investigations of all alleged misconduct. (Corporate SOP No. CW-L-S-002.)
- Procedures and guidance for recalling data if necessary (Corporate SOP No. CW-L-S-002).
- Effective external and internal monitoring system that includes procedures for internal audits (Section 15).
- Produce results, which are accurate and include QA/QC information that meets client pre-defined Data Quality Objectives (DQOs).
- Present services in a confidential, honest and forthright manner.
- Provide employees with guidelines and an understanding of the Ethical and Quality Standards of our Industry.
- Operate our facilities in a manner that protects the environment and the health and safety of employees and the public.

- Obey all pertinent federal, state and local laws and regulations and encourage other members of our industry to do the same.
- Educate clients as to the extent and kinds of services available.
- Assert competency only for work for which adequate personnel and equipment are available and for which adequate preparation has been made.
- Promote the status of environmental laboratories, their employees, and the value of services rendered by them.

5.3 Quality System Documentation

The laboratory's Quality System is communicated through a variety of documents.

- Quality Assurance Manual – Each laboratory has a lab specific quality assurance manual.
- Corporate SOPs and Policies - Corporate SOPs and Policies are developed for use by all relevant laboratories. They are incorporated into the laboratory's normal SOP distribution, training and tracking system. Corporate SOPs may be general or technical.
- Work Instructions - A subset of procedural steps, tasks or forms associated with an operation of a management system (e.g., checklists, preformatted bench sheets, forms).
- Laboratory SOPs – General and Technical
- Laboratory QA/QC Policy Memorandums

5.3.1 Order of Precedence

In the event of a conflict or discrepancy between policies, the order of precedence is as follows:

- Corporate Quality Management Plan (CQMP)
- Corporate SOPs and Policies
- Laboratory QA/QC Policy Memorandum
- Laboratory Quality Assurance Manual (PT-QA-M-001)
- Laboratory SOPs and Policies
- Other (Work Instructions (WI), memos, flow charts, etc.)

Note: The laboratory has the responsibility and authority to operate in compliance with regulatory requirements of the jurisdiction in which the work is performed. Where the CQMP conflicts with those regulatory requirements, the regulatory requirements of the jurisdiction shall hold primacy. The laboratory's QAM shall take precedence over the CQMP in those cases.

5.4 QA/QC Objectives For The Measurement Of Data

Quality Assurance (QA) and Quality Control (QC) are activities undertaken to achieve the goal of producing data that accurately characterize the sites or materials that have been sampled. Quality Assurance is generally understood to be more comprehensive than Quality Control. Quality Assurance can be defined as the integrated system of activities that ensures that a product or service meets defined standards.

Quality Control is generally understood to be limited to the analyses of samples and to be synonymous with the term *"analytical quality control"*. QC refers to the routine application of statistically based procedures to evaluate and control the accuracy of results from analytical measurements. The QC program includes procedures for estimating and controlling precision and bias and for determining reporting limits.

Request for Proposals (RFPs) and Quality Assurance Project Plans (QAPP) provide a mechanism for the client and the laboratory to discuss the data quality objectives in order to ensure that analytical services closely correspond to client needs. The client is responsible for developing the QAPP. In order to ensure the ability of the laboratory to meet the Data Quality Objectives (DQOs) specified in the QAPP, clients are advised to allow time for the laboratory to review the QAPP before being finalized. Additionally, the laboratory will provide support to the client for developing the sections of the QAPP that concern laboratory activities.

Historically, laboratories have described their QC objectives in terms of precision, accuracy, representativeness, comparability, completeness, selectivity and sensitivity (PARCCSS).

5.4.1 Precision

The laboratory objective for precision is to meet the performance for precision demonstrated for the methods on similar samples and to meet data quality objectives of the EPA and/or other regulatory programs. Precision is defined as the degree of reproducibility of measurements under a given set of analytical conditions (exclusive of field sampling variability). Precision is documented on the basis of replicate analysis, usually duplicate or matrix spike (MS) duplicate samples.

5.4.2 Accuracy

The laboratory objective for accuracy is to meet the performance for accuracy demonstrated for the methods on similar samples and to meet data quality objectives of the EPA and/or other regulatory programs. Accuracy is defined as the degree of bias in a measurement system. Accuracy may be documented through the use of laboratory control samples (LCS) and/or MS. A statement of accuracy is expressed as an interval of acceptance recovery about the mean recovery.

5.4.3 Representativeness

The laboratory objective for representativeness is to provide data which is representative of the sampled medium. Representativeness is defined as the degree to which data represent a characteristic of a population or set of samples and is a measurement of both analytical and field sampling precision. The representativeness of the analytical data is a function of the procedures used in procuring and processing the samples. The representativeness can be documented by the relative percent difference between separately procured, but otherwise identical samples or sample aliquots.

The representativeness of the data from the sampling sites depends on both the sampling procedures and the analytical procedures. The laboratory may provide guidance to the client regarding proper sampling and handling methods in order to assure the integrity of the samples.

5.4.4 Comparability

The comparability objective is to provide analytical data for which the accuracy, precision, representativeness and reporting limit statistics are similar to these quality indicators generated by other laboratories for similar samples, and data generated by the laboratory over time.

The comparability objective is documented by inter-laboratory studies carried out by regulatory agencies or carried out for specific projects or contracts, by comparison of periodically

generated statements of accuracy, precision and reporting limits with those of other laboratories.

5.4.5 Completeness

The completeness objective for data is 90% (or as specified by a particular project), expressed as the ratio of the valid data to the total data over the course of the project. Data will be considered valid if they are adequate for their intended use. Data usability will be defined in a QAPP, project scope or regulatory requirement. Data validation is the process for reviewing data to determine its usability and completeness. If the completeness objective is not met, actions will be taken internally and with the data user to improve performance. This may take the form of an audit to evaluate the methodology and procedures as possible sources for the difficulty or may result in a recommendation to use a different method.

5.4.6 Selectivity

Selectivity is defined as: The capability of a test method or instrument to respond to a target substance or constituent in the presence of non-target substances. Target analytes are separated from non-target constituents and subsequently identified/detected through one or more of the following, depending on the analytical method: extractions (separation), digestions (separation), interelement corrections (separation), use of matrix modifiers (separation), specific retention times (separation and identification), confirmations with different columns or detectors (separation and identification), specific wavelengths (identification), specific mass spectra (identification), specific electrodes (separation and identification), etc..

5.4.7 Sensitivity

Sensitivity refers to the amount of analyte necessary to produce a detector response that can be reliably detected (Method Detection Limit) or quantified (Reporting Limit).

5.5 Criteria For Quality Indicators

The laboratory maintains a Quality Control Limit Summary (from LIMS) that contains tables that summarizes the precision and accuracy acceptability limits for analyses performed at TestAmerica Pittsburgh. This summary includes an activation date, is updated each time new limits are generated and is located in the LIMS. Current limits are controlled through the LIMS. The limits in effect for a given date are archived in the LIMS with the associated sample data. Unless otherwise noted, limits within these tables are laboratory generated. Some acceptability limits are derived from US EPA methods when they are required. Where US EPA method limits are not required, the laboratory has developed limits from evaluation of data from similar matrices. Criteria for development of control limits is contained in Section 24.

5.6 Statistical Quality Control

Statistically-derived precision and accuracy limits are required by selected methods (such as SW-846) and programs [such as the Ohio Voluntary Action Plan (VAP)]. The laboratory routinely utilizes statistically-derived limits to evaluate method performance and determine when corrective action is appropriate. The analysts are instructed to use the current limits in the laboratory (dated and approved by the area Technical Manager/supervisor and QA Manager) and entered into the Laboratory Information Management System (LIMS). The Quality Assurance department maintains an archive of all limits used within the laboratory. These limits

are maintained in the LIMS as part of the analytical historical record. If a method defines the QC limits, the method limits are used. For further details refer to SOP No. PT-QA-021.

If a method requires the generation of historical limits, the lab develops such limits from recent data in the QC database of the LIMS following the guidelines described in Section 24. All calculations and limits are documented and dated when approved and effective. On occasion, a client requests contract-specified limits for a specific project.

Current QC limits are entered and maintained in the LIMS analyte database. As sample results and the related QC are entered into LIMS, the sample QC values are compared with the limits in LIMS to determine if they are within the acceptable range. The analyst then evaluates if the sample needs to be rerun or re-extracted/rerun or if a comment should be added to the report explaining the reason for the QC outlier.

5.6.1 QC Charts

The generation and use of QC Charts (Control Charts) are described in the laboratory SOP PT-QA-021.

5.7 Quality System Metrics

In addition to the QC parameters discussed above, the entire Quality System is evaluated on a monthly basis through the use of specific metrics (refer to Section 16). These metrics are used to drive continuous improvement in the laboratory's Quality System.

SECTION 6

DOCUMENT CONTROL

6.1 Overview

The QA Department is responsible for the control of documents used in the laboratory to ensure that approved, up-to-date documents are in circulation and out-of-date (obsolete) documents are archived or destroyed. The following documents, at a minimum, must be controlled:

- Laboratory Quality Assurance Manual
- Laboratory Standard Operating Procedures (SOP)
- Laboratory Policies
- Work Instructions and Forms
- Corporate Policies and Procedures distributed outside the intranet
- Externally generated documents that are used as part of the laboratory's Quality System

Corporate Quality posts Corporate Manuals, SOPs, Policies, Work Instructions, White Papers and Training Materials on the company intranet site. These Corporate documents are only considered controlled when they are read on the intranet site. Printed copies are considered uncontrolled unless the laboratory physically distributes them as controlled documents. A detailed description of the procedure for issuing, authorizing, controlling, distributing, and archiving Corporate documents is found in Corporate SOP No. CW-Q-S-001, Corporate Document Control and Archiving. The laboratory's internal document control procedure is defined in SOP No. PT-QA-010.

The laboratory QA Department also maintains access to various references and document sources integral to the operation of the laboratory. This includes reference methods and regulations. Instrument manuals (hard or electronic copies) are also maintained by the laboratory.

The laboratory maintains control of records for raw analytical data and supporting records such as audit reports and responses, logbooks, standard logs, training files, MDL studies, Proficiency Testing (PT) studies, certifications and related correspondence, and corrective action reports and Nonconformance Memos (NCMs). Raw analytical data consists of bound logbooks, instrument printouts, any other notes, magnetic media, electronic data and final reports.

6.2 Document Approval And Issue

The pertinent elements of a document control system for each document include a unique document title and number, pagination, the total number of pages of the item or and 'end of document' page, the effective date, revision number and the laboratory's name. The QA personnel are responsible for the maintenance of this system.

Controlled documents are authorized by the QA Department. In order to develop a new document, a technical manager/supervisor submits an electronic or paper draft to the QA Department for suggestions and approval before use. Upon approval, QA personnel add the identifying version information to the document and retain that document as the official document on file. That document is then provided to all applicable operational units (may include electronic access). Controlled documents are identified as such and records of their

distribution are kept by the QA Department. Document control may be achieved by either electronic or hardcopy distribution.

The QA Department maintains a list of the official versions of controlled documents.

Quality System Policies and Procedures will be reviewed at a minimum of every two years and revised as appropriate. Changes to documents occur when a procedural change warrants. For DoD program, the related documents are reviewed every year and revised as appropriate.

6.3 Procedures For Document Control Policy

For changes to the QA Manual, refer to SOP No. PT-QA-010. Uncontrolled copies must not be used within the laboratory. Previous revisions and back-up data are stored by the QA department. Electronic copies are stored on the Public server in sops on 'pitsvr07/' (X:) by lab area.

For changes to SOPs and QA manual, refer to SOP No. CW-Q-S-002, Writing a Standard Operating Procedure SOP and laboratory SOP PT-QA-010. The SOP identified above also defines the process of changes to SOPs.

Controlled documents are marked as such, and posted to the intranet (QA Web page) by the QA department. Controlled distribution is achieved electronically. Details of the numbering system, required format, and controlled distribution of documents are described in SOP No. PT-QA-010, "Preparation and Management of Standard Operating Procedures (SOPs).

Forms, worksheets, work instructions and information are organized by department by the QA office. Electronic versions are kept on a hard drive in the QA department; hard copies can be printed out as needed. Most forms used in the laboratory are tracked by a database which can be accessed by the QA department and the IT group. The procedure for the care of these documents is in SOP No. PT-QA-010, "Preparation and Management of Standard Operating Procedures (SOPs) and Other Controlled Documents".

6.4 Obsolete Documents

All invalid or obsolete documents are removed, or otherwise prevented from unintended use. The laboratory has specific procedures as described above to accomplish this. In general, obsolete documents are collected from employees according to distribution lists and are marked obsolete on the cover or destroyed. At least one copy of the obsolete document is archived according to SOP No. PT-QA-019.

SECTION 7

SERVICE TO THE CLIENT

7.1 Overview

The laboratory has established procedures for the review of work requests and contracts, oral or written. The procedures include evaluation of the laboratory's capability and resources to meet the contract's requirements within the requested time period. All requirements, including the methods to be used, must be adequately defined, documented and understood. For many environmental sampling and analysis programs, testing design is site or program specific and does not necessarily "fit" into a standard laboratory service or product. It is the laboratory's intent to provide both standard and customized environmental laboratory services to our clients.

A thorough review of technical and QC requirements contained in contracts is performed to ensure project success. The appropriateness of requested methods, and the lab's capability to perform them must be established. Projects, proposals and contracts are reviewed for adequately defined requirements and the laboratory's capability to meet those requirements. Alternate test methods that are capable of meeting the clients' requirements may be proposed by the lab. A review of the lab's capability to analyze non-routine analytes is also part of this review process.

All projects, proposals and contracts are reviewed for the client's requirements in terms of compound lists, test methodology requested, sensitivity (detection and reporting levels), accuracy, and precision requirements (% Recovery and RPD). The reviewer ensures that the laboratory's test methods are suitable to achieve these requirements and that the laboratory holds the appropriate certifications and approvals to perform the work. The laboratory and any potential subcontract laboratories must be certified, as required, for all proposed tests.

The laboratory must determine if it has the necessary physical, personnel and information resources to meet the contract, and if the personnel have the expertise needed to perform the testing requested. Each proposal is checked for its impact on the capacity of the laboratory's equipment and personnel. As part of the review, the proposed turnaround time will be checked for feasibility.

Electronic or hard copy deliverable requirements are evaluated against the laboratory's capacity for production of the documentation.

If the laboratory cannot provide all services but intends to subcontract such services, whether to another TestAmerica facility or to an outside firm, this will be documented and discussed with the client prior to contract approval. (Refer to Section 8 for Subcontracting Procedures.)

The laboratory informs the client of the results of the review if it indicates any potential conflict, deficiency, lack of accreditation, or inability of the lab to complete the work satisfactorily. Any discrepancy between the client's requirements and the laboratory's capability to meet those requirements is resolved in writing before acceptance of the contract. It is necessary that the contract be acceptable to both the laboratory and the client. Amendments initiated by the client and/or TestAmerica, are documented in writing.
All contracts, QAPPs, Sampling and Analysis Plans (SAPs), contract amendments, and documented communications become part of the project record.

The same contract review process used for the initial review is repeated when there are amendments to the original contract by the client, and the participating personnel are informed of the changes.

7.2 Review Sequence And Key Personnel

Appropriate personnel will review the work request at each stage of evaluation.

For routine projects and other simple tasks, a review by the Project Manager (PM) is considered adequate. The PM confirms that the laboratory has any required certifications, that it can meet the clients' data quality and reporting requirements and that the lab has the capacity to meet the clients turn around needs. It is recommended that, where there is a sales person assigned to the account, an attempt should be made to contact that sales person to inform them of the incoming samples.

For new, complex or large projects, the proposed contract is given to the National Account Director, who will decide which lab will receive the work based on the scope of work and other requirements, including certification, testing methodology, and available capacity to perform the work. The contract review process is outlined in TestAmerica's Corporate SOP No. CA-L-P-002**,** Contract Compliance Policy.

This review encompasses all facets of the operation. The scope of work is distributed to the appropriate personnel, as needed based on scope of contract, to evaluate all of the requirements shown above (not necessarily in the order below):

- Legal & Contracts Director if applicable
- Customer Service Manager
- The Laboratory Project Management
- The Laboratory Director Technical Manager
- Laboratory Quality Assurance Manager if applicable
- PM or CSM reviews the formal laboratory quote. The Laboratory Director makes final acceptance for their facility.

The Sales Director, Legal Contracts Director, Account Executive or local account representative then submits the final proposal to the client.

In the event that one of the above personnel is not available to review the contract, his or her back-up will fulfill the review requirements.

The Legal & Contracts Director maintains copies of all signed contracts***.*** In Pittsburgh laboratory copies of contracts are maintained in the laboratory network public drive (N:\Weekly\Quotes_Scanned) by the sales/marketing personnel.

7.3 Documentation

Appropriate records are maintained for every contract or work request. All stages of the contract review process are documented and include records of any significant changes. Contracts review documentation is forwarded to the Human Resources Coordinator and is maintained in the network public drive.

The contract will be distributed to and maintained by the appropriate sales/marketing personnel and the Account Manager. A copy of the contract and formal quote will be filed with the laboratory PM and the Lab Director.

Records are maintained of pertinent discussions with a client relating to the client's requirements or the results of the work during the period of execution of the contract. The PM keeps a phone log or electronic mail of conversations with the client.

7.3.1 Project-Specific Quality Planning

Communication of contract specific technical and QC criteria is an essential activity in ensuring the success of site specific testing programs. To achieve this goal, the laboratory assigns a PM to each client. It is the PM's responsibility to ensure that project-specific technical and QC requirements are effectively evaluated and communicated to the laboratory personnel before and during the project. QA department involvement may be needed to assist in the evaluation of custom QC requirements.

PM's are the primary client contact and they ensure resources are available to meet project requirements. Although PM's do not have direct reports or staff in production, they coordinate opportunities and work with laboratory management and supervisory staff to ensure available resources are sufficient to perform work for the client's project. Project management is positioned between the client and laboratory resources.

Prior to work on a new project, the dissemination of project information and/or project opening meetings may occur to discuss schedules and unique aspects of the project. Items to be discussed may include the project technical profile, turnaround times, holding times, methods, analyte lists, reporting limits, deliverables, sample hazards, or other special requirements. The PM introduces new projects to the laboratory staff through project kick-off meetings or to the supervisory staff during production meetings. These meetings provide direction to the laboratory staff in order to maximize production and client satisfaction, while maintaining quality. In addition, project notes may be associated with each sample batch as a reminder upon sample receipt and analytical processing.

During the project, any change that may occur within an active project is agreed upon between the client/regulatory agency and the PM/laboratory. These changes (e.g., use of a non-standard method or modification of a method) and approvals must be documented prior to implementation. Documentation pertains to any document, e.g., letter, e-mail, variance, contract addendum, which has been signed by both parties.

Such changes are also communicated to the laboratory during operations meetings. Such changes are updated to the project notes and are introduced to the managers at these meetings. The laboratory staff is then introduced to the modified requirements via the PM or the individual laboratory Technical Manager. After the modification is implemented into the laboratory process, documentation of the modification is made in the case narrative of the data report(s).

The laboratory strongly encourages client visits to the laboratory and for formal/informal information sharing session with employees in order to effectively communicate ongoing client needs as well as project specific details for customized testing programs.

7.4 Special Services

The laboratory cooperates with clients and their representatives to monitor the laboratory's performance in relation to work performed for the client. It is the laboratory's goal to meet all client requirements in addition to statutory and regulatory requirements. The laboratory has procedures to ensure confidentiality to clients (Section 25).

Note: ISO/IEC 17025 states that a laboratory "shall afford clients or their representatives cooperation to clarify the client's request". This topic is discussed in Section 7.

The laboratory's standard procedures for reporting data are described in Section 25. Special services are also available and provided upon request. These services include:

- Reasonable access for our clients or their representatives to the relevant areas of the laboratory for the witnessing of tests performed for the client.
- Assist client-specified third party data validators as specified in the client's contract.
- Supplemental information pertaining to the analysis of their samples. Note: An additional charge may apply for additional data/information that was not requested prior to the time of sample analysis or previously agreed upon.

7.5 Client Communication

Project managers are the primary communication link to the clients. They shall inform their clients of any delays in project completion as well as any non-conformances in either sample receipt or sample analysis. Project management will maintain ongoing client communication throughout the entire client project.

Laboratory Director, Technical Manager or designee are available to discuss any technical questions or concerns that the client may have.

7.6 Reporting

The laboratory works with our clients to produce any special communication reports required by the contract.

7.7 Client Surveys

The laboratory assesses both positive and negative client feedback. The results are used to improve overall laboratory quality, client service and testing activities.

TestAmerica's Sales and Marketing teams periodically develops lab and client specific surveys to assess client satisfaction.

SECTION 8

SUBCONTRACTING OF TESTS

8.1 Overview

For the purpose of this quality manual, the phrase subcontract laboratory refers to a laboratory external to the TestAmerica laboratories. The phrase "work sharing" refers to internal transfers of samples between the TestAmerica laboratories. The term outsourcing refers to the act of subcontracting tests.

When contracting with our clients, the laboratory makes commitments regarding the services to be performed and the data quality for the results to be generated. When the need arises to outsource testing for our clients because project scope, changes in laboratory capabilities, capacity or unforeseen circumstances, we must be assured that the subcontractors or work sharing laboratories understand the requirements and will meet the same commitments we have made to the client. Refer to TestAmerica's Corporate SOP's on Subcontracting Procedures (CA-L-S-002) and the Work Sharing Process (CA-C-S-001).

When outsourcing analytical services, the laboratory will assure, to the extent necessary, that the subcontract or work sharing laboratory maintains a program consistent with the requirements of this document, the requirements specified in TNI/ISO 17025 and/or the client's Quality Assurance Project Plan (QAPP). All QC guidelines specific to the client's analytical program are transmitted to the subcontractor and agreed upon before sending the samples to the subcontract facility. Additionally, work requiring accreditation will be placed with an appropriately accredited laboratory. The laboratory performing the subcontracted work will be identified in the final report, as will non-TNI accredited work where required.

Project Managers (PMs), Customer Service Managers (CSM), Account Executives (AE) or designee for the Export Lab are responsible for obtaining client approval prior to outsourcing any samples. The laboratory will advise the client of a subcontract or work sharing arrangement in writing and when possible approval from the client shall be retained in the project folder.

Note: In addition to the client, some regulating agencies, (e.g, USDA) or contracts (e.g, certain USACE projects) may require notification prior to placing such work**.**

For DOD projects the subcontractor laboratories used must have an established and documented laboratory quality system that complies with DoD QSM requirements. The subcontractor laboratories are evaluated following the procedures outlined below and as seen in Figure 8-1. The subcontractor laboratory must receive project-specific approval from the DoD client before any samples are analyzed.

The QSM has 5 specific requirements for subcontracting:

1. Subcontractor laboratories must have an established laboratory quality system that complies with the QSM.
2. Subcontractor laboratories must be approved by the specific DoD Component laboratory approval process.
3. Subcontractor laboratories must demonstrate the ability to generate acceptable results from the analysis of PT samples, subject to availability, using each applicable method, in the specified matrix, and provide appropriate documentation to the DoD client.

4. Subcontractor laboratories must receive project-specific approval from the DoD client before any samples are analyzed.
5. Subcontractor laboratories are subject to project-specific, on-site assessments by the DoD client or their designated representatives

8.2 Qualifying And Monitoring Subcontractors

Whenever a PM or Account Executive (AE) or Customer Service Manager (CSM becomes aware of a client requirement or laboratory need where samples must be outsourced to another laboratory, the other laboratory(s) shall be selected based on the following:

- The first priority is to attempt to place the work in a qualified TestAmerica laboratory;
- Firms specified by the client for the task (Documentation that a subcontractor was designated by the client must be maintained with the project file. This documentation can be as simple as placing a copy of an e-mail from the client in the project folder);
- Firms listed as pre-qualified and currently under a subcontract with TestAmerica: A listing of all approved subcontracting laboratories is available on the TestAmerica intranet site. Supporting documentation is maintained by corporate offices and by the TestAmerica laboratory originally requesting approval of the subcontract lab. Verify necessary accreditation, where applicable, (e.g., on the subcontractors TNI, A2LA accreditation or State Certification).
- Firms identified in accordance with the company's Small Business Subcontracting program as small, women-owned, veteran-owned and/or minority-owned businesses;
- TNI or A2LA accredited laboratories.
- In addition, the firm must hold the appropriate certification to perform the work required.

All TestAmerica laboratories are pre-qualified for work sharing provided they hold the appropriate accreditations, can adhere to the project/program requirements, and the client approved sending samples to that laboratory. The client must provide acknowledgement that the samples can be sent to that facility (an e-mail is sufficient documentation or if acknowledgement is verbal, the date, time, and name of person providing acknowledgement must be documented). The originating laboratory is responsible for communicating all technical, quality, and deliverable requirements as well as other contract needs. (Corporate SOP No. CA-C-S-001, Work Sharing Process).

When the potential sub-contract laboratory has not been previously approved, Account Executives, CSMs or PMs may nominate a laboratory as a subcontractor based on need. The decision to nominate a laboratory must be approved by the Laboratory Director. The Laboratory Director requests that the QA Manager begin the process of approving the subcontract laboratory as outlined in Corporate SOP No. CA-L-S-002, Subcontracting Procedures. The client must provide acknowledgement that the samples can be sent to that facility (an e-mail is sufficient documentation or if acknowledgement is verbal, the date, time, and name of person providing acknowledgement must be documented).

8.2.1 Once the appropriate accreditation and legal information is received by the laboratory, it is evaluated for acceptability (where applicable) and forwarded to Corporate Contracts for formal contracting with the laboratory. They will add the lab to the approved list on the intranet site and notify the finance group for JD Edwards.

8.2.2 The client will assume responsibility for the quality of the data generated from the

use of a subcontractor they have requested the lab to use. The qualified subcontractors on the intranet site are known to meet minimal standards. TestAmerica does not certify laboratories. The subcontractor is on our approved list and can only be recommended to the extent that we would use them.

8.2.3 The status and performance of qualified subcontractors will be monitored periodically by the Corporate Contracts and/or Quality Departments. Any problems identified will be brought to the attention of TestAmerica's Corporate Finance or Corporate Quality personnel.

- Complaints shall be investigated. Documentation of the complaint, investigation and corrective action will be maintained in the subcontractor's file on the intranet site. Complaints are posted using the Vendor Performance Report.
- Information shall be updated on the intranet when new information is received from the subcontracted laboratories.
- Subcontractors in good standing will be retained on the intranet listing. The QA Manager will notify all TestAmerica laboratories, Corporate Quality and Corporate Contracts if any laboratory requires removal from the intranet site. This notification will be posted on the intranet site and e-mailed to all Laboratory Directors/Managers, QA Managers and Sales Personnel.

8.3 Oversight And Reporting

The PM or CSM must request that the selected subcontractor be presented with a subcontract, if one is not already executed between the laboratory and the subcontractor. The subcontract must include terms which flow down the requirements of our clients, either in the subcontract itself or through the mechanism of work orders relating to individual projects. A standard subcontract and the Lab Subcontractor Vendor Package (posted on the intranet) can be used to accomplish this, and the Legal & Contracts Director can tailor the document or assist with negotiations, if needed. The PM (or AE or CSM) responsible for the project must advise and obtain client consent to the subcontract as appropriate, and provide the scope of work to ensure that the proper requirements are made a part of the subcontract and are made known to the subcontractor.

Prior to sending samples to the subcontracted laboratory, the PM confirms their certification status to determine if it's current and scope-inclusive. The information is documented on the project folder or scanned into LIMS. For TestAmerica laboratories, certifications can be viewed on the company's TotalAccess Database.

The Sample Control department is responsible for ensuring compliance with QA requirements and applicable shipping regulations when shipping samples to a subcontracted laboratory.

All subcontracted samples must be accompanied by a TestAmerica Chain of Custody (COC). A copy of the original COC sent by the client must also be included with all samples workshared within TestAmerica. Client CoCs are only forwarded to external subcontractors when samples are shipped directly from the project site to the subcontractor lab. Under routine circumstances, client COCs are not provided to external subcontractors.

Through communication with the subcontracted laboratory, the PM monitors the status of the subcontracted analyses, facilitates successful execution of the work, and ensures the timeliness and completeness of the analytical report.

Non-TNI accredited work must be identified in the subcontractor's report as appropriate. If TNI accreditation is not required, the report does not need to include this information.

Reports submitted from subcontractor laboratories are not altered and are included in their original form in the final project report. This clearly identifies the data as being produced by a subcontractor facility. If subcontract laboratory data is incorporated into the laboratories EDD (i.e., imported), the report must explicitly indicate which lab produced the data for which methods and samples.

Note: The results submitted by a TestAmerica work sharing laboratory may be transferred electronically and the results reported by the TestAmerica work sharing lab are identified on the final report. The report must explicitly indicate which lab produced the data for which methods and samples. The final report must include a copy of the completed COC for all work sharing reports.

8.4 Contingency Planning

The Laboratory Director may waive the full qualification of a subcontractor process temporarily to meet emergency needs; however, this decision & justification must be documented in the project files, and the 'Purchase Order Terms And Conditions For Subcontracted Laboratory Services' must be sent with the samples and Chain-of-Custody. In the event this provision is utilized, the laboratory (e.g., PM) will be required to verify and document the applicable accreditations of the subcontractor. All other quality and accreditation requirements will still be applicable, but the subcontractor need not have signed a subcontract with TestAmerica at this time. The comprehensive approval process must then be initiated within 30 calendar days of subcontracting.

SECTION 9

PURCHASING SERVICES AND SUPPLIES

9.1 Overview

Evaluation and selection of suppliers and vendors is performed, in part, on the basis of the quality of their products, their ability to meet the demand for their products on a continuous and short term basis, the overall quality of their services, their past history, and competitive pricing. This is achieved through evaluation of objective evidence of quality furnished by the supplier, which can include certificates of analysis, recommendations, and proof of historical compliance with similar programs for other clients. To ensure that quality critical consumables and equipment conform to specified requirements, which may affect quality, all purchases from specific vendors are approved by a member of the supervisory or management staff. Capital expenditures are made in accordance with TestAmerica's Corporate Controlled Purchases Procedure, SOP No. CW-F-S-007.

Contracts will be signed in accordance with TestAmerica's Corporate Authorization Matrix Policy, Policy No. CW-F-P-002. Request for Proposals (RFP's) will be issued where more information is required from the potential vendors than just price. Process details are available in TestAmerica's Corporate Procurement and Contracts Policy (Policy No. CW-F-P-004). RFP's allow TestAmerica to determine if a vendor is capable of meeting requirements such as supplying all of the TestAmerica facilities, meeting required quality standards and adhering to necessary ethical and environmental standards. The RFP process also allows potential vendors to outline any additional capabilities they may offer.

9.2 Glassware

Glassware used for volumetric measurements must be Class A or verified for accuracy according to laboratory procedure. Pyrex (or equivalent) glass should be used where possible. For safety purposes, thick-wall glassware should be used where available.

9.3 Reagents, Standards & Supplies

Purchasing guidelines for equipment and reagents must meet the requirements of the specific method and testing procedures for which they are being purchased. Solvents and acids are pre-tested in accordance with TestAmerica's Corporate SOP on Solvent & Acid Lot Testing & Approval, SOP No. CA-Q-S-001.

9.3.1 Purchasing

Chemical reagents, solvents, glassware, and general supplies are ordered as needed to maintain sufficient quantities on hand. Materials used in the analytical process must be of a known quality. The wide variety of materials and reagents available makes it advisable to specify recommendations for the name, brand, and grade of materials to be used in any determination. This information is contained in the method SOP. The analyst completes the Purchase Requisition Form (Figure 9-1) when requesting reagents, standards, or supplies*:* The analyst may check the item out of the on-site consignment system that contains items approved for laboratory use. If an item is not in the consignment system, the analyst must obtain approval from the area team leader/supervisor and Laboratory Director prior to placing the order. All the orders are submitted to the Laboratory Receptionist or Team Leaders/designated laboratory area personnel by completing the Purchase Requisition Form (Figure 9-1). The Receptionist or

Team Leaders/designated laboratory area personnel will enter the orders into the JD Edwards system (JDE). The Receptionist also places the orders for rush items, office supplies and obtains purchase orders for instrument/equipment repairs and maintenance. The laboratory Director will approve or deny the order in the JDE. Every order is given a purchase order number in the JDE. The actual order to the vendor is placed through the purchasing department in the TestAmerica North Canton Laboratory.

9.3.2 Receiving

It is the responsibility of the Sample Receiving department to receive the shipment. It is the responsibility of the analyst who ordered the materials to document the date the materials were received. Once the ordered reagents or materials are received, the analyst compares the information on the label or packaging to the original order to ensure that the purchase meets the quality level specified. The analyst dates and initials the packing slip and forwards it to the Receptionist for filing. Material Safety Data Sheets (MSDSs) are available online through the Company's intranet website. Anyone may review these for relevant information on the safe handling and emergency precautions of on-site chemicals.

9.3.3 Specifications

Methods in use in the laboratory specify the grade of reagent that must be used in the procedure. If the quality of the reagent is not specified, analytical reagent grade will be used. It is the responsibility of the analyst to check the procedure carefully for the suitability of grade of reagent.

Chemicals must not be used past the manufacturer's expiration date and must not be used past the expiration time noted in a method SOP. If expiration dates are not provided, the laboratory may contact the manufacturer to determine an expiration date.

The laboratory assumes a five year expiration date on inorganic dry chemicals and solvents unless noted otherwise by the manufacturer or by the reference source method. Chemicals/solvents should not be used past the manufacturer's or SOPs expiration date unless 'verified' (refer to item 3 listed below).

- An expiration date cannot be extended if the dry chemical/solvent is discolored or appears otherwise physically degraded, the dry chemical/solvent must be discarded.

- Expiration dates can be extended if the dry chemical/solvent is found to be satisfactory based on acceptable performance of quality control samples (Continuing Calibration Verification (CCV), Blanks, Laboratory Control Sample (LCS), etc.).

- If the dry chemical/solvent is used for the preparation of standards, the expiration dates can be extended 6 months if the dry chemical/solvent is compared to an unexpired independent source in performing the method and the performance of the dry chemical/solvent is found to be satisfactory. The comparison must show that the dry chemical/solvent meets CCV limits. The comparison studies are maintained with each lab department and copy forwarded to QA office.

Wherever possible, standards must be traceable to national or international standards of measurement or to national or international reference materials. Records to that effect are available to the user.

Compressed gases in use are checked for pressure and secure positioning daily. The minimum total pressure must be 500 psig or the tank must be replaced. To prevent a tank from going to dryness, close observation of the tank gauge must take place as pressure decreases towards 500psig, or the tank must be replaced. The quality of the gases must meet method or manufacturer specification or be of a grade that does not cause any analytical interference.

Water used in the preparation of standards or reagents must have a specific conductivity of less than 1- µmho /cm (or specific resistivity of greater than 1.0 megohm-cm) at 25°C. The specific conductivity is checked and recorded daily. If the water's specific conductivity is greater than the specified limit, the Facility Manager and appropriate Technical Managers/Supervisors must be notified immediately in order to notify all departments, decide on cessation (based on intended use) of activities, and make arrangements for correction.

The laboratory may purchase reagent grade (or other similar quality) water for use in the laboratory. This water must be certified "clean" by the supplier for all target analytes or otherwise verified by the laboratory prior to use. This verification is documented.

Standard lots are verified before first time use if the laboratory switches manufacturers or has historically had a problem with the type of standard.

Purchased bottleware used for sampling must be certified clean and the certificates must be maintained. If uncertified sampling bottleware is purchased, all lots must be verified clean prior to use. This verification must be maintained.

Records of manufacturer's certification and traceability statements are maintained in files or binders in each laboratory section. These records include date of receipt, lot number (when applicable), and expiration date (when applicable). Incorporation of the item into the record indicates that the analyst has compared the new certificate with the previous one for the same purpose and that no difference is noted, unless approved and so documented by the Technical Manager (s) or QA Manager.

9.3.4 Storage

Reagent and chemical storage is important from the aspects of both integrity and safety. Light-sensitive reagents may be stored in brown-glass containers. Storage conditions are per the Corporate Environmental Health & Safety Manual (Corp. Doc. No. CW-E-M-001) and method SOPs or manufacturer instructions.

9.4 Purchase Of Equipment/Instruments/Software

When a new piece of equipment is needed, either for additional capacity or for replacing inoperable equipment, the analyst or supervisor makes a supply request to the Department Manager, Technical Manager (s) and/or the Laboratory Director. If they agree with the request, the procedures outlined in TestAmerica's Corporate Policy No. CA-T-P-001, Qualified Products List, are followed. A decision is made as to which piece of equipment can best satisfy the requirements. The appropriate written requests are completed and purchasing places the order.

Upon receipt of a new or used piece of equipment, an identification name is assigned and added to the equipment list. IT must also be notified so that they can synchronize the instrument for back-ups. Its capability is assessed to determine if it is adequate or not for the specific application. For instruments, a calibration curve is generated, followed by MDLs, Demonstration of Capabilities (DOCs), and other relevant criteria (refer to Section 19). For

software, its operation must be deemed reliable and evidence of instrument verification must be retained by the IT Department or QA Department. Software certificates supplied by the vendors are filed with the LIMS Administrator. The manufacturer's operation manual is retained at the be

9.5 Services

Service to analytical instruments (except analytical balances) is performed on an as needed basis. Routine preventative maintenance is discussed in Section 20. The need for service is determined by analysts and/or Technical Managers. The service providers that perform the services are approved by the Laboratory Technical Manager / Director.

9.6 Suppliers

TestAmerica selects vendors through a competitive proposal / bid process, strategic business alliances or negotiated vendor partnerships (contracts). This process is defined in the Corporate Finance documents on Vendor Selection (SOP No. CW-F-S-018) and Procurement & Contracts Policy (Policy No. CW-F-P-004). The level of control used in the selection process is dependent on the anticipated spending amount and the potential impact on TestAmerica business. Vendors that provide test and measuring equipment, solvents, standards, certified containers, instrument related service contracts or subcontract laboratory services shall be subject to more rigorous controls than vendors that provide off-the-shelf items of defined quality that meet the end use requirements. The JD Edwards purchasing system includes all suppliers/vendors that have been approved for use.

Evaluation of suppliers is accomplished by ensuring the supplier ships the product or material ordered and that the material is of the appropriate quality. This is documented by signing off on packing slips or other supply receipt documents. The purchasing documents contain the data that adequately describe the services and supplies ordered.

Any issues of vendor performance are to be reported immediately by the laboratory staff to the Corporate Purchasing Group by completing a Vendor Performance Report.

The Corporate Purchasing Group will work through the appropriate channels to gather the information required to clearly identify the problem and will contact the vendor to report the problem and to make any necessary arrangements for exchange, return authorization, credit, etc.

As deemed appropriate, the Vendor Performance Reports will be summarized and reviewed to determine corrective action necessary, or service improvements required by vendors

The laboratory has access to a listing of all approved suppliers of critical consumables, supplies and services. This information is provided through the JD Edwards purchasing system.

9.6.1 New Vendor Procedure

TestAmerica employees who wish to request the addition of a new vendor must complete a J.D. Edwards Vendor Add Request Form.

New vendors are evaluated based upon criteria appropriate to the products or services provided as well as their ability to provide those products and services at a competitive cost. Vendors are also evaluated to determine if there are ethical reasons or potential conflicts of interest with

TestAmerica employees that would make it prohibitive to do business with them as well as their financial stability. The QA Department and/or the Technology Director are consulted with vendor and product selection that have an impact on quality.

Figure 9-1.

Example - Purchase Requisition Form

Date:	**For Purchasing Use Only**
Vendor Name:	**Order Date:**
Exact Date Needed:	**Account Number:**
Requested By:	**Order Number:**
Department Name/Number:	**P.O. Number:**

Item	Quantity	Unit of Measure	Catalog No.	Description	Unit Cost	Total Cost
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						

Authorized Signature Date

SECTION 10

COMPLAINTS

10.1 Overview

The laboratory considers an effective client complaint handling processes to be of significant business and strategic value. Listening to and documenting client concerns captures 'client knowledge' that enables our operations to continually improve processes and client satisfaction. An effective client complaint handling process also provides assurance to the data user that the laboratory will stand behind its data, service obligations and products.

A client complaint is any expression of dissatisfaction with any aspect of our business services (e.g., communications, responsiveness, data, reports, invoicing and other functions) expressed by any party, whether received verbally or in written form. Client inquiries, complaints or noted discrepancies are documented, communicated to management, and addressed promptly and thoroughly.

The laboratory has procedures for addressing both external and internal complaints with the goal of providing satisfactory resolution to complaints in a timely and professional manner.

The nature of the complaint is identified, documented and investigated, and an appropriate action is determined and taken. In cases where a client complaint indicates that an established policy or procedure was not followed, the QA Department must evaluate whether a special audit must be conducted to assist in resolving the issue. A written confirmation or letter to the client, outlining the issue and response taken is recommended as part of the overall action taken.

The process of complaint resolution and documentation utilizes the procedures outlined in Section 12 (Corrective Actions) and is documented following the Non Conformance and Corrective Action System, SOP No. PT-QA-016. It is the laboratory's goal to provide a satisfactory resolution to complaints in a timely and professional manner.

10.2 External Complaints

An employee that receives a complaint initiates the complaint resolution process by first documenting the complaint in the database, according to (SOP No. PT-QA-016).

Complaints fall into two categories: correctable and non-correctable. An example of a correctable complaint would be one where a report re-issue would resolve the complaint. An example of a non-correctable complaint would be one where a client complains that their data was repeatedly late. Non-correctable complaints should be reviewed for preventive action measures to reduce the likelihood of future occurrence and mitigation of client impact.

The general steps in the complaint handling process are:

- Receiving and Documenting Complaints
- Complaint Investigation and Service Recovery
- Process Improvement

The laboratory shall inform the initiator of the complaint of the results of the investigation and the corrective action taken, if any.

10.3 Internal Complaints

Internal complaints include, but are not limited to: errors and non-conformances, training issues, internal audit findings, and deviations from methods. Corrective actions may be initiated by any staff member who observes a nonconformance and shall follow the procedures outlined in Section 12. In addition, Corporate Management, Sales and Marketing and IT may initiate a complaint by contacting the laboratory or through the corrective action system described in Section 12.

10.4 Management Review

The number and nature of client complaints is reported by the QA Manager to the laboratory and QA Director in the QA Monthly report. Monitoring and addressing the overall level and nature of client complaints and the effectiveness of the solutions is part of the Annual Management Review (Section 16).

SECTION 11

CONTROL OF NON-CONFORMING WORK

11.1 Overview

When data discrepancies are discovered or deviations and departures from laboratory SOPs, policies and/or client requests have occurred, corrective action is taken immediately. First, the laboratory evaluates the significance of the nonconforming work. Then, a corrective action plan is initiated based on the outcome of the evaluation. If it is determined that the nonconforming work is an isolated incident, the plan could be as simple as adding a qualifier to the final results and/or making a notation in the case narrative. If it is determined that the nonconforming work is a systematic or improper practices issue, the corrective action plan could include a more in depth investigation and a possible suspension of an analytical method. In all cases, the actions taken are documented using the laboratory's corrective action system (refer to Section 12).

Due to the frequently unique nature of environmental samples, sometimes departures from documented policies and procedures are needed. When an analyst encounters such a situation, the problem is presented to the supervisor for advice. The supervisor may elect to discuss it with the Laboratory Director or QA Manager or have a PM contact the client to decide on a logical course of action. Once an approach is agreed upon, the analyst documents it using the laboratories corrective action system described in Section 12. This information can then be supplied to the client in the form of a case narrative with the report.

Project Management may encounter situations where a client may request that a special procedure be applied to a sample that is not standard lab practice. Based on a technical evaluation, the lab may accept or opt to reject the request based on technical or ethical merit. An example might be the need to report a compound that the lab does not normally report. The lab would not have validated the method for this compound following the procedures in Section 19. The client may request that the compound be reported based only on the calibration. Such a request would need to be approved by the Laboratory Director and QA Manager, documented and included in the project folder. Deviations **must** also be noted on the final report with a statement that the compound is not reported in compliance with TNI (or the analytical method) requirements and the reason. Data being reported to a non-TNI state would need to note the change made to how the method is normally run.

11.2 Responsibilities And Authorities

TestAmerica's Corporate SOP entitled *Internal Investigation of Potential Data Discrepancies and Determination for Data Recall* (SOP No. CW-L-S-002), outlines the general procedures for the reporting and investigation of data discrepancies and alleged incidents of misconduct or violations of TestAmerica's data integrity policies as well as the policies and procedures related to the determination of the potential need to recall data.

Under certain circumstances, the Laboratory Director, a Technical Manager, or a member of the QA team may authorize departures from documented procedures or policies. The departures may be a result of procedural changes due to the nature of the sample; a one-time procedure for a client; QC failures with insufficient sample to reanalyze, etc.. In most cases, the client will be informed of the departure prior to the reporting of the data. Any departures must be well documented using the laboratory's corrective action procedures. This information is documented on a Nonconformance Memo (NCM) and may also be documented in logbooks

and/or data review checklists as appropriate. Any impacted data must be referenced in a case narrative and/or flagged with an appropriate data qualifier.

Any misrepresentation or possible misrepresentation of analytical data discovered by any laboratory staff member must be reported to facility Senior Management within 24-hours. The Senior Management staff is comprised of the Laboratory Director, the QA Manager, and the Technical Managers. The reporting of issues involving alleged violations of the company's Data Integrity or Manual Integration procedures must be conveyed to an Ethics and Compliance Officer (ECO), Director of Quality & Client Advocacy and the laboratory's Quality Director within 24 hours of discovery.

Whether an inaccurate result was reported due to calculation or quantitation errors, data entry errors, improper practices, or failure to follow SOPs, the data must be evaluated to determine the possible effect.

The Laboratory Director, QA Manager, ECOs, Corporate Quality, the COO, General Managers and the Quality Directors have the authority and responsibility to halt work, withhold final reports, or suspend an analysis for due cause as well as authorize the resumption of work.

11.3 Evaluation Of Significance And Actions Taken

For each nonconforming issue reported, an evaluation of its significance and the level of management involvement needed is made. This includes reviewing its impact on the final data, whether or not it is an isolated or systematic issue, and how it relates to any special client requirements.

TestAmerica's Corporate Data Investigation & Recall Procedure (SOP No. CW-L-S-002) distinguishes between situations when it would be appropriate for laboratory management to make the decision on the need for client notification (written or verbal) and data recall (report revision) and when the decision must be made with the assistance of the ECO's and Corporate Management. Laboratory level decisions are documented and approved using the laboratory's standard nonconformance/corrective action reporting in lieu of the data recall determination form contained in TestAmerica's Corporate SOP No. CW-L-S-002.

11.4 Prevention Of Nonconforming Work

If it is determined that the nonconforming work could recur, further corrective actions must be made following the laboratory's corrective action system. Periodically as defined by the laboratory's preventive action schedule, or on a monthly basis, the QA Department evaluates non-conformances to determine if any nonconforming work has been repeated multiple times. If so, the laboratory's corrective action process may be followed.

11.5 Method Suspension/Restriction (Stop Work Procedures)

In some cases, it may be necessary to suspend/restrict the use of a method or target compound which constitutes significant risk and/or liability to the laboratory. Suspension/restriction procedures can be initiated by any of the persons noted in Section 11.2, Paragraph 5.

Prior to suspension/restriction, confidentiality will be respected, and the problem with the required corrective and preventive action will be stated in writing and presented to the Laboratory Director.

The Laboratory Director shall arrange for the appropriate personnel to meet with the QA Manager as needed. This meeting shall be held to confirm that there is a problem, that suspension/restriction of the method is required and will be concluded with a discussion of the steps necessary to bring the method/target or test fully back on line. In some cases, that may not be necessary if all appropriate personnel have already agreed there is a problem and there is agreement on the steps needed to bring the method, target or test fully back on line.

The QA Manager will also initiate a corrective action report as described in Section 12 if one has not already been started. A copy of any meeting notes and agreed upon steps should be faxed or e-mailed by the laboratory to the appropriate General Manager and member of Corporate QA. This fax/e-mail acts as notification of the incident.

After suspension/restriction, the lab will hold all reports to clients pending review. No faxing, mailing or distributing through electronic means may occur. The report must not be posted for viewing on the internet. It is the responsibility of the Laboratory Director to hold all reporting and to notify all relevant laboratory personnel regarding the suspension/restriction (e.g., Project Management, Log-in, etc.). Clients will NOT generally be notified at this time. Analysis may proceed in some instances depending on the non-conformance issue.

Within 72 hours, the QA Manager will determine if compliance is now met and reports can be released, OR determine the plan of action to bring work into compliance, and release work. A team, with all principals involved (Laboratory Director, Technical Manager/Director, QA Manager) can devise a start-up plan to cover all steps from client notification through compliance and release of reports. Project Management, and the Directors of Client Services and Sales and Marketing must be notified if clients must be notified or if the suspension/restriction affects the laboratory's ability to accept work. The QA Manager must approve start-up or elimination of any restrictions after all corrective action is complete. This approval is given by final signature on the completed corrective action report.

SECTION 12

CORRECTIVE ACTION

12.1 Overview

A major component of TestAmerica's Quality Assurance (QA) Program is the problem investigation and feedback mechanism designed to keep the laboratory staff informed on quality related issues and to provide insight to problem resolution. When nonconforming work or departures from policies and procedures in the quality system or technical operations are identified, the corrective action procedure provides a systematic approach to assess the issues, restore the laboratory's system integrity, and prevent reoccurrence. Corrective actions are documented using Non-Conformance Memos (NCM) in LIMS (Figure 12-1) or the Corrective Action Reports (CAR) using the corrective action database (Figures 12-2 and 12-3).

12.2 General

Problems within the quality system or within analytical operations may be discovered in a variety of ways, such as QC sample failures, internal or external audits, proficiency testing (PT) performance, client complaints, staff observation, etc..

The purpose of a corrective action system is to:

- Identify non-conformance events and assign responsibility(s) for investigating.
- Resolve non-conformance events and assign responsibility for any required corrective action.
- Identify systematic problems before they become serious.
- Identify and track client complaints and provide resolution.

12.2.1 Non-Conformance Memo (NCM) - is used to document the following types of corrective actions (Figures 12-1):

- Deviations from an established procedure or SOP
- QC outside of limits (non-matrix related)
- Isolated reporting / calculation errors
- Client Complaints
- Discrepancies in materials / goods received vs. manufacturer packing slips.

12.2.2 Corrective Action Database (Figures 12-2 - 12-3) - is used to document the following types of corrective actions:

- Questionable trends that are found in the review of NCMs.
- Issues found while reviewing NCMs that warrant further investigation.
- Failed or unacceptable PT results.
- Corrective actions that cross multiple departments in the laboratory.
- Systematic reporting / calculation errors.
- Complaints received from clients are documented in the corrective action database.
- Data recall investigations

- Identified poor process or method performance trends
- Excessive revised reports

This will provide background documentation to enable root cause analysis and preventive action.

12.3 Closed Loop Corrective Action Process

Any employee in the company can initiate a corrective action. There are four main components to a closed-loop corrective action process once an issue has been identified: Cause Analysis, Selection and Implementation of Corrective Actions (both short and long term), Monitoring of the Corrective Actions, and Follow-up.

12.3.1 Cause Analysis

- Upon discovery of a non-conformance event, the event must be defined and documented. An NCM, CAR or the documentation in the complaint database must be initiated. Someone is assigned to investigate the issue and the event is investigated for root cause. Table 12-1 provides some general guidelines on determining responsibility for assessment.
- The cause analysis step is the key to the process as a long term corrective action cannot be determined until the cause is determined.
- If the root cause is not readily obvious, the Supervisor, Laboratory Technical Manager, Laboratory Director, or QA Manager (or QA designee) is consulted.

12.3.2 Selection and Implementation of Corrective Actions

- Where corrective action is needed, the laboratory shall identify potential corrective actions. The action(s) most likely to eliminate the problem and prevent recurrence are selected and implemented. Responsibility for implementation is assigned.
- Corrective actions shall be to a degree appropriate to the magnitude of the problem identified through the cause analysis.
- Whatever corrective action is determined to be appropriate, the laboratory shall document and implement the changes. The NCM or CAR is used for this documentation.

12.3.3 Root Cause Analysis

Root Cause Analysis is a class of problem solving (investigative) methods aimed at identifying the basic or causal factor(s) that underlie variation in performance or the occurrence of a significant failure. The root cause may be buried under seemingly innocuous events, many steps preceding the perceived failure. At first glance, the immediate response is typically directed at a symptom and not the cause. Typically, root cause analysis would be best with three or more incidents to triangulate a weakness.

Systematically analyze and document the Root Causes of the more significant problems that are reported. Identify, track, and implement the corrective actions required to reduce the likelihood of recurrence of significant incidents. Trend the Root Cause data from these incidents to identify Root Causes that, when corrected, can lead to dramatic improvements in performance by eliminating entire classes of problems.

Identify the one event associated with problem and ask why this event occurred. Brainstorm the root causes of failures; for example, by asking why events occurred or conditions existed; and then why the cause occurred 5 consecutive times until you get to the root cause. For each

of these sub events or causes, ask why it occurred. Repeat the process for the other events associated with the incident.

Root cause analysis does not mean the investigation is over. Look at technique, or other systems outside the normal indicators. Often creative thinking will find root causes that ordinarily would be missed, and continue to plague the laboratory or operation.

12.3.4 Monitoring of the Corrective Actions

- The Technical Manager and QA Manager are responsible to ensure that the corrective action taken was effective.
- Ineffective actions are documented and re-evaluated until acceptable resolution is achieved. Technical Managers are accountable to the Laboratory Director to ensure final acceptable resolution is achieved and documented appropriately.
- Each NCM is entered into a database for tracking purposes and a monthly summary of all NCMs is reviewed to aid in ensuring that the appropriate corrective actions have taken effect. CARs are also compiled and reviewed monthly. Corrective actions or complaints that result in corrective action are also reviewed monthly.
- The QA Manager reviews NCMs and CARs monthly for trends. Highlights are included in the QA monthly report (refer to Section 16). If a significant trend develops that adversely affects quality, an audit of the area is performed and corrective action implemented.
- Any out-of-control situations that are not addressed acceptably at the laboratory level may be reported to the Corporate Quality Director by the QA Manager, indicating the nature of the out-of-control situation and problems encountered in solving the situation.

12.3.5 Follow-up Audits

- Follow-up audits may be initiated by the QA Manager and shall be performed as soon as possible when the identification of a nonconformance casts doubt on the laboratory's compliance with its own policies and procedures, or on its compliance with state or federal requirements.
- These audits often follow the implementation of the corrective actions to verify effectiveness. An additional audit would only be necessary when a critical issue or risk to business is discovered.

(Also refer to Section 15.1.4, Special Audits.)

12.4 Technical Corrective Actions

In addition to providing acceptance criteria and specific protocols for technical corrective actions in the method SOPs, the laboratory has general procedures to be followed to determine when departures from the documented policies and procedures and quality control have occurred (refer to Section 11). The documentation of these procedures is through the use of an NCM or CAR.

Table 12-1 includes examples of general technical corrective actions. For specific criteria and corrective actions, refer to the analytical methods or specific method SOPs. The laboratory may also maintain Work Instructions on these items that are available upon request.

Table 12-1 provides some general guidelines for identifying the individual(s) responsible for assessing each QC type and initiating corrective action. The table also provides general guidance on how a data set should be treated if associated QC measurements are

unacceptable. Specific procedures are included in Method SOPs, Work Instructions, QAM Sections 19 and 20. All corrective actions are reviewed monthly, at a minimum, by the QA Manager and highlights are included in the QA monthly report.

To the extent possible, samples shall be reported only if all quality control measures are acceptable. If the deficiency does not impair the usability of the results, data will be reported with an appropriate data qualifier and/or the deficiency will be noted in the case narrative. Where sample results may be impaired, the Project Manager is notified by an NCM and appropriate corrective action (e.g., reanalysis) is taken and documented**.**

12.5 Basic Corrections

When mistakes occur in records, each mistake shall be crossed-out, [not obliterated (e.g. no white-out)], and the correct value entered alongside. All such corrections shall be initialed (or signed) and dated by the person making the correction. In the case of records stored electronically, the original “uncorrected” file must be maintained intact and a second “corrected” file is created.

This same process applies to adding additional information to a record. All additions made later than the initial must also be initialed (or signed) and dated.

When corrections are due to reasons other than obvious transcription errors, the reason for the corrections (or additions) shall also be documented.

Figure 12-1.
Example - Nonconformance Memo Screen - LIMS

Nonconformance Memo – LIMS

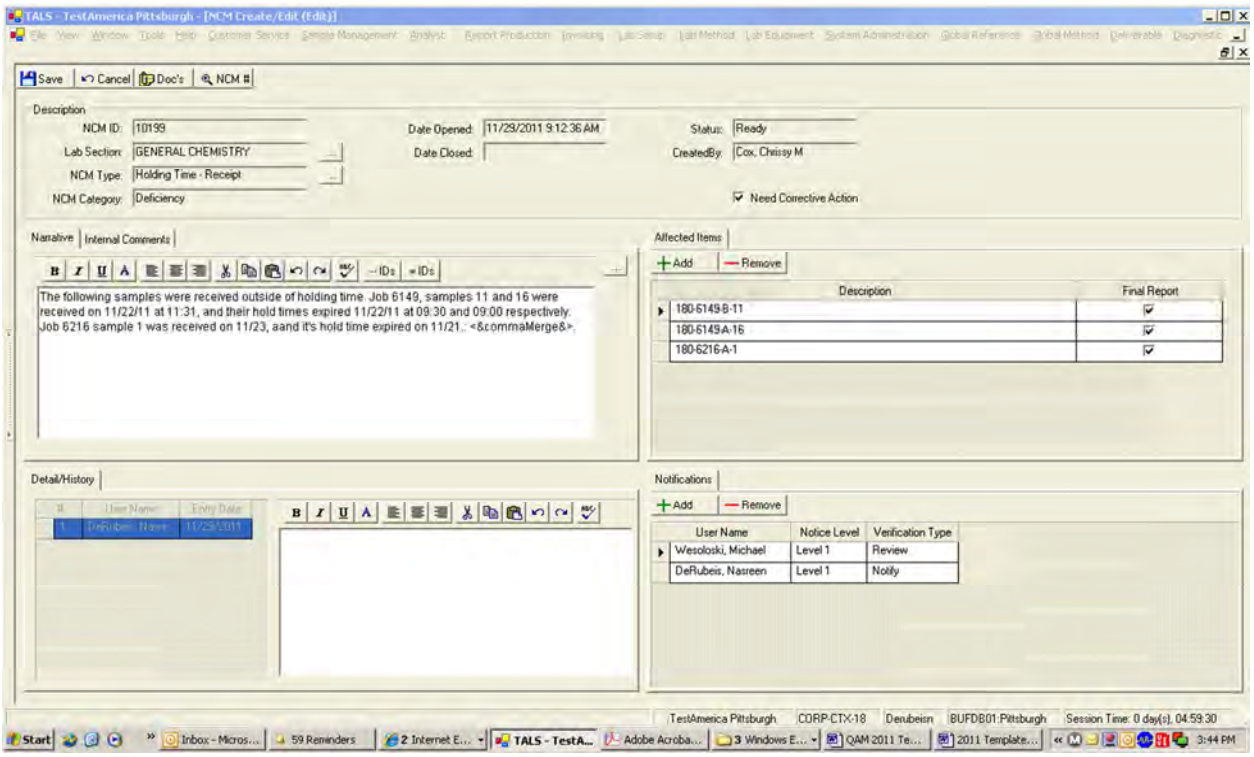


Table 12-1.

Example – General Corrective Action Procedures

QC Activity *(Individual Responsible for Initiation/Assessment)*	Acceptance Criteria	Recommended Corrective Action
Initial Instrument Blank *(Analyst)*	- Instrument response < MDL.	- Prepare another blank. - If same response, determine cause of contamination: reagents, environment, instrument equipment failure, etc..
Initial Calibration Standards *(Analyst, Technical Manager(s))*	- Correlation coefficient > 0.99 or standard concentration value. - % Recovery within acceptance range. - See details in Method SOP.	- Reanalyze standards. - If still unacceptable, remake standards and recalibrate instrument.

QC Activity ***(Individual Responsible for Initiation/Assessment)***	**Acceptance Criteria**	**Recommended Corrective Action**
Independent Calibration Verification (Second Source) *(Analyst, Technical Manager(s))*	- % Recovery within control limits.	- Remake and reanalyze standard. - If still unacceptable, then remake calibration standards or use new primary standards and recalibrate instrument.
Continuing Calibration Standards *(Analyst, Data Reviewer)*	% Recovery within control limits.	- Reanalyze standard. - If still unacceptable, then recalibrate and rerun affected samples.
Matrix Spike / Matrix Spike Duplicate (MS/MSD) *(Analyst, Data Reviewer)*	- % Recovery within limits documented in LIMS.	- If the acceptance criteria for duplicates or matrix spikes are not met because of matrix interferences, the acceptance of the analytical batch is determined by the validity of the LCS. - If the LCS is within acceptable limits the batch is acceptable. - The results of the duplicates, matrix spikes and the LCS are reported with the data set. - For matrix spike or duplicate results outside criteria the data for that sample shall be reported with qualifiers.
Laboratory Control Sample (LCS) *(Analyst, Data Reviewer)*	- % Recovery within limits specified in LIMS,	- Batch must be re-prepared and re-analyzed. **Note:** If there is insufficient sample or the holding time cannot be met, contact client and report with flags. This includes any allowable marginal exceedance. When not using marginal exceedances, the following exceptions apply: 1) when the acceptance criteria for the positive control are exceeded high (i.e., high bias) and there are associated samples that are non-detects, then those non-detects may be reported with data qualifying codes; 2) when the acceptance criteria for the positive control are exceeded low (i.e., low bias), generally with low bias samples are reprepared and reanalzyed.
Surrogates *(Analyst, Data Reviewer)*	- % Recovery within limits of method or within three standard deviations of the historical mean.	- Individual sample must be repeated. Place comment in LIMS. - Surrogate results outside criteria shall be reported with qualifiers.
Method Blank (MB) *(Analyst, Data Reviewer)*	< Reporting Limit [1] For DoD requirements no analytes detected at greater than and equal to ½ RL. For common lab contaminants, no analytes detected at greater than and equal to RL (refer to SOP PT-QA-029).	- Reanalyze blank. - If still positive, determine source of contamination. If necessary, reprocess (i.e. digest or extract) entire sample batch. Report blank results. - Qualify the result(s) if the concentration of a targeted analyte in the MB is at or above the reporting limit and is > 1/10 of the amount measured in the sample.

QC Activity ***(Individual Responsible for Initiation/Assessment)***	**Acceptance Criteria**	**Recommended Corrective Action**
Proficiency Testing (PT) Samples *(QA Manager, Technical Manager(s))*	- Criteria supplied by PT Supplier.	- Any failures or warnings must be investigated for cause. Failures may result in the need to repeat a PT sample to show the problem is corrected.
Internal / External Audits *(QA Manager, Technical Manager(s), Laboratory Director)*	- Defined in Quality System documentation such as SOPs, QAM, etc..	- Non-conformances must be investigated through CAR system and necessary corrections must be made.
Reporting / Calculation Errors (Depends on issue – possible individuals include: Analysts, Data Reviewers, Project Managers, *Technical Manager(s)*, QA Manager, Corporate QA, Corporate Management)	- SOP CW-L-S-002, Internal Investigation of Potential Data Discrepancies and Determination for Data Recall.	- Corrective action is determined by type of error. Follow the procedures in SOP CW-L-S-002 .
Client Complaints *(Project Managers, Lab Director, Sales and Marketing)*	-	- Corrective action is determined by the type of complaint. For example, a complaint regarding an incorrect address on a report will result in the report being corrected and then follow-up must be performed on the reasons the address was incorrect (e.g., database needs to be updated).
QA Monthly Report (Refer to Section 16 for an example) (QA Manager, Lab Director, *Technical Manager(s)*)	- QAM, SOPs.	- Corrective action is determined by the type of issue. For example, CARs for the month are reviewed and possible trends are investigated.
Health and Safety Violation (Safety Officer, Lab Director, *Technical Manager(s)*)	- Environmental Health and Safety (EHS) Manual.	- Non-conformance is investigated and corrected through CAR system.

Note:

1. Except as noted below for certain compounds, the method blank should be below the reporting limit unless there is a client specific requirement. Concentrations up to five times the reporting limit will be allowed for the ubiquitous laboratory and reagent contaminants: methylene chloride, toluene, acetone, 2-butanone and phthalates **provided** they appear in similar levels in the reagent blank and samples. This allowance presumes that the detection limit is significantly below any regulatory limit to which the data are to be compared and that blank subtraction will not occur. For benzene and ethylene dibromide (EDB) and other analytes for which regulatory limits are extremely close to the detection limit, the method blank must be below the method detection limit.

SECTION 13

PREVENTIVE ACTION / IMPROVEMENT

13.1 Overview

The laboratory's preventive action programs improve or eliminate potential causes of nonconforming product and/or nonconformance to the quality system. This preventive action process is a proactive and continuous process if improvement activities that can be initiated through feedback from clients, employees, business providers, and affiliates. The QA Department has the overall responsibility to ensure that the preventive action process is in place, and that relevant information on actions is submitted for management review.

Dedicating resources to an effective preventive action system emphasizes the laboratory's commitment to its Quality Program. It is beneficial to identify and address negative trends before they develop into complaints, problems and corrective actions. Additionally, customer service and client satisfaction can be improved through continuous improvements to laboratory systems.

Opportunities for improvement may be discovered during management reviews, the monthly QA Metrics Report, evaluation of internal or external audits, results and evaluation of proficiency testing (PT) performance, data analysis & review processing operations, client complaints, staff observation, etc..

The monthly Management Systems Metrics Report shows performance indicators in all areas of the laboratory and quality system. These areas include revised reports, corrective actions, audit findings, internal auditing and data authenticity audits, client complaints, PT samples, holding time violations, SOPs, ethics training, etc. These metrics are used in evaluating the management and quality system performance on an ongoing basis and provide a tool for identifying areas for improvement.

The laboratory's corrective action process is integral to implementation of preventive actions. A critical piece of the corrective action process is the implementation of actions to prevent further occurrence of a non-compliance event. Historical review of corrective action provides a valuable mechanism for identifying preventive action opportunities.

13.1.1 The following elements are part of a preventive action system:

- Identification of an opportunity for preventive action.
- Process for the preventive action.
- Define the measurements of the effectiveness of the process once undertaken.
- Execution of the preventive action.
- Evaluation of the plan using the defined measurements.
- Verification of the effectiveness of the preventive action.
- Close-Out by documenting any permanent changes to the Quality System as a result of the Preventive Action. Documentation of Preventive Action is incorporated into the monthly QA reports, corrective action process and management review.

13.1.2 Any Preventive Actions undertaken or attempted shall be taken into account during the Annual Management Systems Review (Section 16). A highly detailed report is not required;

however a summary of success and failure within the preventive action program is sufficient to provide management with a measurement for evaluation.

13.2 Management Of Change

The Management of Change process, see PT-QA-WI-028, is designed to manage significant events and changes that occur within the laboratory. The potential risks inherent with a new event or change are identified and evaluated. The risks are minimized or eliminated through pre-planning and the development of preventive measures. The types of indicators monitored under this collective system include:

Change Type	Examples
Facility Changes	-movement of prep or instrument groups to a new location in the laboratory -introduction of significant changes in air handling or gas and solvent delivery systems -significant room additions or renovations -significant electrical or network upgrades or changes
Accreditation Changes	-voluntary surrender of accreditations no longer deemed necessary to the laboratory -loss of accreditation -addition of new accreditation programs
Reagents and Waste Streams	- new chemicals/reagents not previously used in the laboratory -deletion of chemicals/reagents that will mean they are no longer used at all in the laboratory -major changes to the volume of chemicals/reagents being used - a new waste stream must be developed
Addition or Deletion of Laboratory Capabilities	-implementation of new regulated methods -“retiring” of active methods -method development for “in-house” methods Note: New regulatory methods and method development require specific processes and documentation before the process can begin or the method can enter production. See QA and EHS for requirements.
Key Personnel Changes	-key personnel promotions and their effect on that individuals group (experience, productivity, leadership, manpower) -key personnel losses -impact of new personnel that may add new experience or capabilities to the laboratory
New Types of Instrumentation	-addition of a new instrument class/technology -significant instrument upgrades that impact sensitivity, productivity or capability Note: New instrumentation requires collection and submission of instrument IDOC information before entering production. See QA for requirements.
Changes in Quality Systems and Policies	-implementation of a new Corrective Action System -changes to the Internal Audit program -implementation of uploads for Proficiency Testing samples

FIGURE 13-1
EXAMPLE – MANAGEMENT OF CHANGE REQUEST FORM

MANAGEMENT OF CHANGE REQUEST FORM (CRF)

To be completed by initiator

1. What is the proposed change?

2. How will it be implemented, and who will be responsible?

3. What is the potential impact (be specific)
   a. To clients

   b. To the laboratory

   c. Other

4. What approval is needed? □Regulatory □ LD □QA □Corp QA □DM □ Other_____
5.
6. Who should be notified, and when

7. What is the timeframe for the change
   a. Is this temporary

   b. Is there a “trial period”

8. Was the change successful

SECTION 14

CONTROL OF RECORDS

The laboratory maintains a records management system appropriate to its needs and that complies with applicable standards or regulations as required. The system produces unequivocal, accurate records that document all laboratory activities. The laboratory retains all original observations, calculations and derived data, calibration records and a copy of the analytical report for a minimum of five years after it has been issued.

14.1 Overview

The laboratory has established procedures for identification, collection, indexing, access, filing, storage, maintenance and disposal of quality and technical records. A record index is listed in Table 14-1. Quality records are maintained by the Quality Assurance (QA) department electronically in laboratory's designated network drive which is backed up as part of the regular network backup. Records are of two types; either electronic or hard copy paper formats depending on whether the record is computer or hand generated (some records may be in both formats). Technical records are maintained by report production group and HR Coordinator as outlined in SOP No. PT-QA-019.

Table 14-1. Record Index[1]

	Record Types [1]:	**Retention Time:**
Technical Records	- Raw Data - Logbooks[2] - Standards - Certificates - Analytical Records - MDLs/IDLs/DOCs - Lab Reports	5 Years from analytical report issue*
Official Documents	- Quality Assurance Manual (QAM) - Work Instructions - Policies - SOPs - Policy Memorandums - Manuals	5 Years from document retirement date*
QA Records	- Internal & External Audits/Responses - Certifications - Corrective/Preventive Actions - Management Reviews - Method & Software Validation / Verification Data - Data Investigation	5 Years from archival* **Data Investigation:** 5 years or the life of the affected raw data storage whichever is greater (beyond 5 years if ongoing project or pending investigation)
Project Records	- Sample Receipt & COC Documentation - Contracts and Amendments - Correspondence - QAPP -SAP - Telephone Logbooks - Lab Reports	5 Years from analytical report issue*
Administrative Records	Finance and Accounting	10 years

	Record Types [1]:	Retention Time:
	EH&S Manual, Permits	7 years
	Disposal Records	Indefinitely
	Employee Handbook	Indefinitely
	Personnel files, Employee Signature & Initials, Administrative Training Records (e.g., Ethics)	Refer to HR Manual
	Administrative Policies Technical Training Records	7 years

[1] Record Types encompass hardcopy and electronic records.
[2] Examples of Logbook types: Maintenance, Instrument Run, Preparation (standard and samples), Standard and Reagent Receipt, Archiving, Balance Calibration, Temperature (hardcopy or electronic records).
* Exceptions listed in Table 14-2.

14.1.1 All records are stored and retained in such a way that they are secure and readily retrievable at the laboratory facility or an offsite location that provides a suitable environment to prevent damage or deterioration and to prevent loss at the laboratory or the Business Records Management Facility. Depending on the type of report requested, the onsite retention of laboratory data records varies. All records shall be protected against fire, theft, loss, environmental deterioration, and vermin. In the case of electronic records, electronic or magnetic sources, storage media are protected from deterioration caused by magnetic fields and/or electronic deterioration.

Access to the data is limited to laboratory and company employees**.** Records archived off-site are stored in a secure location where a record is maintained of any entry into the storage facility. Whether off-site storage is used, logs are maintained to note removal and return of records. All data records are uploaded into LIMS and maintained in LIMS. Records are maintained for a minimum of five years unless otherwise specified by a client or regulatory requirement.

For raw data and project records, record retention shall be calculated from the date the project report is issued. For other records, such as Controlled Documents, QA, or Administrative Records, the retention time is calculated from the date the record is formally retired. Records related to the programs listed in Table 14-2 have lengthier retention requirements and are subject to the requirements in Section 14.1.3.

14.1.2 Programs with Longer Retention Requirements

Some regulatory programs have longer record retention requirements than the standard record retention time. These are detailed in Table 14-2 with their retention requirements. In these cases, the longer retention requirement is enacted. If special instructions exist such that client data cannot be destroyed prior to notification of the client, the container or box containing that data is marked as to who to contact for authorization prior to destroying the data.

Table 14-2. Special Record Retention Requirements

Program	[1]Retention Requirement
Commonwealth of MA – All environmental data 310 CMR 42.14	10 years
FIFRA – 40 CFR Part 160	Retain for life of research or marketing permit for pesticides regulated by EPA
Housing and Urban Development (HUD) Environmental Lead Testing	10 years
Alaska	10 years
Louisiana – All	10 years
Michigan Department of Environmental Quality – all environmental data	10 years
Navy Facilities Engineering Service Center (NFESC)	10 years
TSCA - 40 CFR Part 792	10 years after publication of final test rule or negotiated test agreement

[1]Note: Extended retention requirements must be noted with the archive documents or addressed in facility-specific records retention procedures.

14.1.3 The laboratory has procedures to protect and back-up records stored electronically and to prevent unauthorized access to or amendment of these records. All analytical data is maintained as hard copy or in a secure readable electronic format. For analytical reports that are maintained as copies in PDF format, refer to SOP No. PT-QA-019, Records Information Management and SOP No. PT-QA-020, Report Production.

14.1.4 The record keeping system allows for historical reconstruction of all laboratory activities that produced the analytical data, as well as rapid recovery of historical data (Records stored off site should be accessible within 2 days of a request for such records). The history of the sample from when the laboratory took possession of the samples must be readily understood through the documentation. This shall include inter-laboratory transfers of samples and/or extracts.

- The records include the identity of personnel involved in sampling, sample receipt, preparation, or testing. All analytical work contains the initials (at least) of the personnel involved. All analytical work contains the initials (at least) of the personnel involved. The laboratory's copy of the chain of custody is stored with the invoice in LIMS. Details of this procedure is described in SOP No. PT-QA-019. The chain of custody would indicate the name of the sampler. If any sampling notes are provided with the chain of custody, they are scanned into LIMS.
- All information relating to the laboratory facilities equipment, analytical test methods, and related laboratory activities, such as sample receipt, sample preparation, or data verification are documented.
- The record keeping system facilitates the retrieval of all working files and archived records for inspection and verification purposes (e.g., set format for naming electronic files, set format for what is included with a given analytical data set are described in SOP No. PT-QA-019. Instrument data is stored sequentially by instrument. Run logs are maintained for each instrument; a copy of each day's run long or instrument sequence is stored with the

data to aid in re-constructing an analytical sequence. Where an analysis is performed without an instrument, bound logbooks or bench sheets are used to record and file data or the data is entered in LIMS. Standard and reagent information is recorded in electronic standard log in LIMS.

- Changes to hardcopy records shall follow the procedures outlined in Section 12 and 19. Changes to electronic records in LIMS or instrument data are recorded in audit trails.
- The reason for a signature or initials on a document is clearly indicated in the records such as “sampled by,” “prepared by,” “reviewed by”, or “analyzed by”.
- All generated data except those that are generated by automated data collection systems, are recorded directly, promptly and legibly in permanent dark ink.
- Hard copy data may be scanned into PDF format for record storage as long as the scanning process can be verified in order to ensure that no data is lost and the data files and storage media must be tested to verify the laboratory’s ability to retrieve the information prior to the destruction of the hard copy that was scanned. The procedure for this verification can be found in SOP No. PT-QA-019.
- Also refer to Section 19.14.1 ‘Computer and Electronic Data Related Requirements’**.**

14.2 Technical And Analytical Records

14.2.1 The laboratory retains records of original observations, derived data and sufficient information to establish an audit trail, calibration records, staff records and a copy of each analytical report issued, for a minimum of five years unless otherwise specified by a client or regulatory requirement. The records for each analysis shall contain sufficient information to enable the analysis to be repeated under conditions as close as possible to the original. The records shall include the identity of laboratory personnel responsible for the sampling, performance of each analysis and reviewing results.

14.2.2 Observations, data and calculations are recorded real-time and are identifiable to the specific task.

14.2.3 Changes to hardcopy records shall follow the procedures outlined in Section 12 and 19. Changes to electronic records in LIMS or instrument data are recorded in audit trails.

The essential information to be associated with analysis, such as strip charts, tabular printouts, computer data files, analytical notebooks, and run logs, include:

- Laboratory sample ID code**;**
- Date of analysis; Time of Analysis is also required if the holding time is seventy-two (72) hours or less, or when time critical steps are included in the analysis (e.g., drying times, incubations, etc.); instrumental analyses have the date and time of analysis recorded as part of their general operations. Where a time critical step exists in an analysis, location for such a time is included as part of the documentation in a specific logbook, on a benchsheet or in LIMS.
- Instrumentation identification and instrument operating conditions/parameters. Operating conditions/parameters are typically recorded in instrument maintenance logs where available.
- analysis type**;**
- all manual calculations and manual integrations**;**
- analyst's or operator's initials/signature**;**

- sample preparation including cleanup, separation protocols, incubation periods or subculture, ID codes, volumes, weights, instrument printouts, meter readings, calculations, reagents**;**
- test results**;**
- standard and reagent origin, receipt, preparation, and use**;**
- calibration criteria, frequency and acceptance criteria**;**
- data and statistical calculations, review, confirmation, interpretation, assessment and reporting conventions**;**
- quality control protocols and assessment**;**
- electronic data security, software documentation and verification, software and hardware audits, backups, and records of any changes to automated data entries; and
- Method performance criteria including expected quality control requirements. These are indicated both in the LIMS and on specific analytical report formats**.**

14.3 Laboratory Support Activities

In addition to documenting all the above-mentioned activities, the following are retained QA records and project records (previous discussions in this section relate where and how these data are stored):

- all original raw data, whether hard copy or electronic, for calibrations, samples and quality control measures, including analysts' work sheets and data output records (chromatograms, strip charts, and other instrument response readout records)**;**
- a written description or reference to the specific test method used which includes a description of the specific computational steps used to translate parametric observations into a reportable analytical value**;**
- copies of final reports**;**
- archived SOPs**;**
- correspondence relating to laboratory activities for a specific project**;**
- all corrective action reports, audits and audit responses**;**
- proficiency test results and raw data; and
- results of data review, verification, and crosschecking procedures

14.3.1 Sample Handling Records

Records of all procedures to which a sample is subjected while in the possession of the laboratory are maintained. These include but are not limited to records pertaining to:

- sample preservation including appropriateness of sample container and compliance with holding time requirement;
- sample identification, receipt, acceptance or rejection and login;
- sample storage and tracking including shipping receipts, sample transmittal / COC forms; and
- procedures for the receipt and retention of samples, including all provisions necessary to protect the integrity of samples.

14.4 Administrative Records

The laboratory also maintains the administrative records in either electronic or hard copy form. Refer to Table 14-1.

14.5 Records Management, Storage And Disposal

14.5.1 All records (including those pertaining to test equipment), certificates and reports are safely stored, held secure and in confidence to the client. Certification related records are available upon request.

14.5.2 All information necessary for the historical reconstruction of data is maintained by the laboratory. Records that are stored only on electronic media must be supported by the hardware and software necessary for their retrieval.

14.5.3 Records that are stored or generated by computers or personal computers have hard copy, write-protected backup copies, or an electronic audit trail controlling access**.**

14.5.4 The laboratory has a record management system (a.k.a., document control) for control of laboratory instrument/run logbooks, standard logbooks, balance logs, maintenance logs, bench sheets where applicable and records for data reduction, validation and reporting. Laboratory notebooks are issued on a per analysis basis, and are numbered sequentially. All sample data are recorded in LIMS. Bench sheets are filed sequentially. Standards are maintained in the electronic standards in LIMS**.** Records are considered archived when noted as such in the records management system (a.k.a., document control).

14.5.5 Transfer of Ownership

In the event that the laboratory transfers ownership or goes out of business, the laboratory shall ensure that the records are maintained or transferred according to client's instructions. Upon ownership transfer, record retention requirements shall be addressed in the ownership transfer agreement and the responsibility for maintaining archives is clearly established. In addition, in cases of bankruptcy, appropriate regulatory and state legal requirements concerning laboratory records must be followed. In the event of the closure of the laboratory, all records will revert to the control of the corporate headquarters. Should the entire company cease to exist, as much notice as possible will be given to clients and the accrediting bodies who have worked with the laboratory during the previous 5 years of such action.

14.5.6 Records Disposal

14.5.6.1 Records are removed from the archive and destroyed after 5 years unless otherwise specified by a client or regulatory requirement. On a project specific or program basis, clients may need to be notified prior to record destruction. Records are destroyed in a manner that ensures their confidentiality such as shredding, mutilation or incineration. (Refer to Tables 14-1 and 14-2 and SOP No. PT-QA-019).

14.5.6.2 Electronic copies of records must be destroyed by erasure or physically damaging off-line storage media so no records can be read.

14.5.6.3 If a third party records management company is hired to dispose of records, a "Certificate of Destruction" is required.

SECTION 15

AUDITS

15.1 Internal Audits

Internal audits are performed to verify that laboratory operations comply with the requirements of the lab's quality system and with the external quality programs under which the laboratory operates. Audits are planned and organized by the QA staff. Personnel conducting the audits should be independent of the area being evaluated. Auditors will have sufficient authority, access to work areas, and organizational freedom necessary to observe all activities affecting quality and to report the assessments to laboratory management and when requested to corporate management.

Audits are conducted and documented as described in the TestAmerica Corporate SOP on performing Internal Auditing, SOP No. CA-Q-S-004. More detail on the specific elements for internal audits and data audit is described in Pittsburgh Laboratory's SOP No. PT-QA-002, and SOP No. PT-QA-013. Technical data review requirement are described in Section 19.14.4 and SOP No. PT-QA-018. The types and frequency of routine internal audits are shown in Table 15-1. Special or ad hoc assessments may be conducted as needed under the direction of the QA staff.

Table 15-1. Types of Internal Audits and Frequency

Description	Performed by	Frequency
Quality Systems Audits	QA Department, QA approved designee, or Corporate QA	All areas of the laboratory annually
Method Audits	Joint responsibility: a) QA Manager or designee b) Technical Manager or Designee (Refer to CA-Q-S-004)	Methods Audits Frequency: 50% of methods annually **100% of methods annually (DoD)**
Special	QA Department or Designee	Surveillance or spot checks performed as needed, e.g., to confirm corrective actions from other audits.
Performance Testing	Analysts with QA oversight	Two successful per year for each TNI field of testing or as dictated by regulatory requirements

15.1.1 Annual Quality Systems Audit

An annual quality systems audit is required to ensure compliance to analytical methods and SOPs, TestAmerica's Data Integrity and Ethics Policies, TNI quality systems, client, state requirements, and DoD QSM and the effectiveness of the internal controls of the analytical process, including but not limited to data review, quality controls, preventive action and corrective action. The completeness of earlier corrective actions is assessed for effectiveness & sustainability. The audit is divided into sections for each operating or support area of the lab, and each section is comprehensive for a given area. The area audits may be performed on a

rotating schedule throughout the year to ensure adequate coverage of all areas. This schedule may change as situations in the laboratory warrant.

Effectiveness of training will be determined during our annual QA systems evaluation. Evidence of successful training includes:

- Audit and surveillance results, control charts, proficiency testing results, data analysis, corrective and preventive actions, customer feedback, and management reviews in efforts to monitor trends and continually improve the quality system:
- Adequate documentation of training within operational areas, including one-on-one technical training for individual technologies, and particularly for people cross-trained.
- Analysts knowledge of QA Manual and SOPs. Analysts following SOPs, i.e., practice matches SOPs.
- Analysts regularly communicate to supervisors and QA if SOPs need revision.

15.1.2 QA Technical Audits

QA technical audits are based on client projects, associated sample delivery groups, and the methods performed. Reported results are compared to raw data to verify the authenticity of results. The validity of calibrations and QC results are compared to data qualifiers, footnotes, and case narratives. Documentation is assessed by examining run logs and records of manual integrations. Manual calculations are checked. Where possible, electronic audit miner programs (e.g., MintMiner and Chrom AuditMiner) are used to identify unusual manipulations of the data deserving closer scrutiny. QA technical audits will include all methods within a two-year period.

15.1.3 SOP Method Compliance

Compliance of all SOPs with the source methods and compliance of the operational groups with the SOPs will be assessed by the Technical Manager or qualified designee at least every two years. It is also recommended that the work of each newly hired analyst is assessed within 3 months of working independently, (e.g., completion of method IDOC). In addition, as analysts add methods to their capabilities, (new IDOC) reviews of the analyst work products will be performed within 3 months of completing the documented training.

15.1.4 Special Audits

Special audits are conducted on an as needed basis, generally as a follow up to specific issues such as client complaints, corrective actions, PT results, data audits, system audits, validation comments, regulatory audits or suspected ethical improprieties. Special audits are focused on a specific issue, and report format, distribution, and timeframes are designed to address the nature of the issue.

15.1.5 Performance Testing

The laboratory participates semi-annually in performance audits conducted through the analysis of PT samples provided by a third party. The laboratory generally participates in the following types of PT studies: Water Pollution Program, Water Supply Program, Hazardous Waste Program, client supplied PTs and Lab internal PTs.

It is TestAmerica's policy that PT samples be treated as typical samples in the production process. Furthermore, where PT samples present special or unique problems, in the regular production process they may need to be treated differently, as would any special or unique request submitted by any client. The QA Manager must be consulted and in agreement with any decisions made to treat a PT sample differently due to some special circumstance.

Written responses to unacceptable PT results are required. In some cases it may be necessary for blind QC samples to be submitted to the laboratory to show a return to control.

15.2 EXTERNAL AUDITS

External audits are performed when certifying agencies or clients conduct on-site inspections or submit performance testing samples for analysis. It is TestAmerica's policy to cooperate fully with regulatory authorities and clients. The laboratory makes every effort to provide the auditors with access to personnel, documentation, and assistance. Laboratory supervisors are responsible for providing corrective actions to the QA Manager who coordinates the response for any deficiencies discovered during an external audit. Audit responses are due in the time allotted by the client or agency performing the audit. When requested, a copy of the audit report and the labs corrective action plan will be forwarded to Corporate Quality.

The laboratory cooperates with clients and their representatives to monitor the laboratory's performance in relation to work performed for the client. The client may only view data and systems related directly to the client's work. All efforts are made to keep other client information confidential.

15.2.1 Confidential Business Information (CBI) Considerations

During on-site audits, auditors may come into possession of information claimed as business confidential. A business confidentiality claim is defined as "a claim or allegation that business information is entitled to confidential treatment for reasons of business confidentiality or a request for a determination that such information is entitled to such treatment." When information is claimed as business confidential, the laboratory must place on (or attach to) the information at the time it is submitted to the auditor, a cover sheet, stamped or typed legend or other suitable form of notice, employing language such as "trade secret", "proprietary" or "company confidential". Confidential portions of documents otherwise non-confidential must be clearly identified. CBI may be purged of references to client identity by the responsible laboratory official at the time of removal from the laboratory. However, sample identifiers may not be obscured from the information. Additional information regarding CBI can be found in within the 2009 TNI standards.

15.3 Audit Findings

Audit findings are documented using the corrective action process database or spreadsheet. The laboratory's corrective action responses for both types of audits may include action plans that could not be completed within a predefined timeframe. In these instances, a completion date must be set and agreed to by operations management and the QA Manager.

Developing and implementing corrective actions to findings is the responsibility of the Technical Manager where the finding originated. Findings that are not corrected by specified due dates are reported monthly to management in the QA monthly report. When requested a copy of the audit report and the labs corrective action plan will be forwarded to Corporate Quality.

If any audit finding casts doubt on the effectiveness of the operations or on the correctness or validity of the laboratory's test results, the laboratory shall take timely corrective action, and shall notify clients in writing if the investigations show that the laboratory results have been affected. Once corrective action is implemented, a follow-up audit is scheduled to ensure that the problem has been corrected.

Clients must be notified promptly in writing, of any event such as the identification of defective measuring or test equipment that casts doubt on the validity of results given in any test report or amendment to a test report. The investigation must begin within one business day of discovery of the problem and the client will be notified as soon as the impact is known but no later than two weeks after identification of the problem.

SECTION 16

MANAGEMENT REVIEWS

16.1 Quality Assurance Report

A comprehensive QA Report shall be prepared each month by the laboratory's QA Department and forwarded to the Laboratory Director, Technical Manager(s), their Quality Director as well as the General Manager. All aspects of the QA system are reviewed to evaluate the suitability of policies and procedures. During the course of the year, the Laboratory Director, General Manager or Corporate QA may request that additional information be added to the report.

On a monthly basis, Corporate QA compiles information from all the monthly laboratory reports. The Corporate Quality Directors prepare a report that includes a compilation of all metrics and notable information and concerns regarding the QA programs within the laboratories. The report also includes a listing of new regulations that may potentially impact the laboratories. This report is presented to the Senior Management Team and General Managers.

16.2 Annual Management Review

The senior lab management team (Laboratory Director, QA Manager, General Manager, Senior Project Manager, and) conducts a review annually of its quality systems and LIMS to ensure its continuing suitability and effectiveness in meeting client and regulatory requirements and to introduce any necessary changes or improvements. It will also provide a platform for defining goals & objectives and action items that feed into the laboratory planning system. Corporate Operations and Corporate QA personnel is to be included in this meeting at the discretion of the Laboratory Director. The LIMS review consists of examining any audits, complaints or concerns that have been raised through the year that are related to the LIMS. The laboratory will summarize any critical findings that cannot be solved by the lab and report them to Corporate IT.

This management system review (Corporate SOP No. CA-Q-S-008 & Work Instruction No. CA-Q-WI-020) uses information generated during the preceding year to assess the "big picture" by ensuring that routine actions taken and reviewed on a monthly basis are not components of larger systematic concerns. The monthly review should keep the quality systems current and effective, therefore, the annual review is a formal senior management process to review specific existing documentation. Significant issues from the following documentation are compiled or summarized by the QA Manager prior to the review meeting:

- Matters arising from the previous annual review.
- Prior Monthly QA Reports issues.
- Laboratory QA Metrics.
- Review of report reissue requests.
- Review of client feedback and complaints.
- Issues arising from any prior management or staff meetings.
- Minutes from prior senior lab management meetings. Issues that may be raised from these meetings include:
    - Adequacy of staff, equipment and facility resources.
    - Adequacy of policies and procedures.
    - Future plans for resources and testing capability and capacity.

- The annual internal double blind PT program sample performance (if performed),
- Compliance to the Ethics Policy and Data Integrity Plan. Including any evidence/incidents of inappropriate actions or vulnerabilities related to data Integrity.
- Review of Corrective and Preventative Actions, assessments by external bodies and recommendations for improvement.

A report is generated by the QA Manager and management. The report is distributed to the appropriate General Manager and the Quality Director. The report includes, but is not limited to:

- The date of the review and the names and titles of participants.
- A reference to the existing data quality related documents and topics that were reviewed.
- Quality system or operational changes or improvements that will be made as a result of the review [e.g., an implementation schedule including assigned responsibilities for the changes (Action Table)].

Changes to the quality systems requiring update to the laboratory QA Manual shall be included in the next revision of the QA Manual.

16.3 Potential Integrity Related Managerial Reviews

Potential integrity issues (data or business related) must be handled and reviewed in a confidential manner until such time as a follow-up evaluation, full investigation, or other appropriate actions have been completed and issues clarified. TestAmerica's Corporate Data Investigation/Recall SOP shall be followed (SOP No. CW-L-S-002). All investigations that result in finding of inappropriate activity are documented and include any disciplinary actions involved, corrective actions taken, and all appropriate notifications of clients.

TestAmerica's COO, VP of Client & Technical Services, General Managers and Quality Directors receive a monthly report from the Director of Quality & Client Advocacy summarizing any current data integrity or data recall investigations. The General Manager's are also made aware of progress on these issues for their specific labs.

SECTION 17

PERSONNEL

17.1 Overview

The laboratory's management believes that its highly qualified and professional staff is the single most important aspect in assuring a high level of data quality and service. The staff consists of professionals and support personnel as outlined in the organization chart in Figure 4-1.

All personnel must demonstrate competence in the areas where they have responsibility. Any staff that is undergoing training shall have appropriate supervision until they have demonstrated their ability to perform their job function on their own. Staff shall be qualified for their tasks based on appropriate education, training, experience and/or demonstrated skills as required.

The laboratory employs sufficient personnel with the necessary education, training, technical knowledge and experience for their assigned responsibilities.

All personnel are responsible for complying with all QA/QC requirements that pertain to the laboratory and their area of responsibility. Each staff member must have a combination of experience and education to adequately demonstrate a specific knowledge of their particular area of responsibility. Technical staff must also have a general knowledge of lab operations, test methods, QA/QC procedures and records management.

Laboratory management is responsible for formulating goals for lab staff with respect to education, training and skills and ensuring that the laboratory has a policy and procedures for identifying training needs and providing training of personnel. The training shall be relevant to the present and anticipated responsibilities of the lab staff.

The laboratory only uses personnel that are employed by or under contract to, the laboratory. Contracted personnel, when used, must meet competency standards of the laboratory and work in accordance to the laboratory's quality system.

17.2 Education And Experience Requirements For Technical Personnel

The laboratory makes every effort to hire analytical staffs that possess a college degree (AA, BA, BS) in an applied science with some chemistry in the curriculum. Exceptions can be made based upon the individual's experience and ability to learn. Selection of qualified candidates for laboratory employment begins with documentation of minimum education, training, and experience prerequisites needed to perform the prescribed task. Minimum education and training requirements for TestAmerica employees are outlined in job descriptions and are generally summarized for analytical staff in the table below.

The laboratory maintains job descriptions for all personnel who manage, perform or verify work affecting the quality of the environmental testing the laboratory performs. Job Descriptions are located on the TestAmerica intranet site's Human Resources web-page (Also see Section 4 for position descriptions/responsibilities).

Experience and specialized training are occasionally accepted in lieu of a college degree (basic lab skills such as using a balance, pipette or quantitation techniques, etc., are also considered).

As a general rule for analytical staff:

Specialty	Education	Experience
Extractions, Digestions, some electrode methods (pH, DO, Redox, etc.), or Titrimetric and Gravimetric Analyses	H.S. Diploma	On the job training (OJT)
GFAA, CVAA, FLAA, Single component or short list Chromatography (e.g., Fuels, BTEX-GC, IC	A college degree in an applied science or 2 years of college and at least 1 year of college chemistry	Or 2 years prior analytical experience is required
ICP, ICPMS, Long List or complex chromatography (e.g., Pesticides, PCB, Herbicides, HPLC, etc.), GCMS	A college degree in an applied science or 2 years of college chemistry	or 5 years of prior analytical experience
Spectra Interpretation	A college degree in an applied science or 2 years of college chemistry	And 2 years relevant experience Or 5 years of prior analytical experience
Technical Manager (s) – **General**	Bachelors Degree in an applied science or engineering with 24 semester hours in chemistry An advanced (MS, PhD.) degree may substitute for one year of experience	And 2 years experience in environmental analysis of representative analytes for which they will oversee
Technical Manager (s) – **Wet Chem** only (no advanced instrumentation)	Associates degree in an applied science or engineering or 2 years of college with 16 semester hours in chemistry	And 2 years relevant experience

When an analyst does not meet these requirements, they can perform a task under the direct supervision of a qualified analyst, peer reviewer or Technical Manager, and are considered an analyst in training. The person supervising an analyst in training is accountable for the quality of the analytical data and must review and approve data and associated corrective actions.

17.3 Training

The laboratory is committed to furthering the professional and technical development of employees at all levels.

Orientation to the laboratory's policies and procedures, in-house method training, and employee attendance at outside training courses and conferences all contribute toward employee proficiency. Below are examples of various areas of required employee training:

Required Training	Time Frame	Employee Type
Environmental Health & Safety	Prior to lab work	All

Ethics – New Hires	1 week of hire	All
Ethics – Comprehensive	90 days of hire	All
Data Integrity	30 days of hire	Technical and PMs
Quality Assurance	90 days of hire	All
Ethics – Comprehensive Refresher	Annually	All
Initial Demonstration of Capability (DOC)	Prior to unsupervised method performance	Technical

The laboratory maintains records of relevant authorization/competence, education, professional qualifications, training, skills and experience of technical personnel (including contracted personnel) as well as the date that approval/authorization was given. These records are kept on file at the laboratory. Also refer to "Demonstration of Capability" in Section 19.

The training of technical staff is kept up to date by:

- Each employee must have documentation in their training file that they have read, understood and agreed to follow the most recent version of the laboratory QA Manual and SOPs in their area of responsibility. This documentation is updated as SOPs are updated.
- Documentation from any training courses or workshops on specific equipment, analytical techniques or other relevant topics are maintained in their training file.
- Documentation of proficiency (refer to Section 19).
- An Ethics Agreement signed by each staff member (renewed each year) and evidence of annual ethics training.
- A Confidentiality Agreement signed by each staff member signed at the time of employment.
- Human Resources maintains documentation and attestation forms on employment status & records; benefit programs; timekeeping/payroll; and employee conduct (e.g., ethics violations). This information is maintained in the employee's secured personnel file.

Evidence of successful training could include such items as:

- Adequate documentation of training within operational areas, including one-on-one technical training for individual technologies, and particularly for people cross-trained.
- Analysts knowledge to refer to QA Manual for quality issues.
- Analysts following SOPs, i.e., practice matches SOPs.
- Analysts regularly communicate to supervisors and QA if SOPs need revision, rather than waiting for auditors to find problems.

Further details of the laboratory's training program are described in the Laboratory Training SOP No. PT-QA-001.

17.4 Data Integrity And Ethics Training Program

Establishing and maintaining a high ethical standard is an important element of a Quality System. Ethics and data integrity training is integral to the success of TestAmerica and is provided for each employee at TestAmerica. It is a formal part of the initial employee orientation within 1 week of hire followed by technical data integrity training within 30 days, comprehensive

training within 90 days, and an annual refresher for all employees. Senior management at each facility performs the ethics training for their staff.

In order to ensure that all personnel understand the importance TestAmerica places on maintaining high ethical standards at all times; TestAmerica has established a Corporate Ethics Policy (Policy No. CW-L-P-004) and an Ethics Statement. All initial and annual training is documented by signature on the signed Ethics Statement demonstrating that the employee has participated in the training and understands their obligations related to ethical behavior and data integrity.

Violations of this Ethics Policy will not be tolerated. Employees who violate this policy will be subject to disciplinary actions up to and including termination. Criminal violations may also be referred to the Government for prosecution. In addition, such actions could jeopardize TestAmerica's ability to do work on Government contracts, and for that reason, TestAmerica has a Zero Tolerance approach to such violations.

Employees are trained as to the legal and environmental repercussions that result from data misrepresentation. Key topics covered in the presentation include:

- Organizational mission and its relationship to the critical need for honesty and full disclosure in all analytical reporting.
- Ethics Policy
- How and when to report ethical/data integrity issues. Confidential reporting.
- Record keeping.
- Discussion regarding data integrity procedures.
- Specific examples of breaches of ethical behavior (e.g. peak shaving, altering data or computer clocks, improper macros, etc., accepting/offering kickbacks, illegal accounting practices, unfair competition/collusion)
- Internal monitoring. Investigations and data recalls.
- Consequences for infractions including potential for immediate termination, debarment, or criminal prosecution.
- Importance of proper written narration / data qualification by the analyst and project manager with respect to those cases where the data may still be usable but are in one sense or another partially deficient.

Additionally, a data integrity hotline (1-800-736-9407) is maintained by TestAmerica and administered by the Corporate Quality Department.

SECTION 18

ACCOMMODATIONS AND ENVIRONMENTAL CONDITIONS

18.1 Overview

The laboratory is a 33,000 ft^2 secure laboratory facility with controlled access and designed to accommodate an efficient workflow and to provide a safe and comfortable work environment for employees. All visitors sign in and are escorted by laboratory personnel. Access is controlled by various measures.

The laboratory is equipped with structural safety features. Each employee is familiar with the location, use, and capabilities of general and specialized safety features associated with their workplace. The laboratory provides and requires the use of protective equipment including safety glasses, protective clothing, gloves, etc., OSHA and other regulatory agency guidelines regarding required amounts of bench and fume hood space, lighting, ventilation (temperature and humidity controlled), access, and safety equipment are met or exceeded.

Traffic flow through sample preparation and analysis areas is minimized to reduce the likelihood of contamination. Adequate floor space and bench top area is provided to allow unencumbered sample preparation and analysis space. Sufficient space is also provided for storage of reagents and media, glassware, and portable equipment. Ample space is also provided for refrigerated sample storage before analysis and archival storage of samples after analysis. Laboratory HVAC and deionized water systems are designed to minimize potential trace contaminants.

The laboratory is separated into specific areas for sample receiving, sample preparation, volatile organic sample analysis, non-volatile organic sample analysis, inorganic sample analysis, and administrative functions.

18.2 Environment

Laboratory accommodation, test areas, energy sources, lighting are adequate to facilitate proper performance of tests. The facility is equipped with heating, ventilation, and air conditioning (HVAC) systems appropriate to the needs of environmental testing performed at this laboratory.

The environment in which these activities are undertaken does not invalidate the results or adversely affect the required accuracy of any measurements.

The laboratory provides for the effective monitoring, control and recording of environmental conditions that may affect the results of environmental tests as required by the relevant specifications, methods, and procedures. Such environmental conditions include humidity, voltage, temperature, and vibration levels in the laboratory.

When any of the method or regulatory required environmental conditions change to a point where they may adversely affect test results, analytical testing will be discontinued until the environmental conditions are returned to the required levels.

Environmental conditions of the facility housing the computer network and LIMS are regulated to protect against raw data loss.

18.3 Work Areas

There is effective separation between neighboring areas when the activities therein are incompatible with each other. Examples include:

- Volatile organic chemical analysis areas, including sample preparation.

Access to and use of all areas affecting the quality of analytical testing is defined and controlled by secure access to the laboratory building as described below in the Building Security section.

Adequate measures are taken to ensure good housekeeping in the laboratory and to ensure that any contamination does not adversely affect data quality. These measures include regular cleaning to control dirt and dust within the laboratory.

Work areas are available to ensure an unencumbered work area. Work areas include:

- Access and entryways to the laboratory.
- Sample receipt areas.
- Sample storage areas.
- Chemical and waste storage areas.
- Data handling and storage areas.
- Sample processing areas.
- Sample analysis areas.

18.4 Floor Plan

A floor plan can be found in Appendix 1.

18.5 Building Security

Building keys and alarm codes are distributed to employees as necessary.

Visitors to the laboratory sign in and out in a visitor's logbook. A visitor is defined as any person who visits the laboratory who is not an employee of the laboratory. In addition to signing into the laboratory, the Environmental, Health and Safety Manual contains requirements for visitors and vendors. There are specific safety forms that must be reviewed and signed.

Visitors (with the exception of company employees) are escorted by laboratory personnel at all times, or the location of the visitor is noted in the visitor's logbook.

SECTION 19

TEST METHODS AND METHOD VALIDATION

19.1 Overview

The laboratory uses methods that are appropriate to meet our clients' requirements and that are within the scope of the laboratory's capabilities. These include sampling, handling, transport, storage and preparation of samples, and, where appropriate, an estimation of the measurement of uncertainty as well as statistical techniques for analysis of environmental data.

Instructions are available in the laboratory for the operation of equipment as well as for the handling and preparation of samples. All instructions, Standard Operating Procedures (SOPs), reference methods and manuals relevant to the working of the laboratory are readily available to all staff. Deviations from published methods are documented (with justification) in the laboratory's approved SOPs. SOPs are submitted to clients for review at their request. Significant deviations from published methods require client approval and regulatory approval where applicable.

19.2 Standard Operating Procedures (SOPs)

The laboratory maintains SOPs that accurately reflect all phases of the laboratory such as assessing data integrity, corrective actions, handling customer complaints as well as all analytical methods and sampling procedures. The method SOPs are derived from the most recently promulgated/approved, published methods and are specifically adapted to the laboratory facility. Modifications or clarifications to published methods are clearly noted in the SOPs. All SOPs are controlled in the laboratory. A SOP list is included in Appendix 4. The most current list of SOPs is maintained in the QA SOP directory in PT-QA-W-002.

- All SOPs contain a revision number, effective date, and appropriate approval signatures. Controlled copies are available to all staff.
- Procedures for writing an SOP are incorporated by reference to TestAmerica's Corporate SOP entitled 'Writing a Standard Operating Procedure', No. CW-Q-S-002 or the laboratory's SOP No. PT-QA-010, Preparation and Management of Standard Operating Procedures (SOPs) and Other Controlled Documents .
- SOPs are reviewed at a minimum of every 2 years (annually for Drinking Water and DoD SOPs), and where necessary, revised to ensure continuing suitability and compliance with applicable requirements.

19.3 Laboratory Methods Manual

For each test method, the laboratory shall have available the published referenced method as well as the laboratory developed SOP.

Note: If more stringent standards or requirements are included in a mandated test method or regulation than those specified in this manual, the laboratory shall demonstrate that such requirements are met. If it is not clear which requirements are more stringent, the standard from the method or regulation is to be followed. Any exceptions or deviations from the referenced methods or regulations are noted in the specific analytical SOP.

The laboratory maintains an SOP Index for both technical and non-technical SOPs. Technical SOPs are maintained to describe a specific test method. Non-technical SOPs are maintained to describe functions and processes not related to a specific test method.

19.4 Selection Of Methods

Since numerous methods and analytical techniques are available, continued communication between the client and laboratory is imperative to assure the correct methods are utilized. Once client methodology requirements are established, this and other pertinent information is summarized by the Project Manager. These mechanisms ensure that the proper analytical methods are applied when the samples arrive for log-in. For non-routine analytical services (e.g., special matrices, non-routine compound lists), the method of choice is selected based on client needs and available technology. The methods selected should be capable of measuring the specific parameter of interest, in the concentration range of interest, and with the required precision and accuracy.

19.4.1 Sources of Methods

Routine analytical services are performed using standard EPA-approved methodology. In some cases, modification of standard approved methods may be necessary to provide accurate analyses of particularly complex matrices. When the use of specific methods for sample analysis is mandated through project or regulatory requirements, only those methods shall be used.

When clients do not specify the method to be used or methods are not required, the methods used will be clearly validated and documented in an SOP and available to clients and/or the end user of the data.

The analytical methods used by the laboratory are those currently accepted and approved by the U. S. EPA and the state or territory from which the samples were collected. Reference methods include:

- *Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act, and Appendix A-C; 40 CFR Part 136, USEPA Office of Water. Revised as of July 1, 1995, Appendix A to Part 136 - Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater (EPA 600 Series)*
- *Methods for Chemical Analysis of Water and Wastes, EPA 600 (4-79-020), 1983.*
- *Methods for the Determination of Inorganic Substances in Environmental Samples, EPA-600/R-93/100, August 1993.*
- *Methods for the Determination of Metals in Environmental Samples, EPA/600/4-91/010, June 1991. Supplement I: EPA-600/R-94/111, May 1994.*
- *Statement of Work for Organics Analysis, OLM04.2, USEPA Contract Laboratory Program, Multi-media, Multi-concentration.*
- *Standard Methods for the Examination of Water and Wastewater, 18th/19th /20th /on-line edition; Eaton, A.D. Clesceri, L.S. Greenberg, A.E. Eds; American Water Works Association, Water Pollution Control Federation, American Public Health Association: Washington, D.C.*
- *Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846), Third Edition, September 1986, Final Update I, July 1992, Final Update IIA, August 1993, Final Update II, September 1994; Final Update IIB, January 1995; Final Update III, December 1996; Final Update IV, January 2008.*

- *Annual Book of ASTM Standards, American Society for Testing & Materials (ASTM), Philadelphia, PA.*
- *Code of Federal Regulations (CFR) 40, Parts 136, 141, 172, 173, 178, 179 and 261*
- *Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846), Third Edition, September 1986, Final Update I, July 1992, Final Update IIA, August 1993, Final Update II, September 1994; Final Update IIB, January 1995; Final Update III, December 1996; Final Update IV, January 2008.*

The laboratory reviews updated versions to all the aforementioned references for adaptation based upon capabilities, instrumentation, etc., and implements them as appropriate. As such, the laboratory strives to perform only the latest versions of each approved method as regulations allow or require.

Other reference procedures for non-routine analyses may include methods established by specific states (e.g., Underground Storage Tank methods), ASTM or equipment manufacturers. Sample type, source, and the governing regulatory agency requiring the analysis will determine the method utilized.

The laboratory shall inform the client when a method proposed by the client may be inappropriate or out of date. After the client has been informed, and they wish to proceed contrary to the laboratory's recommendation, it will be documented.

19.4.2 Demonstration of Capability

Before the laboratory may institute a new method and begin reporting results, the laboratory shall confirm that it can properly operate the method. In general, this demonstration does not test the performance of the method in real world samples, but in an applicable and available clean matrix sample. If the method is for the testing of analytes that are not conducive to spiking, demonstration of capability may be performed on quality control samples.

19.4.2.1 A demonstration of capability (DOC, Lab SOP # PT-QA-001) is performed whenever there is a change in instrument type (e.g., new instrumentation), method or personnel (e.g., analyst hasn't performed the test within the last 12 months).

19.4.2.2 The initial demonstration of capability must be thoroughly documented and approved by the Technical Director or Lab Director and QA Manager prior to independently analyzing client samples. All associated documentation must be retained in accordance with the laboratories archiving procedures.

19.4.2.3 The laboratory must have an approved SOP, demonstrate satisfactory performance, and conduct an MDL study (when applicable). There may be other requirements as stated within the published method or regulations (i.e., retention time window study).

Note: In some instances, a situation may arise where a client requests that an unusual analyte be reported using a method where this analyte is not normally reported. If the analyte is being reported for regulatory purposes, the method must meet all procedures outlined within this QA Manual (SOP, MDL, and Demonstration of Capability). If the client states that the information is not for regulatory purposes, the result may be reported as long as the following criteria are met:

- The instrument is calibrated for the analyte to be reported using the criteria for the method and ICV/CCV criteria are met (unless an ICV/CCV is not required by the method or criteria are per project DQOs).
- The laboratory's nominal or default reporting limit (RL) is equal to the quantitation limit (QL), must be at or above the lowest non-zero standard in the calibration curve and must be reliably determined. Project RLs are client specified reporting levels which may be higher than the QL. Results reported below the QL must be qualified as estimated values. Also see Section 19.6.1.3, Relationship of Limit of Detection (LOD) to Quantitation Limit (QL).
- The client request is documented and the lab informs the client of its procedure for working with unusual compounds. The final report must be footnoted: *Reporting Limit based on the low standard of the calibration curve.*

19.4.3 Initial Demonstration of Capability (IDOC) Procedures

Initial Demonstration and Capability (IDOC) procedure is described in Pittsburgh SOP No. PT-QA-010.

19.4.3.1 The spiking standard used must be prepared independently from those used in instrument calibration. The LCS is used to document IDOCs for all applicable methods.

19.4.3.2 The analyte(s) shall be diluted in a volume of clean matrix sufficient to prepare four aliquots (4 LCS) at the concentration specified by a method or the laboratory SOP.

19.4.3.3 At least four laboratory control samples from different batches shall be prepared (including any applicable clean-up procedures) and analyzed according to the test method (either concurrently or over a period of days).

19.4.3.4 Using all of the results, calculate the mean recovery in the appropriate reporting units and the standard deviations for each parameter of interest.

19.4.3.5 When it is not possible to determine the mean and standard deviations, such as for presence, absence and logarithmic values, the laboratory will assess performance against criteria described in the Method SOP.

19.4.3.6 Compare the information obtained above to the corresponding acceptance criteria for precision and accuracy in the test method (if applicable) or in laboratory generated acceptance criteria (LCS or interim criteria) if there is no mandatory criteria established. If any one of the parameters do not meet the acceptance criteria, the performance is unacceptable for that parameter.

19.4.3.7 When one or more of the tested parameters fail at least one of the acceptance criteria, the analyst must proceed according to either option listed below:

- Locate and correct the source of the problem and repeat the test for all parameters of interest beginning with 19.4.3.3 above.
- Beginning with 19.4.3.3 above, repeat the test for all parameters that failed to meet criteria. Repeated failure, however, will confirm a general problem with the measurement system. If this occurs, locate and correct the source of the problem and repeat the test for all compounds of interest beginning with 19.4.3.1 above.

Note: Results of successive LCS analyses can be used to fulfill the DOC requirement.

A certification statement (refer to Figure 19-1 as an example shall be used to document the completion of each initial demonstration of capability. A copy of the certification is archived in the analyst's training folder.

19.5 Laboratory Developed Methods And Non-Standard Methods

Any new method developed by the laboratory must be fully defined in an SOP and validated by qualified personnel with adequate resources to perform the method. Method specifications and the relation to client requirements must be clearly conveyed to the client if the method is a non-standard method (not a published or routinely accepted method). The client must also be in agreement to the use of the non-standard method.

19.6 Validation Of Methods

Validation is the confirmation by examination and the provision of objective evidence that the particular requirements for a specific intended use are fulfilled.

All non-standard methods, laboratory designed/developed methods, standard methods used outside of their scope, and major modifications to published methods must be validated to confirm they are fit for their intended use. The validation will be as extensive as necessary to meet the needs of the given application. The results are documented with the validation procedure used and contain a statement as to the fitness for use.

19.6.1 Method Validation and Verification Activities for All New Methods

While method validation can take various courses, the following activities can be required as part of method validation. Method validation records are designated QC records and are archived accordingly.

19.6.1.1 Determination of Method Selectivity

Method selectivity is the demonstrated ability to discriminate the analyte(s) of interest from other compounds in the specific matrix or matrices from other analytes or interference. In some cases to achieve the required selectivity for an analyte, a confirmation analysis is required as part of the method.

19.6.1.2 Determination of Method Sensitivity

Sensitivity can be both estimated and demonstrated. Whether a study is required to estimate sensitivity depends on the level of method development required when applying a particular measurement system to a specific set of samples. Where estimations and/or demonstrations of sensitivity are required by regulation or client agreement, such as the procedure in 40 CFR Part 136 Appendix B, under the Clean Water Act, these shall be followed.

19.6.1.3 Relationship of Limit of Detection (LOD) to the Quantitation Limit (QL)

An important characteristic of expression of sensitivity is the difference in the LOD and the QL. The LOD is the minimum level at which the presence of an analyte can be reliably concluded. The QL is the minimum concentration of analyte that can be quantitatively determined with acceptable precision and bias. For most instrumental measurement systems, there is a region where semi-quantitative data is generated around the LOD (both above and below the estimated MDL or LOD) and below the QL. In this region, detection of an analyte may be

confirmed but quantification of the analyte is unreliable within the accuracy and precision guidelines of the measurement system. When an analyte is detected below the QL, and the presence of the analyte is confirmed by meeting the qualitative identification criteria for the analyte, the analyte can be reliably reported, but the amount of the analyte can only be estimated. If data is to be reported in this region, it must be done so with a qualification that denotes the semi-quantitative nature of the result.

19.6.1.4 Determination of Interferences

A determination that the method is free from interferences in a blank matrix is performed.

19.6.1.5 Determination of Range

Where appropriate to the method, the quantitation range is determined by comparison of the response of an analyte in a curve to established or targeted criteria. Generally the upper quantitation limit is defined by highest acceptable calibration concentration. The lower quantitation limit or QL cannot be lower than the lowest non-zero calibration level, and can be constrained by required levels of bias and precision.

19.6.1.6 Determination of Accuracy and Precision

Accuracy and precision studies are generally performed using replicate analyses, with a resulting percent recovery and measure of reproducibility (standard deviation, relative standard deviation) calculated and measured against a set of target criteria.

19.6.1.7 Documentation of Method

The method is formally documented in an SOP. If the method is a minor modification of a standard laboratory method that is already documented in an SOP, an SOP Attachment describing the specific differences in the new method is acceptable in place of a separate SOP.

19.6.1.8 Continued Demonstration of Method Performance

Continued demonstration of Method Performance is addressed in the SOP. Continued demonstration of method performance is generally accomplished by batch specific QC samples such as LCS, method blanks or PT samples.

19.7 Method Detection Limits (MDL)/ Limits Of Detection (LOD)

Method detection limits (MDL) are initially determined in accordance with 40 CFR Part 136, Appendix B or alternatively by other technically acceptable practices that have been accepted by regulators. MDL is also sometimes referred to as Limit of Detection (LOD). The MDL theoretically represents the concentration level for each analyte within a method at which the Analyst is 99% confident that the true value is not zero. The MDL is determined for each analyte initially during the method validation process and updated as required in the analytical methods, whenever there is a significant change in the procedure or equipment, or based on project specific requirements. Generally, the analyst prepares at least seven replicates of solution spiked at one to five times the estimated method detection limit (most often at the lowest standard in the calibration curve) into the applicable matrix with all the analytes of interest. Each of these aliquots is extracted (including any applicable clean-up procedures) and analyzed in the same manner as the samples. Where possible, the seven replicates should be analyzed over 2-4 days to provide a more realistic MDL. [To allow for some flexibility, this low level standard may be analyzed

every batch or every week or some other frequency rather than doing the study all at once. In addition, a larger number of data points may be used if the appropriate t-value multiplier is used]

Refer to the Corporate SOP No. CA-Q-S-006 or the laboratory's SOP No. PT-QA-007 for details on the laboratory's MDL process and DoD requirements.

19.8 Instrument Detection Limits (IDL)

19.8.1 The IDL is sometimes used to assess the reasonableness of the MDLs or in some cases required by the analytical method or program requirements. IDLs are most used in metals analyses but may be useful in demonstration of instrument performance in other areas.

19.8.2 IDLs are calculated to determine an instrument's sensitivity independent of any preparation method. IDLs are calculated either using 7 replicate spike analyses, like MDL but without sample preparation, or by the analysis of 10 instrument blanks and calculating 3 x the absolute value of the standard deviation.

19.8.3 If IDL is > than the MDL, it may be used as the reported MDL. For ICP IDLs determined shall be less than or equal to the MDL as per DoD QSM, Version 3, Appendix DoD-B, Table B-6. DoD QSM 4.2 requirements are detailed in SOP No. PT-QA-029.

19.9 Verification Of Detection And Reporting Limits

19.9.1 Once the MDL is determined, it must be verified on each instrument used for the given method. TestAmerica defines the DoD QSM Detection Limit (DL) as being equal to the MDL. TestAmerica also defines the DoD QSM Limit of Detection (LOD) as being equal to the lowest concentration standard that successfully verifies the MDL, also referred to as the MDLV standard. MDL and MDLV standards are extracted/digested and analyzed through the entire analytical process. The MDL and MDLV determinations do not apply to methods that are not readily spiked (e.g. pH, turbidity, etc.) or where the lab does not report to the MDL. If the MDLV standard is not successful, then the laboratory will redevelop their MDL or perform and pass two consecutive MDLVs at a higher concentration and set the LOD at the higher concentration. Initial and quarterly verification is required for all methods listed in the laboratory's DoD ELAP Scope of Accreditation. Refer to the laboratory SOP PT-QA-007 Detection Limits (MDLs/DLs) for further details.

19.9.2 When the laboratory establishes a quantitation limit, it must be initially verified by the analysis of a low level standard or QC sample at 1-2 times the reporting limit and annually thereafter. The annual requirement is waived for methods that have an annually verified MDL. The laboratory will comply with any regulatory requirements.

19.9.3 The laboratory quantitation limit is equivalent to the DoD Limit of Quantitation (LOQ), which is at a concentration equal to or greater than the lowest non-zero calibration standard. The DoD QSM requires the laboratory to perform an initial characterization of the bias and precision at the LOQ and quarterly LOQ verifications thereafter. If the quarterly verification results are not consistent with three-standard deviation confidence limits established initially, then the bias and precision will be reevaluated and clients contacted for any on-going projects. For DoD projects, TestAmerica makes a distinction between the Reporting Limit (RL) and the LOQ. The RL is a level at or above the LOQ that is used for specific project reporting purposes, as agreed to between the laboratory and the client. The RL cannot be lower than the LOQ concentration, but may be higher.

19.10 Retention Time Windows

Most organic analyses and some inorganic analyses use chromatography techniques for qualitative and quantitative determinations. For every chromatography analysis or as specific in the reference method, each analyte will have a specific time of elution from the column to the detector. This is known as the analyte's retention time. The variance in the expected time of elution is defined as the retention time window. As the key to analyte identification in chromatography, retention time windows must be established on every column for every analyte used for that method. These records are kept with the files associated with an instrument for later quantitation of the analytes. Complete details are available in the laboratory SOPs.

19.11 Evaluation Of Selectivity

The laboratory evaluates selectivity by following the checks within the applicable analytical methods, which include mass spectral tuning, second column confirmation, ICP interelement interference checks, chromatography retention time windows, sample blanks, spectrochemical, atomic absorption or fluorescence profiles, co-precipitation evaluations and specific electrode response factors.

19.12 Estimation Of Uncertainty Of Measurement

19.12.1 Uncertainty is "a parameter associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measurand" (as defined by the International Vocabulary of Basic and General Terms in Metrology, ISO Geneva, 1993, ISBN 92-67-10175-1). Knowledge of the uncertainty of a measurement provides additional confidence in a result's validity. Its value accounts for all the factors which could possibly affect the result, such as adequacy of analyte definition, sampling, matrix effects and interferences, climatic conditions, variances in weights, volumes, and standards, analytical procedure, and random variation. Some national accreditation organizations require the use of an "expanded uncertainty": the range within which the value of the measurand is believed to lie within at least a 95% confidence level with the coverage factor k=2.

19.12.2 Uncertainty is not error. Error is a single value, the difference between the true result and the measured result. On environmental samples, the true result is never known. The measurement is the sum of the unknown true value and the unknown error. Unknown error is a combination of systematic error, or bias, and random error. Bias varies predictably, constantly, and independently from the number of measurements. Random error is unpredictable, assumed to be Gaussian in distribution, and reducible by increasing the number of measurements.

19.12.3 The minimum uncertainty associated with results generated by the laboratory can be determined by using the Laboratory Control Sample (LCS) accuracy range for a given analyte. The LCS limits are used to assess the performance of the measurement system since they take into consideration all of the laboratory variables associated with a given test over time (except for variability associated with the sampling and the variability due to matrix effects). The percent recovery of the LCS is compared either to the method-required LCS accuracy limits or to the statistical, historical, in-house LCS accuracy limits.

19.12.4 To calculate the uncertainty for the specific result reported, multiply the result by the decimal of the lower end of the LCS range percent value for the lower end of the uncertainty range, and multiply the result by the decimal of the upper end of the LCS range percent value for the upper end of the uncertainty range. These calculated values represent uncertainties at approximately the 99% confidence level with a coverage factor of k =3. As an example, for a

reported result of 1.0 mg/L with an LCS recovery range of 50 to 150%, the estimated uncertainty in the result would be 1.0 +/- 0.5 mg/L. Uncertainty determination is further described in SOP No. PT-QA-005.

19.12.5 In the case where a well recognized test method specifies limits to the values of major sources of uncertainty of measurement (e.g., 524.2, 525, etc.) and specifies the form of presentation of calculated results, no further discussion of uncertainty is required.

19.13 Sample Reanalysis Guidelines

Because there is a certain level of uncertainty with any analytical measurement, a sample re-preparation (where appropriate) and subsequent analysis (hereafter referred to as 'reanalysis') may result in either a higher or lower value from an initial sample analysis. There are also variables that may be present (e.g., sample homogeneity, analyte precipitation over time, etc.) that may affect the results of a reanalysis. Based on the above comments, the laboratory will reanalyze samples at a client's request with the following caveats. **Client specific Contractual Terms & Conditions for reanalysis protocols may supercede the following items.**

- Homogenous samples: If a reanalysis agrees with the original result to within the RPD limits for MS/MSD or Duplicate analyses, or within $\pm$ 1 reporting limit for samples $\leq$ 5x the reporting limit, the original analysis will be reported. At the client's request, both results may be reported.
- If the reanalysis does not agree (as defined above) with the original result, then the laboratory will investigate the discrepancy and reanalyze the sample a third time for confirmation if sufficient sample is available.
- Any potential charges related to reanalysis are discussed in the contract terms and conditions or discussed at the time of the request. The client will typically be charged for reanalysis unless it is determined that the lab was in error.
- Due to the potential for increased variability, reanalysis may not be applicable to Non-homogenous, Encore, and Sodium Bisulfate preserved samples. See the Area Technical Manager/Supervisor or Laboratory Director if unsure.

19.14 Control Of Data

The laboratory has policies and procedures in place to ensure the authenticity, integrity, and accuracy of the analytical data generated by the laboratory.

19.14.1 Computer and Electronic Data Related Requirements

The three basic objectives of our computer security procedures and policies are shown below. The laboratory is currently running the TALs LIMS which is a custom in-house developed LIMS system that has been highly customized to meet the needs of the laboratory. It is referred to as LIMS for the remainder of this section. The LIMS utilizes Microsoft SQL Server e which is an industry standard relational database platform. It is referred to as Database for the remainder of this section.

19.14.1.1 **Maintain the Database Integrity:** Assurance that data is reliable and accurate through data verification (review) procedures, password-protecting access, anti-virus protection, data change requirements, as well as an internal LIMS permissions procedure.

- LIMS Database Integrity is achieved through data input validation, internal user controls, and data change requirements.
- Spreadsheets and other software developed in-house must be verified with documentation through hand calculations prior to use. Cells containing calculations must be lock-protected and controlled.
- Instrument hardware and software adjustments are safeguarded through maintenance logs, audit trails and controlled access.

19.14.1.2 **Ensure Information Availability:** Protection against loss of information or service is ensured through scheduled back-ups, stable file server network architecture, secure storage of media, line filter, Uninterruptible Power Supply (UPS), and maintaining older versions of software as revisions are implemented.

19.14.1.3 **Maintain Confidentiality:** Ensure data confidentiality through physical access controls such as password protection or website access approval, when electronically transmitting data.

19.14.2 Data Reduction

The complexity of the data reduction depends on the analytical method and the number of discrete operations involved (e.g., extractions, dilutions, instrument readings and concentrations). The analyst calculates the final results from the raw data or uses appropriate computer programs to assist in the calculation of final reportable values.

For manual data entry, e.g., Wet Chemistry, the data is reduced by the analyst and then verified by the Department Manager or alternate analyst prior to updating the data in LIMS. The spreadsheets, or any other type of applicable documents, are signed by both the analyst and alternate reviewer to confirm the accuracy of the manual entry(s). The applicable data/spreadsheet is scanned in LIMS with the batch.

Manual integration of peaks will be documented and reviewed and the raw data will be flagged in accordance with the TestAmerica Corporate SOP No. CA-Q-S-002, Acceptable Manual Integration Practices.

Analytical results are reduced to appropriate concentration units specified by the analytical method, taking into account factors such as dilution, sample weight or volume, etc. Blank correction will be applied only when required by the method or per manufacturer's indication; otherwise, it should not be performed. Calculations are independently verified by appropriate laboratory staff. Calculations and data reduction steps for various methods are summarized in the respective analytical SOPs or program requirements.

19.14.2.1 All raw data must be retained, including computer file (if appropriate), and/or run log. All criteria pertinent to the method must be recorded. The documentation is recorded at the time observations or calculations are made and must be signed or initialed/dated (month/day/year). It must be easily identifiable who performed which tasks if multiple people were involved.

19.14.2.2 In general, concentration results are reported in milligrams per liter (mg/l) or micrograms per liter (µg/l) for liquids and milligrams per kilogram (mg/kg) or micrograms per kilogram (µg/kg) for solids. For values greater than 10,000 mg/l, results can be reported in percent, i.e., 10,000 mg/l = 1**%.** Units are defined in each lab SOP.

19.14.2.3 In reporting, the analyst or the instrument output records the raw data result using values of known certainty plus one uncertain digit. If final calculations are performed external to LIMS, the results should be entered in LIMS with at least three significant figures. In general, results are reported to 2 significant figures on the final report.

19.14.2.4 For those methods that do not have an instrument printout or an instrumental output compatible with the LIMS System, the raw results and dilution factors are entered directly into LIMS by the analyst, and the software calculates the final result for the analytical report. LIMS has a defined significant figure criterion for each analyte.

19.14.2.5 The laboratory strives to import data directly from instruments or calculation spreadsheets to ensure that the reported data are free from transcription and calculation errors. For those analyses with an instrumental output compatible with the LIMS, the raw results and dilution factors are transferred into LIMS electronically after reviewing the quantitation report, and removing unrequested or poor spectrally-matched compounds. The analyst prints a copy of what has been entered to check for errors. This printout and the instrument's printout of calibrations, concentrations, retention times, chromatograms, and mass spectra, if applicable, are retained with the data file. The data file is stored on the server and every night backed up to a tape file.

19.14.3 Logbook / Worksheet Use Guidelines

Logbooks and worksheets are filled out 'real time' and have enough information on them to trace the events of the applicable analysis/task. (e.g. calibrations, standards, analyst, sample ID, date, time on short holding time tests, temperatures when applicable, calculations are traceable, etc.)

- Corrections are made following the procedures outlined in Section 12.
- Logbooks are controlled by the QA department. A record is maintained of all logbooks in the lab.
- Unused portions of pages must be "Z"'d out, signed and dated.
- Worksheets are created with the approval of the Lab area supervisor/Technical Manager and QA Manager at the facility. The QA Manager controls all worksheets following the procedures in Section 6.

19.14.4 Review / Verification Procedures

Data review procedures comprise a set of computerized and manual checks applied at appropriate levels of the measurement process. Technical data review procedures are out lined in Pittsburgh SOP No. PT-QA-018 to ensure that reported data are free from calculation and transcription errors, that QC parameters have been reviewed and evaluated before data is reported. The laboratory uses the Corporate SOP No. CA-Q-S-002, Acceptable Manual Integration Practices, discussing Manual Integrations to ensure the authenticity of the data. The general review concepts are discussed below, more specific information can be found in the SOPs.

19.14.4.1 The data review process at the laboratory starts at the Sample Receiving level. Sample Receiving personnel review chain-of-custody forms and input the sample information and required analyses into a computer LIMS. The Sample Receiving

personnel review the transaction of the chain-of-custody forms and the inputted information. The Project Managers (or designees) perform final review of the chain-of-custody forms and inputted information.

19.14.4.2 The next level of data review occurs with the Analysts. As results are generated, analysts review their work to ensure that the results generated meet QC requirements and relevant EPA methodologies. The Analysts transfer the data into the LIMS and add data qualifiers if applicable. To ensure data compliance, a different analyst performs a second level of review. Second level review is accomplished by checking reported results against raw data and evaluating the results for accuracy. During the second level review, blank runs, QA/QC check results, initial and continuing calibration results, laboratory control samples, sample data, qualifiers and spike information are evaluated. Where calibration is not required on a daily basis, secondary review of the initial calibration results may be conducted at the time of calibration. Approximately 15% of all sample data from manual methods and from automated methods, all GC/MS spectra and all manual integrations are reviewed. Manual integrations are also electronically reviewed utilizing auditing software to help ensure compliance to ethics and manual integration policies. Issues that deem further review include the following:

- QC data are outside the specified control limits for accuracy and precision
- Reviewed sample data does not match with reported results
- Unusual detection limit changes are observed
- Samples having unusually high results
- Samples exceeding a known regulatory limit
- Raw data indicating some type of contamination or poor technique
- Inconsistent peak integration
- Transcription errors
- Results outside of calibration range

19.14.4.3 Unacceptable analytical results may require reanalysis of the samples. Any problems are brought to the attention of the Laboratory Director, Project Manager, Quality Assurance Manager, Technical Manager/area Supervisor for further investigation. Corrective action is initiated whenever necessary.

19.14.4.4 The results are then entered or directly transferred into the computer database and a hard copy (or .pdf) is printed for the client.

19.14.4.5 As a final review prior to the release of the report, the Project Manager (or designee) reviews the results for appropriateness and completeness. This review and approval ensures that client requirements have been met and that the final report has been properly completed. The process includes, but is not limited to, verifying that chemical relationships are evaluated, COC is followed, cover letters/ narratives are present, flags are appropriate, and project specific requirements are met.

19.14.4.6 Any project that requires a data package is subject to a tertiary data review for transcription errors and acceptable quality control requirements. The Project Manager (or designee) then signs the final report. They also check the report for any clerical or invoicing errors. When complete, the report is sent out to the client.

19.14.4.7 A visual summary of the flow of samples and information through the laboratory, as well as data review and validation, is presented in Figure 19-2.

19.14.5 Manual Integrations

Computerized data systems provide the analyst with the ability to re-integrate raw instrument data in order to optimize the interpretation of the data. Though manual integration of data is an invaluable tool for resolving variations in instrument performance and some sample matrix problems, when used improperly, this technique would make unacceptable data appear to meet quality control acceptance limits. Improper re-integrations lead to legally indefensible data, a poor reputation, or possible laboratory decertification. Because guidelines for re-integration of data are not provided in the methods and most methods were written prior to widespread implementation of computerized data systems, the laboratory trains all analytical staff on proper manual integration techniques using TestAmerica's Corporate SOP (CA-Q-S-002) as the guideline.

19.14.5.1 The analyst must adjust baseline or the area of a peak in some situations, for example when two compounds are not adequately resolved or when a peak shoulder needs to be separated from the peak of interest. The analyst must use professional judgment and common sense to determine when manual integrating is required. Analysts are encouraged to ask for assistance from a senior analyst or manager when in doubt.

19.14.5.2 Analysts shall not increase or decrease peak areas for the sole purpose of achieving acceptable QC recoveries that would have otherwise been unacceptable. The intentional recording or reporting of incorrect information (or the intentional omission of correct information) is against company principals and policy and is grounds for immediate termination.

19.14.5.3 Client samples, performance evaluation samples, and quality control samples are all treated equally when determining whether or not a peak area or baseline should be manually adjusted.

19.14.5.4 All manual integrations receive a second level review. Manual integrations must be indicated on an expanded scale "after" chromatograms such that the integration performed can be easily evaluated during data review. Expanded scale "before" chromatograms are also required for all manual integrations on QC parameters (calibrations, calibration verifications, laboratory control samples, internal standards, surrogates, etc.) unless the laboratory has another documented corporate approved procedure in place that can demonstrate an active process for detection and deterrence of improper integration practices.

Figure 19-1.
Example - Demonstration of Capability Documentation

DEMONSTRATION OF CAPABILITIY (DOC)

Laboratory Name:_____
Laboratory Address:_____
Method:_____ Matrix:_____
Date:_____ Analyst(s):_____
Source of Analyte(s):_____

Analytical Results

Analyst	Conc. (Units)	Rep 1	Rep 2	Rep 3	Rep 4	Avg. % Recovery	% RSD
_____	_____	_____	_____	_____	_____	_____	_____

% RSD = Percent relative standard deviation = standard deviation divided by average % Recovery

Raw data reference: _____

Certification Statement:

We, the undersigned, certify that:
1. The cited test method has met Demonstration of Capability requirements.
2. The test method was performed by the analyst(s) identified on this certification.
3. A copy of the test method and the laboratory-specific SOPs are available for all personnel on site.
4. The data associated with the method demonstration of capability are true, accurate, complete, and self-explanatory.
5. All raw data necessary to reconstruct and validate these analyses have been retained at the facility, and the associated information is well organized and available for review.

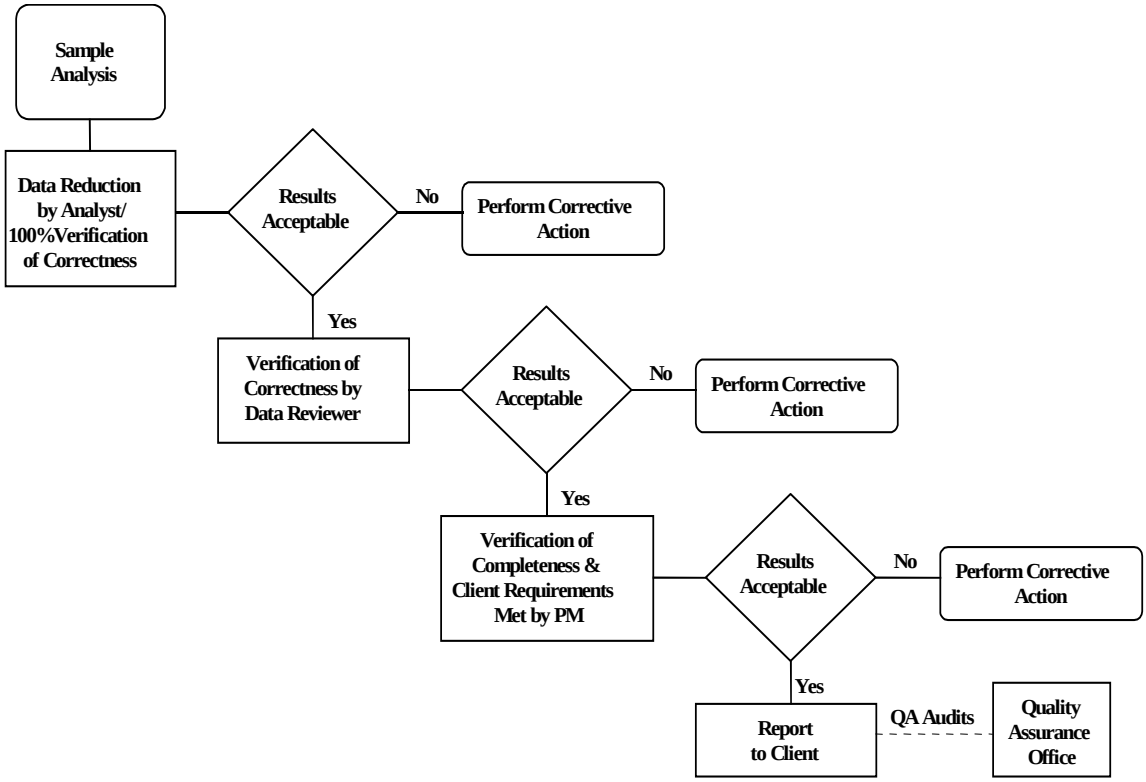
_____ _____
Analyst Signature Date

_____ _____
Technical Director Signature Date

_____ _____
Quality Assurance Coordinator Signature Date

Figure 19-2

Work Flow



SECTION 20

EQUIPMENT AND CALIBRATIONS

20.1 Overview

The laboratory purchases the most technically advanced analytical instrumentation for sample analyses. Instrumentation is purchased on the basis of accuracy, dependability, efficiency and sensitivity. Each laboratory is furnished with all items of sampling, preparation, analytical testing and measurement equipment necessary to correctly perform the tests for which the laboratory has capabilities. Each piece of equipment is capable of achieving the required accuracy and complies with specifications relevant to the method being performed. Before being placed into use, the equipment (including sampling equipment) is calibrated and checked to establish that it meets its intended specification. The calibration routines for analytical instruments establish the range of quantitation. Calibration procedures are specified in laboratory SOPs. A list of laboratory instrumentation is presented in Table 20-1.

Equipment is only operated by authorized and trained personnel. Manufacturers instructions for equipment use are readily accessible to all appropriate laboratory personnel.

20.2 Preventive Maintenance

20.2.1 The laboratory follows a well-defined maintenance program to ensure proper equipment operation and to prevent the failure of laboratory equipment or instrumentation during use. This program of preventive maintenance helps to avoid delays due to instrument failure.

20.2.2 Routine preventive maintenance procedures and frequency, such as cleaning and replacements, should be performed according to the procedures outlined in the manufacturer's manual. Qualified personnel must also perform maintenance when there is evidence of degradation of peak resolution, a shift in the calibration curve, loss of sensitivity, or failure to continually meet one of the quality control criteria.

20.2.3 Table 20-2 through 20-14 lists examples of scheduled routine maintenance. It is the responsibility of each Technical Manager to ensure that instrument maintenance logs are kept for all equipment in his/her department. Preventative maintenance procedures may be / are also outlined in analytical SOPs or instrument manuals. Further detail for equipment maintenance is included in SOP No. PT-QA-022. (Note: for some equipment, the log used to monitor performance is also the maintenance log. Multiple pieces of equipment may share the same log as long as it is clear as to which instrument is associated with an entry.)

20.2.4 Instrument maintenance logs are controlled and are used to document instrument problems, instrument repair and maintenance activities. Maintenance logs shall be kept for all major pieces of equipment. Instrument maintenance logs may also be used to specify instrument parameters.

20.2.4.1 Documentation must include all major maintenance activities such as contracted preventive maintenance and service and in-house activities such as the replacement of electrical components, lamps, tubing, valves, columns, detectors, cleaning and adjustments.

20.2.4.2 Each entry in the instrument log includes the Analyst's initials, the date, a detailed description of the problem (or maintenance needed/scheduled), a detailed explanation of the solution or maintenance performed, and a verification that the equipment is functioning properly (state what was used to determine a return to control. e.g. CCV run on *'date'* was acceptable, or instrument recalibrated on 'date' with acceptable verification, etc.) must also be documented in the instrument records.

20.2.4.3 When maintenance or repair is performed by an outside agency, service receipts detailing the service performed can be affixed into the logbooks adjacent to pages describing the maintenance performed. This stapled in page must be signed across the page entered and the logbook so that it is clear that a page is missing if only half a signature is found in the logbook.

20.2.5 If an instrument requires repair (subjected to overloading or mishandling, gives suspect results, or otherwise has shown to be defective or outside of specified limits) it shall be taken out of operation and tagged as out-of-service or otherwise isolated until such a time as the repairs have been made and the instrument can be demonstrated as operational by calibration and/or verification or other test to demonstrate acceptable performance. The laboratory shall examine the effect of this defect on previous analyses.

20.2.6 In the event of equipment malfunction that cannot be resolved, service shall be obtained from the instrument vendor manufacturer, or qualified service technician, if such a service can be tendered. If on-site service is unavailable, arrangements shall be made to have the instrument shipped back to the manufacturer for repair. Back up instruments, which have been approved, for the analysis shall perform the analysis normally carried out by the malfunctioning instrument. If the back up is not available and the analysis cannot be carried out within the needed timeframe, the samples shall be subcontracted.

20.2.7 If an instrument is sent out for service or transferred to another facility, it must be recalibrated and verified (including new initial MDL study) prior to return to lab operations.

20.3 Support Equipment

This section applies to all devices that may not be the actual test instrument, but are necessary to support laboratory operations. These include but are not limited to: balances, ovens, refrigerators, freezers, incubators, water baths, field sampling devices, temperature measuring devices, thermal/pressure sample preparation devices and volumetric dispensing devices if quantitative results are dependent on their accuracy, as in standard preparation and dispensing or dilution into a specified volume. All raw data records associated with the support equipment are retained to document instrument performance.

20.3.1 Weights and Balances

The accuracy of the balances used in the laboratory is checked every working day, before use. All balances are placed on stable counter tops.

Each balance is checked prior to initial serviceable use with at least two certified ASTM type 1 weights spanning its range of use (weights that have been calibrated to ASTM type 1 weights may also be used for daily verification). ASTM type 1 weights used only for calibration of other weights (and no other purpose) are inspected for corrosion, damage or nicks at least annually and if no damage is observed, they are calibrated at least every 5 years by an outside calibration laboratory. Any weights (including ASTM Type 1) used for daily balance checks or

other purposes are recalibrated/recertified annually to NIST standards (this may be done internally if laboratory maintains “calibration only” ASTM type 1 weights).

All balances are serviced annually by a qualified service representative, who supplies the laboratory with a certificate that identifies traceability of the calibration to the NIST standards.

All of this information is recorded in logs, and the recalibration/recertification certificates are kept on file. Refer to SOP No. PT-QA-012 for balance and weight calibration.

20.3.2 pH, Conductivity, and Turbidity Meters

The pH meters used in the laboratory are accurate to ± 0.1 pH units, and have a scale readability of at least 0.05 pH units. The meters automatically compensate for the temperature, and are calibrated with at least two working range buffer solutions before each use.

Conductivity meters are also calibrated before each use with a known standard to demonstrate the meters do not exceed an error of 1% or one umhos/cm.

Turbidity meters are also calibrated before each use. All of this information is documented in logs.

Consult pH and Conductivity, and Turbidity SOPs for further information.

20.3.3 Thermometers

All thermometers are calibrated on an annual basis with a NIST-traceable thermometer. IR thermometers, digital probes and thermocouples are calibrated quarterly.

The NIST thermometer is recalibrated every five years (unless thermometer has been exposed to temperature extremes or apparent separation of internal liquid) by an approved outside service and the provided certificate of traceability is kept on file. The NIST thermometer(s) have increments of 1 degree (0.5 degree or less increments are required for drinking water microbiological laboratories), and have ranges applicable to method and certification requirements. The NIST traceable thermometer is used for no other purpose than to calibrate other thermometers.

All of this information is documented in logbooks. Monitoring method-specific temperatures, including incubators, heating blocks, water baths, and ovens, is documented in method-specific logbooks. More information on this subject can be found in the thermometer calibration SOP No. PT-QA-008.

20.3.4 Refrigerators/Freezer Units, Waterbaths, Ovens and Incubators

The temperatures of all refrigerator units and freezers used for sample and standard storage are monitored each working day. (Sample storage is monitored 7 days a week for DoD requirement).

Ovens, waterbaths and incubators are monitored on days of use.

All of this equipment has a unique identification number, and is assigned a unique thermometer for monitoring.

Sample storage refrigerator temperatures are kept between > 0ºC and ≤ 6 ºC.

Specific temperature settings/ranges for other refrigerators, ovens waterbaths, and incubators can be found in method specific SOPs.

All of this information is documented in Daily Temperature Logbooks or electronically. Refer to SOP No. PT-QA-008 for temperature monitoring.

20.3.5 Autopipettors, Dilutors, and Syringes

Mechanical volumetric dispensing devices (except Class A Glassware) are given unique identification numbers and the delivery volumes are verified gravimetrically, at a minimum, on a quarterly basis. Glass micro-syringes are considered the same as Class A glassware.

For those dispensers that are not used for analytical measurements, a label is / can be applied to the device stating that it is not calibrated. Any device not regularly verified can not be used for any quantitative measurements. Pipette calibration is described in Pittsburgh SOP No. PT-QA-017.

Micro-syringes are purchased from Hamilton Company. Each syringe is traceable to NIST. The laboratory keeps on file an “Accuracy and Precision Statement of Conformance” from Hamilton attesting established accuracy.

20.3.6 Field Sampling Devices (Isco Auto Samplers)

Each Auto Sampler (ISCO) is assigned a unique identification number in order to keep track of the calibration. This number is also recorded on the sampling documentation.

The Auto Sampler is calibrated semiannually by setting the sample volume to 100ml and recording the volume received. The results are filed in a logbook/binder. The Auto Sampler is programmed to run three (3) cycles and each of the three cycles is measured into a graduated cylinder to verify 100ml are received.

If the RSD (Relative Standard Deviation) between the 3 cycles is greater than 10%, the procedure is repeated and if the result is still greater than 10%, then the Auto Sampler is taken out of service until it is repaired and calibration verification criteria can be met. The results of this check are kept in a logbook/binder.

20.4 Instrument Calibrations

Calibration of analytical instrumentation is essential to the production of quality data. Strict calibration procedures are followed for each method. These procedures are designed to determine and document the method detection limits, the working range of the analytical instrumentation and any fluctuations that may occur from day to day.

Sufficient raw data records are retained to allow an outside party to reconstruct all facets of the initial calibration. Records contain, but are not limited to, the following: calibration date, method, instrument, analyst(s) initials or signatures, analysis date, analytes, concentration, response, type of calibration (Avg RF, curve, or other calculations that may be used to reduce instrument responses to concentration.)

Sample results must be quantitated from the initial calibration and may not be quantitated from any continuing instrument calibration verification unless otherwise required by regulation, method or program.

If the initial calibration results are outside of the acceptance criteria, corrective action is performed and any affected samples are reanalyzed if possible. If the reanalysis is not possible, any data associated with an unacceptable initial calibration will be reported with appropriate data qualifiers (refer to Section 12).

Note: Instruments are calibrated initially and as needed after that and at least annually (the annual requirement does not apply to Isotope dilution).

20.4.1 Calibration Standards

Calibration standards are prepared using the procedures indicated in the Reagents and Standards section of the determinative method SOP. If a reference method does not specify the number of calibration standards, a minimum of 3 calibration points (exception being ICP and ICP/MS methods) will be used.

Standards for instrument calibration are obtained from a variety of sources. All standards are traceable to national or international standards of measurement, or to national or international standard reference materials.

The lowest concentration calibration standard that is analyzed during an initial calibration must be at or below the stated reporting limit for the method based on the final volume of extract (or sample).

The other concentrations define the working range of the instrument/method or correspond to the expected range of concentrations found in actual samples that are also within the working range of the instrument/method. Results of samples not bracketed by initial instrument calibration standards (within calibration range to at least the same number of significant figures used to report the data) must be reported as having less certainty, e.g., defined qualifiers or flags (additional information may be included in the case narrative). The exception to these rules is ICP methods or other methods where the referenced method does not specify two or more standards.

All initial calibrations are verified with a standard obtained from a second source and traceable to a national standard, when available (or vendor certified different lot if a second source is not available). For unique situations, such as air analysis where no other source or lot is available, a standard made by a different analyst would be considered a second source. This verification occurs immediately after the calibration curve has been analyzed, and before the analysis of any samples.

20.4.1.1 Calibration Verification

The calibration relationship established during the initial calibration must be verified at least daily as specified in the laboratory method SOPs in accordance with the referenced analytical methods and in the 2009 TNI standard. The process of calibration verification applies to both external standard and internal standard calibration techniques, as well as to linear and non-linear calibration models. Initial calibration verification is with a standard source secondary (second source standard) to the calibration standards, but continuing calibration verifications may use the same source standards as the calibration curve.

Note: The process of calibration verification referred to is fundamentally different from the approach called "calibration" in some methods. As described in those methods, the calibration factors or response factors calculated during calibration are used to update the calibration factors or response factors used for sample quantitation. This approach, while employed in other EPA programs, amounts to a daily single-point calibration.

All target analytes and surrogates, including those reported as non-detects, must be included in periodic calibration verifications for purposes of retention time confirmation and to demonstrate that calibration verification criteria are being met, i. e., RPD, per 2009 TNI Std. EL-V1M4 Sec. 1.7.2.

All samples must be bracketed by periodic analyses of standards that meet the QC acceptance criteria (e.g., calibration and retention time). The frequency is found in the determinative methods or SOPs.

Generally, the initial calibrations must be verified at the beginning of each 12-hour analytical shift during which samples are analyzed. (Some methods may specify more or less frequent verifications). The 12-hour analytical shift begins with the injection of the calibration verification standard (or the MS tuning standard in MS methods). The shift ends after the completion of the analysis of the last sample, QC, or standard that can be injected within 12 hours of the beginning of the shift.

A continuing instrument calibration verification (CCV) must be repeated at the beginning and, for methods that have quantitation by external calibration models, at the end of each analytical batch. Some methods have more frequent CCV requirements see specific SOPs. Most Inorganic methods require the CCV to be analyzed after every 10 samples or injections, including matrix or batch QC samples.

Note: If an internal standard calibration is being used (basically GCMS) then bracketing standards are not required, only daily verifications are needed. The results from these verification standards must meet the calibration verification criteria and the retention time criteria (if applicable).

If the results of a CCV are outside the established acceptance criteria and analysis of a second consecutive (and immediate) CCV fails to produce results within acceptance criteria, corrective action shall be performed. Once corrective actions have been completed & documented, the laboratory shall demonstrate acceptable instrument / method performance by analyzing two consecutive CCVs, or a new initial instrument calibration shall be performed.

Sample analyses and reporting of data may not occur or continue until the analytical system is calibrated or calibration verified. However, data associated with an unacceptable calibration verification may be fully useable under the following special conditions: **and reported based upon discussion and approval of the client:**

a). when the acceptance criteria for the CCV are exceeded high (i.e., high bias) and the associated samples within the batch are non-detects, then those non-detects may be reported with a footnote or case narrative explaining the high bias. Otherwise the samples affected by the unacceptable CCV shall be re-analyzed after a new calibration curve has been established, evaluated and accepted; or

b). when the acceptance criteria for the CCV are exceeded low (i.e., low bias), samples affected by the unacceptable CCV shall be re-analyzed after a new calibration curve has been established, evaluated and accepted.

20.4.1.2 Verification of Linear and Non-Linear Calibrations

Calibration verification for calibrations involves the calculation of the percent drift or the percent difference of the instrument response between the initial calibration and each subsequent analysis of the verification standard. (These calculations are available in the laboratory method SOPs.) Verification standards are evaluated based on the % Difference from the average CF or RF of the initial calibration or based on % Drift or % Recovery if a linear or quadratic curve is used.

Regardless of whether a linear or non-linear calibration model is used, if initial verification criterion is not met, then no sample analyses may take place until the calibration has been verified or a new initial calibration is performed that meets the specifications listed in the method SOPs. If the calibration cannot be verified after the analysis of a single verification standard, then adjust the instrument operating conditions and/or perform instrument maintenance, and analyze another aliquot of the verification standard. If the calibration cannot be verified with the second standard, then a new initial calibration is performed.

- When the acceptance criteria for the calibration verification are exceeded high, i.e., high bias, and there are associated samples that are non-detects, then those non-detects may be reported. Otherwise, the samples affected by the unacceptable calibration verification shall be reanalyzed after a new calibration curve has been established, evaluated and accepted.

- When the acceptance criteria for the calibration verification are exceeded low, i.e., low bias, those samples affected by the unacceptable verification shall be reanalyzed after a new calibration curve has been established, evaluated and accepted. Alternatively, a reporting limit standard may be analyzed to demonstrate that the laboratory can still support non-detects at their reporting limit.

20.5 Tentatively Identified Compounds (Tics) – GC/MS Analysis

For samples containing components not associated with the calibration standards, a library search may be made for the purpose of tentative identification. The necessity to perform this type of identification will be determined by the purpose of the analyses being conducted. Data system library search routines should not use normalization routines that would misrepresent the library or unknown spectra when compared to each other.

Note: If the TIC compound is not part of the client target analyte list but is calibrated by the laboratory and is both qualitatively and/or quantitatively identifiable, it should not be reported as a TIC. If the compound is reported on the same form as true TICs, it should be qualified and/or narrated that the reported compound is qualitatively and quantitatively (if verification in control) reported compared to a known standard that is in control (where applicable).

For example, the RCRA permit or waste delisting requirements may require the reporting of non-target analytes. Only after visual comparison of sample spectra with the nearest library searches may the analyst assign a tentative identification.

20.6 GC/MS TUNING

Prior to any GCMS analytical sequence, including calibration, the instrument parameters for the tune and subsequent sample analyses within that sequence must be set.

Prior to tuning/auto-tuning the mass spec, the parameters may be adjusted within the specifications set by the manufacturer or the analytical method. These generally don't need any adjustment but it may be required based on the current instrument performance. If the tune verification does not pass it may be necessary to clean the source or perform additional maintenance. Any maintenance is documented in the maintenance log.

Table 20-1 Equipment List

Instrument Type	Manufacturer	Instrument Software	Model Number	Serial Number	Yr Put into Service	Condition When Received
GC w/ Dual ECD	Hewlett-Packard Lab ID: GC1		6890	US00024872	--	
GC w/ Dual ECD with EPC	Hewlett-Packard Lab ID: GC2	Real-Time Plot Version 4.1 ZF12	5890A	3235A48356	1991	
GC w/ Dual FID	Hewlett-Packard Lab ID: GC3		5890 Series II	2921A23920	--	Used
GC w/ Dual ECD	Hewlett-Packard Lab ID: GC4	Real-Time Plot Version 4.1 ZF12	5890E	3118A35332	1989	
GC w/ Dual NPD	Hewlett-Packard Lab ID: GC5	Chem Station Rev. A 09.03 [1417]	6890A	US00025516	1998	
GC w/ Dual FPD	Hewlett-Packard Lab ID: GC6	Chem Station Rev. A 09.03 [1417]	6890N	US10145113	2001	
GC w/ Dual ECD	Hewlett-Packard Lab ID: GC8	Chem Station Rev. A 06.03 [509]	6890	US00023401	1998	
GC w/ Dual ECD	Hewlett-Packard Lab ID: GC10	Chem Station Rev. A 09.01 [1206]	6890N	US10145114	2001	
GC w/ Dual ECD	Hewlett-Packard Lab ID: GC12	Chem Station Rev. A 09.01 [1206]	6890N	US10237038	2002	
GC w/ Dual ECD	Hewlett-Packard Lab ID: GC14	Chem Station Rev. A 07.01 [682]	6890	US00026141	2005	Used
Balance	Mettler Lab ID: 119696		AE200	119696		
Hydrogen Generator	Parker Balston				2005	
Hydrogen Generator	Parker Balston		H2-800	H2800104C	2006	
Nitrogen Generator	Parker Balston				2005	
GC/MS	Hewlett-Packard Lab ID: HP3	Enviroquant Chem Station G1701BA Version B.01.001	6890 (GC) 5973 (MSD)	US00009844 (GC) US72020964 (MSD)	1997	New
Concentrator	OI Analytical		Eclipse	D617466100P	2006	New
GC/MS	Hewlett-Packard Lab ID: HP4	Enviroquant Chem Station G1701BA Version B.01.001	6890 (GC) 5973 (MSD)	US00010799 (GC) US72821085 (MSD)	1998	New
Concentrator	OI Analytical		Eclipse	D616466032P	2006	New
GC/MS	Hewlett-Packard Lab ID: HP5	Enviroquant Chem Station G1701BA Version B.01.001	6890 (GC) 5973 (MSD)	US00023292 (GC) US82322212 (MSD)	1998	New
Concentrator	OI Analytical		Eclipse	D616466026P	2006	New
GC/MS	Hewlett-Packard Lab ID: HP6	Enviroquant Chem Station G1701BA Version B.01.001	6890 (GC) 5973 (MSD)	US00030465 (GC) US92522786 (MSD)	1999	New
Concentrator	OI Analytical		Eclipse	B414466952P	2006	New
GC/MS	Hewlett-Packard Lab ID: HP7	Enviroquant Chem Station G1701BA	6890 (GC) 5973 (MSD)	US00028345 (GC) US91411730	2005	Used

		Version B.01.001		(MSD)		
Concentrator	OI Analytical		Eclipse	D617466098P	2006	New
Autosampler	EST Analytical		Centurion: CENT WS	CENTS136020110	2010	New
GC/MS	Hewlett-Packard Lab ID: HP8		6890 FID	US00001295 (GC) 3526I01420 (Headspace)	2001	New
Oven	Fisher Scientific Lab ID: VOA Glassware Oven		625G	503N0042	2005	New
Balance	Sartorius Lab ID: 40019078		B120S	40019078		
GC/MS	Hewlett-Packard Lab ID: 71	EnviroQuant Chem Station G1701BA Version B.01.00	6890 (GC) 5973 (MSD)	US00029391 (GC) US91422511 (MSD)	1999	New
GC/MS	Hewlett-Packard Lab ID: 722	EnviroQuant Chem Station G1701BA Version B.01.00	6890 (GC) 5973 (MSD)	US00029396 (GC) US91922512 (MSD)	1999	New
GC/MS	Hewlett-Packard Lab ID: 731	EnviroQuant Chem Station G1701BA Version B.01.00	6890 (GC) 5973 (MSD)	US00031329 (GC) US93112052 (MSD)	2000	New
GC/MS	Hewlett-Packard Lab ID: 732	MSD Chem Station D.01.02.16 06/15/2004	6890N (GC) 5973 (MSD)	CN10426047 (GC) US41746674 (MSD)	2004	New
GC/MS	Hewlett-Packard Lab ID: 733	EnviroQuant Chem Station G1701BA Version B.01.001	6890 (GC) 5972 (MSD)	US91411735 (MSD) US00028233 (GC)	2005	Used
GC/MS	Hewlett-Packard Lab ID: APEX	EnviroQuant Chem Station G1701BA Version B.01.001	6890 (GC) 5973 (MSD)	US 71410457 (MSD) US00007984 (GC)	2002	Used
GC/MS	Hewlett-Packard Lab ID: MSD7	EnviroQuant Chem Station G1701BA Version B.01.001	6890 (GC) 5972 (MSD)	US80210935 (MSD) DE00020249 (GC)	2002	Used
ICP	Thermo Fisher Lab ID: TRACEICP	Thermo-Spec	61E Trace	209390	1993	New
ICP	Thermo Fisher Lab ID: 6500	ITEVA	6500	ICP-20074812	2008	New
ICP/MS	Thermo Electron Lab ID: ICPMS	Plasma Lab	X-Series ICPMS	X0225	2003	New
ICP/MS	Thermo Electron Lab ID: ICPMS2	Plasma Lab	X Series ICPMS	X0344	2006	Used
Mercury Analyzer	Leeman Labs Lab ID: HGHYDRA	WIN HG	Hydra	3009	2003	New
Mercury Analyzer	Leeman Labs	ENVOY	Hydra II	0024	2010	New
Waterbath	Fisher Scientific Lab ID: Hg Waterbath		Isotemp 228	011N0286	2004	New
Metals Digestion Block	Environmental Express Lab ID: H_2O #1		Hot Block		2003	New
Metals Digestion Block	Environmental Express Lab ID: H_2O #2		Hot Block		2003	New
Metals Digestion Block	Environmental Express Lab ID: H_2O #3		Hot Block		2000	New
Metals Digestion Block	Environmental Express Lab ID: H_2O #4		Hot Block		2003	New

Metals Digestion Block	Environmental Express Lab ID: H_2O #5		Hot Block		2003	New
Metals Digestion Block	Environmental Express Lab ID: H_2O #6		Hot Block		2000	New
Metals Digestion Block	Environmental Express Lab ID: Soil #1		Hot Block		2003	New
Metals Digestion Block	Environmental Express Lab ID: Soil #2		Hot Block		2003	New
Metals Digestion Block	Environmental Express Lab ID: Soil #3		Hot Block		2003	New
Metals Digestion Block	Environmental Express Lab ID: Soil #4		Hot Block		2003	New
Metals Digestion Block	Environmental Express Lab ID: Soil #5		Hot Block		2003	New
Metals Digestion Block	Environmental Express Lab ID: Soil #6		Hot Block		2003	New
Balance	AND Lab ID: P1856709		EK-610I	P1856709	2008	New
Balance	AND Lab ID: P1856710		EK-610I	P1856710	2008	New
Ion Chromatograph (IC2100A)	Dionex	Chromeleon Client 6.80 SP4 Build 2361 (130805) 58031	ICS 2100	11050879	2011	New
Ion Chromatograph (IC25)	Dionex	Chromeleon Client 6.80 SP4 Build 2361 (130805) 58031	IC 25	00040396	2000	New
Ion Chromatograph (IC3)	Dionex	Chromeleon Client 6.80 SP4 Build 2361 (130805) 58031	ICS 5000	11020753	2011	New
Ion Chromatograph (IC2000)	Dionex	Chromeleon Client 6.80 SP4 Build 2361 (130805) 58031	ICS 2000	08050561	2008	New
Ion Chromatograph (ICS2100B)	Dionex	Chromeleon Client 6.80 SP4 Build 2361 (130805) 58031	ICS 2100	11050258	2011	New
Astoria 2 Analyzer system	Astoria Pacific International	FASPAC II Flow Analyzer Software Version 2.1.2	200-A100-03	200231	2010	New
Astoria 2 Analyzer Sampler 311, XYZ, Diluter			311-A100-03	4940A14695	2010	New
Astoria 2 Analyzer 322 Two Channel Auxiliary Pump			322-A100-00	322199	2010	New
Astoria Analyzer Diluter Module 312-M2, 5 ml Syringe			312-A200-5ML	4803A12911	2010	New
Diluter Module: Valve Module, 312 Diluter			312-B002-00	300971	2010	New

Autoanalyzer (ALPKEM1)	OI Analytical (Test: 350.1)	WINFLOW 4.03	Alpkem Flow Solution IV	928893438	1998	New
UV/VIS	Milton Roy	Spectronic	Genesys5	3V08239002	2003	Used
UV/VIS	Thermo Electron Corp. (Test: 3060A/7196A)		GENESYS 10 335900-000	2D5K278001	2007	New
Midi Distillation Blocks	Westco Scientific		Easy Dist		2000	New
Midi Distillation Blocks	Westco Scientific		Easy Dist		2000	New
Midi Distillation Blocks	Westco Scientific		Easy Dist		2001	New
Midi Distillation Blocks	Westco Scientific		Easy Dist		2005	New
pH meter	Fisher Scientific		AR25	AR93315378	2004	New
pH meter	Fisher Scientific		AR25	AR93312320	1990	New
pH meter	Fisher Scientific		AR25	AR 81202030	2003	New
pH meter	Fisher Scientific		XL25	94003394	2007	New
Autotitrator	Man-Tech Associates (Test: pH, Specific Conductance, Alkalinity, Hardness, Fluoride, and Acidity		PC-Titration Plus	MS0A3-329	2003	New
MultiMeter	Myron L Co.		Ultrameter 6P	616555		New
Oven	Thermolyne		6000			New
Oven	Blue M Electric Co. Lab ID: Oven #2		OV-18A	OV1-15300		New
Oven	Fisher Scientific Lab ID: OV02		Isotemp 630G	001O0035		New
Oven	Precision Scientific Lab ID: OV08		18EG	10AV-9		New
Oven	Fisher Lab ID: ZHE Oven		Isotemp Oven Model 301			
COD Reactor	HACH		DRB200	1131194	2005	New
COD Reactor	HACH		45600	020300022933	2002	New
TOC Analyzer	OI Analytical Lab ID: 1010		1010	5108710555	2001	New
TOC Analyzer	OI Analytical Lab ID: 1030		Aurora 1030	E717730273	2007	New
TOC (Lloyd Khan Method) Analyzer	Thermo Electron Corp.	Eager 300 Version 2.2 9/2004	Flash EA 112 MAS 200R NC Soil Analyzer	20057159-20057135	2006	New
Autoanalyzer	Thermo Clinical Labsystems Lab ID: KONELAB-1 (Tests:9012/420.2 /420.4/9066/SM 4500 CL E/410.4)	KoneLab Workstation Software	Aqua 200	A0619933	2005	New
Method 1677 Autoanalyzer (ALPKEM2)	OI Analytical FS3000	WINFLOW v 4.03	A0001604	135804017	2001	New

Method 1677 Autoanalyzer (ALPKEM3)	OI Analytical FS3000	WINFLOW v 4.03	A0001604	120804293	2007	Used
BOD Meter - Automated	YSI	BOD Assay PLUS V. 3.0	52	03L0794	2004	New
BOD Meter - Manual	YSI		50B	91K033593	2003	New
Flashpoint Tester	Rapid Tester Lab ID: SETA-1		RT-00001	024149	2002	New
Flashpoint Tester	Petrotest Pensky Martin		PMA-4	0741043006	2004	New
Flashpoint Tester	Fisher Scientific		K-16200	2501		
Turbidimeter	HF Scientific Inc.		Micro 100	105034		
Speed Vap II	Horizon		Speed Vap # 9000	01-0333	2001	New
Speed Vap II	Horizon		Speed Vap # 9000	01-0332	2001	New
Hotplate	Thermolyne Lab ID: #2		Cimarec 3	611941237080		Used
Hotplate	Thermolyne Lab ID: #3		Cimarec 3	1073390872643		Used
Hotplate	Thermolyne Lab ID: #1		Cimarec 3	1073010868586	2005	New
Waterbath	Thermo Electron Corp.		Precision 2872	202471	2007	New
Centrifuge	Damon/IEC Division Lab ID: CENT-3		CU-5000	33473227		
Balance	Mettler Lab ID: 1126472457		PB602	1126472457	2005	New
Balance	Sartorius Lab ID: 37110039		A210P	37110039	2003	New
Balance	Mettler Lab ID: G76383		AE240	G76383		
Balance	Fisher Lab ID: 25606		S-400	25606		
Balance	Mettler Lab ID: AB204S		AB204S	1126020829	2005	New
Balance	A & D Lab ID: GR-200		GR-200	14224939	2007	New
Sonicator	Fisher Scientific		550 Sonic Dismembrator	F2099	1985	
Concentrator	Meyer		N-Evap 112	5376		
Concentrator	Meyer		N-Evap 115	9217		
Concentrator	Horizon Lab ID: 1		Dry Vap	227253	2006	New
Concentrator	Horizon Lab ID: 2		Dry Vap	227254	2006	New
Concentrator	Horizon Lab ID: 3		Dry Vap	227255	2006	New
Concentrator	Horizon Lab ID: 4		Dry Vap	227256	2006	New
Soxtherm Extractor	Gerhardt Lab ID: 1		SE-3A/S306A	4012404	2002	New
Soxtherm Extractor	Gerhardt Lab ID: 7		SE-3A/S306A	4012399	2002	New
Soxtherm Extractor	Gerhardt Lab ID: 6		SE-3A/S306A	4012398	2002	New
Soxtherm	Gerhardt		SE-	4012403	2002	New

Extractor	Lab ID: 5		3A/S306A			
Soxtherm Extractor	Gerhardt Lab ID: 4		SE-3A/S306A	4012402	2002	New
Soxtherm Extractor	Gerhardt Lab ID: 2		SE-3A/S306A	4012401	2002	New
Soxtherm Extractor	Gerhardt Lab ID: 3		SE-3A/S306A	4012400	2002	New
Soxtherm Extractor	Gerhardt Lab ID: 8		SE-3A/S306A	4002039	2002	New
Soxtherm Extractor	Gerhardt Lab ID: 9		SE-3A/S306A	4020237	2007	Used
Electric Kiln	Cress		FTX-27P	46053	1992	
Electric Oven	Wilt Industries		A85		1999	
TCLP Tumbler	Associated Design & Manufacturing Co. Lab ID: T-8		6004-0590	1788		
ZHE Rotator	Associated Design & Manufacturing Co. Lab ID: Z1		3740-8-BRE	1223		
ZHE Rotator	Bodine (Associated Design) Lab ID: Z2		362RA9018			
ZHE Rotator	Bodine Electric Co. Lab ID: Z3/Z5		42R5BFC1-E3			
ZHE Rotator	Bodine (Associated Design) Lab ID: Z4		34R4BFC1-5R			
TCLP Tumbler	Environmental Express Lab ID: T6			3209-12-466		
TCLP Tumbler	Environmental Express Lab ID: T7			3209-12-467		
TCLP Tumbler	Environmental Express Lab ID: T9			3209-12-463		
TCLP Tumbler	Dayton (motor) Lab ID: T1		2Z794D			
TCLP Tumbler	Dayton (motor) Lab ID: T2		5K939E			
TCLP Tumbler	Dayton (motor) Lab ID: T3		5K939B			
TCLP Tumbler	Dayton (motor) Lab ID: T5		5K939B			
pH Meter	Accumet		AR25			
Balance	A & D Lab ID: 14628771		GF6000	14628771		
Balance	A & D Lab ID: 11684		GX4000	14536813		
Balance	Mettler Lab ID: 1120122641		PB8001S	1120122641		
Hot Plate	Thermodyne Lab ID: TCLP Hot Plate		2200			
Centrifuge	Beckman		J6-M	8749	2007	New
Centrifuge	Beckman		J6-M	8551	2007	New

Centrifuge	Thermo Electron Corp. Lab ID: Cent-1		K	71654833		
Centrifuge	Thermo Electron Corp Lab ID: Cent-2		K	71654125		
Method 1664A UCT Cartridge	Enviro-Clean		ENUCNIOG XF	UCT #1	2009	New
Oil-Less Vacuum Pump for UCT Cartridge System	Rocker (110V, 60 Hz)		400	TGTJ094	2009	New
SPE-DEX Extractor System	Horizon Technology		4790	#1 - 09-1208 #2 - 09-1210 #3 - 09-1209 #4 - 09-1207	2009	New
GPC – AccuPrep (GPC2)	J2 Scientific		MPS	GPC-1022-1.0-DI	2009	New
GPC - AccuVap Concentrator System	J2 Scientific		FLX	AVM-251-2.5-F	2009	New
GPC – Autosampler Module	J2 Scientific	J2 Software	PrepLinc AS4	ASA-1045-1.3	2009	New
Freezer	Kenmore by Sears		253.280528 03	WB91633867	2009	New
Digital Barometer	Fisher Scientific		02-401	91116011	2009	New
Digital Burette	Brand		4761161 TM (catalogue #)	11G38510	2010	New
IR Thermometer	EXTECH Instruments		42511	SR IR#1	2010	New
IR Thermometer	EXTECH Instruments		42511	SR IR#2	2010	New
IR Thermometer	EXTECH Instruments		42511	WC IR#1	2010	New
IR Thermometer	EXTECH Instruments		42511	OP IR#1	2010	New
Gel Permeation Chromatograph – GPC1	J2 Scientific	J2 Software	Prep Linc GPC	GPC-1089-1.0 4340A1855 PLH-1126-1.1	2010	New
GC w/ Dual ECD	Hewlett-Packard Lab ID: GC15	Chem Station Rev. B 04.03(16)	7890A	10441121	2010	New
Autosampler	Hewlett-Packard Lab ID: GC15		7693	10390085	2010	New
Freezer	Kenmore Lab ID: WC Freezer #2		253.280528 06	WB02643189	2010	New
Freezer	Frigidaire Lab ID: Tissue Freezer #3		FKFH21F7 WB	WB02442941	2010	New
Freezer	Frigidaire Lab ID: Tissue Freezer #4		FKCH17F7WC	WB02851917	2010	New
Freezer	Frigidaire Lab ID: Tissue Freezer #5		253.280928 01	WB92436406	2010	New
UV/VIS	Thermo Fisher Scientific		GENESYS 10S Vis Spectrophot ometer	2D9P070001	2011	New
Muffle Furnace	Thermo Fisher		F6010	01529788011106 21	2011	New

Tables 20-2 through 20-13. Schedule of Routine Maintenance

Table 20-2

Inductively Coupled Argon Plasma/Mass Spectrometry (ICP/MS) Instrument Maintenance Schedule

Daily	Weekly	Monthly	Quarterly	Annually	As Needed
Check sample waste container level.	Check peristaltic pump: proper roller pressure, sample introduction tubing, correct pump rotation, and 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 20-3

ICP Instrument Maintenance Schedule

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 20-4

Cold Vapor Atomic Absorption (Leeman PS 200) Instrument Maintenance Schedule

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 20-5

Gas Chromatograph Instrument Maintenance Schedule

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 igniter. 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	

Table 20-5

Gas Chromatograph Instrument Maintenance Schedule

Daily	As Needed	Quarterly/Semi-annually/Annually
	maintenance schedule	
	Reactivate flow controller filter dryers when presence of moisture is suspected.	
	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 20-6

Mass Spectrometer Instrument Maintenance Schedule

Daily	Weekly	As Needed	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	Change oil in the mechanical rough pump. Relubricate the turbomolecular pump-bearing		

Table 20-6

Mass Spectrometer Instrument Maintenance Schedule

Daily	Weekly	As Needed	Quarterly	Semi-Annually	Annually
		variety of symptoms including inability of the analyst to tune the instrument to specifications, poor response, and high background contamination.	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 20-7

Wet Chemistry and Support Equipment Maintenance Schedule

Equipment	Daily	Monthly	Annually	As Needed
Sonicator	Daily when used: Inspect probe tips for inconsistencies (etching/pitting).		Tune sonicator assembly	Disassemble and clean sonicator probe tips. Replace probe tip.
Analytical/Top Loading Balance	Check using Class S or Class 1 verified weights once daily or before use Clean pan and weighing compartment		Manufacturer cleaning and calibration.	
Refrigerators/Walk-In Coolers	Temperatures checked and documented.			Refrigerant system and electronics serviced.
Ovens	Temperatures checked and documented.			Electronics serviced.
pH Meter	Inspect electrode. Verify electrodes are properly connected and filled. Inspect electrode proper levels			Clean electrode. Refill reference electrode

Table 20-7

Wet Chemistry and Support Equipment Maintenance Schedule

Equipment	Daily	Monthly	Annually	As Needed
	of filling solutions. Make sure electrode is stored in buffer (pH 4.0).			
Specific Digital Ion Analyzer	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.
Dissolved Oxygen Meter	Daily when used: Calibrate with check standards. Check probe membrane for deterioration. Clean and replace membrane with electrode solution.			Electronics serviced.
Conductance Meter	Daily when used: Check probe and cables. Standardize with KCl. Inspect conductivity cell			Electronics serviced.
Chemical Oxygen Demand (COD) Reactor	Daily when used: Calibrate with check standards.			Electronics serviced.
Spectrophotometer	Check the zero %A adjustment. Clean sample compartment. Clean cuvettes.	Clean windows	Check instrument manual. Perform wavelength calibration. Replace lamp annually or when erratic response is observed. Clean and align optics.	Dust the lamp and front of the front lens
Digestion Block			Check temperature with NIST thermometer	
Flash Point Tester	Check tubing. Clean sample cup each use. Check gas.		Check thermometer against NIST	

Table 20-7

Wet Chemistry and Support Equipment Maintenance Schedule

Equipment	Daily	Monthly	Annually	As Needed
	Clean flash assembly. Check stirrer		thermometer, when used.	
Zero Headspace Extractors	Verify rotation speed and record. Check for leakage			Vendor repair
TCLP Extractors	Verify rotation speed and record.			

Table 20-8

AlpChem Auto Analyzer Instrument Maintenance Schedule

As Needed	Daily	Monthly	Bi-monthly	Annually
Prepare fresh reagents.	Check detector and make sure there are no trapped bubbles in detector cell.	Replace tubing.	Lubricate pump roller.	Clean pump rollers with steel wool and lubricate.
	Check Valves			
	Check Reference source			
Replace pump tubing	Check peristaltic tubing and rollers. Check sampler	Clean pump, diluter, and XYZ Sampler.		
	Clean sample probe shaft.			

Table 20-9

Alpkem FS3000 (1677 Available Cyanide) Instrument Maintenance Schedule

As Needed	Daily	Monthly	Bi-monthly
Prepare fresh reagents.	Clean detector cell and make sure there are no trapped bubbles in lines.	Replace tubing.	Lubricate pump roller Replace Diffusion Membrane
Replace pump tubing	Check peristaltic tubing and rollers.		Clean Reference Electrode
			Replace Reference solution

Table 20-10

Konelab Instrument Maintenance Schedule

Daily	Weekly	Monthly
Run “Start Up”	Empty liquid waste	Restore adjustments from disk
Review water check	Clean wash wells and tubing to waste	Save database to CD
Empty waste bin	Check for chemical residue	Print – then delete messages
Fill diluent with fresh DI water	Clean off any chemical residue	Print – Water Check
Check waste container	Check syringe plunger Teflon tip	Run Dichromate test at 480nm
Run “Stand By”	Run Dichromate test at 480 nm	Clean and Lube incubator rod
Print or save results to file	Reboot computer	Clean and Lube fetcher rod
Clear daily files		
Clean incubator		

Table 20-11
Ion Chromatograph Instrument Maintenance Schedule

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 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 20-12

Total Organic Carbon Analyzer Instrument Maintenance Schedule

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

Note: Refer to manufacturer's instructions for each equipment to identify and perform maintenance operations.

Table 20-13.

Periodic Calibration

Instrument	Type of Calibration/ Number of Standards	Frequency	Acceptance Limits	Corrective Action
Analytical Balance	Accuracy determined using NIST traceable weights. Minimum of 2 standards bracketing the weight of interest. Inspected and calibrated by an approved vendor annually.	Daily	± 0.1% or ± 0.5mg, whichever is larger unless method specific guidance exists.	Clean, check level, insure lack of drafts, and that unit is warmed up, recheck. If fails, call service.

Instrument	Type of Calibration/ Number of Standards	Frequency	Acceptance Limits	Corrective Action
Top Loading Balance	Accuracy determined using NIST traceable weights. Minimum of 2 standards bracketing the weight of interest. Inspected and calibrated by an approved vendor annually.	Daily	± 0.5%	Clean. Replace.
Weights (NIST Traceable – non Class 1)	Accuracy determined against NIST Traceable Class 1 weights.	1 year	As per certificate.	Replace.
Weights (NIST Traceable –Class 1)	Accuracy determined by an approved vendor.	3 Years	As per certificate.	Replace.
NIST-Traceable Thermometer	Accuracy determined by an approved weights and measurement laboratory.	5 years	As per certificate.	Replace.
Thermometer	Against NIST-traceable thermometer	Yearly at appropriate temperature range for intended use	± 1.2°C	Replace
Minimum-Maximum Thermometers	Against NIST-traceable thermometer	Yearly	± 1.5°C	Replace
InfraRed Temperature Guns	Against NIST-traceable thermometer	Quarterly at appropriate temperature range for intended use.	± 1.5°C	Repair/replace
Digital Thermometer	Against NIST-traceable thermometer - at two temperatures that bracket target temperature(s); if only a single temperature is used, at the temperature of use	TNI Annually - DoD requires Quarterly at appropriate temperature range for intended use.	± 1.5°C	Repair/replace
Dial-type Thermometers	Against NIST-traceable thermometer	Quarterly at appropriate temperature range for intended use.	± 1.5°C	Replace
Refrigerator	Temperature checked using NIST-traceable thermometer. Thermometer must be immersed in a liquid such as mineral oil or glycol.	Daily. If out of range, check again in two hours.	4.0 ± 2°C	Adjust. Repair. While waiting for repair, seal door, attach “Out of Service” sign, move items to functional unit. Notify Team Leader.

Instrument	Type of Calibration/ Number of Standards	Frequency	Acceptance Limits	Corrective Action
Freezer	Temperature checked using NIST-traceable thermometer	Daily. If out of range, check again in two hours.	(-10) to (-20)°C	Adjust. Repair. While waiting for repair, seal door, attach "Out of Service" sign, move items to functional unit. Notify Team Leader.
Oven	Temperature checked using NIST-traceable thermometer.	When in use.	Compliance with method specific requirements or within ± 5% of set temperature 104 ± 1°C (drying) 180 ± 2°C (TDS)	Adjust. Replace.
Incubator	Temperature checked using NIST-traceable thermometer.	When in use.	BOD: 20 ± 1.0°C	Adjust. Replace.
Water Bath	Temperature checked using NIST-traceable thermometer.	When in use.	± 2°C	Adjust. Replace.
Volumetric Dispensing Devices (Eppendorf ® pipette, automatic dilutor or dispensing devices)	One delivery by weight. Using DI water, dispense into tared vessel. Record weight with device ID number.	Quarterly	± 2% Calculate accuracy by dividing weight by stated volume times 100 for percent.	Adjust. Replace.
Glass Microliter Syringes	Accuracy verified every six months as per SOP.	Accuracy must be initially demonstrated if syringe was not received with a certificate attesting to established accuracy.	± 1%	Not applicable.
Conductivity Meter	Cell impedance calibrated with three KCl standards.	Each use.	r ≥ 0.99	Recalibrate.
Deionized Water	Check in-line conductivity meter on system with conductivity meter in Wet Chem Department.	Daily	<10 µmhos/cm^2	Record on log. Report discrepancies to QA Manager.

SECTION 21

MEASUREMENT TRACEABILITY

21.1 Overview

Traceability of measurements shall be assured using a system of documentation, calibration, and analysis of reference standards. Laboratory equipment that are peripheral to analysis and whose calibration is not necessarily documented in a test method analysis or by analysis of a reference standard shall be subject to ongoing certifications of accuracy. At a minimum, these must include procedures for checking specifications of ancillary equipment: balances, thermometers, temperature, Deionized (DI) and Reverse Osmosis (RO) water systems, automatic pipettes and other volumetric measuring devices. (Refer to Section 20.3). With the exception of Class A Glassware and Glass microliter syringes , quarterly accuracy checks are performed for all mechanical volumetric devices. Microsyringes can be verified at least semi-annually or disposed of after 6 months of use. Wherever possible, subsidiary or peripheral equipment is checked against standard equipment or standards that are traceable to national or international standards. Class A Glassware and Glass microliter syringes should be routinely inspected for chips, acid etching or deformity (e.g., bent needle). If the Class A glassware or syringe is suspect, the accuracy of the glassware will be assessed prior to use.

21.2 NIST-Traceable Weights And Thermometers

Reference standards of measurement shall be used for calibration only and for no other purpose, unless it can be shown that their performance as reference standards would not be invalidated.

For NIST-traceable weights and thermometers, the laboratory requires that all calibrations be conducted by a calibration laboratory accredited by A2LA, NVLAP (National Voluntary Laboratory Accreditation Program) or another accreditation organization that is a signatory to a MRA (Mutual Recognition Arrangement) of one or more of the following cooperations – ILAC (International Laboratory Accreditation Cooperation) or APLAC (Asia – Pacific Laboratory Accreditation Cooperation). A certificate and scope of accreditation is kept on file at the laboratory.

21.3 Reference Standards / Materials

Reference standards/materials, where commercially available, are traceable to certified reference materials. Commercially prepared standard materials are purchased from vendors accredited by A2LA, NVLAP, ISO 9001:2000, ISO 17025 standard with an accompanying Certificate of Analysis that documents the standard purity. If a standard cannot be purchased from a vendor that supplies a Certificate of Analysis, the purity of the standard is documented by analysis. The receipt of all reference standards must be documented. Reference standards are labeled with a unique Standard Identification Number and expiration date. All documentation received with the reference standard is retained as a QC record and references the Standard Identification Number.

All reference, primary and working standards/materials, whether commercially purchased or laboratory prepared, must be checked regularly to ensure that the variability of the standard or material from the ‘true’ value does not exceed method requirements. The accuracy of calibration

standards is checked by comparison with a standard from a second source. In cases where a second standard manufacturer is not available, a vendor certified different lot is acceptable for use as a second source. For unique situations, such as air analysis where no other source or lot is available, a standard made by a different analyst would be considered a second source. The appropriate Quality Control (QC) criteria for specific standards are defined in laboratory SOPs. In most cases, the analysis of an Initial Calibration Verification (ICV) or LCS (where there is no sample preparation) is used as the second source confirmation. These checks are generally performed as an integral part of the analysis method (e.g. calibration checks, laboratory control samples).

All standards and materials must be stored and handled according to method or manufacturer's requirements in order to prevent contamination or deterioration. Refer to the Corporate Environmental Health & Safety Manual or laboratory SOPs. For safety requirements, please refer to method SOPs and the laboratory Environmental Health and Safety Manual.

Standards and reference materials shall not be used after their expiration dates unless their reliability is verified by the laboratory and their use is approved by the Quality Assurance Manager. The laboratory must have documented contingency procedures for re-verifying expired standards.

21.4 Documentation And Labeling Of Standards, Reagents, And Reference Materials

Reagents must be at a minimum the purity required in the test method. The date of reagent receipt and the expiration date are documented. The lots for most of the common solvents and acids are tested for acceptability prior to company wide purchase. (Refer to TestAmerica's Corporate SOP (CA-Q-S-001), Solvent and Acid Lot Testing and Approval.)

All manufacturer or vendor supplied Certificate of Analysis or Purity must be retained, stored appropriately, and readily available for use and inspection. These records are maintained in the QA public drive N:\QA\Facility_QA_Documents\Certificate_of_Analysis. Standard certificates are maintained by each department and a copy should be scanned into LIMS Reagent log. Records must be kept of the date of receipt and date of expiration of standards, reagents and reference materials. In addition, records of preparation of laboratory standards, reagents, and reference materials must be retained, stored appropriately, and be readily available for use and inspection. For detailed information on documentation and labeling, please refer to method specific SOPs and SOP No. PT-QA-006, Procurement of Standard and Materials; Labeling and Traceability.

Commercial materials purchased for preparation of calibration solutions, spike solutions, etc., are usually accompanied with an assay certificate or the purity is noted on the label. If the assay purity is 96% or better, the weight provided by the vendor may be used without correction. If the assay purity is less than 96% a correction will be made to concentrations applied to solutions prepared from the stock commercial material.

21.4.1 All standards, reagents, and reference materials that may affect quality must be labeled in an unambiguous manner. Standards are logged into the laboratory's LIMS system, and are assigned a unique identification number. The following information is typically recorded within LIMS.

- Standard ID

- Description of Standard
- Department
- Preparer's name
- Final volume and number of vials prepared
- Solvent type and lot number
- Preparation Date
- Expiration Date
- Standard source type (stock or daughter)
- Standard type (spike, surrogate, other)
- Parent standard ID (if applicable)
- Parent Standard Analyte Concentration (if applicable)
- Parent Standard Amount used (if applicable)
- Component Analytes
- Final concentration of each analyte
- Comment box (text field)

Records are maintained electronically for standard and reference material preparation. These records show the traceability to purchased stocks or neat compounds. These records also include method of preparation, date of preparation, expiration date and preparer's name or initials. Preparation procedures are provided in the Method SOPs.

21.4.2 All standards, reagents, and reference materials must be clearly labeled with a minimum of the following information:

- Expiration Date (include prep date for reagents)
- Standard ID (from electronic standard log in LIMS)
- Special Health/Safety warnings if applicable

Records must also be maintained of the date of receipt for commercially purchased items or date of preparation for laboratory prepared items. Special Health/Safety warnings must also be available to the analyst. This information is maintained in standard/reagent log. Health and safety warning are in the MSDS (Material Safety Data Sheets) which is accessed through company intranet site.

21.4.3 In addition, the following information may be helpful:

- Date of receipt for commercially purchased items or date of preparation for laboratory prepared items
- Date opened (for multi-use containers, if applicable)
- Description of standard (if different from manufacturer's label or if standard was prepared in the laboratory)
- Recommended Storage Conditions
- Concentration (if applicable)
- Initials of analyst preparing standard or opening container

All containers of prepared reagents must include, expiration date and an ID number to trace back to preparation.

Procedures for preparation of reagents can be found in the Method SOPs.

Standard ID numbers must be traceable through associated logbooks, worksheets and raw data.

All reagents and standards must be stored in accordance to the following priority: 1) with the manufacturer's recommendations; 2) with requirements in the specific analytical methods as specified in the laboratory SOP.

SECTION 22

SAMPLING

22.1 Overview

The laboratory provides sampling services for the following matrices:

- Groundwater Sampling
- Wastewater Sampling
- Potable Sampling
- Waste Sampling
- Soil and Sediment Sampling
- Flow Monitoring
- Field Parameter Analysis
- Cleaning and Decontamination of Field Equipment

22.2 Sampling Containers

The laboratory offers clean sampling containers for use by clients. These containers are obtained from reputable container manufacturers and meet EPA specifications as required. Any certificates of cleanliness that are provided by the supplier are maintained at the laboratory. For detailed information regarding container/bottle order, refer to laboratory SOP PT-QA-028, Bottle and Cooler Preparation.

22.2.1 Preservatives

Upon request, preservatives are provided to the client in pre-cleaned sampling containers. In some cases containers may be purchased pre-preserved from the container supplier. Whether prepared by the laboratory or bought pre-preserved, the grades of the preservatives are at a minimum:

- Hydrochloric Acid – AR Select (ACS) or equivalent
- Methanol – Purge and Trap grade
- Nitric Acid – AR Select (ACS) or equivalent
- Sodium Hydroxide – AR Select (ACS) or equivalent
- Sulfuric Acid – AR Select (ACS) or equivalent
- Hexane – Ultra Resi – Analyzed or equivalent

22.3 Definition Of Holding Time

The date and time of sampling documented on the COC form establishes the day and time zero. As a general rule, when the maximum allowable holding time is expressed in “days” (e.g., 14 days, 28 days), the holding time is based on calendar day measured. Holding times expressed in “hours” (e.g., 6 hours, 24 hours, etc.) are measured from date and time zero. The first day of holding time ends twenty-four hours after sampling. Holding times for analysis include any

necessary reanalysis. However there are some programs that determine holding time compliance based on the date and specific time of analysis compared to the time of sampling regardless of how long the holding time is. DOD work requires that all holding times be measured to the exact time of sampling – not the day. For DOD requirements, refer to SOP: PT-QA-029 for DoD QSM 4.2.

22.4 Sampling Containers, Preservation Requirements, Holding Times

The preservation and holding time criteria specified in the SOPs are derived from the source documents for the methods. If method required holding times as specified in the SOPs or preservation requirements are not met, the reports will be qualified using a flag, footnote or case narrative. As soon as possible or "ASAP" is an EPA designation for tests for which rapid analysis is advised, but for which neither EPA nor the laboratory have a basis for a holding time.

22.5 Sample Aliquots / Subsampling

Taking a representative sub-sample from a container is necessary to ensure that the analytical results are representative of the sample collected in the field. The size of the sample container, the quantity of sample fitted within the container, and the homogeneity of the sample need consideration when sub-sampling for sample preparation. It is the laboratory's responsibility to take a representative subsample or aliquot of the sample provided for analysis.

Analysts should handle each sample as if it is potentially dangerous. At a minimum, safety glasses, gloves, and lab coats must be worn when preparing aliquots for analysis.

Guidelines for subsampling are located SOP # PT-QA-024.

SECTION 23

HANDLING OF SAMPLES

Sample management procedures at the laboratory ensure that sample integrity and custody are maintained and documented from sampling/receipt through disposal.

23.1 Chain Of Custody (COC)

The COC form is the written documented history of any sample and is initiated when bottles are sent to the field, or at the time of sampling. This form is completed by the sampling personnel and accompanies the samples to the laboratory where it is received and stored under the laboratory's custody. The purpose of the COC form is to provide a legal written record of the handling of samples from the time of collection until they are received at the laboratory. It also serves as the primary written request for analyses from the client to the laboratory. The COC form acts as a purchase order for analytical services when no other contractual agreement is in effect. An example of a COC form may be found in Figure 23-1.

23.1.1 Field Documentation

The information the sampler needs to provide at the time of sampling on the container label is:

- Sample identification
- Date and time
- Preservative

During the sampling process, the COC form is completed and must be legible (see Figure 23-1). This form includes information such as:

- Client name, address, phone number and fax number (if available)
- Project name and/or number
- The sample identification
- Date, time and location of sampling
- Sample collectors name
- The matrix description
- The container description
- The total number of each type of container
- Preservatives used
- Analysis requested
- Requested turnaround time (TAT)
- Any special instructions
- Purchase Order number or billing information (e.g. quote number) if available
- The date and time that each person received or relinquished the sample(s), including their signed name.

When the sampling personnel deliver the samples directly to TestAmerica personnel, the samples are stored in a cooler with ice, as applicable, and remain solely in the possession of

the client's field technician until the samples are delivered to the laboratory personnel. The sample collector must assure that each container is in his/her physical possession or in his/her view at all times, or stored in such a place and manner to preclude tampering. The field technician relinquishes the samples in writing on the COC form to the sample control personnel at the laboratory or to a TestAmerica courier. When sampling personnel deliver the samples through a common carrier (Fed-Ex, UPS), the CoC relinquished date/time is completed by the field personnel and samples are released to the carrier. Samples are only considered to be received by lab when personnel at the fixed laboratory facility have physical contact with the samples.

Note: Independent couriers are not required to sign the COC form. The COC is usually kept in the sealed sample cooler. The receipt from the courier is stored in the project folder.

23.1.2 Legal / Evidentiary Chain-of-Custody

The laboratory may, upon special request, adhere to legal/evidentiary chain of custody requirements. If TestAmerica agrees to such procedures the samples are identified for legal/evidentiary purposes on the COC, login will complete the custody seal (Figure 23-4), retain the shipping record with the COC, and initiate an internal COC (Figure 23-5) for laboratory use by analysts and sample disposal record.

23.2 Sample Receipt

Samples are received at the laboratory by designated sample receiving personnel and a unique laboratory project identification number is assigned. Each sample container shall be assigned a unique sample identification number that is cross-referenced to the client identification number such that traceability of test samples is unambiguous and documented. Each sample container is affixed with a durable sample identification label. Sample acceptance, receipt, tracking and storage procedures are summarized in the following sections.

23.2.1 Laboratory Receipt

When samples arrive at the laboratory, sample receiving personnel inspect the coolers and samples. The integrity of each sample must be determined by comparing sample labels or tags with the COC and by visual checks of the container for possible damage. Any non-conformance, irregularity, or compromised sample receipt must be documented via the Sample Receipt application, Sample Receipt checklist (Figure 23-3). and brought to the immediate attention of the Project Manager who will, in turn, contact the client. The COC, shipping documents, documentation of any non-conformance, irregularity, or compromised sample receipt, record of client contact, and resulting instructions become part of the project record. This procedure is further described in SOP No. PT-QA-027, Sample Receiving and Chain-of-Custody.

23.2.1.1 Unique Sample Identification

All samples that are processed through the laboratory receive a unique sample identification to ensure that there can be no confusion regarding the identity of such samples at anytime. This system includes identification for all samples, subsamples and subsequent extracts and/or digestates.

The laboratory assigns a unique identification (e.g., Sample ID) code to each sample container received at the laboratory. This Primary ID is made up of the following information (consisting of 4 components):

Example: 180 - 9608 - A - 1

Location ID (3-digit # for the lab) | Login ID | Container Occurrence | Sample Number

The above example states that TestAmerica Pittsburgh Laboratory (Location 180). Login ID is 9608 (unique to a particular client/job occurrence). The container code indicates it is the first container ("A") of Sample #1.

If the primary container goes through a prep step that creates a "new" container, then the new container is considered secondary and gets another ID. An example of this being a client sample in a 1-Liter amber bottle is sent through a Liquid/Liquid Extraction and an extraction vial is created from this step. The vial would be a SECONDARY container. The secondary ID has 5 components.

Example: 180 - 9608 - A - 1 - **A** ← **Secondary Container Occurrence**

Example: 180-9608-A-1-A, would indicate the PRIMARY container listed above that went through a step that created the 1st occurrence of a Secondary container.

With this system, a client sample can literally be tracked throughout the laboratory in every step from receipt to disposal.

23.3 Sample Acceptance Policy

The laboratory has a written sample acceptance policy (Figure 23-2) that clearly outlines the circumstances under which samples shall be accepted or rejected. These include:

- a COC filled out completely;
- samples must be properly labeled;
- proper sample containers with adequate volume for the analysis and necessary QC;
- samples must be preserved according to the requirements of the requested analytical method ;
- sample holding times must be adhered to ;
- all samples submitted for water/solid Volatile Organic analyses must have a Trip Blank submitted at the same time;
- Efforts should be made to minimize any air bubbles in aqueous volatile samples. Air bubbles also the escape of volatile organics. This is especially important because air bubbles tend to form in iced samples. Volatile vials containing air bubbles larger than a pea will be treated as non-conformances;
- Samples that require chilling must be received at < 6 ℃;

- If Matrix Spikes are required for the project, separate sample volumes must be available for the requested analyses;
- the project manager will be notified if any sample is received in damaged condition

Data from samples which do not meet these criteria are flagged and the nature of the variation from policy is defined.

23.3.1.1 After inspecting the samples, the sample receiving personnel sign and date the COC form, make any necessary notes of the samples' conditions and store them in appropriate refrigerators or storage locations.

23.3.1.2 Any deviations from these checks that question the suitability of the sample for analysis, or incomplete documentation as to the tests required will be resolved by consultation with the client. If the sample acceptance policy criteria are not met, the laboratory shall either:

- Retain all correspondence and/or records of communications with the client regarding the disposition of rejected samples, or
- Fully document any decision to proceed with sample analysis that does not meet sample acceptance criteria.
- If the conditions listed on the Acceptance Policy are not satisfactory and when lacking direction or agreement with the client, the sample will be rejected by the laboratory.

Note: North Carolina requires that they be notified when samples are processed that do not meet sample acceptance criteria.

Once sample acceptance is verified, the samples are logged into the LIMS according SOP No. PT-QA-027.

23.4 Sample Storage

In order to avoid deterioration, contamination or damage to a sample during storage and handling, from the time of receipt until all analyses are complete, samples are stored in refrigerators suitable for the sample matrix. In addition, samples to be analyzed for volatile organic parameters are stored in separate refrigerators designated for volatile organic parameters only. Samples are never to be stored with reagents, standards or materials that may create contamination.

Refrigerators and other units used to store samples must not be used for standard, reagent or similar storage.

To ensure the integrity of the samples during storage, refrigerator blanks are maintained in the volatile sample refrigerators and analyzed every two weeks.

Analysts and technicians retrieve the sample container allocated to their analysis from the designated cold room or refrigerator and place them on carts, analyze the sample, and return the remaining sample or empty container to the cold room or refrigerator from which it originally

came. All unused portions of samples, including empty sample containers, are returned to the secure sample control area. Raw samples requiring cold storage are kept in the cold room for approximately 30 days after reported. Volatile samples are stored in the VOA refrigerator. All sample extracts are kept in the refrigerators for approximately two to four weeks after analysis, which meets or exceeds most sample holding times. After this time the sample extracts are moved to cold room, where they are stored for an additional three to six months before they are disposed of. This holding period allows samples to be checked if a discrepancy or question arises. Special arrangements may be made to store samples for longer periods of time. This extended holding period allows additional metal analyses to be performed on the archived sample and assists clients in dealing with legal matters or regulatory issues.

Access to the laboratory is controlled such that sample storage need not be locked at all times unless a project specifically demands it. Samples are accessible to laboratory personnel only. Visitors to the laboratory are prohibited from entering the refrigerator and laboratory areas unless accompanied by an employee of TestAmerica.

23.5 Hazardous Samples And Foreign Soils

To minimize exposure to personnel and to avoid potential accidents, hazardous, for any sample that is known to be hazardous at the time of receipt a cautionary email communication should be sent to all applicable laboratory personnel by the project manager or designee. All hazardous samples are disposed of appropriately through a hazardous waste disposal process. Foreign soil samples are sent out for incineration by an USDA-approved waste disposal facility. Analysts will notify Sample Control of any sample determined to be hazardous after completion of analysis by sending an email. All hazardous samples are either returned to the client or disposed of appropriately through a hazardous waste disposal firm that lab-packs all hazardous samples and removes them from the laboratory. Foreign soil samples are sent out for incineration by a USDA-approved waste disposal facility.

23.6 Sample Shipping

In the event that the laboratory needs to ship samples, the samples are placed in a cooler with enough ice to ensure the samples remain just above freezing and at or below 6.0°C during transit. The samples are carefully surrounded by packing material to avoid breakage (yet maintain appropriate temperature). A trip blank is enclosed for those samples requiring water/solid volatile organic analyses. The chain-of-custody form is signed by the sample control technician and attached to the shipping paperwork. Samples are generally shipped overnight express or hand-delivered by a TestAmerica courier to maintain sample integrity. All personnel involved with shipping and receiving samples must be trained to maintain the proper chain-of-custody documentation and to keep the samples intact and on ice. The Environmental, Health and Safety Manual contains additional shipping requirements.

Note: If a client does not request trip blank analysis on the COC or other paperwork, the laboratory will not analyze the trip blanks that were supplied. However, in the interest of good client service, the laboratory will advise the client at the time of sample receipt that it was noted that they did not request analysis of the trip blank; and that the laboratory is providing the notification to verify that they are not inadvertently omitting a key part of regulatory compliance testing.

23.7 Sample Disposal

Samples should be retained for a minimum of 30 days after the project report is sent, however, provisions may be made for earlier disposal of samples once the holding time is exceeded. Some samples are required to be held for longer periods based on regulatory or client requirements (e.g., 60 days after project report is sent). The laboratory must follow the longer sample retention requirements where required by regulation or client agreement. Several possibilities for sample disposal exist: the sample may be consumed completely during analysis, the sample may be returned to the customer or location of sampling for disposal, or the sample may be disposed of in accordance with the laboratory's waste disposal procedures (SOP No. PT-HS-001 and Chemical Hygiene Plan). All procedures in the laboratory Environmental, Health and Safety Manual are followed during disposal. Samples are normally maintained in the laboratory no longer than two months from receipt unless otherwise requested. Unused portions of samples found or suspected to be hazardous according to state or federal guidelines may be returned to the client upon completion of the analytical work.

If a sample is part of a known litigation, the affected legal authority, sample data user, and/or submitter of the sample must participate in the decision about the sample's disposal. All documentation and correspondence concerning the disposal decision process must be kept on file. Pertinent information includes the date of disposal, nature of disposal (such as sample depletion, hazardous waste facility disposal, return to client), names of individuals who conducted the arrangements and physically completed the task. The laboratory will remove or deface sample labels prior to disposal unless this is accomplished through the disposal method (e.g., samples are incinerated). A Waste Disposal Record should be completed.

Figure 23-1.

Example: Chain of Custody (COC)

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TAL-4142 (0907)

Client	Project Manager	Date	Chain of Custody Number 364410
Address	Telephone Number (Area Code)/Fax Number	Lab Number	Page _____ of _____
City / State / Zip Code	Site Contact / Lab Contact	Analysis (Attach list if more space is needed)	Special Instructions/ Conditions of Receipt
Project Name and Location (State)	Carrier/Waybill Number		
Contract/Purchase Order/Quote No.	Matrix / Containers & Preservatives		

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Air	Aqueous	Sed.	Sol.	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH												

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal
☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required
☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other_____

QC Requirements (Specify)

1. Relinquished By	Date	Time	1. Received By	Date	Time
2. Relinquished By	Date	Time	2. Received By	Date	Time
3. Relinquished By	Date	Time	3. Received By	Date	Time

Comments

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

Figure 23-2

Example: Sample Acceptance Policy

All incoming work will be evaluated against the criteria listed below. Where applicable, data from any samples that do not meet the criteria listed below will be noted on the laboratory report defining the nature and substance of the variation. In addition the client will be notified either by telephone, fax or e-mail ASAP after the receipt of the samples.

1) Samples must arrive with labels intact with a Chain of Custody filled out completely. The following information must be recorded.
   - *Client name, address, phone number and fax number (if available)*
   - *Project name and/or number*
   - *Unique sample identification*
   - *Date, time and location of sampling*
   - *The collectors name*
   - *The matrix description*
   - *The container description*
   - *The total number of each type of container*
   - *Preservatives used*
   - *Analysis requested*
   - *Requested turnaround time (TAT)*
   - *Any special instructions*
   - *Purchase Order number or billing information (e.g. quote number) if available*
   - *The date and time that each person received or relinquished the sample(s), including their signed name.*
   - **Information must be legible**

2) Samples must be properly labeled.
   - Use durable labels (labels provided by TestAmerica are preferred)
   - Include a unique identification number
   - Include sampling date and time & sampler ID
   - Include preservative used.
   - Use indelible ink
   - **Information must be legible**

3) Proper sample containers with adequate volume for the analysis and necessary QC are required for each analysis requested.

4) Samples must be preserved according to the requirements of the requested analytical method. (See Sampling Guide)

5) Most analytical methods require chilling samples to 4° C (other than water samples for metals analysis). For these methods, the criteria are met if the samples are chilled to below 6° C and above freezing (0°C). For methods with other temperature criteria (e.g. some bacteriological methods require $\leq$ 10 ^{o}C), the samples must arrive within $\pm$ 2° C of the required temperature or within the method specified range. **Note:** Samples that are hand delivered to the laboratory immediately after collection may not have had time to cool sufficiently. In this case the samples will be considered acceptable as long as there is evidence that the chilling process has begun (arrival on ice).

5i.) Samples that are delivered to the laboratory on the same day they are collected may not meet the requirements of Section 5. In these cases, the samples shall be considered acceptable if the samples were received on ice.

5ii.) If sample analysis is begun within fifteen (15) minutes of collection, thermal preservation is not required.

5iii.) Thermal preservation is not required in the field if the laboratory receives and refrigerates the sample within fifteen (15) minutes of collection.

- Chemical preservation (pH) will be verified prior to analysis and documented, either in sample control or at the analyst's level. The project manager will be notified immediately if there is a discrepancy. If analyses will still be performed, all affected results will be flagged to indicate improper preservation.

- **FOR WATER SAMPLES TESTED FOR CYANIDE (Method OIA-1677)**
  - In the Field: Samples are to be tested for Sulfide using lead acetate paper prior to the addition of Sodium Hydroxide (NaOH). If sulfide is present, the sample is treated in the field with lead carbonate or if the client requests the sample to be treated at the lab it will be filtered and treated at the lab with Cadmium Chloride.
    - If the sulfide test and treatment is not performed in the field, the lab will test the samples for sulfide using lead acetate paper at the time of receipt and if sulfide is present in the sample, the client will be notified and given the option of retaking the sample and treating in the field per the method requirements or the laboratory can analyze the samples as delivered and qualify the results in the final report.
  - It is the responsibility of the client to notify the laboratory if thiosulfate, sulfite, or thiocyanate are known or suspected to be present in the sample. This notification may be on the chain of custody. The samples may need to be subcontracted to a laboratory that performs a UV digestion. If the lab does not perform the UV digestion on samples that contain these compounds, the results must be qualified in the final report.
  - The laboratory must test the sample for oxidizing agents (e.g. Chlorine) prior to analysis and treat according to the methods prior to distillation. (ascorbic acid or sodium arsenite are the preferred choice).

6) *Matrix Spikes* are required for your project, separate sample volumes must be available for the requested analyses.

7) For Volatile Organic analyses: Efforts should be made to minimize any air bubbles in aqueous volatile samples. Air bubbles also the escape of volatile organics. This is especially important because air bubbles tend to form in iced samples. Volatile vials containing air bubbles larger than a pea will be treated as non-conformances.

8) All samples submitted for Volatile Organic analyses must have a Trip Blank submitted at the same time. TestAmerica will supply a blank with the bottle order.

9) Sample Holding Times

- TestAmerica will make every effort to analyze samples within the regulatory holding time. Samples must be received in the laboratory with enough time to perform the sample analysis. Except for short holding time samples (< 48hr HT) sample must be received with at least 48 hrs (working days) remaining on the holding time for us to ensure analysis.

- Analyses that are designated as "field" analyses (Odor, pH, Dissolved Oxygen, Disinfectant Residual; a.k.a. Residual Chlorine, and Redox Potential) should be analyzed ASAP by the field

sampler prior to delivering to the lab (within 15 minutes). However, if the analyses are to be performed in the laboratory, TestAmerica will make every effort to analyze the samples within 24 hours from receipt of the samples in the testing laboratory. Samples for "field" analyses received after 4:00 pm on Friday or on the weekend will be analyzed no later than the next business day after receipt (Monday unless a holiday). Samples will remain refrigerated and sealed until the time of analysis. Samples analyzed in the laboratory will be qualified on the final report to indicate holding time exceedance.

10) The project manager will be notified if any sample is received in damaged condition. TestAmerica will request that a sample be resubmitted for analysis. The laboratory will notify the client upon sample receipt if the samples exhibit obvious signs of damage, contamination or inadequate preservation.

11) Recommendations for packing samples for shipment.

- Pack samples in Ice rather than "Blue" ice packs.
- Soil samples should be placed in plastic zip-lock bags. The containers often have dirt around the top and do not seal very well and are prone to intrusion from the water from melted ice.
- Water samples would be best if wrapped with bubble-wrap or paper (newspaper, or paper towels work) and then placed in plastic zip-lock bags.
- Fill extra cooler space with bubble wrap.

12) For DoD work, the Project Manager will notify the client that samples are received after hours they lab will not accept the samples until the following day.

If the conditions listed on the Acceptance Policy are not satisfactory and when lacking direction or agreement with the client, the sample will be rejected by the laboratory.

Figure 23-3.

Example: Sample Receipt Checklist

Login Sample Receipt Checklist

Client: Cardno ENTRIX

Job Number: 180-264-1

Login Number: 264
List Number: 1
Creator: Gamber, Tom

List Source: TestAmerica Pittsburgh

Question	Answer	Comment
Radioactivity either was not measured or, if measured, is at or below background	True	
The cooler's custody seal, if present, is intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the sample IDs on the containers and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
VOA sample vials do not have headspace or bubble is <6mm (1/4") in diameter.	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Figure 23-4.

Example: Custody Seal

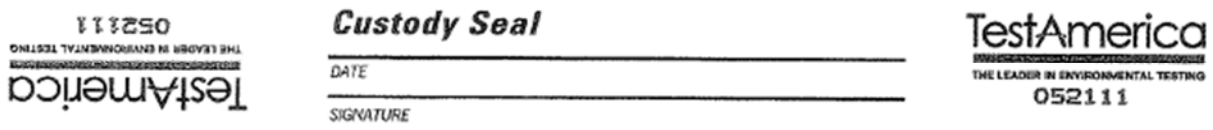


Figure 23-5.

Example: Internal Chain-of-Custody (COC) Form

Historical Internal Chain of Custody

Login	Smp	Customer Sample ID	Matrix	Container ID	Lab Sample ID	Container Type	Location	Custody User	I/O	ICOC ID	ICOC Date
280-2756	1	J19WL7	Solid	280-126041	280-2756-A-1	Plastic 250ml - unpreserved	AH66	Chavez, Lawrence	I	280-13864	05/25/10 12:38
280-2756	1	J19WL7	Solid	280-126041	280-2756-A-1	Plastic 250ml - unpreserved	128	Berry III, Paul B	I	280-9241	04/24/10 10:24
280-2756	1	J19WL7	Solid	280-126041	280-2756-A-1	Plastic 250ml - unpreserved	WC Dpt	Berry III, Paul B	I	280-9234	04/24/10 08:52
280-2756	1	J19WL7	Solid	280-132543	280-2756-A-1-A						
280-2756	1			280-132544	280-2756-A-1-B						
280-2756	1			280-132545	280-2756-A-1-C						
280-2756	1	J19WL7	Solid	280-134154	280-2756-A-1-D						
280-2756	1	J19WL7	Solid	280-155231	280-2756-A-1-E						
280-2756	1	J19WL7	Solid	280-126042	280-2756-B-1	Soil jar 4oz	AH66	Chavez, Lawrence	I	280-13864	05/25/10 12:38
280-2756	1	J19WL7	Solid	280-126042	280-2756-B-1	Soil jar 4oz	128	Johnson, Aaron S	I	280-12354	05/12/10 22:18
280-2756	1	J19WL7	Solid	280-126042	280-2756-B-1	Soil jar 4oz	OP Dpt	Johnson, Aaron S	I	280-12286	05/12/10 15:24
280-2756	1	J19WL7	Solid	280-165103	280-2756-B-1-A						
280-2756	1	J19WL7	Solid	280-126043	280-2756-C-1	Soil jar 4oz	AH66	Chavez, Lawrence	I	280-13864	05/25/10 12:38
280-2756	1	J19WL7	Solid	280-126043	280-2756-C-1	Soil jar 4oz	128	Johnson, Aaron S	I	280-10311	04/30/10 01:16
280-2756	1	J19WL7	Solid	280-126043	280-2756-C-1	Soil jar 4oz	OP Dpt	Johnson, Aaron S	I	280-10172	04/29/10 15:27
280-2756	1	J19WL7	Solid	280-126043	280-2756-C-1	Soil jar 4oz	128	Skrip, Sean P	I	280-9923	04/28/10 15:52
280-2756	1	J19WL7	Solid	280-126043	280-2756-C-1	Soil jar 4oz	OP Dpt	Skrip, Sean P	I	280-9812	04/28/10 09:27
280-2756	1	J19WL7	Solid	280-134359	280-2756-C-1-A						
280-2756	1	J19WL7	Solid	280-138785	280-2756-C-1-B						
280-2756	1	J19WL7	Solid	280-165318	280-2756-C-1-C						
280-2756	1	J19WL7	Solid	280-170514	280-2756-C-1-D						
280-2756	2	J19WL8	Solid	280-126044	280-2756-A-2	Plastic 250ml - unpreserved	AH66	Chavez, Lawrence	I	280-13864	05/25/10 12:38
280-2756	2	J19WL8	Solid	280-126044	280-2756-A-2	Plastic 250ml - unpreserved	128	Berry III, Paul B	I	280-9241	04/24/10 10:24
280-2756	2	J19WL8	Solid	280-126044	280-2756-A-2	Plastic 250ml - unpreserved	WC Dpt	Berry III, Paul B	I	280-9234	04/24/10 08:52
280-2756	2	J19WL8	Solid	280-132546	280-2756-A-2-A						
280-2756	2	J19WL8	Solid	280-134155	280-2756-A-2-B						
280-2756	2	J19WL8	Solid	280-155232	280-2756-A-2-C						
280-2756	2	J19WL8	Solid	280-126045	280-2756-B-2	Soil jar 4oz	AH66	Chavez, Lawrence	I	280-13864	05/25/10 12:38
280-2756	2	J19WL8	Solid	280-126045	280-2756-B-2	Soil jar 4oz	OP Dpt	Pottruff, Erma J	I	280-12627	05/14/10 16:02
280-2756	2	J19WL8	Solid	280-126045	280-2756-B-2	Soil jar 4oz	OP Dpt	Pottruff, Erma J	I	280-12624	05/14/10 15:45
280-2756	2	J19WL8	Solid	280-126045	280-2756-B-2	Soil jar 4oz	OP Dpt	Decker, Susan H	I	280-12603	05/14/10 14:11
280-2756	2	J19WL8	Solid	280-126045	280-2756-B-2	Soil jar 4oz	128	Johnson, Aaron S	I	280-12354	05/12/10 22:18
280-2756	2	J19WL8	Solid	280-126045	280-2756-B-2	Soil jar 4oz	OP Dpt	Johnson, Aaron S	I	280-12286	05/12/10 15:24
280-2756	2	J19WL8	Solid	280-165104	280-2756-B-2-A						
280-2756	2	J19WL8	Solid	280-126046	280-2756-C-2	Soil jar 4oz	AH66	Chavez, Lawrence	I	280-13864	05/25/10 12:38
280-2756	2	J19WL8	Solid	280-126046	280-2756-C-2	Soil jar 4oz	128	Johnson, Aaron S	I	280-10311	04/30/10 01:16
280-2756	2	J19WL8	Solid	280-126046	280-2756-C-2	Soil jar 4oz	OP Dpt	Johnson, Aaron S	I	280-10172	04/29/10 15:27
280-2756	2	J19WL8	Solid	280-126046	280-2756-C-2	Soil jar 4oz	128	Skrip, Sean P	I	280-9923	04/28/10 15:52
280-2756	2	J19WL8	Solid	280-126046	280-2756-C-2	Soil jar 4oz	OP Dpt	Skrip, Sean P	I	280-9812	04/28/10 09:27
280-2756	2	J19WL8	Solid	280-134360	280-2756-C-2-A						

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SECTION 24

ASSURING THE QUALITY OF TEST RESULTS

24.1 Overview

In order to assure our clients of the validity of their data, the laboratory continuously evaluates the quality of the analytical process. The analytical process is controlled not only by instrument calibration as discussed in Section 20, but also by routine process quality control measurements (e.g. Blanks, Laboratory Control Samples (LCS), Matrix Spikes (MS), duplicates (DUP), surrogates, Internal Standards (IS)). These quality control checks are performed as required by the method or regulations to assess precision and accuracy. Quality control samples are to be treated in the exact same manner as the associated field samples being tested. In addition to the routine process quality control samples, Proficiency Testing (PT) Samples (concentrations unknown to laboratory) are analyzed to help ensure laboratory performance.

24.2 Controls

Sample preparation or pre-treatment is commonly required before analysis. Typical preparation steps include homogenization, solvent extraction, sonication, acid digestion, filteration, distillation, reflux, evaporation, drying and ashing. During these pre-treatment steps, samples are arranged into discreet manageable groups referred to as preparation (prep) batches. Prep batches provide a means to control variability in sample treatment. Control samples are added to each prep batch to monitor method performance and are processed through the entire analytical procedure with investigative/field samples.

24.3 Negative Controls

Table 24-1. Negative Controls

Control Type	Details
Method Blank (MB)	are used to assess preparation and analysis for possible contamination during the preparation and processing steps.
	The specific frequency of use for method blanks during the analytical sequence is defined in the specific standard operating procedure for each analysis. Generally it is 1 for each batch of samples; not to exceed 20 environmental samples.
	The method blank is prepared from a clean matrix similar to that of the associated samples that is free from target analytes (e.g., Reagent water, Ottawa sand, glass beads, etc.) and is processed along with and under the same conditions as the associated samples. The method blank goes through all of the steps of the process (including as necessary: filtration, clean-ups, etc.).
	Reanalyze or qualify associated sample results when the concentration of a targeted analyte in the blank is at or above the reporting limit as established by the method or by regulation, AND is greater than 1/10 of the amount measured in the sample.
Calibration Blanks	are prepared and analyzed along with calibration standards where applicable. They are prepared using the same reagents that are used to prepare the standards. In some analyses the calibration blank may be included in the calibration curve.

Table 24-1. Negative Controls

Control Type	Details
Instrument Blanks	are blank reagents or reagent water that may be processed during an analytical sequence in order to assess contamination in the analytical system. In general, instrument blanks are used to differentiate between contamination caused by the analytical system and that caused by the sample handling or sample prep process. Instrument blanks may also be inserted throughout the analytical sequence to minimize the effect of carryover from samples with high analyte content.
Trip Blank [1]	are required to be submitted by the client with each shipment of samples requiring aqueous and solid volatiles analyses (or as specified in the client's project plan). Additionally, trip blanks may be prepared and analyzed for volatile analysis of air samples, when required by the client. A trip blank may be purchased (certified clean) or is prepared by the laboratory by filling a clean container with pure deionized water that has been purged to remove any volatile compounds. Appropriate preservatives are also added to the container. The trip blank is sent with the bottle order and is intended to reflect the environment that the containers are subjected to throughout shipping and handling and help identify possible sources if contamination is found. The field sampler returns the trip blank in the cooler with the field samples.
Field Blanks [1]	are sometimes used for specific projects by the field samplers. A field blank prepared in the field by filling a clean container with pure reagent water and appropriate preservative, if any, for the specific sampling activity being undertaken. (EPA OSWER)
Equipment Blanks [1]	are also sometimes created in the field for specific projects. An equipment blank is a sample of analyte-free media which has been used to rinse common sampling equipment to check effectiveness of decontamination procedures. (TNI)
Holding Blanks	also referred to as refrigerator or freezer blanks, are used to monitor the sample storage units for volatile organic compounds during the storage of VOA samples in the laboratory

[1] When known, these field QC samples should not be selected for matrix QC as it does not provide information on the behavior of the target compounds in the field samples. Usually, the client sample ID will provide information to identify the field blanks with labels such as "FB", "EB", or "TB."

Evaluation criteria and corrective action for these controls are defined in the specific standard operating procedure for each analysis. Also further detail is provided in SOP No. PT-QA-021.

24.4 Positive Controls

Control samples (e.g., QC indicators) are analyzed with each batch of samples to evaluate data based upon (1) Method Performance (Laboratory Control Sample (LCS) or Blank Spike (BS)), which entails both the preparation and measurement steps; and (2) Matrix Effects (Matrix Spike (MS) or Sample Duplicate (MD, DUP), which evaluates field sampling accuracy, precision, representativeness, interferences, and the effect of the matrix on the method performed. Each regulatory program and each method within those programs specify the control samples that are prepared and/or analyzed with a specific batch

Note that frequency of control samples vary with specific regulatory, methodology and project specific criteria. Complete details on method control samples are as listed in each analytical SOP.

24.4.1 Method Performance Control - Laboratory Control Sample (LCS)

24.4.1.1 The LCS measures the accuracy of the method in a blank matrix and assesses method performance independent of potential field sample matrix affects in a laboratory batch.

24.4.1.2 The LCS is prepared from a clean matrix similar to that of the associated samples that is free from target analytes (for example: Reagent water, Ottawa sand, glass beads, etc.) and is processed along with and under the same conditions as the associated samples. The LCS is spiked with verified known amounts of analytes or is made of a material containing known and verified amounts of analytes, taken through all preparation and analysis steps along with the field samples. Where there is no preparation taken for an analysis (such as in aqueous volatiles), or when all samples and standards undergo the same preparation and analysis process (such as Phosphorus), a calibration verification standard may be reported as the LCS. In some instances where there is no practical clean solid matrix available, aqueous LCS's may be processed for solid matrices; final results may be calculated as mg/kg or ug/kg, assuming 100% solids and a weight equivalent to the aliquot used for the corresponding field samples, to facilitate comparison with the field samples.

24.4.1.3 Certified pre-made reference material purchased from a NIST/A2LA accredited vendor may also be used for the LCS when the material represents the sample matrix or the analyte is not easily spiked (e.g. solid matrix LCS for metals, TDS, etc.).

24.4.1.4 The specific frequency of use for LCS during the analytical sequence is defined in the specific standard operating procedure for each analysis. It is generally 1 for each batch of samples; not to exceed 20 environmental samples.

24.4.1.5 If the mandated or requested test method, or project requirements, do not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample (and Matrix Spike) where applicable (e.g. no spike of pH). However, in cases where the components interfere with accurate assessment (such as simultaneously spiking chlordane, toxaphene and PCBs in Method 608), the test method has an extremely long list of components or components are incompatible, at a minimum, a representative number of the listed components (see below) shall be used to control the test method. The selected components of each spiking mix shall represent all chemistries, elution patterns and masses, permit specified analytes and other client requested components. However, the laboratory shall ensure that all reported components are used in the spike mixture within a two-year time period. For DoD requirements refer to SOP PT-QA-029.

- For methods that have 1-10 target analytes, spike all components.
- For methods that include 11-20 target analytes, spike at least 10 or 80%, whichever is greater.
- For methods with more than 20 target analytes, spike at least 16 components.
- Exception: Due to analyte incompatibility in pesticides, Toxaphene and Chlordane are only spiked at client request based on specific project needs.

- Exception: Due to analyte incompatibility between the various PCB aroclors, aroclors 1016 and 1260 are used for spiking as they cover the range of all of the aroclors. Specific aroclors may be used by request on a project specific basis.

24.5 Sample Matrix Controls

Table 24-2. Sample Matrix Control

Control Type	Details	
Matrix Spikes (MS)	Use	used to assess the effect sample matrix of the spiked sample has on the precision and accuracy of the results generated by the method used;
	Typical Frequency [1]	At a minimum, with each matrix-specific batch of samples processed, an MS is carried through the complete analytical procedure. Unless specified by the client, samples used for spiking are randomly selected and rotated between different client projects. If the mandated or requested test method does not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample and Matrix Spike. Refer to the method SOP for complete details
	Description	essentially a sample fortified with a known amount of the test analyte(s).
Surrogate	Use	Measures method performance to sample matrix (organics only).
	Typical Frequency [1]	Are added to all samples, standards, and blanks, for all organic chromatography methods except when the matrix precludes its use or when a surrogate is not available. The recovery of the surrogates is compared to the acceptance limits for the specific method. Poor surrogate recovery may indicate a problem with sample composition and shall be reported, with data qualifiers, to the client whose sample produced poor recovery.
	Description	Are similar to matrix spikes except the analytes are compounds with properties that mimic the analyte of interest and are unlikely to be found in environment samples.
Duplicates[2]	Use	For a measure of analytical precision, with each matrix-specific batch of samples processed, a matrix duplicate (MD or DUP) sample, matrix spike duplicate (MSD), or LCS duplicate (LCSD) is carried through the complete analytical procedure.
	Typical Frequency [1]	Duplicate samples are usually analyzed with methods that do not require matrix spike analysis.
	Description	Performed by analyzing two aliquots of the same field sample independently or an additional LCS.
Internal Standards	Use	Are spiked into all environmental and quality control samples (including the initial calibration standards) to monitor the qualitative aspect of organic and some inorganic analytical measurements.
	Typical Frequency [1]	All organic and ICP methods as required by the analytical method.
	Description	Used to correct for matrix effects and to help troubleshoot variability in analytical response and are assessed after data acquisition. Possible sources of poor internal standard response are sample matrix, poor analytical technique or instrument performance.

[1] See the specific analytical SOP for type and frequency of sample matrix control samples.

[2] LCSD's are normally not performed except when regulatory agencies or client specifications require them. The recoveries for the spiked duplicate samples must meet the same laboratory established recovery limits as the accuracy QC samples. If an LCSD is analyzed both the LCS and LCSD must meet the same recovery criteria and be included in the final report. The precision measurement is reported as "Relative Percent Difference" (RPD). Poor precision between duplicates (except LCS/LCSD) may indicate non-homogeneous matrix or sampling.

24.6 Acceptance Criteria (Control Limits)

24.6.1 As mandated by the test method and regulation, each individual analyte in the LCS, MS, or Surrogate Spike is evaluated against the control limits published in the test method. Where there are no established acceptance criteria, the laboratory calculates in-house control limits with the use of control charts or, in some cases, utilizes client project specific control limits. When this occurs, the regulatory or project limits will supersede the laboratory's in-house limits.

Note: For methods, analytes and matrices with very limited data (e.g., unusual matrices not analyzed often), interim limits are established using available data or by analogy to similar methods or matrices.

24.6.2 Once control limits have been established, they are verified, reviewed, and updated if necessary on an annual basis unless the method requires more frequent updating. Control limits are established per method (as opposed to per instrument) regardless of the number of instruments utilized.

24.6.3 Laboratory generated % Recovery acceptance (control) limits are generally established by taking $\pm$ 3 Standard Deviations (99% confidence level) from the average recovery of a minimum of 20-30 data points (more points are preferred).

24.6.3.1 Regardless of the calculated limit, the limit should be no tighter than the Calibration Verification (ICV/CCV). (Unless the analytical method specifies a tighter limit).

24.6.3.2 In-house limits cannot be any wider than those mandated in a regulated analytical method. Client or contract required control limits are evaluated against the laboratory's statistically derived control limits to determine if the data quality objectives (DQOs) can be achieved. If laboratory control limits are not consistent with DQOs, then alternatives must be considered, such as method improvements or use of an alternate analytical method.

24.6.3.3 The lowest acceptable recovery limit will be 10% (the analyte must be detectable and identifiable). Exception: The lowest acceptable recovery limit for Benzidine will be 5% and the analyte must be detectable and identifiable.

24.6.3.4 The maximum acceptable recovery limit will be 150%.

24.6.3.5 The maximum acceptable RPD limit will be 35% for waters and 40% for soils. The minimum RPD limit is 10%.

24.6.3.6 If either the high or low end of the control limit changes by $\leq$ 5% from previous, the control chart is visually inspected and, using professional judgment, they may be left unchanged if there is no affect on laboratory ability to meet the existing limits.

24.6.4 The lab must be able to generate a current listing of their control limits and track when the updates are performed. In addition, the laboratory must be able to recreate historical control limits. Refer to laboratory SOP No. PT-QA-021.

24.6.4.1 The Reference Data Summary generated from LIMS shows the precision and accuracy acceptability limits for analyses performed. This summary includes an

effective date, is updated each time new limits are generated and is located in LIMS. Unless otherwise noted, limits are laboratory generated. The analysts are instructed to use the current limits in the laboratory (dated and approved by the Team Leader/Area Supervisor and QA Manager) and entered into the Laboratory Information Management System (LIMS). Further details are described in Pittsburgh SOP No. PT-QA-021.

24.6.5 A LCS that is within the acceptance criteria establishes that the analytical system is in control and is used to validate the process. Samples that are analyzed with an LCS with recoveries outside of the acceptance limits may be determined as out of control and should be reanalyzed if possible. If reanalysis is not possible, then the results for all affected analytes for samples within the same batch must be qualified when reported. The internal corrective action process (see Section 12) is also initiated if an LCS exceeds the acceptance limits. Sample results may be qualified and reported without reanalysis if:

24.6.5.1 The analyte results are below the reporting limit and the LCS is above the upper control limit.

24.6.5.2 If the analytical results are above the relevant regulatory limit and the LCS is below the lower control limit. For further detail refer to SOP PT-QA-021 and method specific SOPs. For DoD requirements refer to SOPs PT-QA-25 and PT-QA-029.

24.6.6 If the MS/MSDs do not meet acceptance limits, the MS/MSD and the associated spiked sample is reported with a qualifier for those analytes that do not meet limits. If obvious preparation errors are suspected, or if requested by the client, unacceptable MS/MSDs are reprocessed and reanalyzed to prove matrix interference. A more detailed discussion of acceptance criteria and corrective action can be found in the lab's method SOPs and in Section 12.

24.6.7 If a surrogate standard falls outside the acceptance limits, if there is not obvious chromatographic matrix interference, reanalyze the sample to confirm a possible matrix effect. If the recoveries confirm or there was obvious chromatographic interference, results are reported from the original analysis and a qualifier is added. If the reanalysis meets surrogate recovery criteria, the second run is reported (or both are reported if requested by the client). Under certain circumstances, where all of the samples are from the same location and share similar chromatography, the reanalysis may be performed on a single sample rather than all of the samples and if the surrogate meets the recovery criteria in the reanalysis, all of the affected samples would require reanalysis.

24.7 ADDITIONAL PROCEDURES TO ASSURE QUALITY CONTROL

24.7.1 The laboratory has written and approved method SOPs to assure the accuracy of the test method including calibration (see Section 20), use of certified reference materials (see Section 21) and use of PT samples (see Section 15).

24.7.2 A discussion regarding MDLs, Limit of Detection (LOD) and Limit of Quantitation (LOQ) can be found in Section 19.

24.7.3 Use of formulae to reduce data is discussed in the method SOPs and in Section 20.

24.7.4 Selection of appropriate reagents and standards is included in Section 9 and 21.

24.7.5 A discussion on selectivity of the test is included in Section 5.

24.7.6 Constant and consistent test conditions are discussed in Section 18.

24.7.7 The laboratories sample acceptance policy is included in Section 23.

SECTION 25

REPORTING RESULTS

25.1 Overview

The results of each test are reported accurately, clearly, unambiguously, and objectively in accordance with State and Federal regulations as well as client requirements. Analytical results are issued in a format that is intended to satisfy customer and laboratory accreditation requirements as well as provide the end user with the information needed to properly evaluate the results. Where there is conflict between client requests and laboratory ethics or regulatory requirements, the laboratory's ethical and legal requirements are paramount, and the laboratory will work with the client during project set up to develop an acceptable solution. Refer to Section 7. A variety of report formats are available to meet specific needs.

In cases where a client asks for simplified reports, there must be a written request from the client. There still must be enough information that would show any analyses that were out of conformance (QC out of limits) and there should be a reference to a full report that is made available to the client.

Review of reported data is included in Section 19.

25.2 Test Reports

Analytical results are reported in a format that is satisfactory to the client and meets all requirements of applicable accrediting authorities and agencies. A variety of report formats are available to meet specific needs. The report is printed on laboratory letterhead, reviewed, and signed by the appropriate project manager. At a minimum, the standard laboratory report shall contain the following information:

25.2.1 A report title (e.g. Analytical Report) on the cover page with a "Result" column header on the sample result page.

25.2.2 Each report cover page printed on company letterhead, which includes the laboratory name, address and telephone number.

25.2.3 A unique identification of the report (e.g. job Number) and on each page an identification in order to ensure the page is recognized as part of the report and a clear identification of the end.

Note: Page numbers of report are represented as page # of ## at the bottom of the page. Where the first number is the page number and the second is the total number of pages.

25.2.4 A copy of the chain of custody (COC).

- Any COCs involved with Subcontracting are included.
- The applicable COC is paginated and it is an integral part of the report.
- Any additional addendum to the report must be treated in a similar fashion so it is a recognizable part of the report and cannot accidentally get separated from the report (eg. Sampling information)

25.2.5 The name and address of client and a project name/number, if applicable.

25.2.6 Client project manager or other contact

25.2.7 Description and unambiguous identification of the tested sample(s) including the client identification code.

25.2.8 Date of receipt of sample, date and time of collection, and date(s) and time of test preparation and performance, and time of preparation or analysis if the required holding time for either activity is less than or equal to 72 hours.

25.2.9 Date reported or date of revision, if applicable.

25.2.10 Method of analysis including method code (EPA, Standard Methods, etc).

25.2.11 Reporting Limit.

25.2.12 Method detection limits (if requested)

25.2.13 Definition of Data qualifiers and reporting acronyms (e.g. ND).

25.2.14 Sample results.

25.2.15 QC data consisting of method blank, surrogate, LCS, and MS/MSD recoveries and control limits are included unless the client specifies they do not require reporting the QC.

25.2.16 Condition of samples at receipt including temperature. This may be accomplished in a narrative or by attaching sample login sheets (Refer to Sec. 25.2.4 – Item 3 regarding additional addenda). The temperature is documented on the sample receipt checklist and noted in the report case narrative.

25.2.17 A statement expressing the validity of the results, that the source methodology was followed and all results were reviewed for error.

25.2.18 A statement to the effect that the results relate only to the items tested and the sample as received by the laboratory.

25.2.19 A statement that the report shall not be reproduced except in full, without prior express written approval by the laboratory coordinator .

25.2.20 A signature and title of the person(s) accepting responsibility for the content of the report and date of issue. Signatories are appointed by the Lab Director.

25.2.21 When TNI accreditation is required, the lab shall certify that the test results meet all requirements of TNI or provide reasons and/or justification if they do not.

25.2.22 If applicable, the laboratory includes a cover letter.

25.2.23 Where applicable, a narrative to the report that explains the issue(s) and corrective action(s) taken in the event that a specific accreditation or certification requirement was not met.

25.2.24 When soil samples are analyzed, a specific identification as to whether soils are reported on a "wet weight" or "dry weight" basis.

25.2.25 Appropriate laboratory certification number for the state of origin of the sample, if applicable.

25.2.26 If only part of the report is provided to the client (client requests some results before all of it is complete), it must be clearly indicated on the report (e.g., preliminary report). A complete report must be sent once all of the work has been completed.

25.2.27 Any non-TestAmerica subcontracted analysis results are provided as a separate report on the official letterhead of the subcontractor. All TestAmerica subcontracting is clearly identified on the report as to which laboratory performed a specific analysis.

25.2.28 A clear statement notifying the client that non-accredited tests were performed and directing the client to the laboratory's accreditation certificates of approval shall be provided when non-accredited tests are included in the report.

Note: Refer to the Corporate SOP on Electronic Reporting and Signature Policy (No. CA-I-P-002) for details on internally applying electronic signatures of approval.

25.3 Reporting Level Or Report Type

The laboratory offers four levels of quality control reporting. Each level, in addition to its own specific requirements, contains all the information provided in the preceding level. The packages provide the following information in addition to the information described above:

- Level I is a report with the features described in Section 25.2 above.
- Level II is a Level I report plus summary information, including results for the method blank reported to the laboratory MDL, percent recovery for laboratory control samples and matrix spike samples, and the RPD values for all MSD and sample duplicate analyses.
- Level III contains all the information supplied in Level II, but presented on the CLP-like summary forms, and relevant calibration information. A Level II report is not included, unless specifically requested. No raw data is provided.
- Level IV is the same as Level III with the addition of all raw supporting data.

In addition to the various levels of QC packaging, the laboratory also provides reports in diskette deliverable form. Initial reports may be provided to clients by facsimile. All faxed reports are followed by hardcopy. Procedures used to ensure client confidentiality are outlined in Section 25.6.

25.3.1 Electronic Data Deliverables (EDDs)

EDDs are routinely offered as part of TestAmerica's services. Pittsburgh offers a variety of EDD formats including Excel, CSV or as requested by the client.

EDD specifications are submitted to the IT department by the PM for review and undergo the contract review process. Once the facility has committed to providing data in a specific electronic format, the coding of the format may need to be performed. This coding is documented and validated. The validation of the code is retained by the IT staff coding the EDD.

EDDs shall be subject to a review to ensure their accuracy and completeness. If EDD generation is automated, review may be reduced to periodic screening if the laboratory can demonstrate that it can routinely generate that EDD without errors. Any revisions to the EDD format must be reviewed until it is demonstrated that it can routinely be generated without errors. If the EDD can be reproduced accurately and if all subsequent EDDs can be produced error-free, each EDD does not necessarily require a review.

25.4 Supplemental Information For Test

The lab identifies any unacceptable QC analyses or any other unusual circumstances or observations such as environmental conditions and any non-standard conditions that may have affected the quality of a result. This is typically in the form of a footnote or a qualifier and/or a narrative explaining the discrepancy in the front of the report.

25.4.1 Numeric results with values outside of the calibration range, either high or low are qualified as ‘estimated’.

25.4.2 Where quality system requirements are not met, a statement of compliance/non-compliance with requirements and/or specifications is required, including identification of test results derived from any sample that did not meet TNI sample acceptance requirements such as improper container, holding time, or temperature.

25.4.3 Where applicable, a statement on the estimated uncertainty of measurements; information on uncertainty is needed when a client’s instructions so require.

25.4.4 Opinions and Interpretations - The test report contains objective information, and generally does not contain subjective information such as opinions and interpretations. If such information is required by the client, the Laboratory Director will determine if a response can be prepared. If so, the Laboratory Director will designate the appropriate member of the management team to prepare a response. The response will be fully documented, and reviewed by the Laboratory Director, before release to the client. There may be additional fees charged to the client at this time, as this is a non-routine function of the laboratory.

Note: Review of data deliverable packages for submittal to regulatory authorities requires responses to non-conforming data concerning potential impact on data quality. This necessitates a limited scope of interpretation, and this work is performed by the Manager(s)/Team Leaders or as assigned by the lab Director. This is the only form of “interpretation” of data that is routinely performed by the laboratory.

When opinions or interpretations are included in the report, the laboratory provides an explanation as to the basis upon which the opinions and interpretations have been made. Opinions and interpretations are clearly noted as such and where applicable, a comment should be added suggesting that the client verify the opinion or interpretation with their regulator.

25.5 Environmental Testing Obtained From Subcontractors

If the laboratory is not able to provide the client the requested analysis, the samples would be subcontracted following the procedures outlined in the Corporate SOP on Subcontracting (SOP # CA-L-S-002).

Data reported from analyses performed by a subcontractor laboratory are clearly identified as such on the analytical report provided to the client. Results from a subcontract laboratory outside of TestAmerica are reported to the client on the subcontract laboratory's original report stationary and the report includes any accompanying documentation.

For DoD projects the subcontractor laboratories used must have an established and documented laboratory quality system that complies with DoD QSM requirements. The subcontractor laboratories will be evaluated according to SOP # CA-L-S-002, Subcontracting Procedures.,. The subcontractor laboratory must receive project-specific approval from the DoD client before any samples are analyzed as per DoD QSM, Version 3.0 & 4.2, Section 4.5.

25.6 Client Confidentiality

In situations involving the transmission of environmental test results by telephone, facsimile or other electronic means, client confidentiality must be maintained.

TestAmerica will not intentionally divulge to any person (other than the Client or any other person designated by the Client in writing) any information regarding the services provided by TestAmerica or any information disclosed to TestAmerica by the Client. Furthermore, information known to be potentially endangering to national security or an entity's proprietary rights will not be released.

Note: This shall not apply to the extent that the information is required to be disclosed by TestAmerica under the compulsion of legal process. TestAmerica will, to the extent feasible, provide reasonable notice to the client before disclosing the information.

Note: Authorized representatives of an accrediting authority are permitted to make copies of any analyses or records relevant to the accreditation process, and copies may be removed from the laboratory for purposes of assessment.

25.6.1 Report deliverable formats are discussed with each new client. If a client requests that reports be faxed or e-mailed, the reports are faxed with a cover sheet or e-mailed with the following note that includes a confidentiality statement similar to the following:

This material is intended only for the use of the individual(s) or entity to whom it is addressed, and may contain information that is privileged and confidential. If you are not the intended recipient, or the employee or agent responsible for delivering this material to the intended recipient, you are hereby notified that any dissemination, distribution or copying of this communication is strictly prohibited. If you have received this communication in error, please notify us immediately by telephone at the 1-800-765-0980 (or for e-mails: please notify us immediately by e-mail or by phone (1-800-765-0980) and delete this material from any computer.

25.7 Format Of Reports

The format of reports is designed to accommodate each type of environmental test carried out and to minimize the possibility of misunderstanding or misuse.

25.8 Amendments To Test Reports

Corrections, additions, or deletions to reports are only made when justification arises through supplemental documentation. Justification is documented using the laboratory's corrective action system (refer to Section 12).

The revised report is retained on the data server, as is the original report. The revised report is stored in the data server under the job number followed by "Rev (n)" where 'n' is the revision number. The revised report will have the words "Revision (n)" on the report cover page beneath the report date. Additionally, a section entitled "Revised Report" will appear on the Case Narrative page. A brief explanation of the reasons of the re-issue will be included in this section.

25.9 Policies On Client Requests For Amendments

25.9.1 Policy on Data Omissions or Reporting Limit Increases

Fundamentally, our policy is simply to not omit previously reported results (including data qualifiers) or to not raise reporting limits and report sample results as ND. This policy has few exceptions. Exceptions are:

- Laboratory error.
- Sample identification is indeterminate (confusion between COC and sample labels).
- An incorrect analysis (not analyte) was requested (e.g., COC lists 8315 but client wanted 8310). A written request for the change is required.
- Incorrect limits reported based on regulatory requirements.
- The requested change has absolutely *no possible* impact on the interpretation of the analytical results and there is *no possibility* of the change being interpreted as misrepresentation by anyone inside or outside of our company.

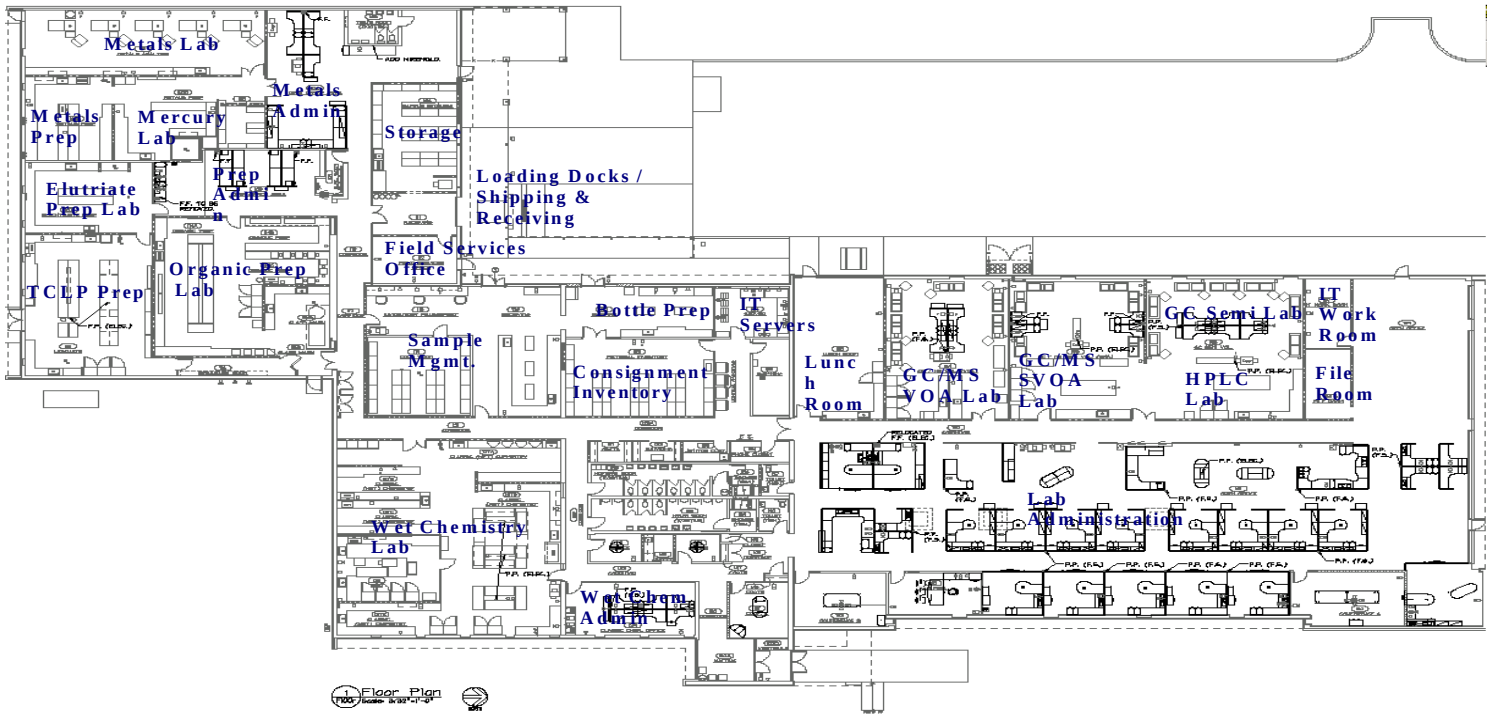
25.9.2 Multiple Reports

TestAmerica does not issue multiple reports for the same Lot number where there is different information on each report (this does not refer to copies of the same report) unless required to meet regulatory needs and approved by QA.

Appendix 1.

Laboratory Floor Plan

Pittsburgh Lab Floor Plan



Key Areas
- GC/MS VOA (Volatiles)
- GC/MS SVOA (Semivolatiles)
- GC Semi Lab
- HPLC Lab
- Organic Prep Lab
- Wet / General Chemistry
- Metals & Mercury Lab
- Elutriate Lab
- TCLP Prep
- Bottle Prep
- Sample Control/ Sample Receiving
- Field Services

301 Alpha Drive, Pittsburgh PA 15238

Appendix 2. Glossary/Acronyms

Glossary:

Acceptance Criteria:
Specified limits placed on characteristics of an item, process, or service defined in requirement documents. (ASQC)

Accreditation:
The process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory.

Accuracy:
The degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator. (QAMS)

Analyst:
The designated individual who performs the "hands-on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality. (TNI)

Analytical Uncertainty:
A subset of Measurement Uncertainty that includes all laboratory activities performed as part of the analysis. (TNI)

Assessment: The evaluation process used to measure or establish the performance, effectiveness, and conformance of an organization and/or its systems to defined criteria (to the standards and requirements of laboratory accreditation). (TNI)

Audit: A systematic and independent examination of facilities, equipment, personnel, training, procedures, record-keeping, data validation, data management, and reporting aspects of a system to determine whether QA/QC and technical activities are being conducted as planned and whether these activities will effectively achieve quality objectives. (TNI)

Batch:
Environmental samples which are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A **preparation batch** is composed of one to 20 environmental samples of the same matrix, meeting the above mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 24 hours. An **analytical batch** is composed of prepared environmental samples (extracts, digestates or concentrates) which are analyzed together as a group. An analytical batch can include prepared samples originating from various quality system matrices and can exceed twenty (20) samples. (TNI)

Bias: The systematic or persistent distortion of a measurement process, which causes errors in one direction (i.e., the expected sample measurement is different from the sample's true value). (TNI)

Blank:
A sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results. (ASQC)

Calibration:
A set of operations that establish, under specified conditions, the relationship between values of quantities indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material, and the corresponding values realized by standards. (TNI)

1) In calibration of support equipment the values realized by standards are established through the use of reference standards that are traceable to the International System of Units (SI).

2) In calibration according to methods, the values realized by standards are typically established through the use of Reference Materials that are either purchased by the laboratory with a certificate of analysis or purity, or prepared by the laboratory using support equipment that has been calibrated or verified to meet specifications.

Calibration Curve:
The mathematical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response. (TNI)

Calibration Standard:
A substance or reference material used to calibrate an instrument (QAMS)

Certified Reference Material (CRM):
A reference material, accompanied by a certificate, having a value, measurement uncertainty, and stated metrological traceability chain to a national metrology institute. (TNI)

Chain of Custody (COC) Form**:** Record that documents the possession of the samples from the time of collection to receipt in the laboratory. This record generally includes: the number and types of containers; the mode of collection; the collector; time of collection; preservation; and requested analyses. (TNI)

Compromised Samples:
Those samples which are improperly sampled, insufficiently documented (chain of custody and other sample records and/or labels), improperly preserved, collected in improper containers, or exceeding holding times when delivered to a laboratory. Under normal conditions, compromised samples are not analyzed. If emergency situation require analysis, the results must be appropriately qualified.

Confidential Business Information (CBI):
Information that an organization designates as having the potential of providing a competitor with inappropriate insight into its management, operation or products. TNI and its representatives agree to safeguarding identified CBI and to maintain all information identified as such in full confidentiality.

Confirmation:
Verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited to Second Column Confirmation; Alternate wavelength; Derivatization; Mass spectral interpretation; Alternative detectors or Additional Cleanup procedures. (TNI)

Conformance:
An affirmative indication or judgment that a product or service has met the requirements of the relevant specifications, contract, or regulation; also the state of meeting the requirements. (ANSI/ASQC E4-1994)

Correction: Actions necessary to correct or repair analysis specific non-conformances. The acceptance criteria for method specific QC and protocols as well as the associated corrective actions. The analyst will most frequently be the one to identify the need for this action as a result of calibration checks and QC sample analysis**.** No significant action is taken to change behavior, process or procedure.

Corrective Action:
The action taken to eliminate the causes of an existing nonconformity, defect or other undesirable situation in order to prevent recurrence. (ISO 8402)

Data Audit:
A qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data re of acceptable quality (i.e., that they meet specified acceptance criteria). (TNI)

Data Reduction:
The process of transforming the number of data items by arithmetic or statistical calculations, standard curves, and concentration factors, and collation into a more useable form. (TNI)

Deficiency:
An unauthorized deviation from acceptable procedures or practices, or a defect in an item. (ASQC)

Demonstration of Capability: A procedure to establish the ability of the analyst to generate analytical results of acceptable accuracy and precision. (TNI)

Document Control:
The act of ensuring that documents (and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly, and controlled to ensure use of the correct version at the location where the prescribed activity if performed. (ASQC)

Duplicate Analyses:
The analyses or measurements of the variable of interest performed identically on two subsamples of the same sample. The results from duplicate analyses are used to evaluate analytical or measurement precision but not the precision of sampling, preservation or storage internal to the laboratory. (EPA-QAD)

Equipment Blank:
Sample of analyte-free media which has been used to rinse common sampling equipment to check effectiveness of decontamination procedures.

External Standard Calibration:
Calibrations for methods that do not utilize internal standards to compensate for changes in instrument conditions.

Field Blank:
Blank prepared in the field by filing a clean container with pure de-ionized water and appropriate preservative, if any, for the specific sampling activity being undertaken (EPA OSWER)

Field of Accreditation:
Those matrix, technology/method, and analyte combinations for which the accreditation body offers accreditation.

Holding Times :
The maximum times that samples may be held prior to analyses and still be considered valid or not compromised. (40 CFR Part 136)

Internal Standard:
A known amount of standard added to a test portion of a sample as a reference for evaluating and controlling the precision and bias of the applied analytical test method. (TNI)

Internal Standard Calibration:
Calibrations for methods that utilize internal standards to compensate for changes in instrument conditions.

Instrument Blank:
A clean sample (e.g., distilled water) processed through the instrumental steps of the measurement process; used to determine instrument contamination. (EPA-QAD)

Instrument Detection Limit (IDL): The minimum amount of a substance that can be measured with a specified degree of confidence that the amount is greater than zero using a specific instrument. The IDL is associated with the instrumental portion of a specific method only, and sample preparation steps are not considered in its derivation. The IDL is a statistical estimation at a specified confidence interval of the concentration at which the relative uncertainty is ± 100%. The IDL represents a range where qualitative detection occurs on a specific instrument. Quantitative results are not produced in this range.

Laboratory Control Sample (however named, such as laboratory fortified blank, spiked blank, or QC check sample):
A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes, taken through all preparation and analysis steps of the procedure unless otherwise noted in a reference method. It is generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system.

An LCS shall be prepared at a minimum of 1 per batch of 20 or less samples per matrix type per sample extraction or preparation method except for analytes for which spiking solutions are not available such as total suspended solids, total dissolved solids, total volatile solids, total solids, pH, color, odor, temperature, dissolved oxygen or turbidity. The results of these samples shall be used to determine batch acceptance.

Least Squares Regression (1st Order Curve):
The least squares regression is a mathematical calculation of a straight line over two axes. The y axis represents the instrument response (or Response ratio) of a standard or sample and the x axis represents the concentration. The regression calculation will generate a correlation coefficient (r) that is a measure of the "goodness of fit" of the regression line to the data. A value of 1.00 indicates a perfect fit. In order to be used for quantitative purposes, r must be greater than or equal to 0.99 for organics and 0.995 for inorganics.

Limit of Detection (LOD):
[a.k.a., Method Detection Limit (MDL]: A laboratory's estimate of the minimum amount of an analyte in a given matrix that an analytical process can reliably detect in their facility. (TNI)

LOD Verification [a.k.a., MDL Verification]**:** A processed QC sample in the matrix of interest, spiked with the analyte at no more than 3X the LOD for single analyte tests and 4X the LOD for multiple analyte tests and processed through the entire analytical procedure.

Limit(s) of Quantitation (LOQ) [a.k.a., Reporting Limit]: The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. (TNI)

(QS) Matrix:
The component or substrate that contains the analyte of interest. For purposes of batch and QC requirement determinations, the following matrix distinctions shall be used:

> Aqueous: Any aqueous sample excluded from the definition of Drinking Water or Saline/Estuarine. Includes surface water, groundwater, effluents, and TCLP or other extracts.

Drinking Water: any aqueous sample that has been designated as a potable or potential potable water source.

Saline/Estuarine: any aqueous sample from an ocean or estuary, or other salt water source such as the Great Salt Lake.

Non-aqueous Liquid: any organic liquid with <15% settleable solids.

Biological Tissue: any sample of a biological origin such as fish tissue, shellfish, or plant material. Such samples shall be grouped according to origin.

Solids: includes soils, sediments, sludges, and other matrices with >15% settleable solids.

Chemical Waste: a product or by-product of an industrial process that results in a matrix not previously defined.

Air *& Emissions*: whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas or vapor that are collected with a sorbant tube, impinger solution, filter, or other device. (TNI)

Matrix Spike (spiked sample or fortified sample):

A sample prepared, taken through all sample preparation and analytical steps of the procedure unless otherwise noted in a referenced method, by adding a known amount of target analyte to a specified amount of sample for which an independent test result of target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency.

Matrix Spike Duplicate (spiked sample or fortified sample duplicate):
A replicate matrix spike prepared and analyzed to obtain a measure of the precision of the recovery for each analyte.

Method Blank:
A sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses.

Method Detection Limit:
The minimum concentration of a substance (an analyte) that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. (40 CFR Part 136, Appendix B)

Negative Control:
Measures taken to ensure that a test, its components, or the environment do not cause undesired effects, or produce incorrect test results.

Non-conformance**:** An indication, judgment, or state of not having met the requirements of the relevant specifications, contract, or regulation.

Performance Audit:
The routine comparison of independently obtained qualitative and quantitative measurement system data with routinely obtained data in order to evaluate the proficiency of an analyst or laboratory.

Positive Control:
Measures taken to ensure that a test and/or its components are working properly and producing correct or expected results from positive test subjects.

Precision:
The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms.

Preservation:
Any conditions under which a sample must be kept in order to maintain chemical and/or biological integrity prior to analysis. (TNI)

Proficiency Testing:
A means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source. (TNI)

Proficiency Testing Program:
The aggregate of providing rigorously controlled and standardized environmental samples to a laboratory for analysis, reporting of results, statistical evaluation of the results and the collective demographics and results summary of all participating laboratories. (TNI)

Proficiency Test Sample (PT):
A sample, the composition of which is unknown to the laboratory and is provided to test whether the analyst/laboratory can produce analytical results within specified acceptance criteria. (TNIS)

Quality Assurance:
An integrated system of management activities involving planning, implementation, assessment,~~—~~ reporting and quality improvement to ensure that a process, item, ~~product~~ or service is of the type of quality needed and expected by the client. (TNI)

Quality Assurance [Project] Plan (QAPP):
A formal document describing the detailed quality control procedures by which the quality requirements defined for the data and decisions pertaining to a specific project are to be achieved. (EAP-QAD)

Quality Control:
The overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer; operational techniques and activities that are used to fulfill requirements for quality; also the system of activities and checks used to ensure that measurement systems are maintained within prescribed limits, providing protection against "out of control" conditions and ensuring that the results are of acceptable quality. (TNI)

Quality Control Sample:
A sample used to assess the performance of all or a portion of the measurement system. One of any number of samples, such as Certified Reference Materials, a quality system matrix fortified by spiking, or actual samples fortified by spiking, intended to demonstrate that a measurement system or activity is in control. (TNI)

Quality Manual:
A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users. (TNI)

Quality System:
A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), 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 activities. (TNI)

Raw Data:
The documentation generated during sampling and analysis. This documentation includes, but is not limited to, field notes, electronic data, magnetic tapes, untabulated sample results, QC sample results, print outs of chromatograms, instrument outputs, and handwritten records. (TNI)

Record Retention:
The systematic collection, indexing and storing of documented information under secure conditions.

Reference Material:
Material or substance one or more properties of which are sufficiently homogeneous and well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials. (ISO Guide 30-2.1)

Reference Standard:
Standard used for the calibration of working measurement standards in a given organization or a given location. (TNI)

Sampling: Activity related to obtaining a representative sample of the object of conformity assessment, according to a procedure.

Second Order Polynomial Curve (Quadratic): The 2nd order curves are a mathematical calculation of a slightly curved line over two axis. The y axis represents the instrument response (or Response ratio) of a standard or sample and the x axis represents the concentration. The 2nd order regression will generate a coefficient of determination (COD or r^2) that is a measure of the "goodness of fit" of the quadratic curvature the data. A value of 1.00 indicates a perfect fit. In order to be used for quantitative purposes, r^2 must be greater than or equal to 0.99.

Selectivity:
The ability to analyze, distinguish, and determine a specific analyte or parameter from another component that may be a potential interferent or that may behave similarly to the target analyte or parameter within the measurement system. (TNI)

Sensitivity:
The capability of a method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest. (TNI)

Spike:
A known mass of target analyte added to a blank, sample or sub-sample; used to determine recovery efficiency or for other quality control purposes.

Standard:
The document describing the elements of laboratory accreditation that has been developed and established within the consensus principles of standard setting NELAC and meets the approval requirements of standard adoption organizations procedures and policies. (TNI)

Standard Operating Procedures (SOPs):
A written document which details the method for an operation, analysis, or action, with thoroughly prescribed techniques and steps. SOPs are officially approved as the methods for performing certain routine or repetitive tasks. (TNI)

Storage Blank: A blank matrix stored with field samples of a similar matrix (volatiles only) that measures storage contribution to any source of contamination.

Surrogate:
A substance with properties that mimic the analyte of interest. It is unlikely to be found in environment samples and is added to them for quality control purposes.

Surrogate compounds must be added to all samples, standards, and blanks, for all organic chromatography methods except when the matrix precludes its use or when a surrogate is not available. Poor surrogate recovery may indicate a problem with sample composition and shall be reported to the client whose sample produced poor recovery. (QAMS)

Systems Audit (also Technical Systems Audit):
A thorough, systematic, qualitative on-site assessment of the facilities, equipment, personnel, training, procedures, record keeping, data validation, data management, and reporting aspects of a total measurement system. (EPA-QAD)

Technical Manager: A member of the staff of an environmental laboratory who exercises actual day-to-day supervision of laboratory operations for the appropriate fields of accreditation and reporting of results

Technology: A specific arrangement of analytical instruments, detection systems, and/or preparation techniques.

Traceability: The ability to trace the history, application, or location of an entity by means of recorded identifications. In a calibration sense, traceability relates measuring equipment to national or international standards, primary standards, basic physical constants or properties, or reference materials. In a data collection sense, it relates calculations and data generated throughout the project back to the requirements for the quality of the project. (TNI)

Trip Blank:
A blank matrix placed in a sealed container at the laboratory that is shipped, held unopened in the field, and returned to the laboratory in the shipping container with the field samples.

Uncertainty:
A parameter associated with the result of a measurement that characterizes the dispersion of the value that could reasonably be attributed to the measured value.

Acronyms:

CAR – Corrective Action Report
CCV – Continuing Calibration Verification
CF – Calibration Factor
CFR – Code of Federal Regulations
COC – Chain of Custody
DOC – Demonstration of Capability
DQO – Data Quality Objectives
DUP - Duplicate
EHS – Environment, Health and Safety
EPA – Environmental Protection Agency

GC - Gas Chromatography
GC/MS - Gas Chromatography/Mass Spectrometry
HPLC - High Performance Liquid Chromatography
ICP - Inductively Coupled Plasma Atomic Emission Spectroscopy
ICP/MS – ICP/Mass Spectrometry
ICV – Initial Calibration Verification
IDL – Instrument Detection Limit
IH – Industrial Hygiene
IS – Internal Standard
LCS – Laboratory Control Sample
LCSD – Laboratory Control Sample Duplicate
LIMS – Laboratory Information Management System
LOD – Limit of Detection
LOQ – Limit of Quantitation
MDL – Method Detection Limit
MDLCK – MDL Check Standard
MDLV – MDL Verification Check Standard
MRL – Method Reporting Limit Check Standard
MS – Matrix Spike
MSD – Matrix Spike Duplicate
MSDS - Material Safety Data Sheet
NELAP - National Environmental Laboratory Accreditation Program
PT – Performance Testing
TNI – The NELAC Institute
QAM – Quality Assurance Manual
QA/QC – Quality Assurance / Quality Control
QAPP – Quality Assurance Project Plan
RF – Response Factor
RPD – Relative Percent Difference
RSD – Relative Standard Deviation
SD – Standard Deviation
SOP: Standard Operating Procedure
TAT – Turn-Around-Time
VOA – Volatiles
VOC – Volatile Organic Compound

Appendix 3.

Laboratory Certifications, Accreditations, Validations

Pittsburgh maintains certifications, accreditations, certifications, and validations with numerous state and national entities. Programs vary but may include on-site audits, reciprocal agreements with another entity, performance testing evaluations, review of the QA Manual, Standard Operating Procedures, Method Detection Limits, training records, etc. At the time of this QA Manual revision, the laboratory has accreditation/certification/licensing with the following organizations:

Organization	Certificate Number Or Laboratory ID Number
Arkansas	88-0690
California	04224CA
Connecticut	PH-0688
DoD ELAP	ADE-1442
Florida	E871008
Illinois	002602
Kansas	E-10350
Louisiana	04041
New Hampshire	203010
New Jersey	PA005
New York	11182
North Carolina	434
Pennsylvania	02-00416
South Carolina	89014002
Utah	STLP
USDA	P330-10-00139
USDA	P-Soil -01
West Virginia	142
Wisconsin	998027800

The certificates and parameter lists (which may differ) are available, upon request, from a laboratory representative. They may be found on the corporate web site, the laboratory's public server and in the QA web page.

Appendix 4.

Pittsburgh Laboratory SOP List

Document No.	Title
CA-C-S-001	Work Sharing Process
CA-C-S-002	Complaint Handling and Service Recovery
CA-I-P-002	Electronic Reporting and Signature Policy
CW-L-P-004	Ethics Policy
CA-L-P-002	Contract Compliance Policy
CA-L-S-002	Subcontracting Procedures
CA-L-S-001	Internal Investigation of Potential Data Discrepancies & Determination for Data Recall
CA-Q-M-002	Corporate Quality Management Plan
CA-Q-QM-002	Policy on GC/MS Tuning for Full Scan Volatile and Semi-Volatile Methods
CA-Q-QM-003	Technical Guidance on Reporting of Multi-Component Organochlorine Analytes
CA-Q-QM-004	Technical Guidance on Checking for Spectral Interferences in Optical ICP analysis
CA-Q-QM-006	Technical Guidelines for Analysis of Complex GC/ECD Chromatograms
CA-Q-QM-007	Guidance on the Digestion and Final Volumes for CVAA Mercury Methods
CA-Q-S-001	Solvents and Acids Lots Testing and Approval
CA-Q-S-002	Acceptable Manual Integration Practices
CA-Q-S-004	Internal Auditing
CA-Q-S-005	Calibration Curves (General)
CA-Q-S-006	Detection Limits
CA-Q-S-007	Remote Data Processing
CW-Q-S-004	Management Systems Review
CA-Q-P-001	DoD Quality Approach and Lab Approval Process
CA-Q-WI-015	Work Instruction for Electronic Chromatography File Surveillance using Mint Miner Manual Integration Data Mining Tool
CA-T-P-001	Qualified Products List
CA-T-P-002	Selection of Calibration Points
CA-T-P-003	Reporting Results for Methods that Require Second Column Confirmation

Document No.	Title
CW-L-P-002	Subpoenas Policy
CW-L-P-003	Organizational Conflicts of Interest
CW-Q-S-001	Corporate Document Control and Archiving
CW-Q-S-002	Writing a Standard Operating Procedure
PT-GC-001	Gas Chromatographic and HPLC Analysis Based on Method 8000B, SW-846 8081A, 8082, 8141A, 8151A, 8015, 610 and 8310
PT-GC-002	Analysis of Organochlorine Pesticides and PCBs by Method 608
PT-GC-004	1,2-Dibromoethane(EDB) and 1,2-Dibromo-3-Chloropropane(DBCP) in Water by Microextraction and Gas Chromatography, Method 8011
PT-GC-005	Polychlorinated Biphenyls (PCBs) by GC/ECD - Method: SW-846 8082A
PT-GC-006	Chlorinated Pesticides - Method: SW-846 8081B
PT-GC-007	Organophosphorus Pesticides by Gas Chromatography - Method: SW-846 8141B
PT-GC-009	Determination of Inorganic Anions by Ion Chromatography EPA Method 300 SW-846 Method 9056A
PT-GC-010	TOC Analysis for Solids by Lloyd Kahn Method
PT-GC-011	Ethylene Glycol - 8015B/C
PT-HS-001	Waste Collection, accumulation and Storage
PT-IP-002	Acid Digestion of Soils, SW-846 Method 3050B
PT-IP-003	Acid Digestion of Aqueous Samples by SW-846 Methods 3005A, 3010A and EPA Methods 200.7 and 200.8
PT-IP-004	TVA Kingston Sequential Extraction Procedure
PT-IP-005	Acid Digestion of Aqueous Samples SM 20thd Ed, Method 3030C
PT-IP-W-001	Metals Prep Guide - TA Pittsburgh
PT-IT-001	Work Instruction for Servers Data Back-up
PT-MS-001	GCMS Analysis Based on Method 8270C and 625
PT-MS-002	Volatile Organics by GC/MS Based on Methods 8260B, 624
PT-MS-005	VOA Holding Blanks
PT-MS-007	GCMS Volatile Organic Analysis by EPA CLP SOW OLM04.2
PT-MS-008	GC/MS Analysis, Method: SW-846 8270D
PT-MS-009	Analysis of Dissolved Gases in Groundwater Modified Method RSK-175

Document No.	Title
PT-MT-001	Inductively Coupled Plasma-Atomic Emission Spectroscopy, Spectrometric Method for Trace Element Analyses, SW-846 Method 6010B, 6010C and EPA Method 200.7
PT-MT-002	Analysis of Metals by Inductively Coupled Plasma/Mass Spectrometry (ICPMS) for Methods 200.8, 6020, 6020A & ILM05.2
PT-MT-005	Preparation and Analysis of Mercury in Aqueous Samples by Cold Vapor Atomic Absorption, SW-846 7470A and MCAWW 245.1
PT-MT-007	Preparation and Analysis of Mercury in Solid Samples by Cold Vapor Atomic Absorption Spectroscopy, SW846 7471A & 7471B
PT-MT-009	Speciated Isotope Dilution Mass Spectrometry, USEPA Method 6800
PT-OP-001	Extraction and Cleanup of Organic Compounds from Waters and Solids, Based on SW-846 3500 Series, 3600 Series, 8151A and 600 Series Methods
PT-OP-002	Simplified Laboratory Runoff Procedure (SLRP)
PT-OP-003	Standard Elutriate Test (SET)
PT-OP-004	Toxicity Characteristic Leaching Procedure and Synthetic Precipitation Leaching Procedure
PT-OP-005	Modified and Effluent Elutriate Tests (MET and EET)
PT-OP-006	Long Tube Column Settling Test
PT-OP-007	Illinois Resuspension Tests
PT-OP-008	Dredging Elutriate Test (DRET)
PT-OP-009	Sequential Batch Leach Test (SBLT) for Freshwater Sediments
PT-OP-010	Extraction Procedure Test for Plant Bioaccumulation - DTPA Extraction Procedure
PT-OP-011	Extractable Residue (Lipids) from Animal Tissue
PT-OP-012	Effluent Elutriate Test (EET) Method: Tierra Project Specific SOP - Based on SOP No. PT-OP-005
PT-OP-013	Long Tube Column Settling Test Method: Appendix B, Chapter 4, Main Test of the Upland Testing Manual – Tierra Project Specific SOP - Based on SOP No. PT-OP-006
PT-OP-014	Dredging Elutriate Test (DRET) Method: Tierra Project Specific SOP - Based on SOP No. PT-OP-008
PT-OP-016	Porewater Generation
PT-PM-001	Project Management
PT-PM-W-001	Bottle Kit Guide
PT-QA-001	Employee Orientation & Training
PT-QA-M-001	Pittsburgh Laboratory Quality Assurance Manual
PT-QA-002	Internal Auditing
PT-QA-003	Glassware Clean-up for Organic/Inorganic Procedures

Document No.	Title
PT-QA-004	Quarantine Soil Procedure
PT-QA-005	Measurement Uncertainty
PT-QA-006	Procurement of Standards and Materials; Labeling and Traceability
PT-QA-007	Detection Limits
PT-QA-008	Thermometer Calibration and Temperature Monitoring
PT-QA-009	Rounding and Significant Figures
PT-QA-010	Tracking, Review and Revision of SOPs
PT-QA-011	Data Recording Requirements
PT-QA-012	Selection and Calibration of Balances and Weights
PT-QA-013	Independent QA Data Review
PT-QA-014	Reporting Limits
PT-QA-015	Maintaining Time Integrity
PT-QA-016	Nonconformance & Corrective Action System
PT-QA-017	Aqueous Pipette Calibration – Gravimetric Method
PT-QA-018	Technical Data Review Requirements
PT-QA-019	Records Information Management
PT-QA-020	Report Production
PT-QA-021	Quality Assurance Program
PT-QA-022	Equipment Maintenance
PT-QA-024	Subsampling
PT-QA-026	Container Accuracy Verification – Gravimetric
PT-QA-027	Sample Receiving and Chain of Custody
PT-QA-028	Bottle and Cooler Preparation
PT-QA-029	DoD QSM Version 4.2 Requirements
PT-QA-030	Sample Management and Tracking for Cold and Warm Storage
PT-QA-W-002	SOP List
PT-QA-W-003	BNA Dilution Calculation Table

Document No.	Title
PT-QA-W-004	VOA Dilution Calculation Table
PT-QA-W-005	GC Dilution Calculation Table
PT-QA-W-006	Metals Dilution Calculation Table
PT-QA-W-007	Wet Chem Dilution Calculation Table
PT-WC-001	Determination of Solids in Waters and Wastes (Methods 160.1/160.2/160.3/160.4/160.5 & 2540C/2540D/2540B/2540G&E/2540F)
PT-WC-002	Color, Method 110.2
PT-WC-003	Alkalinity, SM Method 2320B
PT-WC-004	Total Hardness (mg/L as CaCO3) by Method SM 2340C; and Hardness by Calculation SM 2340B
PT-WC-005	Turbidity by Method 180.1
PT-WC-006	Determination of Chlorine Contamination in Used Oil Using CLOR-D-TECT 1000 Used Oil Screening Kit, SW-846 Method 9077 and ASTM Method
PT-WC-007	Nitrate/Nitrite, Nitrite, EPA Method 353.2
PT-WC-008	Acid Volatile Sulfides (AVS) and Simultaneously Extracted Metals (SEM) in Sediment
PT-WC-009	Performance Checks on Spectronic 21 and Model 1001 Spectro-Photometers
PT-WC-010	Total Sulfide as Acid Soluble Sulfide, Method 9030B/9034, Standard Method 20th Ed. 4500S-2-F
PT-WC-011	Chloride (Automated), Method SM 4500-CL E
PT-WC-012	pH, Specific Conductance and Alkalinity (Automatic Titrator)
PT-WC-013	Specific Conductance by 120.1, 2510B, and 9050A
PT-WC-014	Nitrogen, Ammonia (Automated), Method 350.1
PT-WC-015	Chromium, Hexavalent (Colorimetric) by SM3500-Cr-B, SW846 3060A/7196
PT-WC-016	Biochemical Oxygen Demand (BOD) and Carbonaceous Biochemical Oxygen Demand (CBOD) by Dissolved Oxygen Probe - SM5210B
PT-WC-017	Total Organic Carbon (TOC) and Total Inorganic Carbon (TIC), Methods SM 5310C and SW-846 9060/9060A
PT-WC-018	Cyanide – Semi-Automated, Pyridine-Barbituric Acid For Total and Amenable, Cyanide in Water (Methods 335.4) and Soil Analyses (Method
PT-WC-020	Percent Moisture, Ash, Organic Matter and Total Solids in Soil Samples - SM 2540G and ASTM D297-84
PT-WC-021	Flash Point by Pensky-Martens Closed Tester, SW-846 Method 1010A and ASTM D93-08
PT-WC-022	Ignitability of Solids for Waste Characterization EPA SW-846 Chapter 7, Section 7.1
PT-WC-023	Chemical Oxygen Demand, Low Level, Method 410.4
PT-WC-025	n-hexane extractable material (HEM) in Sludge, Sediment and Soil samples - 9071B

Document No.	Title
PT-WC-026	PH Electrometric by SM 4500 H+B and SW-846 Methods: 9045C/D and 9040B/C
PT-WC-027	Salinity by Calculation, Electrical Conductivity Method SM 2520B
PT-WC-028	Hexane Extractable Material (HEM; Oil and Grease) and Silica Gel Treated Hexane Extractable Material (SGT-HEM; TPH), Method 1664A and 9070A
PT-WC-029	Available Cyanide by Ligand Exchange and Flow Injection Analysis (FIA) Method 1677
PT-WC-031	Cyanide Extraction Procedure for Solids and Oils, SW-846 Method 9013
PT-WC-032	Total Organic Carbon Analysis for Solid Matrices by Walkley Black
PT-WC-033	DI-Leachate Procedure for Solids (1 Hour Routine DI Leachate and 18 Hour ASTM DI Leachate Procedure)
PT-WC-034	Paint Filter Liquids Test, SW-846 Method 9095B
PT-WC-035	Acidity of Water and Waste Water, SM Method 2310B
PT-WC-036	Flash Point of Liquids by Setaflash (Small Scale) Closed-Cup Apparatus, SW-846 Method 1020B and ASTM Standard D 3278-96
PT-WC-037	Oxidation Reduction Potential, SM 2580B (20th Ed)
PT-WC-038	Phenolics (Automated), Method 420.1/420.2, SW-846 9065/9066
PT-WC-039	Screening Apparent Specific Gravity and Bulk Density of Waste - Method: ASTM D 5057-90
PT-WC-040	Anion Surfactants as MBAS, Standard Methods 5540C
PT-WC-041	Compatibility of Screening Analysis of Waste, Method: ASTM D5058 Test Method C – Water Compatibility
PT-FS-001	Field Measurement of Dissolved Oxygen (DO) Method: SM 4500-O G
PT-FS-002	Field Measurement of Total Residual Chlorine Method: SM 4500-Cl G
PT-FS-003	Field Measurement of pH Method: SM 4500 H+B
PT-FS-004	Field Measurement of Specific Conductance Method: SM 2510B
PT-GT-008	Hydraulic Conductivity of Saturated Porous Materials using a Flexible Wall Permeameter (ASTM D5084– Method C)

Note: The SOPs are subject to change, refer to PT-QA-W-002 for current list of SOPs.

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October 27, 2015

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Prepared by
Date
Expiration Date
Est. Start Date 10/22/2015

Project: New PA Brownfields Site ***Quote Number: 18015235 - No Version***

Quote Deliverables

Deliverable: STD Invoice Format — Standard Invoice Format
Type: Invoice — **TurnAround:** 10_Days

Company	Locations	Name	Mechanism	Media	Time	Copies
KU Resources Inc.	Duquesne, PA	Stephanie Gundling	Email	Pdf	After Invoice	1

Deliverable: Std_Tal_Login_Ack — Standard TAL, Login, Checklist, Acknowledgement
Type: SampConf — **TurnAround:** 10_Days

Company	Locations	Name	Mechanism	Media	Time	Copies
KU Resources Inc	KU Resources Inc	Stephanie Gundling	Email	Pdf	After Review	1

Deliverable: Stnd_Tal (UDS) — TALs, Standard edd
Type: Edd — **TurnAround:** 10_Days

Company	Locations	Name	Mechanism	Media	Time	Copies
KU Resources Inc	KU Resources Inc	Stephanie Gundling	Email	Pdf	After Complete	1

Deliverable: UDS Level 2 Report — UDS Level 2 Report
Type: Report — **TurnAround:** 10_Days

Company	Locations	Name	Mechanism	Media	Time	Copies
KU Resources Inc	KU Resources Inc	Stephanie Gundling	Email	Pdf	After Complete	1

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Groundwater TAT: 10_Days (Business Days)

Matrix	Method	Test Description	Quantity	Unit Price	Extended Price
Water	8260C (5030C)	TCL 4.2 GC/MS Volatiles LL	1	$ 0.00	$ 0.00
Water	8270D LL (3520C)	TCL 4.2 Semivolatiles LL LVI	1	$ 0.00	$ 0.00
Water	8082A (3510C)	TCL PCBs LL	1	$ 0.00	$ 0.00
Water	6020A (3005A)	Lead	1	$ 0.00	$ 0.00
		Total Groundwater			**$ 0.00**

Solid TAT: 10_Days (Business Days)

Matrix	Method	Test Description	Quantity	Unit Price	Extended Price
Solid	8260C (5035)	TCL 4.2 GC/MS Volatiles terra core	1	$ 0.00	$ 0.00
Solid	8260C (5035)	TCL 4.2 GC/MS Volatiles terra core methanol	1	$ 0.00	$ 0.00
Solid	8270D LL (3541)	TCL 4.2 Semivolatiles LL	1	$ 0.00	$ 0.00
Solid	8082A (3541 - 3665A - 3660B)	TCL PCBs LL	1	$ 0.00	$ 0.00
Solid	6020A (3050B)	Lead	1	$ 0.00	$ 0.00

Solid TAT: 1_Day (Business Days)

Matrix	Method	Test Description	Quantity	Unit Price	Extended Price
Solid	2540G	Percent Moisture	1	$ 0.00	$ 0.00
		Total Solid			**$ 0.00**

Air Gas TAT: 10_Days (Business Days) (to be analyzed by Knoxville)

Matrix	Method	Test Description	Quantity	Unit Price	Extended Price
Air	TO-15 (Passivated Can)	TA-Standard Analyte List	1	$ 0.00	$ 0.00
		Total Air Gas			**$ 0.00**

Quote Other Charges

Description	Quantity	Unit Price	Extended Price
Safe and Environmentally Responsible Waste Management	1	$ 1.50	$ 1.50
Supplies - Terracore Kits	1	$ 15.00	$ 15.00

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Total Other Charge	**$16.50**

Total Other Charges	**$ 16.50**
Total Analysis Charges	**$ 0.00**
Grand Total for Quote 18015235	**$ 16.50**

**Quoted charges do not include sales tax. Applicable sales tax will be added to invoices where required by law.

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PROJECT DETAILS

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Groundwater

Matrix	Method	Test Description	Analyte	RL	MDL	Units
Water	8260C (5030C)	TCL 4.2 GC/MS Volatiles LL	1,1,1-Trichloroethane	1.00	0.286	ug/L
			1,1,2,2-Tetrachloroethane	1.00	0.200	ug/L
			1,1,2-Trichloro-1,2,2-trifluoroethane	1.00	0.320	ug/L
			1,1,2-Trichloroethane	1.00	0.201	ug/L
			1,1-Dichloroethane	1.00	0.116	ug/L
			1,1-Dichloroethene	1.00	0.296	ug/L
			1,2,4-Trichlorobenzene	1.00	0.271	ug/L
			1,2-Dibromo-3-Chloropropane	1.00	0.141	ug/L
			1,2-Dichlorobenzene	1.00	0.152	ug/L
			1,2-Dichloroethane	1.00	0.212	ug/L
			1,2-Dichloropropane	1.00	0.0948	ug/L
			1,3-Dichlorobenzene	1.00	0.105	ug/L
			1,4-Dichlorobenzene	1.00	0.206	ug/L
			2-Butanone (MEK)	5.00	0.548	ug/L
			2-Hexanone	5.00	0.159	ug/L
			4-Methyl-2-pentanone (MIBK)	5.00	0.528	ug/L
			Acetone	5.00	2.50	ug/L
			Benzene	1.00	0.105	ug/L
			Bromoform	1.00	0.191	ug/L
			Bromomethane	1.00	0.313	ug/L
			Carbon disulfide	1.00	0.212	ug/L
			Carbon tetrachloride	1.00	0.137	ug/L
			Chlorobenzene	1.00	0.135	ug/L
			Chlorodibromomethane	1.00	0.137	ug/L
			Chloroethane	1.00	0.215	ug/L
			Chloroform	1.00	0.171	ug/L
			Chloromethane	1.00	0.283	ug/L
			cis-1,2-Dichloroethene	1.00	0.237	ug/L
			cis-1,3-Dichloropropene	1.00	0.187	ug/L
			Dichlorobromomethane	1.00	0.130	ug/L
			Dichlorodifluoromethane	1.00	0.193	ug/L
			Ethylbenzene	1.00	0.227	ug/L
			1,2-Dibromoethane	1.00	0.180	ug/L
			Cyclohexane	1.00	0.254	ug/L
			Isopropylbenzene	1.00	0.164	ug/L
			Methyl acetate	1.00	0.138	ug/L
			Methyl tert-butyl ether	1.00	0.183	ug/L
			Methylcyclohexane	1.00	0.261	ug/L
			Methylene Chloride	1.00	0.125	ug/L
			Styrene	1.00	0.0966	ug/L
			Tetrachloroethene	1.00	0.149	ug/L
			Toluene	1.00	0.150	ug/L
			trans-1,2-Dichloroethene	1.00	0.170	ug/L
			trans-1,3-Dichloropropene	1.00	0.148	ug/L

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Project: New PA Brownfields Site ***Quote Number: 18015235 - No Version***

Groundwater

Matrix	Method	Test Description	Analyte	RL	MDL	Units
Continued						
			Trichloroethene	1.00	0.143	ug/L
			Trichlorofluoromethane	1.00	0.199	ug/L
			Vinyl chloride	1.00	0.227	ug/L
			Xylenes, Total	3.00	0.488	ug/L
		Surrogate Cpnd				
			1,2-Dichloroethane-d4 (Surr)			
			4-Bromofluorobenzene (Surr)			
			Dibromofluoromethane (Surr)			
			Toluene-d8 (Surr)			

Matrix	Method	Test Description	Analyte	RL	MDL	Units
Water	8270D LL (3520C)	TCL 4.2 Semivolatiles LL LVI	Acenaphthene	0.200	0.0291	ug/L
			Acenaphthylene	0.200	0.0215	ug/L
			Anthracene	0.200	0.0189	ug/L
			Benzo[a]anthracene	0.200	0.0366	ug/L
			Benzo[a]pyrene	0.200	0.0282	ug/L
			Benzo[b]fluoranthene	0.200	0.0487	ug/L
			Benzo[g,h,i]perylene	0.200	0.0291	ug/L
			Benzo[k]fluoranthene	0.200	0.0301	ug/L
			Bis(2-chloroethyl)ether	1.00	0.0317	ug/L
			Bis(2-chloroethoxy)methane	1.00	0.134	ug/L
			2,2'-oxybis[1-chloropropane]	1.00	0.0239	ug/L
			Bis(2-ethylhexyl) phthalate	2.00	0.439	ug/L
			4-Bromophenyl phenyl ether	1.00	0.117	ug/L
			Butyl benzyl phthalate	1.00	0.213	ug/L
			4-Chloroaniline	1.00	0.291	ug/L
			2-Chloronaphthalene	0.200	0.0307	ug/L
			4-Chlorophenyl phenyl ether	1.00	0.0799	ug/L
			Chrysene	0.200	0.0309	ug/L
			Dibenz(a,h)anthracene	0.200	0.0268	ug/L
			Dibenzofuran	1.00	0.0965	ug/L
			Di-n-butyl phthalate	1.00	0.243	ug/L
			3,3'-Dichlorobenzidine	1.00	0.147	ug/L
			Diethyl phthalate	1.00	0.297	ug/L
			Dimethyl phthalate	1.00	0.183	ug/L
			2,4-Dinitrotoluene	1.00	0.214	ug/L
			2,6-Dinitrotoluene	1.00	0.137	ug/L
			Di-n-octyl phthalate	1.00	0.204	ug/L
			Fluoranthene	0.200	0.0211	ug/L
			Fluorene	0.200	0.0240	ug/L
			Hexachlorobenzene	1.00	0.0610	ug/L
			Hexachlorobutadiene	1.00	0.0937	ug/L
			Hexachlorocyclopentadiene	1.00	0.136	ug/L
			Hexachloroethane	1.00	0.139	ug/L
			Indeno[1,2,3-cd]pyrene	0.200	0.0433	ug/L

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Matrix	Method	Test Description	Analyte	RL	MDL	Units
Continued						
			Isophorone	1.00	0.0738	ug/L
			2-Methylnaphthalene	0.200	0.0192	ug/L
			Naphthalene	0.200	0.0228	ug/L
			2-Nitroaniline	5.00	0.673	ug/L
			3-Nitroaniline	5.00	0.805	ug/L
			4-Nitroaniline	5.00	0.773	ug/L
			Nitrobenzene	2.00	0.149	ug/L
			N-Nitrosodi-n-propylamine	1.00	0.0501	ug/L
			N-Nitrosodiphenylamine	1.00	0.122	ug/L
			Phenanthrene	0.200	0.0415	ug/L
			Pyrene	0.200	0.0226	ug/L
			Carbazole	1.00	0.0267	ug/L
			Acetophenone	2.00	0.112	ug/L
			Atrazine	2.00	0.223	ug/L
			Benzaldehyde	2.00	0.106	ug/L
			1,1'-Biphenyl	1.00	0.105	ug/L
			Caprolactam	5.00	1.47	ug/L
			4-Chloro-3-methylphenol	1.00	0.171	ug/L
			2-Chlorophenol	1.00	0.225	ug/L
			2-Methylphenol	1.00	0.187	ug/L
			Methylphenol, 3 & 4	1.00	0.209	ug/L
			2,4-Dichlorophenol	1.00	0.0671	ug/L
			2,4-Dimethylphenol	1.00	0.171	ug/L
			2,4-Dinitrophenol	5.00	2.50	ug/L
			4,6-Dinitro-2-methylphenol	5.00	1.56	ug/L
			2-Nitrophenol	1.00	0.112	ug/L
			4-Nitrophenol	5.00	0.804	ug/L
			Pentachlorophenol	1.00	0.500	ug/L
			Phenol	1.00	0.0553	ug/L
			2,4,5-Trichlorophenol	1.00	0.122	ug/L
			2,4,6-Trichlorophenol	1.00	0.298	ug/L
		Surrogate Cpnd				
			2-Fluorobiphenyl			
			2-Fluorophenol (Surr)			
			2,4,6-Tribromophenol (Surr)			
			Nitrobenzene-d5 (Surr)			
			Phenol-d5 (Surr)			
			Terphenyl-d14 (Surr)			

Matrix	Method	Test Description	Analyte	RL	MDL	Units
Water	8082A (3510C)	TCL PCBs LL	PCB-1016	0.0100	0.00367	ug/L
			PCB-1221	0.0100	0.00586	ug/L
			PCB-1232	0.0100	0.00603	ug/L
			PCB-1242	0.0100	0.00335	ug/L
			PCB-1248	0.0100	0.00320	ug/L

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Matrix	Method	Test Description	Analyte	RL	MDL	Units
Continued						
			PCB-1254	0.0100	0.00445	ug/L
			PCB-1260	0.0100	0.00286	ug/L
		Surrogate Cpnd				
			DCB Decachlorobiphenyl (Surr)			
			Tetrachloro-m-xylene (Surr)			

Matrix	Method	Test Description	Analyte	RL	MDL	Units
Water	6020A (3005A)	Lead	Lead	1.00	0.0192	ug/L

Solid

Matrix	Method	Test Description	Analyte	RL	RL	Units
Solid	2540G	Percent Moisture	Percent Moisture	0.100	0.100	%

Matrix	Method	Test Description	Analyte	RL	MDL	Units
Solid	8260C (5035)	TCL 4.2 GC/MS Volatiles terra core	1,1,1-Trichloroethane	5.00	0.486	ug/Kg
			1,1,2,2-Tetrachloroethane	5.00	0.718	ug/Kg
			1,1,2-Trichloro-1,2,2-trifluoroethane	5.00	1.07	ug/Kg
			1,1,2-Trichloroethane	5.00	0.831	ug/Kg
			1,1-Dichloroethane	5.00	0.575	ug/Kg
			1,1-Dichloroethene	5.00	0.848	ug/Kg
			1,2-Dibromo-3-Chloropropane	5.00	0.749	ug/Kg
			1,2-Dichlorobenzene	5.00	0.798	ug/Kg
			1,2-Dichloroethane	5.00	0.613	ug/Kg
			1,2-Dichloropropane	5.00	0.543	ug/Kg
			1,2,4-Trichlorobenzene	5.00	0.882	ug/Kg
			1,3-Dichlorobenzene	5.00	0.656	ug/Kg
			1,4-Dichlorobenzene	5.00	0.637	ug/Kg
			2-Butanone (MEK)	5.00	0.882	ug/Kg
			2-Hexanone	5.00	0.690	ug/Kg
			4-Methyl-2-pentanone (MIBK)	5.00	0.653	ug/Kg
			Acetone	20.0	5.00	ug/Kg
			Benzene	5.00	0.675	ug/Kg
			Bromoform	5.00	0.442	ug/Kg
			Bromomethane	5.00	0.739	ug/Kg
			Carbon disulfide	5.00	0.512	ug/Kg
			Carbon tetrachloride	5.00	0.446	ug/Kg
			Chlorobenzene	5.00	0.757	ug/Kg
			Chlorodibromomethane	5.00	0.710	ug/Kg
			Chloroform	5.00	0.585	ug/Kg
			Chloromethane	5.00	0.852	ug/Kg

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Matrix	Method	Test Description	Analyte	RL	MDL	Units
Continued						
			Chloroethane	5.00	1.55	ug/Kg
			cis-1,2-Dichloroethene	5.00	0.703	ug/Kg
			cis-1,3-Dichloropropene	5.00	0.678	ug/Kg
			Dichlorobromomethane	5.00	0.561	ug/Kg
			Dichlorodifluoromethane	5.00	0.666	ug/Kg
			Ethylbenzene	5.00	0.643	ug/Kg
			1,2-Dibromoethane	5.00	0.863	ug/Kg
			Cyclohexane	5.00	0.371	ug/Kg
			Isopropylbenzene	5.00	0.679	ug/Kg
			Methyl acetate	25.0	0.901	ug/Kg
			Methyl tert-butyl ether	5.00	0.748	ug/Kg
			Methylcyclohexane	5.00	0.725	ug/Kg
			Methylene Chloride	5.00	0.672	ug/Kg
			Styrene	5.00	0.705	ug/Kg
			Tetrachloroethene	5.00	0.680	ug/Kg
			Toluene	5.00	0.730	ug/Kg
			trans-1,2-Dichloroethene	5.00	0.596	ug/Kg
			trans-1,3-Dichloropropene	5.00	0.598	ug/Kg
			Trichloroethene	5.00	0.658	ug/Kg
			Trichlorofluoromethane	5.00	0.919	ug/Kg
			Vinyl chloride	5.00	0.469	ug/Kg
			Xylenes, Total	15.0	2.24	ug/Kg
		Surrogate Cpnd				
			1,2-Dichloroethane-d4 (Surr)			
			4-Bromofluorobenzene (Surr)			
			Dibromofluoromethane (Surr)			
			Toluene-d8 (Surr)			

Matrix	Method	Test Description	Analyte	RL	MDL	Units
Solid	8260C (5035)	TCL 4.2 GC/MS Volatiles terra core methanol	1,1,1-Trichloroethane	250	51.5	ug/Kg
			1,1,2,2-Tetrachloroethane	250	46.6	ug/Kg
			1,1,2-Trichloro-1,2,2-trifluoroethane	250	16.5	ug/Kg
			1,1,2-Trichloroethane	250	58.1	ug/Kg
			1,1-Dichloroethane	250	50.7	ug/Kg
			1,1-Dichloroethene	250	53.3	ug/Kg
			1,2-Dibromo-3-Chloropropane	250	17.6	ug/Kg
			1,2-Dichlorobenzene	250	34.1	ug/Kg
			1,2-Dichloroethane	250	48.0	ug/Kg
			1,2-Dichloropropane	250	63.8	ug/Kg
			1,2,4-Trichlorobenzene	250	18.8	ug/Kg
			1,3-Dichlorobenzene	250	25.3	ug/Kg
			1,4-Dichlorobenzene	250	26.3	ug/Kg
			2-Butanone (MEK)	250	54.2	ug/Kg
			2-Hexanone	250	28.5	ug/Kg

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Matrix	Method	Test Description	Analyte	RL	MDL	Units
Continued						
			4-Methyl-2-pentanone (MIBK)	250	29.6	ug/Kg
			Acetone	1000	250	ug/Kg
			Benzene	250	49.5	ug/Kg
			Bromoform	250	53.4	ug/Kg
			Bromomethane	250	78.8	ug/Kg
			Carbon disulfide	250	53.7	ug/Kg
			Carbon tetrachloride	250	54.2	ug/Kg
			Chlorobenzene	250	26.3	ug/Kg
			Chlorodibromomethane	250	32.4	ug/Kg
			Chloroform	250	50.4	ug/Kg
			Chloromethane	250	69.5	ug/Kg
			Chloroethane	250	37.4	ug/Kg
			cis-1,2-Dichloroethene	250	33.3	ug/Kg
			cis-1,3-Dichloropropene	250	36.3	ug/Kg
			Dichlorobromomethane	250	46.6	ug/Kg
			Dichlorodifluoromethane	250	31.8	ug/Kg
			Ethylbenzene	250	31.0	ug/Kg
			1,2-Dibromoethane	250	30.6	ug/Kg
			Cyclohexane	250	29.8	ug/Kg
			Isopropylbenzene	250	26.5	ug/Kg
			Methyl acetate	1250	61.4	ug/Kg
			Methyl tert-butyl ether	250	51.3	ug/Kg
			Methylcyclohexane	250	27.8	ug/Kg
			Methylene Chloride	250	54.5	ug/Kg
			Styrene	250	32.0	ug/Kg
			Tetrachloroethene	250	41.3	ug/Kg
			Toluene	250	42.3	ug/Kg
			trans-1,2-Dichloroethene	250	37.6	ug/Kg
			trans-1,3-Dichloropropene	250	29.1	ug/Kg
			Trichloroethene	250	40.1	ug/Kg
			Trichlorofluoromethane	250	56.0	ug/Kg
			Vinyl chloride	250	64.5	ug/Kg
			Xylenes, Total	500	98.5	ug/Kg
		Surrogate Cpnd				
			1,2-Dichloroethane-d4 (Surr)			
			4-Bromofluorobenzene (Surr)			
			Dibromofluoromethane (Surr)			
			Toluene-d8 (Surr)			

Matrix	Method	Test Description	Analyte	RL	MDL	Units
Solid	8270D LL (3541)	TCL 4.2 Semivolatiles LL	Acenaphthene	6.70	0.641	ug/Kg
			Acenaphthylene	6.70	0.764	ug/Kg
			Anthracene	6.70	0.653	ug/Kg
			Benzo[a]anthracene	6.70	0.836	ug/Kg
			Benzo[a]pyrene	6.70	0.668	ug/Kg

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Matrix	Method	Test Description	Analyte	RL	MDL	Units
Continued						
			Benzo[b]fluoranthene	6.70	1.05	ug/Kg
			Benzo[g,h,i]perylene	6.70	0.664	ug/Kg
			Benzo[k]fluoranthene	6.70	1.35	ug/Kg
			Bis(2-chloroethyl)ether	6.70	0.895	ug/Kg
			Bis(2-chloroethoxy)methane	33.0	2.20	ug/Kg
			2,2'-oxybis[1-chloropropane]	6.70	0.720	ug/Kg
			Bis(2-ethylhexyl) phthalate	66.7	5.39	ug/Kg
			4-Bromophenyl phenyl ether	33.0	2.90	ug/Kg
			Butyl benzyl phthalate	33.0	4.56	ug/Kg
			4-Chloroaniline	33.0	2.67	ug/Kg
			2-Chloronaphthalene	6.70	0.696	ug/Kg
			4-Chlorophenyl phenyl ether	33.0	3.71	ug/Kg
			Chrysene	6.70	0.794	ug/Kg
			Dibenz(a,h)anthracene	6.70	0.742	ug/Kg
			Dibenzofuran	33.0	3.28	ug/Kg
			Di-n-butyl phthalate	33.0	4.18	ug/Kg
			3,3'-Dichlorobenzidine	33.0	3.53	ug/Kg
			Diethyl phthalate	33.0	3.64	ug/Kg
			Dimethyl phthalate	33.0	3.63	ug/Kg
			2,4-Dinitrotoluene	33.0	2.69	ug/Kg
			2,6-Dinitrotoluene	33.0	3.44	ug/Kg
			Di-n-octyl phthalate	33.0	3.52	ug/Kg
			Fluoranthene	6.70	0.713	ug/Kg
			Fluorene	6.70	0.879	ug/Kg
			Hexachlorobenzene	6.70	0.711	ug/Kg
			Hexachlorobutadiene	6.70	0.747	ug/Kg
			Hexachlorocyclopentadiene	33.0	3.60	ug/Kg
			Hexachloroethane	33.0	2.40	ug/Kg
			Indeno[1,2,3-cd]pyrene	6.70	0.687	ug/Kg
			Isophorone	33.0	2.51	ug/Kg
			2-Methylnaphthalene	6.70	0.600	ug/Kg
			Naphthalene	6.70	0.575	ug/Kg
			2-Nitroaniline	170	14.9	ug/Kg
			3-Nitroaniline	170	13.7	ug/Kg
			4-Nitroaniline	170	13.5	ug/Kg
			Nitrobenzene	66.7	2.78	ug/Kg
			N-Nitrosodi-n-propylamine	6.70	0.782	ug/Kg
			N-Nitrosodiphenylamine	33.0	3.09	ug/Kg
			Phenanthrene	6.70	1.06	ug/Kg
			Pyrene	6.70	0.675	ug/Kg
			Carbazole	6.70	0.615	ug/Kg
			Acetophenone	33.0	2.74	ug/Kg
			Atrazine	33.0	3.25	ug/Kg
			Benzaldehyde	33.0	5.00	ug/Kg
			1,1'-Biphenyl	33.0	2.98	ug/Kg
			Caprolactam	170	25.2	ug/Kg

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Solid

Matrix	Method	Test Description		Analyte	RL	MDL	Units
Continued							
				4-Chloro-3-methylphenol	33.0	3.07	ug/Kg
				2-Chlorophenol	33.0	2.73	ug/Kg
				2-Methylphenol	33.0	2.33	ug/Kg
				Methylphenol, 3 & 4	33.0	3.27	ug/Kg
				2,4-Dichlorophenol	6.70	0.669	ug/Kg
				2,4-Dimethylphenol	33.0	5.22	ug/Kg
				2,4-Dinitrophenol	170	39.7	ug/Kg
				4,6-Dinitro-2-methylphenol	170	13.4	ug/Kg
				2-Nitrophenol	33.0	3.68	ug/Kg
				4-Nitrophenol	170	12.2	ug/Kg
				Pentachlorophenol	33.0	2.98	ug/Kg
				Phenol	6.70	0.788	ug/Kg
				2,4,5-Trichlorophenol	33.0	3.56	ug/Kg
				2,4,6-Trichlorophenol	33.0	4.99	ug/Kg
			Surrogate Cpnd				
				2-Fluorobiphenyl			
				2-Fluorophenol (Surr)			
				2,4,6-Tribromophenol (Surr)			
				Nitrobenzene-d5 (Surr)			
				Phenol-d5 (Surr)			
				Terphenyl-d14 (Surr)			

Matrix	Method	Test Description	Analyte	RL	MDL	Units
Solid	8082A (3541 - 3665A - 3660B)	TCL PCBs LL	PCB-1016	0.833	0.382	ug/Kg
			PCB-1221	0.833	0.603	ug/Kg
			PCB-1232	0.833	0.209	ug/Kg
			PCB-1242	0.833	0.308	ug/Kg
			PCB-1248	0.833	0.195	ug/Kg
			PCB-1254	0.833	0.308	ug/Kg
			PCB-1260	0.833	0.286	ug/Kg
		Surrogate Cpnd				
			DCB Decachlorobiphenyl (Surr)			
			Tetrachloro-m-xylene (Surr)			

Matrix	Method	Test Description	Analyte	RL	MDL	Units
Solid	6020A (3050B)	Lead	Lead	0.100	0.00380	mg/Kg

Air Gas

Matrix	Method	Test Description	Analyte	RL	MDL	Units

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Air Gas

Matrix	Method	Test Description	Analyte	RL	MDL	Units
Continued						
Air	TO-15 (Passivated Can)	TA-Standard Analyte List	1,1,1-Trichloroethane	0.200	0.0300	ppb v/v
			1,1,2,2-Tetrachloroethane	0.200	0.0610	ppb v/v
			1,1,2-Trichloro-1,2,2-trifluoroethane	0.200	0.0310	ppb v/v
			1,1,2-Trichloroethane	0.200	0.0540	ppb v/v
			1,1-Dichloroethane	0.200	0.0260	ppb v/v
			1,1-Dichloroethene	0.200	0.0340	ppb v/v
			1,2,4-Trichlorobenzene	2.00	0.0980	ppb v/v
			1,2,4-Trimethylbenzene	0.200	0.0630	ppb v/v
			1,2-Dichloro-1,1,2,2-tetrafluoroethane	0.200	0.0320	ppb v/v
			1,2-Dichlorobenzene	0.200	0.0700	ppb v/v
			1,2-Dichloroethane	0.200	0.0470	ppb v/v
			1,2-Dichloropropane	0.200	0.0520	ppb v/v
			1,3,5-Trimethylbenzene	0.200	0.0650	ppb v/v
			1,3-Dichlorobenzene	0.200	0.0650	ppb v/v
			1,4-Dichlorobenzene	0.200	0.0640	ppb v/v
			1,4-Dioxane	5.00	0.0800	ppb v/v
			2-Butanone (MEK)	1.00	0.200	ppb v/v
			4-Methyl-2-pentanone (MIBK)	0.500	0.0450	ppb v/v
			Acetone	5.00	1.40	ppb v/v
			Benzene	0.200	0.0560	ppb v/v
			Benzyl chloride	0.800	0.0780	ppb v/v
			Bromoform	0.200	0.0480	ppb v/v
			Bromomethane	0.200	0.0320	ppb v/v
			Carbon disulfide	0.500	0.0310	ppb v/v
			Carbon tetrachloride	0.200	0.0380	ppb v/v
			Chlorobenzene	0.200	0.0490	ppb v/v
			Dibromochloromethane	0.200	0.0420	ppb v/v
			Chloroethane	0.800	0.0350	ppb v/v
			Chloroform	0.200	0.0380	ppb v/v
			Chloromethane	0.500	0.160	ppb v/v
			cis-1,2-Dichloroethene	0.200	0.0600	ppb v/v
			cis-1,3-Dichloropropene	0.200	0.0740	ppb v/v
			Cyclohexane	0.500	0.0400	ppb v/v
			Bromodichloromethane	0.200	0.0440	ppb v/v
			Dichlorodifluoromethane	0.500	0.0680	ppb v/v
			Ethylbenzene	0.200	0.0680	ppb v/v
			1,2-Dibromoethane (EDB)	0.200	0.0440	ppb v/v
			Hexachlorobutadiene	0.200	0.0780	ppb v/v
			Hexane	0.800	0.0320	ppb v/v
			Isopropyl alcohol	5.00	0.0940	ppb v/v
			Isopropylbenzene	0.800	0.0600	ppb v/v
			m-Xylene & p-Xylene	0.800	0.120	ppb v/v
			Methyl tert-butyl ether	1.00	0.170	ppb v/v

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Date
Expiration Date
Est. Start Date 10/22/2015

Project: New PA Brownfields Site *Quote Number: 18015235 - No Version*

Air Gas

Matrix	Method	Test Description	Analyte	RL	MDL	Units
Continued						
			Methylene Chloride	0.500	0.130	ppb v/v
			Naphthalene	0.500	0.0900	ppb v/v
			o-Xylene	0.200	0.0610	ppb v/v
			Styrene	0.200	0.0580	ppb v/v
			Tetrachloroethene	0.200	0.0400	ppb v/v
			Tetrahydrofuran	5.00	0.0630	ppb v/v
			Toluene	0.200	0.120	ppb v/v
			trans-1,2-Dichloroethene	0.200	0.0500	ppb v/v
			trans-1,3-Dichloropropene	0.200	0.0480	ppb v/v
			Trichloroethene	0.200	0.0360	ppb v/v
			Trichlorofluoromethane	0.200	0.0240	ppb v/v
			Vinyl acetate	5.00	0.140	ppb v/v
			Vinyl bromide	0.200	0.0350	ppb v/v
			Vinyl chloride	0.200	0.0710	ppb v/v