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Cosmos Technologies Inc.

PHASE II
ENVIRONMENTAL SITE ASSESSMENT

Hill District Scattered Sites – Parcels D, E, and F
Pittsburgh, Pennsylvania, 15219

Prepared For

AMANI CHRISTIAN COMMUNITY DEVELOPMENT CORP.
P.O. BOX 7192
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December 2017

Prepared By

Cosmos Technologies, Inc.

December 5, 2017

Reverend Walls
Amani Christian Community Development Corp.
P.O. Box 7192
Pittsburgh, PA 15213

Subject: Phase II Environmental Site Assessment Report – Hill District Scattered Sites – Parcels D, E, and F - Pittsburgh, Pennsylvania

Dear Mr. Garrett,

Cosmos Technologies, Inc. is pleased to submit our report describing the findings of the Environmental Site Assessment (ESA) Phase II report to the Amani Christian Community Development Corp. (ACCD) for the Hill District Scattered Sites – Parcels D, E, and F (identified in this report as 1835 Cliff St. unit, 1850 Cliff St. unit, and 33 Cliff St. unit, respectively). The property is bounded by Ledlie Street on the east, Arcena Street on the north, Monaca Place on the south, and Cassatt Street on the west, in the Hill District, Pittsburgh, Pennsylvania. We prepared this ESA in accordance with the American Society of Testing and Materials (ASTM) Standard Practice for Environmental Site Assessments: Phase II ESA Process (ASTM Designation: E1903-11, Reapproved 2011).

No recognized environmental conditions were found at the site as established in an ESA Phase I report conducted by Rettew Associates, Inc. However, because of the proximity of a gas station, the recommendation was made to perform a Phase II ESA to identify any petroleum contaminants that may have migrated to the property. The Phase II ESA provides an additional level of environmental risk assessment.

Diesel Range Organics (DRO) and Oil Range Organics (ORO) were found at 1850 Cliff St. (parcel E) and 33 Cliff St. (parcel F) units. Based on the findings of this Phase II ESA, we recommend remediating the presence of DRO and ORO excavating and disposing the upper ten (10) and five (5) feet layers in 1850 Cliff St. and 33 Cliff St. units, respectively. However, no further investigation or remediation is recommended for the 1835 Cliff St. property (parcel D), since no contamination was found in the parcel.

If you have any questions or require further clarification of the report findings, please do not hesitate to contact the undersigned at your convenience. Thank you for the opportunity to provide this service.

Sincerely,

Frederick Douglas

Frederick Douglas, Sr.
President

Cosmos Technologies Inc.

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LIST OF ACRONYMS.

AAI	**All Appropriate Inquiries**
ASTM	**American Society for Testing Materials**
DRO	**Diesel Range Organics**
EDR	**Environmental Data Resources, Inc.**
ESA	**Environmental Site Assessment**
MSC	**Medium-Specific Concentration**
ACCD	**Amani Christian Community Development Corp.**
ODO	**Oil Range Organics**
PADEP	**Pennsylvania DEP Department of Environmental Protection**
PID	**Photo-Ionization Detector**
SAP	**Sampling and Analysis Plan**
SCS	**Soil Conservation Services**
UCB	**Urban Land Culleoka Complex gently slope**
UCD	**Urban Land Culleoka Complex moderately slope**

LIST OF ACRONYMS (cont'd…)

USDA	**United States Department of Agriculture**
USEPA	**United States Environmental Protection Agency**
VOC	**Volatile Organic Compound**

Executive Summary

The Hill District Scattered Sites – Parcels D (1835 Cliff St.), E (1850 Cliff St.), and F (33 Cliff St.) hereafter referred to as the "property" is located in the Hill District, Pittsburgh, Pennsylvania. The property is bounded by Cassatt Street on the west, Arcena Street on the north, Monaca Place south, and Ledlie Street on the east. The Site Location Map attached in Appendix A shows the location of the property. The property is currently owned by the Housing Authority City of Pittsburgh (HACP). The Amani Christian Community Development Corp. (ACCD) engaged Cosmos Technologies, Inc. (hereafter Cosmos) to conduct a Phase II Environmental Site Assessment (ESA) of the property. The property consists of three (3) vacant units – 1835 Cliff St., 1850 Cliff St., and 33 Cliff St.

No recognized environmental conditions were found at the sites as established in an ESA Phase I report conducted by Rettew Associates, Inc. (hereafter Rettew). However, because of the presence of former dry cleaners and auto stations near the boundaries of the property, the recommendation was made to perform a Phase II ESA to identify any petroleum or other contaminants that could have migrated to the site. The Phase II ESA provides an additional level of environmental risk assessment to assist the ACCD in making informed business decisions about the property.

Cosmos performed the Phase II ESA field activities on October 30, 2017. Cesar Simon, a project engineer from Cosmos, supervised the drilling and performed the sampling activities. Geo-Environmental Drilling Company, Inc. was contracted to perform the soil boring activities. The collected soil samples were analyzed by TestAmerica, Inc (hereafter TestAmerica).

One (1) soil boring and associated sampling were performed for each unit. The sampling and analysis plan (SAP) was designed to investigate areas on the property in relative proximity to historical dry cleaners and automotive repair shop/gas station locations; as well as, to capture any potential contaminants moving in the general direction of the groundwater flow. The groundwater flow direction is towards the West-Northwest (WNW).

The samples were analyzed for Volatile Organic Compounds (VOC), Diesel Range Organics (DRO), Oil Range Organics (ORO), Percent Moisture, and Percent Solids. The analytic results showed that VOC contaminants levels were non-detectable and below the target limits set by the United States Environmental Protection Agency (US EPA) and Pennsylvania Department of Environmental Protection (PA DEP). However, DRO and ORO levels in this analysis were above PA DEP target limits at both the 33 Cliff St. and 1850 Cliff St. sites. DROs and OROs were detected in the upper layers (see Section 4.2 and Table 3.)

Based on the findings of this Phase II ESA, we recommend remediating the presence of DRO and ORO by excavating and disposing of the upper ten (10) and five (5) feet layers at 33 Cliff St. and 1850 Cliff St. sites, respectively. However, no further investigation or remediation is recommended for the 1835 Cliff St. property.

1 Introduction

The ACCD engaged Cosmos to conduct a Phase II ESA of three (3) units identified in the Phase I ESA as parcels D, E, and F. In this Phase II ESA report, we identify the sites as 1835 Cliff St. unit (parcel D), 1850 Cliff St. unit (parcel E), and 33 Cliff St unit (parcel F). The units cover the following real state parcels:

- The 1835 Cliff St. unit covers three (3) parcels identified as Block/Lots, 9-M-143, 9-M-146, and 9-M-147.
- The 1850 Cliff St. unit covers four (4) parcels identified as Block/Lots, 9-M-186, 9-M-186-A, 9-M-187, and 9-M-188.
- The 33 Cliff St. unit covers one (1) parcel identified as Block/Lots 9-M-194.

This assessment was prepared in general accordance with the American Society of Testing and Materials (ASTM) Standard Guide for Environmental Site Assessments: Phase II ESA Process (ASTM Designation: E1903-11, Reapproved June 2011).

1.1 Purpose

The purpose of the Phase II ESA was to implement the Phase I ESA recommendations, conducted in October 2011, which identified the past existence of dry cleaners and auto stations close to the boundaries of the property and to identify any petroleum or other contaminants that could have migrated to the site. The Phase II ESA provides an additional level of environmental risk assessment to assist Amani Christian Community Development Corp. (ACCD) in making informed business decisions about the property.

1.2 Scope of Services

The scope of work for this investigation was carried out in general accordance with the ASTM Standard Guide for Environmental Site Assessments: Phase II ESA Process (ASTM Designation: E1903-11, Reapproved June 2011). The following topics are included in this report:

- Review of Existing Information
- Sampling
- Chemical Testing
- Evaluation of Testing Data
- Discussion of Findings and Conclusions

1.3 Special Terms and Conditions

Cosmos evaluated the integrity of all relevant information in this report, but does not assume responsibility for the truth and accuracy of information received from others or for the lack of information that is intentionally, or unintentionally, or negligently withheld from Cosmos by others.

1.4 Limitations and Exceptions of Assessment

Cosmos Technologies, Inc. provided findings and conclusion in this report based on best available information during the period of assessment to achieve the purpose of this evaluation. The Phase II ESA has been performed in accordance with ASTM 1903-11 (Reapproved June 2011) standard and contains all the limitations inherent in this methodology.

No ESA investigation method can eliminate all uncertainty. Furthermore, any sample, either surface or subsurface, taken for chemical analysis may or may not be representative of a larger population. Professional judgment and interpretation are inherent in the process, and uncertainty is inevitable.

Even when Phase II ESA work is executed with the appropriate site-specific standard of care, specific conditions present may be difficult to detect. Such conditions may include but are not limited to, complex geological settings, the fate and transport characteristics of certain hazardous substances and petroleum products, the distribution of existing contamination, physical limitations imposed by the location of utilities and other human-made objects, and the limitations of assessment technologies.

This report was prepared in accordance with general professional consulting principles and practices and consistent with the agreement with the client.

2 Background

A Phase I ESA inspection of the property was performed and found no recognized environmental conditions. However, given the fact that historical records identified that dry cleaners and auto stations were located close to the boundaries of the property, the recommendation was made that the property should be tested to determine the presence of petroleum volatile organic compounds.

2.1 Site Description and Features

2.1.1 Naming convention

In this Phase II ESA report, we name the sites as 1835 Cliff St. unit, 1850 Cliff St. unit, and 33 Cliff St unit for the sites identified in the Phase I ESA report as parcels D, E and F, respectively.

2.1.2 Site Characteristics

As we describe before, the subject property consists of three (3) units identified here as 1835 Cliff St., 1850 Cliff St., and 33 Cliff St. The units cover the following real state parcels:

- The 1835 Cliff St. unit cover three (3) parcels identified as Block/Lots, 9-M-143, 9-M-146, and 9-M-147.
- The 1850 Cliff St. unit cover four (4) parcels identified as Block/Lots, 9-M-186, 9-M-186-A, 9-M-187, and 9-M-188.
- The 33 Cliff St. unit cover one (1) parcel identified as Block/Lots 9-M-194.

Units 1835 Cliff St., 1850 Cliff St., and 33 Cliff St. hereafter referred to as the "property" are located in the Hill District, Pittsburgh, Pennsylvania. The property is bounded by Cassatt Street on the west, Arcena Street on the north, Monaca Place south, and Ledlie Street on the east. The property is approximately 17,859 square feet (0.41 acres) in total area.

The subject property consists of undeveloped vacant land. The property is surrounded by residential dwellings. The property and surroundings are shown in the Site Location Map attached in Appendix A.

2.1.3 Topography and Surface Drainage

A review of the 1:24000 topographic map provided by Environmental Data Resources, Inc. (EDR) indicates that the site topography slopes to the west towards the Allegheny River. The elevation of the property is approximately 1034 feet above sea level. Groundwater and surface drainage on this property are directed to the west towards the Allegheny River.

2.2 Physical Setting

The property is located in the Hill District of Pittsburgh. The site is located on mild slope terrain, at approximately 1034 feet above mean sea level. The latitude (north) and longitude (west) are at 40.446 – 40° 26' 48.1" and 79.984 – 79° 59' 3.5", respectively. The coordinate system on the Universal Transverse Mercator (UTM) is Zone 17 North, UTM X (meters) is 586140, and UTM Y (meters) is 4477810. The property is located in a residential/ commercial area.

2.3 Site History and Land Use

Currently, the property is vacant and has been vacant for approximately the past thirty (30) years. Small trees, shrubs, and grass cover the property. Based on a prior review of Environmental Data Resources (EDR) documents it was evident that residences previously occupied the property until approximately 1979. Phase I ESA review EDR documents such as Allegheny County records of land ownership, various aerial photographs, topographic maps, Sanborn fire insurance maps, a city directory abstract report, and interviews with persons who are familiar with the property. There is no evidence of industrial or other manufacturing activities occurring on these sites.

2.4 Adjacent Property Land Use

Residential and institutional buildings surround the property. The property and surrounding properties are shown in the Site Location Map (Appendix A).

Table 1. Summary of Current and Past Uses of Adjoining Properties

Direction	Current Use	Past Use	Source of Use Data
North	Residential	Residential/ Institutional	Property Visit and Rettew's ESA Phase I report
South	Residential	Residential	Property Visit and Rettew's ESA Phase I report
West	Residential	Residential	Property Visit and Rettew's ESA Phase I report
East	Residential/ Institutional	Residential, Commercial and Institutional	Property Visit and Rettew's ESA Phase I report

2.5 Summary of Previous Assessments

The following items summarize the findings of this investigation:

- The Site parcels are located at Cliff Street in the City of Pittsburgh, Allegheny County, Pennsylvania. The Housing Authority of the City of Pittsburgh (HACP) owns the Site.
- Site Topography: The ground slopes very gently to the West-Northwest toward the Allegheny River basin.
- The Site is set in an urban setting with a long history of development and urban use. The EDR report showed a multitude of nearby and regional facilities that have the potential to impact the Site.
- Fill material and buried remnant structures (e.g., concrete foundations) were observed during the Site reconnaissance and confirmed during an ongoing geotechnical investigation.
- The following five historic facilities were identified during the course of this investigation and had potential to impact select Units of the Site. Those facilities are:
    - Holmes Cleaners (Historical Cleaner)
    - Hill Top Auto Service (Historical Auto Station)
    - Nelson John (Historical Auto Station)
    - Liberty Laundry
    - Pascul Isadore/Walter S Cleaners/Pascule S Tailer Shop – All three names are considered the same facility.
- No historical recognized conditions were identified during the Phase I ESA investigation.

3 Work Performed and Rationale

This section describes the activities necessary to perform Phase II ESA. Cosmos Technologies, Inc. completed a surface and subsurface investigation on October 30, 2017.

3.1 Scope of Assessment

The scope of Phase II ESA was to evaluate the impact, if any, of dry cleaners or auto stations which were near the boundaries of the property in the historical past. A total of three (3) soil borings were drilled, and soils samples analyzed for organics.

3.1.1 Supplemental Record Review

Cosmos engineers reviewed the environmental data records and listings of the property and adjoining properties provided by EDR, Inc in Phase I ESA reported by Rettew.

3.1.2 Conceptual Site Model

A hypothesis was developed based on the preliminary understanding provided in the Phase I ESA, which identified the locations of former dry cleaners, gas stations, and auto repairs/garage shops near the boundaries of the property. The conceptual model defined by Cosmos is that contaminants could have migrated to the sites by gravity in a preferred path. The preferred path follows the groundwater flow direction and the topographic site characteristics.

3.1.3 Soil Sampling and Analysis Rationale Plan

Cosmos designed a sampling and analysis plan (SAP). The sampling plan was designed to measure petroleum contaminants in the soils (see SAP and communication regarding reception and approval from EPA in Appendix F). The SAP selected sites on the property in a general location where dry cleaners and gasoline stations contaminant spills could have migrated to the property in the past. In this report the soil borings identification is given the unit number. For example, boring 1835 refers to the drill executed in unit 1835 Cliff St., boring 1850 refers to the drill executed in unit 1850 Cliff St., boring 33 refers to the drill executed in unit 33 Cliff St. (refer to the Site Location Map in Appendix A to see all boring locations).

Soil borings 33 and 1850 were drilled along the northwestern to identify any possible contaminants which could have migrated from the east-southeast (ESE) in the direction of groundwater flow and the terrain slope to the WNW, which we estimate would be the preferential contaminant path. However, the terrain slope direction changes in unit 1835, lower elevations exist at the south boundary. Following the preferential path and considering that groundwater contaminant in the area migrates principally by gravity, Cosmos selected a lower position at the south of the unit for the soil boring 1835.

Based on the Soils and Foundation Subsurface Investigation Report from Rettew, Cosmos planned to execute the soil borings until a depth of twelve (12) feet. In the SAP,

subsurface samples were planned every four (4) feet of depth. In case of the presence of groundwater in the bores, Cosmos considered liquid sampling.

The rationale for measuring VOCs in the samples was to identify organic petroleum products associated with dry cleaning facilities and auto stations. Also, semi-volatile organics are associated with petroleum products and would tend to adhere to the soil matrix long after the volatile organic compounds have dissipated. To cover a complete range, DRO and ORO were also measured.

The summary of sampling identification, sample location, sample depth, analytical parameters, contaminants of concerns and description of purpose are presented in Table 2 as follows. The soil result profiles of soil borings are shown in Appendix B

Table 2. Summary of Sampling and Analysis Rationale

Sample ID	Matrix	Depth (ft)	Location	Date & Time	Analytical Parameters	Concern Contaminant	Purpose
1835-S1	Soil	0 to 4	Southern (S) perimeter of 1835 Cliff St.	10/30/2017 9:08 a.m.	VOC, DRO, ORO, % Moisture, and % Solids	Petroleum products	Detect organics
33-S1		0 to 4	Northwestern (NW) perimeter of 33 Cliff St.	10/30/2017 9:26 a.m.			
33-S2		4 to 8	Northwestern (NW) perimeter of 33 Cliff St.	10/30/2017 9:42 a.m.			
33-S3		8 to 12	Northwestern (NW) perimeter of 33 Cliff St.	10/30/2017 10:02 a.m.			
1850-S1		0 to 4	Northwestern (NW) perimeter of 1850 Cliff St.	10/30/2017 10:20 a.m.			
1850-S2		4 to 8	Northwestern (NW) perimeter of 1850 Cliff St.	10/30/2017 10:34 a.m.			
1850-S3		8 to 11	Northwestern (NW) perimeter of 1850 Cliff St.	10/30/2017 10:51 a.m.			

3.1.4 Chemical Testing Plan

Cosmos utilized a certified testing laboratory, TestAmerica, Inc. for performing the chemical analyses. The sample bottles were received from TestAmerica, pre-conditioned with stabilizing chemical reagents. Cesar Simon, a Project Engineer from Cosmos

Technologies, Inc., collected the samples in the field and packaged the samples in the sample bottles. A chain of custody was filled by Cesar Simon and handed to Eric Kubet from TestAmerica to deliver the samples to Dominic Nestasie, a Project Manager from TestAmerica. The completed chain of custody was returned to Cosmos Technologies with the analytical results (see page 22 in Appendix C).

3.1.5 Deviations from the Work Plan

Field conditions are variable and in general nonhomogeneous. An ESA SAP was submitted to the EPA. However, deviations from the work plan was necessary due to the following:

- Refusal depth found before twelve feet depth in soil bores 1835 and 1850.
- No fluid was found in any soil bores.

In Cosmos' professional judgment these deviations do not invalidated the Phase II ESA conclusions.

3.2 Exploration, Sampling and Test Screening Methods

Geo-Environmental Drilling Company, Inc. of Pittsburgh was contracted by Cosmos in October 2017 to perform the soil boring activities at the property (See the Site Location Map for the boring locations). During the soil borings activities, Cesar Simon, a Project Engineer from Cosmos, tested the ambient air for volatile organic compounds (VOCs) using a Photo-Ionization Detector (PID) Model MiniRAE 3000. This instrument was rented for this purpose from Field Environmental Instrument, Inc. Calibration records for the device are included in Appendix E. Cesar Simon, also, performed the sample activities from the bore cores extracted by Geo-Environmental.

3.2.1 Test Pits

There were no test pits excavated as a part of this Phase II ESA.

3.2.2 Test Borings

Geo-Environmental Drilling Company, Inc. of Pittsburgh was contracted by Cosmos in October 2017 to perform the soil boring activities at the property. A total of three (3) soil borings were excavated at the approximate locations shown in the Site Location Map (Appendix A). The soil borings were excavated on October 30, 2017. Geo-Environmental performed Direct Push Soil Borings and collected soil samples using the Geoprobe Macro- Core Soil Sampler. The Macro-Core soil samples were collected in clear 4' (length) × 2'' (diameter) plastic liners.

3.2.3 Subsurface Investigation

The following nine (7) subsurface soil samples were collected during this assessment: One (1) sample was obtained in the southern perimeter of 1835 Cliff St. unit (parcel D). Three (3) samples were collected in the northwest perimeter of 33 Cliff St. unit (parcel F). Three (3) samples were collected in the northwest perimeter of 1850 Cliff St. unit (parcel E). Samples were collected using latex gloves and Terracore Kits provided by

TestAmerica. The sampling procedure followed the indication of TestAmerica. Table 2 (page 8) illustrates the details of the subsurface samples.

3.2.4 Monitoring Well Installations

There were no monitoring wells installed as a part of this Phase II ESA.

3.2.5 Other

There were no volatile organic compounds detected during the onsite monitoring of the ambient air using the MiniRAE 3000 PID.

3.3 Chemical Analytical Methods

3.3.1 Soil

The subsurface soil samples were tested and analyzed by TestAmerica, Inc., Pittsburgh. The subsurface soil samples were analyzed for VOC, DRO, ORO, Percent Moisture, and Percent Solids. The rationale for testing for organic compounds is described in Section 3.1.3 and Table 2.

VOC was analyzed using EPA Method SW846 8260 C; DRO and ORO using EPA Method SW846 8015D, and standard method to calculate Percent Moisture and Percent Solids.

3.3.2 Ground Water

There were no groundwater samples collected in this study.

3.3.3 Other

There were no additional chemical analyses performed.

4 Presentation and Evaluation of Results

4.1 Subsurface Conditions

4.1.1 Geologic Setting

Soils/Geology for the property was reviewed from a search conducted by Cosmos. The U.S. Department of Agriculture (USDA) Soil Conservation Service (SCS) indicates that the soils for the property are Urban Land Culleoka Complex gently sloping (UCB) and moderately steep (UCD). 80% of the site area is UCB, and 20% is UCD (see USDA soils report in Appendix D). This soil is characterized as about 60% Urban Land, and 40% Culleoka and similar soils. The Urban Land soil is a mixture of natural soils and fills material from other places. More profound soil types include channery-silt loam and bedrock.

Rettew's Phase I ESA report indicated that: "According to the Pennsylvania Bureau of Topographic and Geologic Survey, the Casselman Formation underlies the Site. The Casselman Formation consists of a heterogeneous unit composed predominately of alternating layers of shale, siltstone, and sandstone. The sandstone is generally shaly and fine to medium grained. This formation includes several freshwater limestone layers along with claystone, several thin, non-persistent coals, and minor red-beds. This formation is generally well bedded. The thickness of beds varies with lithology, ranging from a fraction of an inch to several feet. Sandstone is thick bedded and locally massive. Shale is thin and fissile. Limestone varies from well bedded to nodular. Claystone is very poorly bedded. In this formation, joints and fracturing are poorly to moderately well formed, moderately distributed, closely to moderately spaced, and open and vertical. Sandstone, siltstone, and limestone are moderately resistant to weathering. Claystone, shale, and coal weather extensively and deeply. The resulting overlying mantle is thin. Heavily weathered coal, shale, and claystone may be excavated easily. The foundation stability of this formation is considered fair to good, provided the excavation is to sound material. Heavy structures should not be located on or near claystone because of a tendency to deform under load when wet."

4.1.2 Hydrogeologic Setting

Groundwater is not used at the property or adjacent properties for domestic, fire suppression, or production purposes. No groundwater wells were observed at the units. Groundwater flow information, based upon the generalized topographic gradient, is generally toward the WNW.

A review of the federal, state and local water agency records indicated that there are thirty-six (36) United States Geologic Survey wells located within a 1.0 mile of the property. There is no one federal water supply monitoring well. There are seventy-four (74) Pennsylvania State monitoring wells located within a 1.0 mile of the property.

4.2 Analytical Results

Table 3 summarize subsurface soil sediment results in volatile organics, diesel, and oil range organics and general chemistry. Table 2 lists summary of location, depth, type, and date of samples collected. Appendix B shows the subsurface exploration profile.

Analytical results for soil samples were compared to Pennsylvania Department of Environmental Protection Agency (PA DEP) Medium-Specific Concentrations (MSC) for VOC. TestAmerica, Inc. analyzed the samples. The laboratory analytical report is provided in Appendix C.

Table 3. Summary of Subsurface Soil Sample Results for VOC, DRO, ORO and General Chemistry

Chemical Constituents	**Units**	**PA DEP MSC**	**Sample**						
			1835-S1	**33-S1**	**33-S2**	**33-S3**	**1850-S1**	**1850-S2**	**1850-S3**
Volatile Organics									
Benzene	ug/Kg	130	ND	ND	ND	ND	ND	ND	ND
Naphthalene	ug/Kg	10,000	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethene	ug/Kg	80	ND	ND	ND	ND	ND	ND	ND
Toluene	ug/Kg	44,000	ND	ND	ND	ND	ND	ND	ND
Xylenes, Total	ug/Kg	990,000	ND	ND	ND	ND	ND	ND	ND
Range Organics									
Diesel (DRO)	mg/Kg		ND	**140**	**81**	43	**220**	ND	ND
Oil (ORO)	mg/Kg		ND	**100**	62	ND	**190**	ND	40
General Chemistry									
Percent Moisture	%		14.3	25.1	21.2	17.1	9.6	10.5	11.1
Percent Solids	%		85.7	74.9	78.8	82.9	90.4	89.5	88.9

Note: ND – Not Detected, Result is less than minimum detection limit; MSC – Medium-Specific Concentrations for Organic Regulated Substances in Soil (PA DEP). Bold numbers represent concentrations above the reporting limit (RL) (For Results, see Appendix C)

4.2.1 Soil

Table 3 is a select sample of the chemicals from the full spectrum of chemicals analyzed in the soil sample. Note: volatile organic compounds were non-detectable (ND) (see Table 3 and Appendix C). However, DRO and ORO are above the report limits in the upper layers of units 1850 Cliff St. and 33 Cliff St (parcels E and F, respectively).

4.2.2 Ground Water

There were no groundwater samples collected in this study.

4.2.3 Other

There was no other analytical data or survey carried out during this investigation.

5 Interpretation and Conclusions

5.1 Recognized Environmental Conditions

No recognized environmental conditions were found at the site as established in an ESA Phase I report conducted by Rettew. However, because of the proximity of dry cleaners, gas stations, and auto repairs/garage shops, the recommendation was made to perform a Phase II ESA to identify any petroleum contaminants that could have migrated to the property. The Phase II ESA provides an additional level of environmental risk assessment to assist the ACCD in making informed business decisions about the property.

Based on the findings of the Phase II ESA, Cosmos does not recommend any further investigation for each of the three (3) units of the property.

5.2 Conceptual Model Validation

Based on this analysis, the soil medium at the properties 1850 Cliff St. and 33 Cliff St. (parcels E and F, respectively) are impaired by Diesel Range Organics (DRO) and Oil Range Organics (ORO) contaminants above the regulatory guidelines established by PA DEP and US EPA. However, soil medium was not contaminated in unit 1835 Cliff St. (parcel D).

5.3 Evaluation of Media Quality

The data gathered during the assessment are sufficient to establish that DRO and ORO were identified in the soil medium at the sites 1850 Cliff St. and 33 Cliff St (parcels E and F, respectively). The site 1835 Cliff St. (parcel D) was not contaminated.

5.4 Other Concerns

There were no other concerns identified during this assessment.

5.5 Conclusions

The Phase II ESA for the Cliff Street Project Site was executed following the ASTM Standard Guide for Environmental Site Assessments: Phase II ESA Process (ASTM Designation: E1903-11, Reapproved June 2011).

The samples obtained every four (4) feet in depth for each soil borings do not show the presence of VOC. However, the lab test shows that units 1850 Cliff St. and 33 Cliff St (parcels E and F, respectively) present DRO and ORO in their upper layers. We conclude that top layers are contaminated, and remediation is necessary to remove the contaminated soil layers in these units.

6 Recommendations

We recommend the site remediation by excavating and disposing of the upper soil layers in 1850 Cliff St. unit (parcel E) and 33 Cliff St. unit (parcel F) for a depth of 5 and 10 feet, respectively. Based on area and thickness, approximately 6500 ft^3 and 2950 ft^3 should be removed respectively from each site.

7 Signature of Environmental Professional

This assessment was conducted in accordance with the scope and limitations of American Society of Testing and Materials (ASTM) Standard Guide for Environmental Site Assessments: Phase II Environmental Site Assessment Process (ASTM Designation: E1903-11, Reapproved 2011). Cosmos Technologies, Inc. has developed and performed the All Appropriate Inquiries (AAI) in conformance with the standards and practices set forth in 40 CFR Part 312.

I declare that, to the best of my professional knowledge and belief, I meet the definition of Environmental Professional as defined in Section 312.10 of Title 40, Code of Federal Regulations (CFR); Part 312.10 dated November 1, 2005.

Signature: Date:

12/06/2017

Cesar Simon, Project Engineer

References

1. Pennsylvania Department of Environmental Protection (PA DEP), Statewide Health Standards.
2. The United States Environmental Protection Agency (US EPA), Mid-Atlantic Risk Assessment, Generic Tables.
3. Rettew Associates, Inc., Phase I Environmental Site Assessment for PGH Scattered Sites Residential Project Cliff St., Monaca Place, Cassatt St., Bedford Ave., Webster Ave., and Trent St., City of Pittsburgh, Allegheny County, Pennsylvania, October 12, 2016.
4. Rettew Associates, Inc., Soils and Foundation Subsurface Investigation Report for PGH Scattered Sites Residential Project, City of Pittsburgh, Allegheny County, Pennsylvania., October 12, 2016
5. American Society for Testing and Materials (ASTM), ASTM Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process, E1527-13, Reapproved Nov. 2013.
6. American Society for Testing and Materials (ASTM), ASTM Standard Practice for Environmental Site Assessments: Phase II Environmental Site Assessment Process, E1903-11, Reapproved Jun. 2011.
7. Google Maps
8. Environmental Data Resources, Inc.

APPENDIX A: MAPS

Legend

- Soil Borings
- Sites

Project:
257-02-2017 Amani Phase II ESA

Client:
Amani Christian Community Development Corp.
P.O. Box 7192, Pittsburgh, PA 15213

700 River Ave, Ste 412
Pittsburgh, PA 15212-5956
Office: (412) 321-3951
Fax: (412) 321-3965
Email: info@cosmostechnologiesinc.com
Website: www.cosmostechnologiesinc.com
Cosmos Technologies Inc.

Sheet Name:
Site Location Map

Sheet Number:
L01

Scale:
0 50 100 150 ft

APPENDIX B: Soil Result Profiles

Cosmos Technologies Inc.
700 River Ave., Ste. 412
Pittsburgh, PA 15212-5936
Office: (412) 321-3951
Fax: (412) 321-3954
Email: info@cosmostechnologiesinc.com
Website: www.cosmostechnologiesinc.com

Phase II Environmental Site Assessment
Cliff Street Project Site, Pittsburgh, Pennsylvania, 15219
Soil Result Profiles

Code:	1835 Cliff St.		
depth (ft.)	DRO (mg/Kg)	ORO (mg/Kg)	Report Limit
0			
	ND	ND	59
5			
10			
15			

Code:	33 Cliff St.		
depth (ft.)	DRO (mg/Kg)	ORO (mg/Kg)	Report Limit
0			
	140	**100**	66
5	**81**	**62**	62
10	43	ND	61
15			

Code:	1850 Cliff St.		
depth (ft.)	DRO (mg/Kg)	ORO (mg/Kg)	Report Limit
0			
	220	**190**	55
5	ND	ND	55
10	ND	40	56
15			

APPENDIX C: Laboratory Results

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Pittsburgh
301 Alpha Drive
RIDC Park
Pittsburgh, PA 15238
Tel: (412)963-7058

TestAmerica Job ID: 180-71875-1
Client Project/Site: 1835 Cliff Street
Revision: 1

For:
Cosmos Technologies, Inc.
700 River Avenue
Suite 412
Pittsburgh, Pennsylvania 15212

Attn: David Puchi

Authorized for release by:
11/10/2017 3:20:30 PM

Dominic Nestasie, Manager of Project Management
(412)963-7058
dominic.nestasie@testamericainc.com

LINKS

Review your project results through TotalAccess

Have a Question? Ask The Expert

Visit us at: www.testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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Case Narrative

Client: Cosmos Technologies, Inc.
Project/Site: 1835 Cliff Street

TestAmerica Job ID: 180-71875-1

Job ID: 180-71875-1

Laboratory: TestAmerica Pittsburgh

Narrative

Job Narrative
180-71875-1

Comments:
Per the clients request, this report is being reissued on 11/10/17 with the corrected sample identifications.

Receipt:
The samples were received on 10/30/2017 at 1:40 PM; the samples arrived in good condition, properly preserved and on ice. The temperature of the cooler at time of receipt was 2.1º C.

Receipt Exceptions:
A trip blank was submitted for analysis with these samples; however, it was not listed on the Chain of Custody (COC).

Volatiles:
The laboratory control sample (LCS) for analytical batch 180-227526 recovered outside control limits for the following analytes: Acrolein, Acetone, 2-Chloro ethyl vinyl ether, 1,1,2,2-Tetrachloroethane, Methyl Acetate, 1,2-dibrom-3-chloropropane, Acrylonitrile, Bromoform and 2-Butanone. These analytes were biased high in the LCS and were not detected in the associated samples; therefore, the data has been reported.

The internal standard (ISTD) response for TBA-d9 for the following samples 33-S3 (180-71875-4) and TRIP BLANK (180-71875-8) were outside acceptance criteria. This ISTD does not correspond to any of the requested target compounds; therefore, the data has been reported.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

DRO/ORO:
The continuing calibration verification (CCV) associated with batch 240-302643 recovered above the upper control limit for o-Terphenyl (surr). All analytes of interest met criteria and all samples met surrogate criteria. After careful evaluation the data has been reported.

The matrix spike / matrix spike duplicate (MS/MSD) recoveries for preparation batch 240-302160 and analytical batch 240-302643 were outside control limits. Sample matrix interference and/or non-homogeneity are suspected because the associated laboratory control sample (LCS) recovery was within acceptance limits.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

General Chemistry:
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Organic Prep:
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Definitions/Glossary

Client: Cosmos Technologies, Inc.
Project/Site: 1835 Cliff Street

TestAmerica Job ID: 180-71875-1

Qualifiers

GC Semi VOA

Qualifier	Qualifier Description
^c	CCV Recovery is outside acceptance limits.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Accreditation/Certification Summary

Client: Cosmos Technologies, Inc.
Project/Site: 1835 Cliff Street

TestAmerica Job ID: 180-71875-1

Laboratory: TestAmerica Pittsburgh

Unless otherwise noted, all analytes for this laboratory were covered under each accreditation/certification below.

Authority	Program	EPA Region	Identification Number	Expiration Date
Pennsylvania	NELAP	3	02-00416	04-30-18

Analysis Method	Prep Method	Matrix	Analyte

Laboratory: TestAmerica Canton

Unless otherwise noted, all analytes for this laboratory were covered under each accreditation/certification below.

Authority	Program	EPA Region	Identification Number	Expiration Date
Pennsylvania	NELAP	3	68-00340	08-31-18

Analysis Method	Prep Method	Matrix	Analyte

Sample Summary

Client: Cosmos Technologies, Inc.
Project/Site: 1835 Cliff Street

TestAmerica Job ID: 180-71875-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
180-71875-1	1835-S1	Solid	10/30/17 09:08	10/30/17 13:40
180-71875-2	33-S1	Solid	10/30/17 09:26	10/30/17 13:40
180-71875-3	33-S2	Solid	10/30/17 09:42	10/30/17 13:40
180-71875-4	33-S3	Solid	10/30/17 10:02	10/30/17 13:40
180-71875-5	1850-S1	Solid	10/30/17 10:20	10/30/17 13:40
180-71875-6	1850-S2	Solid	10/30/17 10:34	10/30/17 13:40
180-71875-7	1850-S3	Solid	10/30/17 10:51	10/30/17 13:40
180-71875-8	TRIP BLANK	Water	10/30/17 00:00	10/30/17 13:40

Method Summary

Client: Cosmos Technologies, Inc.
Project/Site: 1835 Cliff Street

TestAmerica Job ID: 180-71875-1

Method	Method Description	Protocol	Laboratory
8260C	Volatile Organic Compounds by GC/MS	SW846	TAL PIT
8015D	Diesel Range Organics (DRO) (GC)	SW846	TAL CAN
2540G	SM 2540G	SM22	TAL PIT

Protocol References:

SM22 = SM22

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL CAN = TestAmerica Canton, 4101 Shuffel Street NW, North Canton, OH 44720, TEL (330)497-9396

TAL PIT = TestAmerica Pittsburgh, 301 Alpha Drive, RIDC Park, Pittsburgh, PA 15238, TEL (412)963-7058

Lab Chronicle

Client: Cosmos Technologies, Inc.
Project/Site: 1835 Cliff Street

TestAmerica Job ID: 180-71875-1

Client Sample ID: 1835-S1 — Lab Sample ID: 180-71875-1

Date Collected: 10/30/17 09:08
Date Received: 10/30/17 13:40
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	2540G		1			227579	10/31/17 15:33	CLL	TAL PIT
	Instrument ID: NOEQUIP									

Client Sample ID: 1835-S1 — Lab Sample ID: 180-71875-1

Date Collected: 10/30/17 09:08
Date Received: 10/30/17 13:40
Matrix: Solid
Percent Solids: 85.6

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	5035			7.1956 g	5 mL	227523	10/31/17 06:01	KLG	TAL PIT
Total/NA	Analysis	8260C		1	5 mL	5 mL	227521	10/31/17 15:02	KLG	TAL PIT
	Instrument ID: CHHP3									
Total/NA	Prep	3546			9.96 g	5 mL	302160	11/06/17 08:43	JT	TAL CAN
Total/NA	Analysis	8015D		1			302643	11/08/17 20:14	DEB	TAL CAN
	Instrument ID: A2HP6F									

Client Sample ID: 33-S1 — Lab Sample ID: 180-71875-2

Date Collected: 10/30/17 09:26
Date Received: 10/30/17 13:40
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	2540G		1			227579	10/31/17 15:33	CLL	TAL PIT
	Instrument ID: NOEQUIP									

Client Sample ID: 33-S1 — Lab Sample ID: 180-71875-2

Date Collected: 10/30/17 09:26
Date Received: 10/30/17 13:40
Matrix: Solid
Percent Solids: 74.9

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	5035			5.0847 g	5 mL	227523	10/31/17 06:01	KLG	TAL PIT
Total/NA	Analysis	8260C		1	5 mL	5 mL	227521	10/31/17 15:25	KLG	TAL PIT
	Instrument ID: CHHP3									
Total/NA	Prep	3546			10.11 g	5 mL	302160	11/06/17 08:43	JT	TAL CAN
Total/NA	Analysis	8015D		1			302643	11/08/17 20:41	DEB	TAL CAN
	Instrument ID: A2HP6F									

Client Sample ID: 33-S2 — Lab Sample ID: 180-71875-3

Date Collected: 10/30/17 09:42
Date Received: 10/30/17 13:40
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	2540G		1			227579	10/31/17 15:33	CLL	TAL PIT
	Instrument ID: NOEQUIP									

Lab Chronicle

Client: Cosmos Technologies, Inc.
Project/Site: 1835 Cliff Street

TestAmerica Job ID: 180-71875-1

Client Sample ID: 33-S2 — Lab Sample ID: 180-71875-3

Date Collected: 10/30/17 09:42 — **Matrix: Solid**
Date Received: 10/30/17 13:40 — **Percent Solids: 78.8**

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	5035			8.6787 g	5 mL	227523	10/31/17 06:01	KLG	TAL PIT
Total/NA	Analysis	8260C		1	5 mL	5 mL	227521	10/31/17 15:47	KLG	TAL PIT
	Instrument ID:	CHHP3								
Total/NA	Prep	3546			10.27 g	5 mL	302160	11/06/17 08:43	JT	TAL CAN
Total/NA	Analysis	8015D		1			302643	11/08/17 21:08	DEB	TAL CAN
	Instrument ID:	A2HP6F								

Client Sample ID: 33-S3 — Lab Sample ID: 180-71875-4

Date Collected: 10/30/17 10:02 — **Matrix: Solid**
Date Received: 10/30/17 13:40

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	2540G		1			227579	10/31/17 15:33	CLL	TAL PIT
	Instrument ID:	NOEQUIP								

Client Sample ID: 33-S3 — Lab Sample ID: 180-71875-4

Date Collected: 10/30/17 10:02 — **Matrix: Solid**
Date Received: 10/30/17 13:40 — **Percent Solids: 82.9**

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	5035			4.7709 g	5 mL	227523	10/31/17 06:01	KLG	TAL PIT
Total/NA	Analysis	8260C		1	5 mL	5 mL	227521	10/31/17 16:10	KLG	TAL PIT
	Instrument ID:	CHHP3								
Total/NA	Prep	3546			9.96 g	5 mL	302160	11/06/17 08:43	JT	TAL CAN
Total/NA	Analysis	8015D		1			302643	11/08/17 21:35	DEB	TAL CAN
	Instrument ID:	A2HP6F								

Client Sample ID: 1850-S1 — Lab Sample ID: 180-71875-5

Date Collected: 10/30/17 10:20 — **Matrix: Solid**
Date Received: 10/30/17 13:40

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	2540G		1			227579	10/31/17 15:33	CLL	TAL PIT
	Instrument ID:	NOEQUIP								

Client Sample ID: 1850-S1 — Lab Sample ID: 180-71875-5

Date Collected: 10/30/17 10:20 — **Matrix: Solid**
Date Received: 10/30/17 13:40 — **Percent Solids: 90.4**

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	5035			3.8447 g	5 mL	227523	10/31/17 06:01	KLG	TAL PIT
Total/NA	Analysis	8260C		1	5 mL	5 mL	227521	10/31/17 16:33	KLG	TAL PIT
	Instrument ID:	CHHP3								

Lab Chronicle

Client: Cosmos Technologies, Inc.
Project/Site: 1835 Cliff Street

TestAmerica Job ID: 180-71875-1

Client Sample ID: 1850-S1
Date Collected: 10/30/17 10:20
Date Received: 10/30/17 13:40

Lab Sample ID: 180-71875-5
Matrix: Solid
Percent Solids: 90.4

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3546			9.99 g	5 mL	302160	11/06/17 08:43	JT	TAL CAN
Total/NA	Analysis	8015D		1			302643	11/08/17 22:01	DEB	TAL CAN
	Instrument ID:	A2HP6F								

Client Sample ID: 1850-S2
Date Collected: 10/30/17 10:34
Date Received: 10/30/17 13:40

Lab Sample ID: 180-71875-6
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	2540G		1			227605	10/31/17 16:26	RMA	TAL PIT
	Instrument ID:	NOEQUIP								

Client Sample ID: 1850-S2
Date Collected: 10/30/17 10:34
Date Received: 10/30/17 13:40

Lab Sample ID: 180-71875-6
Matrix: Solid
Percent Solids: 89.4

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	5035			6.4622 g	5 mL	227523	10/31/17 06:01	KLG	TAL PIT
Total/NA	Analysis	8260C		1	5 mL	5 mL	227521	10/31/17 16:55	KLG	TAL PIT
	Instrument ID:	CHHP3								
Total/NA	Prep	3546			10.19 g	5 mL	302160	11/06/17 08:43	JT	TAL CAN
Total/NA	Analysis	8015D		1			302643	11/08/17 22:55	DEB	TAL CAN
	Instrument ID:	A2HP6F								

Client Sample ID: 1850-S3
Date Collected: 10/30/17 10:51
Date Received: 10/30/17 13:40

Lab Sample ID: 180-71875-7
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	2540G		1			227605	10/31/17 16:26	RMA	TAL PIT
	Instrument ID:	NOEQUIP								

Client Sample ID: 1850-S3
Date Collected: 10/30/17 10:51
Date Received: 10/30/17 13:40

Lab Sample ID: 180-71875-7
Matrix: Solid
Percent Solids: 88.9

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	5035			4.5237 g	5 mL	227646	11/01/17 06:37	KLG	TAL PIT
Total/NA	Analysis	8260C		1	5 mL	5 mL	227636	11/01/17 10:00	KLG	TAL PIT
	Instrument ID:	CHHP3								
Total/NA	Prep	3546			10.00 g	5 mL	302160	11/06/17 08:43	JT	TAL CAN
Total/NA	Analysis	8015D		1			302643	11/08/17 23:22	DEB	TAL CAN
	Instrument ID:	A2HP6F								

Lab Chronicle

Client: Cosmos Technologies, Inc.
Project/Site: 1835 Cliff Street

TestAmerica Job ID: 180-71875-1

Client Sample ID: TRIP BLANK

Date Collected: 10/30/17 00:00
Date Received: 10/30/17 13:40

Lab Sample ID: 180-71875-8

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260C		1	5 mL	5 mL	227526	10/31/17 17:06	PJJ	TAL PIT
	Instrument ID: CHHP4									

Laboratory References:

TAL CAN = TestAmerica Canton, 4101 Shuffel Street NW, North Canton, OH 44720, TEL (330)497-9396

TAL PIT = TestAmerica Pittsburgh, 301 Alpha Drive, RIDC Park, Pittsburgh, PA 15238, TEL (412)963-7058

Analyst References:

Lab: TAL CAN

Batch Type: Prep

JT = Jessica Trushel

Batch Type: Analysis

DEB = Deborah Bolgrin

Lab: TAL PIT

Batch Type: Prep

KLG = Kathy Gordon

Batch Type: Analysis

CLL = Cheryl Loheyde

KLG = Kathy Gordon

PJJ = Patrick Journet

RMA = Rachel Aguiar

Client Sample Results

Client: Cosmos Technologies, Inc.
Project/Site: 1835 Cliff Street

TestAmerica Job ID: 180-71875-1

Client Sample ID: 1835-S1

Date Collected: 10/30/17 09:08
Date Received: 10/30/17 13:40

Lab Sample ID: 180-71875-1
Matrix: Solid
Percent Solids: 85.6

Method: 8260C - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzene	ND		4.1	1.6	ug/Kg	☼	10/31/17 06:01	10/31/17 15:02	1
Naphthalene	ND		4.1	2.6	ug/Kg	☼	10/31/17 06:01	10/31/17 15:02	1
Tetrachloroethene	ND		4.1	1.6	ug/Kg	☼	10/31/17 06:01	10/31/17 15:02	1
Toluene	ND		4.1	1.4	ug/Kg	☼	10/31/17 06:01	10/31/17 15:02	1
Xylenes, Total	ND		8.1	3.5	ug/Kg	☼	10/31/17 06:01	10/31/17 15:02	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*97*		*76 - 111*	*10/31/17 06:01*	*10/31/17 15:02*	*1*
Dibromofluoromethane (Surr)	*87*		*72 - 116*	*10/31/17 06:01*	*10/31/17 15:02*	*1*
1,2-Dichloroethane-d4 (Surr)	*98*		*62 - 118*	*10/31/17 06:01*	*10/31/17 15:02*	*1*
Toluene-d8 (Surr)	*117*		*80 - 129*	*10/31/17 06:01*	*10/31/17 15:02*	*1*

Method: 8015D - Diesel Range Organics (DRO) (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
DRO (C10 - C28)	ND		59	41	mg/Kg	☼	11/06/17 08:43	11/08/17 20:14	1
ORO (C28-C44)	ND		59	41	mg/Kg	☼	11/06/17 08:43	11/08/17 20:14	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*113*	*^c*	*26 - 125*	*11/06/17 08:43*	*11/08/17 20:14*	*1*

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	**14.3**		0.1	0.1	%			10/31/17 15:33	1
Percent Solids	**85.7**		0.1	0.1	%			10/31/17 15:33	1

Client Sample ID: 33-S1

Date Collected: 10/30/17 09:26
Date Received: 10/30/17 13:40

Lab Sample ID: 180-71875-2
Matrix: Solid
Percent Solids: 74.9

Method: 8260C - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzene	ND		6.6	2.6	ug/Kg	☼	10/31/17 06:01	10/31/17 15:25	1
Naphthalene	ND		6.6	4.3	ug/Kg	☼	10/31/17 06:01	10/31/17 15:25	1
Tetrachloroethene	ND		6.6	2.6	ug/Kg	☼	10/31/17 06:01	10/31/17 15:25	1
Toluene	ND		6.6	2.2	ug/Kg	☼	10/31/17 06:01	10/31/17 15:25	1
Xylenes, Total	ND		13	5.7	ug/Kg	☼	10/31/17 06:01	10/31/17 15:25	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*94*		*76 - 111*	*10/31/17 06:01*	*10/31/17 15:25*	*1*
Dibromofluoromethane (Surr)	*95*		*72 - 116*	*10/31/17 06:01*	*10/31/17 15:25*	*1*
1,2-Dichloroethane-d4 (Surr)	*92*		*62 - 118*	*10/31/17 06:01*	*10/31/17 15:25*	*1*
Toluene-d8 (Surr)	*111*		*80 - 129*	*10/31/17 06:01*	*10/31/17 15:25*	*1*

Method: 8015D - Diesel Range Organics (DRO) (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
DRO (C10 - C28)	**140**		66	46	mg/Kg	☼	11/06/17 08:43	11/08/17 20:41	1
ORO (C28-C44)	**100**		66	46	mg/Kg	☼	11/06/17 08:43	11/08/17 20:41	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*117*	*^c*	*26 - 125*	*11/06/17 08:43*	*11/08/17 20:41*	*1*

Client Sample Results

Client: Cosmos Technologies, Inc.
Project/Site: 1835 Cliff Street

TestAmerica Job ID: 180-71875-1

Client Sample ID: 33-S1

Lab Sample ID: 180-71875-2
Date Collected: 10/30/17 09:26
Matrix: Solid
Date Received: 10/30/17 13:40
Percent Solids: 74.9

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	25.1		0.1	0.1	%			10/31/17 15:33	1
Percent Solids	74.9		0.1	0.1	%			10/31/17 15:33	1

Client Sample ID: 33-S2

Lab Sample ID: 180-71875-3
Date Collected: 10/30/17 09:42
Matrix: Solid
Date Received: 10/30/17 13:40
Percent Solids: 78.8

Method: 8260C - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzene	ND		3.7	1.4	ug/Kg	☼	10/31/17 06:01	10/31/17 15:47	1
Naphthalene	ND		3.7	2.4	ug/Kg	☼	10/31/17 06:01	10/31/17 15:47	1
Tetrachloroethene	ND		3.7	1.5	ug/Kg	☼	10/31/17 06:01	10/31/17 15:47	1
Toluene	ND		3.7	1.2	ug/Kg	☼	10/31/17 06:01	10/31/17 15:47	1
Xylenes, Total	ND		7.3	3.1	ug/Kg	☼	10/31/17 06:01	10/31/17 15:47	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*88*		*76 - 111*	*10/31/17 06:01*	*10/31/17 15:47*	*1*
Dibromofluoromethane (Surr)	*94*		*72 - 116*	*10/31/17 06:01*	*10/31/17 15:47*	*1*
1,2-Dichloroethane-d4 (Surr)	*87*		*62 - 118*	*10/31/17 06:01*	*10/31/17 15:47*	*1*
Toluene-d8 (Surr)	*115*		*80 - 129*	*10/31/17 06:01*	*10/31/17 15:47*	*1*

Method: 8015D - Diesel Range Organics (DRO) (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
DRO (C10 - C28)	81		62	43	mg/Kg	☼	11/06/17 08:43	11/08/17 21:08	1
ORO (C28-C44)	62		62	43	mg/Kg	☼	11/06/17 08:43	11/08/17 21:08	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*118*	*^c*	*26 - 125*	*11/06/17 08:43*	*11/08/17 21:08*	*1*

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	21.2		0.1	0.1	%			10/31/17 15:33	1
Percent Solids	78.8		0.1	0.1	%			10/31/17 15:33	1

Client Sample ID: 33-S3

Lab Sample ID: 180-71875-4
Date Collected: 10/30/17 10:02
Matrix: Solid
Date Received: 10/30/17 13:40
Percent Solids: 82.9

Method: 8260C - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzene	ND		6.3	2.5	ug/Kg	☼	10/31/17 06:01	10/31/17 16:10	1
Naphthalene	ND		6.3	4.1	ug/Kg	☼	10/31/17 06:01	10/31/17 16:10	1
Tetrachloroethene	ND		6.3	2.5	ug/Kg	☼	10/31/17 06:01	10/31/17 16:10	1
Toluene	ND		6.3	2.1	ug/Kg	☼	10/31/17 06:01	10/31/17 16:10	1
Xylenes, Total	ND		13	5.4	ug/Kg	☼	10/31/17 06:01	10/31/17 16:10	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*99*		*76 - 111*	*10/31/17 06:01*	*10/31/17 16:10*	*1*
Dibromofluoromethane (Surr)	*94*		*72 - 116*	*10/31/17 06:01*	*10/31/17 16:10*	*1*
1,2-Dichloroethane-d4 (Surr)	*94*		*62 - 118*	*10/31/17 06:01*	*10/31/17 16:10*	*1*
Toluene-d8 (Surr)	*110*		*80 - 129*	*10/31/17 06:01*	*10/31/17 16:10*	*1*

Client Sample Results

Client: Cosmos Technologies, Inc.
Project/Site: 1835 Cliff Street

TestAmerica Job ID: 180-71875-1

Client Sample ID: 33-S3

Lab Sample ID: 180-71875-4
Date Collected: 10/30/17 10:02
Matrix: Solid
Date Received: 10/30/17 13:40
Percent Solids: 82.9

Method: 8015D - Diesel Range Organics (DRO) (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
DRO (C10 - C28)	43	J	61	42	mg/Kg	☼	11/06/17 08:43	11/08/17 21:35	1
ORO (C28-C44)	ND		61	42	mg/Kg	☼	11/06/17 08:43	11/08/17 21:35	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*113*	*^c*	*26 - 125*	*11/06/17 08:43*	*11/08/17 21:35*	*1*

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	17.1		0.1	0.1	%			10/31/17 15:33	1
Percent Solids	82.9		0.1	0.1	%			10/31/17 15:33	1

Client Sample ID: 1850-S1

Lab Sample ID: 180-71875-5
Date Collected: 10/30/17 10:20
Matrix: Solid
Date Received: 10/30/17 13:40
Percent Solids: 90.4

Method: 8260C - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzene	ND		7.2	2.8	ug/Kg	☼	10/31/17 06:01	10/31/17 16:33	1
Naphthalene	ND		7.2	4.7	ug/Kg	☼	10/31/17 06:01	10/31/17 16:33	1
Tetrachloroethene	ND		7.2	2.9	ug/Kg	☼	10/31/17 06:01	10/31/17 16:33	1
Toluene	ND		7.2	2.4	ug/Kg	☼	10/31/17 06:01	10/31/17 16:33	1
Xylenes, Total	ND		14	6.2	ug/Kg	☼	10/31/17 06:01	10/31/17 16:33	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*91*		*76 - 111*	*10/31/17 06:01*	*10/31/17 16:33*	*1*
Dibromofluoromethane (Surr)	*96*		*72 - 116*	*10/31/17 06:01*	*10/31/17 16:33*	*1*
1,2-Dichloroethane-d4 (Surr)	*92*		*62 - 118*	*10/31/17 06:01*	*10/31/17 16:33*	*1*
Toluene-d8 (Surr)	*117*		*80 - 129*	*10/31/17 06:01*	*10/31/17 16:33*	*1*

Method: 8015D - Diesel Range Organics (DRO) (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
DRO (C10 - C28)	220		55	38	mg/Kg	☼	11/06/17 08:43	11/08/17 22:01	1
ORO (C28-C44)	190		55	38	mg/Kg	☼	11/06/17 08:43	11/08/17 22:01	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*110*	*^c*	*26 - 125*	*11/06/17 08:43*	*11/08/17 22:01*	*1*

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	9.6		0.1	0.1	%			10/31/17 15:33	1
Percent Solids	90.4		0.1	0.1	%			10/31/17 15:33	1

Client Sample ID: 1850-S2

Lab Sample ID: 180-71875-6
Date Collected: 10/30/17 10:34
Matrix: Solid
Date Received: 10/30/17 13:40
Percent Solids: 89.4

Method: 8260C - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzene	ND		4.3	1.7	ug/Kg	☼	10/31/17 06:01	10/31/17 16:55	1
Naphthalene	ND		4.3	2.8	ug/Kg	☼	10/31/17 06:01	10/31/17 16:55	1
Tetrachloroethene	ND		4.3	1.7	ug/Kg	☼	10/31/17 06:01	10/31/17 16:55	1

Client Sample Results

Client: Cosmos Technologies, Inc.
Project/Site: 1835 Cliff Street

TestAmerica Job ID: 180-71875-1

Client Sample ID: 1850-S2

Date Collected: 10/30/17 10:34
Date Received: 10/30/17 13:40

Lab Sample ID: 180-71875-6
Matrix: Solid
Percent Solids: 89.4

Method: 8260C - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Toluene	ND		4.3	1.5	ug/Kg	☼	10/31/17 06:01	10/31/17 16:55	1
Xylenes, Total	ND		8.6	3.7	ug/Kg	☼	10/31/17 06:01	10/31/17 16:55	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*97*		*76 - 111*	*10/31/17 06:01*	*10/31/17 16:55*	*1*
Dibromofluoromethane (Surr)	*96*		*72 - 116*	*10/31/17 06:01*	*10/31/17 16:55*	*1*
1,2-Dichloroethane-d4 (Surr)	*91*		*62 - 118*	*10/31/17 06:01*	*10/31/17 16:55*	*1*
Toluene-d8 (Surr)	*110*		*80 - 129*	*10/31/17 06:01*	*10/31/17 16:55*	*1*

Method: 8015D - Diesel Range Organics (DRO) (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
DRO (C10 - C28)	ND		55	38	mg/Kg	☼	11/06/17 08:43	11/08/17 22:55	1
ORO (C28-C44)	ND		55	38	mg/Kg	☼	11/06/17 08:43	11/08/17 22:55	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*116*	*^c*	*26 - 125*	*11/06/17 08:43*	*11/08/17 22:55*	*1*

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	**10.5**		0.1	0.1	%			10/31/17 16:26	1
Percent Solids	**89.5**		0.1	0.1	%			10/31/17 16:26	1

Client Sample ID: 1850-S3

Date Collected: 10/30/17 10:51
Date Received: 10/30/17 13:40

Lab Sample ID: 180-71875-7
Matrix: Solid
Percent Solids: 88.9

Method: 8260C - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzene	ND		6.2	2.4	ug/Kg	☼	11/01/17 06:37	11/01/17 10:00	1
Naphthalene	ND		6.2	4.0	ug/Kg	☼	11/01/17 06:37	11/01/17 10:00	1
Tetrachloroethene	ND		6.2	2.5	ug/Kg	☼	11/01/17 06:37	11/01/17 10:00	1
Toluene	ND		6.2	2.1	ug/Kg	☼	11/01/17 06:37	11/01/17 10:00	1
Xylenes, Total	ND		12	5.4	ug/Kg	☼	11/01/17 06:37	11/01/17 10:00	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*96*		*76 - 111*	*11/01/17 06:37*	*11/01/17 10:00*	*1*
Dibromofluoromethane (Surr)	*91*		*72 - 116*	*11/01/17 06:37*	*11/01/17 10:00*	*1*
1,2-Dichloroethane-d4 (Surr)	*84*		*62 - 118*	*11/01/17 06:37*	*11/01/17 10:00*	*1*
Toluene-d8 (Surr)	*109*		*80 - 129*	*11/01/17 06:37*	*11/01/17 10:00*	*1*

Method: 8015D - Diesel Range Organics (DRO) (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
DRO (C10 - C28)	ND		56	39	mg/Kg	☼	11/06/17 08:43	11/08/17 23:22	1
ORO (C28-C44)	**40**	**J**	56	39	mg/Kg	☼	11/06/17 08:43	11/08/17 23:22	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*120*	*^c*	*26 - 125*	*11/06/17 08:43*	*11/08/17 23:22*	*1*

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	**11.1**		0.1	0.1	%			10/31/17 16:26	1
Percent Solids	**88.9**		0.1	0.1	%			10/31/17 16:26	1

Client Sample Results

Client: Cosmos Technologies, Inc.
Project/Site: 1835 Cliff Street

TestAmerica Job ID: 180-71875-1

Client Sample ID: TRIP BLANK

Lab Sample ID: 180-71875-8

Date Collected: 10/30/17 00:00

Matrix: Water

Date Received: 10/30/17 13:40

Method: 8260C - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzene	ND		5.0	2.0	ug/L			10/31/17 17:06	1
Naphthalene	ND		5.0	3.2	ug/L			10/31/17 17:06	1
Tetrachloroethene	ND		5.0	2.0	ug/L			10/31/17 17:06	1
Toluene	ND		5.0	1.7	ug/L			10/31/17 17:06	1
Xylenes, Total	ND		10	4.3	ug/L			10/31/17 17:06	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*99*		*65 - 116*		*10/31/17 17:06*	*1*
Dibromofluoromethane (Surr)	*92*		*72 - 120*		*10/31/17 17:06*	*1*
1,2-Dichloroethane-d4 (Surr)	*102*		*64 - 137*		*10/31/17 17:06*	*1*
Toluene-d8 (Surr)	*101*		*82 - 132*		*10/31/17 17:06*	*1*

Method: 8260C - Volatile Organic Compounds by GC/MS

Lab Sample ID: MB 180-227521/7
Matrix: Solid
Analysis Batch: 227521

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzene	ND		5.0	2.0	ug/Kg			10/31/17 08:59	1
Naphthalene	ND		5.0	3.2	ug/Kg			10/31/17 08:59	1
Tetrachloroethene	ND		5.0	2.0	ug/Kg			10/31/17 08:59	1
Toluene	ND		5.0	1.7	ug/Kg			10/31/17 08:59	1
Xylenes, Total	ND		10	4.3	ug/Kg			10/31/17 08:59	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*101*		*76 - 111*		*10/31/17 08:59*	*1*
Dibromofluoromethane (Surr)	*97*		*72 - 116*		*10/31/17 08:59*	*1*
1,2-Dichloroethane-d4 (Surr)	*106*		*62 - 118*		*10/31/17 08:59*	*1*
Toluene-d8 (Surr)	*106*		*80 - 129*		*10/31/17 08:59*	*1*

Lab Sample ID: LCS 180-227521/3
Matrix: Solid
Analysis Batch: 227521

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Benzene	40.0	41.1		ug/Kg		103	78 - 118
m-Xylene & p-Xylene	40.0	41.5		ug/Kg		104	78 - 118
Naphthalene	40.0	41.8		ug/Kg		104	67 - 130
o-Xylene	40.0	41.4		ug/Kg		104	78 - 118
Tetrachloroethene	40.0	38.9		ug/Kg		97	78 - 118
Toluene	40.0	42.5		ug/Kg		106	79 - 121
Xylenes, Total	80.0	82.9		ug/Kg		104	78 - 118

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
4-Bromofluorobenzene (Surr)	*105*		*76 - 111*
Dibromofluoromethane (Surr)	*98*		*72 - 116*
1,2-Dichloroethane-d4 (Surr)	*102*		*62 - 118*
Toluene-d8 (Surr)	*106*		*80 - 129*

Lab Sample ID: MB 180-227526/11
Matrix: Water
Analysis Batch: 227526

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzene	ND		5.0	2.0	ug/L			10/31/17 11:35	1
Naphthalene	ND		5.0	3.2	ug/L			10/31/17 11:35	1
Tetrachloroethene	ND		5.0	2.0	ug/L			10/31/17 11:35	1
Toluene	ND		5.0	1.7	ug/L			10/31/17 11:35	1
Xylenes, Total	ND		10	4.3	ug/L			10/31/17 11:35	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*100*		*65 - 116*		*10/31/17 11:35*	*1*
Dibromofluoromethane (Surr)	*111*		*72 - 120*		*10/31/17 11:35*	*1*
1,2-Dichloroethane-d4 (Surr)	*112*		*64 - 137*		*10/31/17 11:35*	*1*
Toluene-d8 (Surr)	*118*		*82 - 132*		*10/31/17 11:35*	*1*

QC Sample Results

Client: Cosmos Technologies, Inc.
Project/Site: 1835 Cliff Street

TestAmerica Job ID: 180-71875-1

Lab Sample ID: LCS 180-227526/7
Matrix: Water
Analysis Batch: 227526

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Benzene	40.0	43.6		ug/L		109	78 - 118
m-Xylene & p-Xylene	40.0	39.5		ug/L		99	78 - 118
Naphthalene	40.0	39.0		ug/L		97	67 - 130
o-Xylene	40.0	40.1		ug/L		100	78 - 118
Tetrachloroethene	40.0	36.3		ug/L		91	78 - 118
Toluene	40.0	40.3		ug/L		101	79 - 121
Xylenes, Total	80.0	79.6		ug/L		100	78 - 118

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
4-Bromofluorobenzene (Surr)	*111*		*65 - 116*
Dibromofluoromethane (Surr)	*120*		*72 - 120*
1,2-Dichloroethane-d4 (Surr)	*126*		*64 - 137*
Toluene-d8 (Surr)	*115*		*82 - 132*

Lab Sample ID: MB 180-227636/8
Matrix: Solid
Analysis Batch: 227636

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzene	ND		5.0	2.0	ug/Kg			11/01/17 09:37	1
Naphthalene	ND		5.0	3.2	ug/Kg			11/01/17 09:37	1
Tetrachloroethene	ND		5.0	2.0	ug/Kg			11/01/17 09:37	1
Toluene	ND		5.0	1.7	ug/Kg			11/01/17 09:37	1
Xylenes, Total	ND		10	4.3	ug/Kg			11/01/17 09:37	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*98*		*76 - 111*		*11/01/17 09:37*	*1*
Dibromofluoromethane (Surr)	*94*		*72 - 116*		*11/01/17 09:37*	*1*
1,2-Dichloroethane-d4 (Surr)	*104*		*62 - 118*		*11/01/17 09:37*	*1*
Toluene-d8 (Surr)	*103*		*80 - 129*		*11/01/17 09:37*	*1*

Lab Sample ID: LCS 180-227636/3
Matrix: Solid
Analysis Batch: 227636

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Benzene	40.0	37.0		ug/Kg		93	78 - 118
m-Xylene & p-Xylene	40.0	36.7		ug/Kg		92	78 - 118
Naphthalene	40.0	36.5		ug/Kg		91	67 - 130
o-Xylene	40.0	36.3		ug/Kg		91	78 - 118
Tetrachloroethene	40.0	34.4		ug/Kg		86	78 - 118
Toluene	40.0	37.5		ug/Kg		94	79 - 121
Xylenes, Total	80.0	73.0		ug/Kg		91	78 - 118

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
4-Bromofluorobenzene (Surr)	*99*		*76 - 111*
Dibromofluoromethane (Surr)	*93*		*72 - 116*
1,2-Dichloroethane-d4 (Surr)	*95*		*62 - 118*
Toluene-d8 (Surr)	*98*		*80 - 129*

Method: 8260C - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: LCSD 180-227636/4
Matrix: Solid
Analysis Batch: 227636

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Benzene	40.0	39.5		ug/Kg		99	78 - 118	6	15
m-Xylene & p-Xylene	40.0	38.4		ug/Kg		96	78 - 118	5	16
Naphthalene	40.0	39.0		ug/Kg		97	67 - 130	6	24
o-Xylene	40.0	38.8		ug/Kg		97	78 - 118	7	15
Tetrachloroethene	40.0	36.8		ug/Kg		92	78 - 118	7	20
Toluene	40.0	39.8		ug/Kg		99	79 - 121	6	18
Xylenes, Total	80.0	77.2		ug/Kg		97	78 - 118	6	15

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
4-Bromofluorobenzene (Surr)	*111*		*76 - 111*
Dibromofluoromethane (Surr)	*102*		*72 - 116*
1,2-Dichloroethane-d4 (Surr)	*108*		*62 - 118*
Toluene-d8 (Surr)	*108*		*80 - 129*

Method: 8015D - Diesel Range Organics (DRO) (GC)

Lab Sample ID: MB 240-302160/23-A
Matrix: Solid
Analysis Batch: 302643

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 302160

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
DRO (C10 - C28)	ND		50	35	mg/Kg		11/06/17 08:43	11/08/17 18:00	1
ORO (C28-C44)	ND		50	35	mg/Kg		11/06/17 08:43	11/08/17 18:00	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*105*		*26 - 125*	*11/06/17 08:43*	*11/08/17 18:00*	*1*

Lab Sample ID: LCS 240-302160/24-A
Matrix: Solid
Analysis Batch: 302376

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 302160

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
DRO (C10 - C28)	250	198		mg/Kg		79	45 - 120

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
o-Terphenyl	*83*		*26 - 125*

Method: 2540G - SM 2540G

Lab Sample ID: 180-71875-6 DU
Matrix: Solid
Analysis Batch: 227605

Client Sample ID: 1850-S2
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Percent Moisture	10.5		10.3		%		2	20
Percent Solids	89.5		89.7		%		0.3	20

QC Association Summary

Client: Cosmos Technologies, Inc.
Project/Site: 1835 Cliff Street

TestAmerica Job ID: 180-71875-1

GC/MS VOA

Analysis Batch: 227521

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-71875-1	1835-S1	Total/NA	Solid	8260C	227523
180-71875-2	33-S1	Total/NA	Solid	8260C	227523
180-71875-3	33-S2	Total/NA	Solid	8260C	227523
180-71875-4	33-S3	Total/NA	Solid	8260C	227523
180-71875-5	1850-S1	Total/NA	Solid	8260C	227523
180-71875-6	1850-S2	Total/NA	Solid	8260C	227523
MB 180-227521/7	Method Blank	Total/NA	Solid	8260C	
LCS 180-227521/3	Lab Control Sample	Total/NA	Solid	8260C	

Prep Batch: 227523

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-71875-1	1835-S1	Total/NA	Solid	5035	
180-71875-2	33-S1	Total/NA	Solid	5035	
180-71875-3	33-S2	Total/NA	Solid	5035	
180-71875-4	33-S3	Total/NA	Solid	5035	
180-71875-5	1850-S1	Total/NA	Solid	5035	
180-71875-6	1850-S2	Total/NA	Solid	5035	

Analysis Batch: 227526

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-71875-8	TRIP BLANK	Total/NA	Water	8260C	
MB 180-227526/11	Method Blank	Total/NA	Water	8260C	
LCS 180-227526/7	Lab Control Sample	Total/NA	Water	8260C	

Analysis Batch: 227636

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-71875-7	1850-S3	Total/NA	Solid	8260C	227646
MB 180-227636/8	Method Blank	Total/NA	Solid	8260C	
LCS 180-227636/3	Lab Control Sample	Total/NA	Solid	8260C	
LCSD 180-227636/4	Lab Control Sample Dup	Total/NA	Solid	8260C	

Prep Batch: 227646

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-71875-7	1850-S3	Total/NA	Solid	5035	

GC Semi VOA

Prep Batch: 302160

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-71875-1	1835-S1	Total/NA	Solid	3546	
180-71875-2	33-S1	Total/NA	Solid	3546	
180-71875-3	33-S2	Total/NA	Solid	3546	
180-71875-4	33-S3	Total/NA	Solid	3546	
180-71875-5	1850-S1	Total/NA	Solid	3546	
180-71875-6	1850-S2	Total/NA	Solid	3546	
180-71875-7	1850-S3	Total/NA	Solid	3546	
MB 240-302160/23-A	Method Blank	Total/NA	Solid	3546	
LCS 240-302160/24-A	Lab Control Sample	Total/NA	Solid	3546	

QC Association Summary

Client: Cosmos Technologies, Inc.
Project/Site: 1835 Cliff Street

TestAmerica Job ID: 180-71875-1

GC Semi VOA (Continued)

Analysis Batch: 302376

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
LCS 240-302160/24-A	Lab Control Sample	Total/NA	Solid	8015D	302160

Analysis Batch: 302643

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-71875-1	1835-S1	Total/NA	Solid	8015D	302160
180-71875-2	33-S1	Total/NA	Solid	8015D	302160
180-71875-3	33-S2	Total/NA	Solid	8015D	302160
180-71875-4	33-S3	Total/NA	Solid	8015D	302160
180-71875-5	1850-S1	Total/NA	Solid	8015D	302160
180-71875-6	1850-S2	Total/NA	Solid	8015D	302160
180-71875-7	1850-S3	Total/NA	Solid	8015D	302160
MB 240-302160/23-A	Method Blank	Total/NA	Solid	8015D	302160

General Chemistry

Analysis Batch: 227579

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-71875-1	1835-S1	Total/NA	Solid	2540G	
180-71875-2	33-S1	Total/NA	Solid	2540G	
180-71875-3	33-S2	Total/NA	Solid	2540G	
180-71875-4	33-S3	Total/NA	Solid	2540G	
180-71875-5	1850-S1	Total/NA	Solid	2540G	

Analysis Batch: 227605

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-71875-6	1850-S2	Total/NA	Solid	2540G	
180-71875-7	1850-S3	Total/NA	Solid	2540G	
180-71875-6 DU	1850-S2	Total/NA	Solid	2540G	

TestAmerica Pittsburgh
301 Alpha Drive RIDC Park
Pittsburgh, PA 15238
Phone (412) 963-7058 Fax (412) 963-2468

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Client Information

Client Contact: Cesar Simon
Company: Cosmos Technologies, Inc.
Address: 700 River Avenue Suite 412
City: Pittsburgh
State, Zip: PA, 15212
Phone:
Email: csimon@cosmostechnologiesinc.com
Project Name: Soil and Water Sample Analyses
Site: 1835 Clift ST.

Sampler: Cesar A Simon
Phone: (412) 224-0555
Due Date Requested:
TAT Requested (days):
PO #: Purchase Order not required
WO #:
Project #: 18018142
SSOW#:

Lab PM: Nestasie, Dominic J
E-Mail: dominic.nestasie@testamericainc.com
Carrier Tracking No(s):
COC No: 180-40698-8859.2
Page: Page 2 of 2
Job #:

Analysis Requested

Preservation Codes:
A - HCL, B - NaOH, C - Zn Acetate, D - Nitric Acid, E - NaHSO4, F - MeOH, G - Amchlor, H - Ascorbic Acid, I - Ice, J - DI Water, K - EDTA, L - EDA
M - Hexane, N - None, O - AsNaO2, P - Na2O4S, Q - Na2SO3, R - Na2S2O3, S - H2SO4, T - TSP Dodecahydrate, U - Acetone, V - MCAA, W - pH 4-5, Z - other (specify)
Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	8260C, Moisture	8015D_DRO - (MOD) Diesel Range Organics [C10-C28]	8260C - PCE,Naphthalene,Benzene,Toluene,Xylene	Total Number of containers	Special Instructions/Note:
			Preservation Code:				N	N	A		
1835 - S1	Oct 30, 2017	9:08		S			✓	✓	✓		
33 - S1	"	9:26		S			✓	✓	✓		
33 - S2	"	9:42		S			✓	✓	✓		
33 - S3	"	10:02		S			✓	✓	✓		
1050 - S1	"	10:20		S			✓	✓	✓		
1050 - S2	"	10:34		S			✓	✓	✓		
1050 - S3	"	10:51		S			✓	✓	✓		

180-71875 Chain of Custody

Possible Hazard Identification
☑ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐ Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by: | Date: | Time: | Method of Shipment:

Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
[signature]	10-30-17 1340	COSMO	[signature]	10-30-17 1340	TAPH
[signature]	10-30-17 1400	TAPH	[signature]	10/30/17 1400	TAPH
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company

Custody Seals Intact: Δ Yes Δ No | Custody Seal No.: TAE3

Cooler Temperature(s) °C and Other Remarks: 2.1°C 0°CF IR 13

Ver: 08/04/2016

TestAmerica Pittsburgh
301 Alpha Drive RIDC Park
Pittsburgh, PA 15238
Phone (412) 963-7058 Fax (412) 963-2468

1.2/C1.2

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Client Information (Sub Contract Lab)	Sampler:	Lab PM: Nestasie, Dominic J	Carrier Tracking No(s):	COC No: 180-306844.1
Client Contact: Shipping/Receiving	Phone:	E-Mail: dominic.nestasie@testamericainc.com	State of Origin: Pennsylvania	Page: Page 1 of 1
Company: TestAmerica Laboratories, Inc.		Accreditations Required (See note): NELAP - Pennsylvania		Job #: 180-71875-1
Address: 4101 Shuffel Street NW,	Due Date Requested: 11/9/2017			
City: North Canton	TAT Requested (days):			
State, Zip: OH, 44720				
Phone: 330-497-9396(Tel) 330-497-0772(Fax)	PO #:			
Email:	WO #:			
Project Name: Soil and Water Sample Analyses	Project #: 18018142			
Site:	SSOW#:			

Analysis Requested

Preservation Codes:

A - HCL, B - NaOH, C - Zn Acetate, D - Nitric Acid, E - NaHSO4, F - MeOH, G - Amchlor, H - Ascorbic Acid, I - Ice, J - DI Water, K - EDTA, L - EDA, M - Hexane, N - None, O - AsNaO2, P - Na2O4S, Q - Na2SO3, R - Na2S2O3, S - H2SO4, T - TSP Dodecahydrate, U - Acetone, V - MCAA, W - pH 4-5, Z - other (specify)

Other:

C116

Sample Identification - Client ID (Lab ID)	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	8015D_DRO/3546 (MOD) Diesel Range Organics [C10-C28]	Total Number of containers	Special Instructions/Note:
			Preservation Code:						
1835-S1 (180-71875-1)	10/30/17	09:08 Eastern		Solid			X	1	
33-S1 (180-71875-2)	10/30/17	09:26 Eastern		Solid			X	1	
33-S2 (180-71875-3)	10/30/17	09:42 Eastern		Solid			X	1	
33-S3 (180-71875-4)	10/30/17	10:02 Eastern		Solid			X	1	
1050-S1 (180-71875-5)	10/30/17	10:20 Eastern		Solid			X	1	
1050-S2 (180-71875-6)	10/30/17	10:34 Eastern		Solid			X	1	
1050-S3 (180-71875-7)	10/30/17	10:51 Eastern		Solid			X	1	

Note: Since laboratory accreditations are subject to change, TestAmerica Laboratories, Inc. places the ownership of method, analyte & accreditation compliance upon out subcontract laboratories. This sample shipment is forwarded under chain-of-custody. If the laboratory does not currently maintain accreditation in the State of Origin listed above for analysis/tests/matrix being analyzed, the samples must be shipped back to the TestAmerica laboratory or other instructions will be provided. Any changes to accreditation status should be brought to TestAmerica Laboratories, Inc. attention immediately. If all requested accreditations are current to date, return the signed Chain of Custody attesting to said complicance to TestAmerica Laboratories, Inc.

Possible Hazard Identification *Unconfirmed*	***Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)*** ☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For* _____ *Months*
Deliverable Requested: I, II, III, IV, Other (specify) Primary Deliverable Rank: 2	Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:		
Relinquished by:	Date/Time: 10/30	Company	Received by:	Date/Time: 11-1-17 0945	Company: TAL
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Custody Seals Intact: Δ Yes Δ No	Custody Seal No.:		Cooler Temperature(s) °C and Other Remarks:		

Ver: 09/20/2016

TestAmerica Canton Sample Receipt Form/Narrative **Login # :**_____

Canton Facility

Client TA Pittsburgh Site Name_____ Cooler unpacked by: MBB

Cooler Received on 11-1-17 Opened on 11-1-17

FedEx: 1st Grd Exp UPS FAS Clipper Client Drop Off TestAmerica Courier Other_____

Receipt After-hours: Drop-off Date/Time_____ Storage Location_____

TestAmerica Cooler # _____ Foam Box Client Cooler Box Other _____

Packing material used: Bubble Wrap Foam Plastic Bag None Other _____

COOLANT: Wet Ice Blue Ice Dry Ice Water None

☐ See Multiple Cooler Form

1. Cooler temperature upon receipt
   IR GUN# IR-8 (CF +0 °C) Observed Cooler Temp. 1.2 °C Corrected Cooler Temp. 1.2 °C
   IR GUN #36 (CF +0.3°C) Observed Cooler Temp._____°C Corrected Cooler Temp._____°C
   IR GUN # 627 (CF -1.3°C) Observed Cooler Temp._____°C Corrected Cooler Temp._____°C

2. Were tamper/custody seals on the outside of the cooler(s)? If Yes Quantity 1 Yes No
   -Were the seals on the outside of the cooler(s) signed & dated? Yes No NA
   -Were tamper/custody seals on the bottle(s) or bottle kits (LLHg/MeHg)? Yes No
   -Were tamper/custody seals intact and uncompromised? Yes No NA
3. Shippers' packing slip attached to the cooler(s)? Yes No
4. Did custody papers accompany the sample(s)? Yes No
5. Were the custody papers relinquished & signed in the appropriate place? Yes No
6. Was/were the person(s) who collected the samples clearly identified on the COC? Yes No
7. Did all bottles arrive in good condition (Unbroken)? Yes No
8. Could all bottle labels be reconciled with the COC? Yes No
9. Were correct bottle(s) used for the test(s) indicated? Yes No
10. Sufficient quantity received to perform indicated analyses? Yes No
11. Are these work share samples? Yes No
    If yes, Questions 11-15 have been checked at the originating laboratory.
11. Were all preserved sample(s) at the correct pH upon receipt? Yes No NA pH Strip Lot# **HC697954**
12. Were VOAs on the COC? Yes No
13. Were air bubbles >6 mm in any VOA vials? ● ⬅ Larger than this. Yes No NA
14. Was a VOA trip blank present in the cooler(s)? Trip Blank Lot #_____ Yes No
15. Was a LL Hg or Me Hg trip blank present? _____ Yes No

Tests that are not checked for pH by Receiving:

VOAs
Oil and Grease
TOC

Contacted PM _____ Date _____ by _____ via Verbal Voice Mail Other

Concerning _____

16. CHAIN OF CUSTODY & SAMPLE DISCREPANCIES

Samples processed by:

_____

_____

_____

_____

_____

17. SAMPLE CONDITION

Sample(s) _____ were received after the recommended holding time had expired.

Sample(s) _____ were received in a broken container.

Sample(s) _____ were received with bubble >6 mm in diameter. (Notify PM)

18. SAMPLE PRESERVATION

Sample(s) _____ were further preserved in the laboratory.

Time preserved: _____ Preservative(s) added/Lot number(s):_____.

Login Sample Receipt Checklist

Client: Cosmos Technologies, Inc.

Job Number: 180-71875-1

Login Number: 71875
List Number: 1
Creator: Kovitch, Christina M

List Source: TestAmerica Pittsburgh

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	N/A	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are 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 containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	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	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

APPENDIX D: USDA Soil Resource Report

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Allegheny County, Pennsylvania

Phase II ESA - Cliff St. Project Site

December 1, 2017

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:642 if printed on A landscape (11" x 8.5") sheet.

Meters: 0 5 10 20 30

Feet: 0 30 60 120 180

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Allegheny County, Pennsylvania
Survey Area Data: Version 12, Oct 27, 2017

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Data not available.

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
UCB	Urban land-Culleoka complex, gently sloping	0.3	80.4%
UCD	Urban land-Culleoka complex, moderately steep	0.1	19.6%
Totals for Area of Interest		**0.4**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however,

onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Allegheny County, Pennsylvania

UCB—Urban land-Culleoka complex, gently sloping

Map Unit Setting

National map unit symbol: l5py
Elevation: 700 to 1,500 feet
Mean annual precipitation: 36 to 46 inches
Mean annual air temperature: 41 to 62 degrees F
Frost-free period: 130 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 60 percent
Culleoka and similar soils: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Pavement, buildings and other artifically covered areas human transported material

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: No

Description of Culleoka

Setting

Landform: Hills
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Fine-loamy residuum weathered from sandstone and siltstone

Typical profile

Ap - 0 to 10 inches: channery silt loam
Bt - 10 to 26 inches: channery silt loam
C - 26 to 31 inches: very channery silt loam
R - 31 to 33 inches: bedrock

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Very low to high (0.00 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Available water storage in profile: Low (about 4.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Hydric soil rating: No

UCD—Urban land-Culleoka complex, moderately steep

Map Unit Setting

National map unit symbol: l5pz
Elevation: 700 to 1,500 feet
Mean annual precipitation: 36 to 46 inches
Mean annual air temperature: 41 to 62 degrees F
Frost-free period: 130 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 60 percent
Culleoka and similar soils: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Pavement, buildings and other artifically covered areas human transported material

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: No

Description of Culleoka

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Fine-loamy residuum weathered from sandstone and siltstone

Typical profile

Ap - 0 to 10 inches: channery silt loam
Bt - 10 to 26 inches: channery silt loam
C - 26 to 31 inches: very channery silt loam
R - 31 to 33 inches: bedrock

Properties and qualities

Slope: 8 to 25 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to high (0.00 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Hydric soil rating: No

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

Glossary

Many of the terms relating to landforms, geology, and geomorphology are defined in more detail in the following National Soil Survey Handbook link: "National Soil Survey Handbook."

ABC soil

A soil having an A, a B, and a C horizon.

Ablation till

Loose, relatively permeable earthy material deposited during the downwasting of nearly static glacial ice, either contained within or accumulated on the surface of the glacier.

AC soil

A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep, rocky slopes.

Aeration, soil

The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil

Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil

A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvial cone

A semiconical type of alluvial fan having very steep slopes. It is higher, narrower, and steeper than a fan and is composed of coarser and thicker layers of material deposited by a combination of alluvial episodes and (to a much lesser degree) landslides (debris flow). The coarsest materials tend to be concentrated at the apex of the cone.

Alluvial fan

A low, outspread mass of loose materials and/or rock material, commonly with gentle slopes. It is shaped like an open fan or a segment of a cone. The material was deposited by a stream at the place where it issues from a narrow mountain valley or upland valley or where a tributary stream is near or at its junction with the main stream. The fan is steepest near its apex, which points upstream, and slopes gently and convexly outward (downstream) with a gradual decrease in gradient.

Alluvium

Unconsolidated material, such as gravel, sand, silt, clay, and various mixtures of these, deposited on land by running water.

Alpha,alpha-dipyridyl

A compound that when dissolved in ammonium acetate is used to detect the presence of reduced iron (Fe II) in the soil. A positive reaction implies reducing conditions and the likely presence of redoximorphic features.

Animal unit month (AUM)

The amount of forage required by one mature cow of approximately 1,000 pounds weight, with or without a calf, for 1 month.

Aquic conditions

Current soil wetness characterized by saturation, reduction, and redoximorphic features.

Argillic horizon

A subsoil horizon characterized by an accumulation of illuvial clay.

Arroyo

The flat-floored channel of an ephemeral stream, commonly with very steep to vertical banks cut in unconsolidated material. It is usually dry but can be transformed into a temporary watercourse or short-lived torrent after heavy rain within the watershed.

Aspect

The direction toward which a slope faces. Also called slope aspect.

Association, soil

A group of soils or miscellaneous areas geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity)

The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low: 0 to 3
Low: 3 to 6
Moderate: 6 to 9
High: 9 to 12
Very high: More than 12

Backslope

The position that forms the steepest and generally linear, middle portion of a hillslope. In profile, backslopes are commonly bounded by a convex shoulder above and a concave footslope below.

Backswamp

A flood-plain landform. Extensive, marshy or swampy, depressed areas of flood plains between natural levees and valley sides or terraces.

Badland

A landscape that is intricately dissected and characterized by a very fine drainage network with high drainage densities and short, steep slopes and narrow interfluves. Badlands develop on surfaces that have little or no vegetative cover overlying unconsolidated or poorly cemented materials (clays, silts, or sandstones) with, in some cases, soluble minerals, such as gypsum or halite.

Bajada

A broad, gently inclined alluvial piedmont slope extending from the base of a mountain range out into a basin and formed by the lateral coalescence of a series of alluvial fans. Typically, it has a broadly undulating transverse profile, parallel to the mountain front, resulting from the convexities of component fans. The term is generally restricted to constructional slopes of intermontane basins.

Basal area

The area of a cross section of a tree, generally referring to the section at breast height and measured outside the bark. It is a measure of stand density, commonly expressed in square feet.

Base saturation

The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.

Base slope (geomorphology)

A geomorphic component of hills consisting of the concave to linear (perpendicular to the contour) slope that, regardless of the lateral shape, forms an apron or wedge at the bottom of a hillside dominated by colluvium and slope-wash sediments (for example, slope alluvium).

Bedding plane

A planar or nearly planar bedding surface that visibly separates each successive layer of stratified sediment or rock (of the same or different lithology)

from the preceding or following layer; a plane of deposition. It commonly marks a change in the circumstances of deposition and may show a parting, a color difference, a change in particle size, or various combinations of these. The term is commonly applied to any bedding surface, even one that is conspicuously bent or deformed by folding.

Bedding system

A drainage system made by plowing, grading, or otherwise shaping the surface of a flat field. It consists of a series of low ridges separated by shallow, parallel dead furrows.

Bedrock

The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bedrock-controlled topography

A landscape where the configuration and relief of the landforms are determined or strongly influenced by the underlying bedrock.

Bench terrace

A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bisequum

Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Blowout (map symbol)

A saucer-, cup-, or trough-shaped depression formed by wind erosion on a preexisting dune or other sand deposit, especially in an area of shifting sand or loose soil or where protective vegetation is disturbed or destroyed. The adjoining accumulation of sand derived from the depression, where recognizable, is commonly included. Blowouts are commonly small.

Borrow pit (map symbol)

An open excavation from which soil and underlying material have been removed, usually for construction purposes.

Bottom land

An informal term loosely applied to various portions of a flood plain.

Boulders

Rock fragments larger than 2 feet (60 centimeters) in diameter.

Breaks

A landscape or tract of steep, rough or broken land dissected by ravines and gullies and marking a sudden change in topography.

Breast height

An average height of 4.5 feet above the ground surface; the point on a tree where diameter measurements are ordinarily taken.

Brush management

Use of mechanical, chemical, or biological methods to make conditions favorable for reseeding or to reduce or eliminate competition from woody vegetation and thus allow understory grasses and forbs to recover. Brush management increases forage production and thus reduces the hazard of erosion. It can improve the habitat for some species of wildlife.

Butte

An isolated, generally flat-topped hill or mountain with relatively steep slopes and talus or precipitous cliffs and characterized by summit width that is less than the height of bounding escarpments; commonly topped by a caprock of resistant material and representing an erosion remnant carved from flat-lying rocks.

Cable yarding

A method of moving felled trees to a nearby central area for transport to a processing facility. Most cable yarding systems involve use of a drum, a pole, and wire cables in an arrangement similar to that of a rod and reel used for fishing. To reduce friction and soil disturbance, felled trees generally are reeled in while one end is lifted or the entire log is suspended.

Calcareous soil

A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Caliche

A general term for a prominent zone of secondary carbonate accumulation in surficial materials in warm, subhumid to arid areas. Caliche is formed by both geologic and pedologic processes. Finely crystalline calcium carbonate forms a nearly continuous surface-coating and void-filling medium in geologic (parent) materials. Cementation ranges from weak in nonindurated forms to very strong in indurated forms. Other minerals (e.g., carbonates, silicate, and sulfate) may occur as accessory cements. Most petrocalcic horizons and some calcic horizons are caliche.

California bearing ratio (CBR)

The load-supporting capacity of a soil as compared to that of standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

Canopy

The leafy crown of trees or shrubs. (See Crown.)

Canyon

A long, deep, narrow valley with high, precipitous walls in an area of high local relief.

Capillary water

Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catena

A sequence, or “chain,” of soils on a landscape that formed in similar kinds of parent material and under similar climatic conditions but that have different characteristics as a result of differences in relief and drainage.

Cation

An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity

The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Catsteps

See Terracettes.

Cement rock

Shaly limestone used in the manufacture of cement.

Channery soil material

Soil material that has, by volume, 15 to 35 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches (15 centimeters) along the longest axis. A single piece is called a channer.

Chemical treatment

Control of unwanted vegetation through the use of chemicals.

Chiseling

Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

Cirque

A steep-walled, semicircular or crescent-shaped, half-bowl-like recess or hollow, commonly situated at the head of a glaciated mountain valley or high on the side of a mountain. It was produced by the erosive activity of a mountain glacier. It commonly contains a small round lake (tarn).

Clay

As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay depletions

See Redoximorphic features.

Clay film

A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Clay spot (map symbol)

A spot where the surface texture is silty clay or clay in areas where the surface layer of the soils in the surrounding map unit is sandy loam, loam, silt loam, or coarser.

Claypan

A dense, compact subsoil layer that contains much more clay than the overlying materials, from which it is separated by a sharply defined boundary. The layer restricts the downward movement of water through the soil. A claypan is commonly hard when dry and plastic and sticky when wet.

Climax plant community

The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse textured soil

Sand or loamy sand.

Cobble (or cobblestone)

A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Cobbly soil material

Material that has 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.6 to 25 centimeters) in diameter. Very cobbly soil material has 35 to 60 percent of these rock fragments, and extremely cobbly soil material has more than 60 percent.

COLE (coefficient of linear extensibility)

See Linear extensibility.

Colluvium

Unconsolidated, unsorted earth material being transported or deposited on side slopes and/or at the base of slopes by mass movement (e.g., direct gravitational action) and by local, unconcentrated runoff.

Complex slope

Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil

A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

Concretions

See Redoximorphic features.

Conglomerate

A coarse grained, clastic sedimentary rock composed of rounded or subangular rock fragments more than 2 millimeters in diameter. It commonly has a matrix of sand and finer textured material. Conglomerate is the consolidated equivalent of gravel.

Conservation cropping system

Growing crops in combination with needed cultural and management practices. In a good conservation cropping system, the soil-improving crops and practices more than offset the effects of the soil-depleting crops and practices. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

Conservation tillage

A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil

Refers to the degree of cohesion and adhesion of soil material and its resistance to deformation when ruptured. Consistence includes resistance of soil material to rupture and to penetration; plasticity, toughness, and stickiness of puddled soil material; and the manner in which the soil material behaves when subject to compression. Terms describing consistence are defined in the “Soil Survey Manual.”

Contour stripcropping

Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section

The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Coprogenous earth (sedimentary peat)

A type of limnic layer composed predominantly of fecal material derived from aquatic animals.

Corrosion (geomorphology)

A process of erosion whereby rocks and soil are removed or worn away by natural chemical processes, especially by the solvent action of running water, but also by other reactions, such as hydrolysis, hydration, carbonation, and oxidation.

Corrosion (soil survey interpretations)

Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.

Cover crop

A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Crop residue management

Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.

Cropping system

Growing crops according to a planned system of rotation and management practices.

Cross-slope farming

Deliberately conducting farming operations on sloping farmland in such a way that tillage is across the general slope.

Crown

The upper part of a tree or shrub, including the living branches and their foliage.

Cryoturbate

A mass of soil or other unconsolidated earthy material moved or disturbed by frost action. It is typically coarser than the underlying material.

Cuesta

An asymmetric ridge capped by resistant rock layers of slight or moderate dip (commonly less than 15 percent slopes); a type of homocline produced by differential erosion of interbedded resistant and weak rocks. A cuesta has a long, gentle slope on one side (dip slope) that roughly parallels the inclined beds; on the other side, it has a relatively short and steep or clifflike slope (scarp) that cuts through the tilted rocks.

Culmination of the mean annual increment (CMAI)

The average annual increase per acre in the volume of a stand. Computed by dividing the total volume of the stand by its age. As the stand increases in age, the mean annual increment continues to increase until mortality begins to reduce the rate of increase. The point where the stand reaches its maximum annual rate of growth is called the culmination of the mean annual increment.

Cutbanks cave

The walls of excavations tend to cave in or slough.

Decreasers

The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing

Postponing grazing or resting grazing land for a prescribed period.

Delta

A body of alluvium having a surface that is fan shaped and nearly flat; deposited at or near the mouth of a river or stream where it enters a body of relatively quiet water, generally a sea or lake.

Dense layer

A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depression, closed (map symbol)

A shallow, saucer-shaped area that is slightly lower on the landscape than the surrounding area and that does not have a natural outlet for surface drainage.

Depth, soil

Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; shallow, 10 to 20 inches; and very shallow, less than 10 inches.

Desert pavement

A natural, residual concentration or layer of wind-polished, closely packed gravel, boulders, and other rock fragments mantling a desert surface. It forms where wind action and sheetwash have removed all smaller particles or where rock fragments have migrated upward through sediments to the surface. It typically protects the finer grained underlying material from further erosion.

Diatomaceous earth

A geologic deposit of fine, grayish siliceous material composed chiefly or entirely of the remains of diatoms.

Dip slope

A slope of the land surface, roughly determined by and approximately conforming to the dip of the underlying bedrock.

Diversion (or diversion terrace)

A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Divided-slope farming

A form of field stripcropping in which crops are grown in a systematic arrangement of two strips, or bands, across the slope to reduce the hazard of water erosion. One strip is in a close-growing crop that provides protection from erosion, and the other strip is in a crop that provides less protection from erosion. This practice is used where slopes are not long enough to permit a full stripcropping pattern to be used.

Drainage class (natural)

Refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized—*excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained,* and *very poorly drained*. These classes are defined in the “Soil Survey Manual.”

Drainage, surface

Runoff, or surface flow of water, from an area.

Drainageway

A general term for a course or channel along which water moves in draining an area. A term restricted to relatively small, linear depressions that at some time move concentrated water and either do not have a defined channel or have only a small defined channel.

Draw

A small stream valley that generally is shallower and more open than a ravine or gulch and that has a broader bottom. The present stream channel may appear inadequate to have cut the drainageway that it occupies.

Drift

A general term applied to all mineral material (clay, silt, sand, gravel, and boulders) transported by a glacier and deposited directly by or from the ice or transported by running water emanating from a glacier. Drift includes unstratified material (till) that forms moraines and stratified deposits that form outwash plains, eskers, kames, varves, and glaciofluvial sediments. The term is generally applied to Pleistocene glacial deposits in areas that no longer contain glaciers.

Drumlin

A low, smooth, elongated oval hill, mound, or ridge of compact till that has a core of bedrock or drift. It commonly has a blunt nose facing the direction from which the ice approached and a gentler slope tapering in the other direction. The longer axis is parallel to the general direction of glacier flow. Drumlins are products of streamline (laminar) flow of glaciers, which molded the subglacial floor through a combination of erosion and deposition.

Duff

A generally firm organic layer on the surface of mineral soils. It consists of fallen plant material that is in the process of decomposition and includes everything from the litter on the surface to underlying pure humus.

Dune

A low mound, ridge, bank, or hill of loose, windblown granular material (generally sand), either barren and capable of movement from place to place or covered and stabilized with vegetation but retaining its characteristic shape.

Earthy fill

See Mine spoil.

Ecological site

An area where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. An ecological site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other ecological sites in kind and/or proportion of species or in total production.

Eluviation

The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Endosaturation

A type of saturation of the soil in which all horizons between the upper boundary of saturation and a depth of 2 meters are saturated.

Eolian deposit

Sand-, silt-, or clay-sized clastic material transported and deposited primarily by wind, commonly in the form of a dune or a sheet of sand or loess.

Ephemeral stream

A stream, or reach of a stream, that flows only in direct response to precipitation. It receives no long-continued supply from melting snow or other source, and its channel is above the water table at all times.

Episaturation

A type of saturation indicating a perched water table in a soil in which saturated layers are underlain by one or more unsaturated layers within 2 meters of the surface.

Erosion

The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (accelerated)

Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as a fire, that exposes the surface.

Erosion (geologic)

Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion pavement

A surficial lag concentration or layer of gravel and other rock fragments that remains on the soil surface after sheet or rill erosion or wind has removed the finer soil particles and that tends to protect the underlying soil from further erosion.

Erosion surface

A land surface shaped by the action of erosion, especially by running water.

Escarpment

A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and resulting from erosion or faulting. Most commonly applied to cliffs produced by differential erosion. Synonym: scarp.

Escarpment, bedrock (map symbol)

A relatively continuous and steep slope or cliff, produced by erosion or faulting, that breaks the general continuity of more gently sloping land surfaces. Exposed material is hard or soft bedrock.

Escarpment, nonbedrock (map symbol)

A relatively continuous and steep slope or cliff, generally produced by erosion but in some places produced by faulting, that breaks the continuity of more gently sloping land surfaces. Exposed earthy material is nonsoil or very shallow soil.

Esker

A long, narrow, sinuous, steep-sided ridge of stratified sand and gravel deposited as the bed of a stream flowing in an ice tunnel within or below the ice (subglacial) or between ice walls on top of the ice of a wasting glacier and left

behind as high ground when the ice melted. Eskers range in length from less than a kilometer to more than 160 kilometers and in height from 3 to 30 meters.

Extrusive rock

Igneous rock derived from deep-seated molten matter (magma) deposited and cooled on the earth's surface.

Fallow

Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grain is grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fan remnant

A general term for landforms that are the remaining parts of older fan landforms, such as alluvial fans, that have been either dissected or partially buried.

Fertility, soil

The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat)

The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity

The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity*.

Fill slope

A sloping surface consisting of excavated soil material from a road cut. It commonly is on the downhill side of the road.

Fine textured soil

Sandy clay, silty clay, or clay.

Firebreak

An area cleared of flammable material to stop or help control creeping or running fires. It also serves as a line from which to work and to facilitate the movement of firefighters and equipment. Designated roads also serve as firebreaks.

First bottom

An obsolete, informal term loosely applied to the lowest flood-plain steps that are subject to regular flooding.

Flaggy soil material

Material that has, by volume, 15 to 35 percent flagstones. Very flaggy soil material has 35 to 60 percent flagstones, and extremely flaggy soil material has more than 60 percent flagstones.

Flagstone

A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist 6 to 15 inches (15 to 38 centimeters) long.

Flood plain

The nearly level plain that borders a stream and is subject to flooding unless protected artificially.

Flood-plain landforms

A variety of constructional and erosional features produced by stream channel migration and flooding. Examples include backswamps, flood-plain splays, meanders, meander belts, meander scrolls, oxbow lakes, and natural levees.

Flood-plain splay

A fan-shaped deposit or other outspread deposit formed where an overloaded stream breaks through a levee (natural or artificial) and deposits its material (commonly coarse grained) on the flood plain.

Flood-plain step

An essentially flat, terrace-like alluvial surface within a valley that is frequently covered by floodwater from the present stream; any approximately horizontal surface still actively modified by fluvial scour and/or deposition. May occur individually or as a series of steps.

Fluvial

Of or pertaining to rivers or streams; produced by stream or river action.

Foothills

A region of steeply sloping hills that fringes a mountain range or high-plateau escarpment. The hills have relief of as much as 1,000 feet (300 meters).

Footslope

The concave surface at the base of a hillslope. A footslope is a transition zone between upslope sites of erosion and transport (shoulders and backslopes) and downslope sites of deposition (toeslopes).

Forb

Any herbaceous plant not a grass or a sedge.

Forest cover

All trees and other woody plants (underbrush) covering the ground in a forest.

Forest type

A stand of trees similar in composition and development because of given physical and biological factors by which it may be differentiated from other stands.

Fragipan

A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Genesis, soil

The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gilgai

Commonly, a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of clayey soils that shrink and swell considerably with changes in moisture content.

Glaciofluvial deposits

Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur in the form of outwash plains, valley trains, deltas, kames, eskers, and kame terraces.

Glaciolacustrine deposits

Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are bedded or laminated.

Gleyed soil

Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors.

Graded stripcropping

Growing crops in strips that grade toward a protected waterway.

Grassed waterway

A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel

Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravel pit (map symbol)

An open excavation from which soil and underlying material have been removed and used, without crushing, as a source of sand or gravel.

Gravelly soil material

Material that has 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

Gravelly spot (map symbol)

A spot where the surface layer has more than 35 percent, by volume, rock fragments that are mostly less than 3 inches in diameter in an area that has less than 15 percent rock fragments.

Green manure crop (agronomy)

A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water

Water filling all the unblocked pores of the material below the water table.

Gully (map symbol)

A small, steep-sided channel caused by erosion and cut in unconsolidated materials by concentrated but intermittent flow of water. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage whereas a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hard bedrock

Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Hard to reclaim

Reclamation is difficult after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Hardpan

A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Head slope (geomorphology)

A geomorphic component of hills consisting of a laterally concave area of a hillside, especially at the head of a drainageway. The overland waterflow is converging.

Hemic soil material (mucky peat)

Organic soil material intermediate in degree of decomposition between the less decomposed fibric material and the more decomposed sapric material.

High-residue crops

Such crops as small grain and corn used for grain. If properly managed, residue from these crops can be used to control erosion until the next crop in the rotation is established. These crops return large amounts of organic matter to the soil.

Hill

A generic term for an elevated area of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well defined outline. Slopes are generally more than 15 percent. The distinction between a hill and a mountain is arbitrary and may depend on local usage.

Hillslope

A generic term for the steeper part of a hill between its summit and the drainage line, valley flat, or depression floor at the base of a hill.

Horizon, soil

A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the “Soil Survey Manual.” The major horizons of mineral soil are as follows:

O horizon: An organic layer of fresh and decaying plant residue.

L horizon: A layer of organic and mineral limnic materials, including coprogenous earth (sedimentary peat), diatomaceous earth, and marl.

A horizon: The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon: The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon: The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon: The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon: Soft, consolidated bedrock beneath the soil.

R layer: Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

M layer: A root-limiting subsoil layer consisting of nearly continuous, horizontally oriented, human-manufactured materials.

W layer: A layer of water within or beneath the soil.

Humus

The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups

Refers to soils grouped according to their runoff potential. The soil properties that influence this potential are those that affect the minimum rate of water infiltration on a bare soil during periods after prolonged wetting when the soil is not frozen. These properties include depth to a seasonal high water table, the infiltration rate, and depth to a layer that significantly restricts the downward movement of water. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff.

Igneous rock

Rock that was formed by cooling and solidification of magma and that has not been changed appreciably by weathering since its formation. Major varieties include plutonic and volcanic rock (e.g., andesite, basalt, and granite).

Illuviation

The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil

A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Increasers

Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration

The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity

The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate

The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate

The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Very low: Less than 0.2

Low: 0.2 to 0.4

Moderately low: 0.4 to 0.75

Moderate: 0.75 to 1.25

Moderately high: 1.25 to 1.75

High: 1.75 to 2.5

Very high: More than 2.5

Interfluve

A landform composed of the relatively undissected upland or ridge between two adjacent valleys containing streams flowing in the same general direction. An elevated area between two drainageways that sheds water to those drainageways.

Interfluve (geomorphology)

A geomorphic component of hills consisting of the uppermost, comparatively level or gently sloping area of a hill; shoulders of backwearing hillslopes can narrow the upland or can merge, resulting in a strongly convex shape.

Intermittent stream

A stream, or reach of a stream, that does not flow year-round but that is commonly dry for 3 or more months out of 12 and whose channel is generally below the local water table. It flows only during wet periods or when it receives ground-water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

Invaders

On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, plants invade following disturbance of the surface.

Iron depletions

See Redoximorphic features.

Irrigation

Application of water to soils to assist in production of crops. Methods of irrigation are:

Basin: Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Border: Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Controlled flooding: Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation: Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle): Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow: Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler: Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation: Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding: Water, released at high points, is allowed to flow onto an area without controlled distribution.

Kame

A low mound, knob, hummock, or short irregular ridge composed of stratified sand and gravel deposited by a subglacial stream as a fan or delta at the margin of a melting glacier; by a supraglacial stream in a low place or hole on the surface of the glacier; or as a ponded deposit on the surface or at the margin of stagnant ice.

Karst (topography)

A kind of topography that formed in limestone, gypsum, or other soluble rocks by dissolution and that is characterized by closed depressions, sinkholes, caves, and underground drainage.

Knoll

A small, low, rounded hill rising above adjacent landforms.

Ksat

See Saturated hydraulic conductivity.

Lacustrine deposit

Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Lake plain

A nearly level surface marking the floor of an extinct lake filled by well sorted, generally fine textured, stratified deposits, commonly containing varves.

Lake terrace

A narrow shelf, partly cut and partly built, produced along a lakeshore in front of a scarp line of low cliffs and later exposed when the water level falls.

Landfill (map symbol)

An area of accumulated waste products of human habitation, either above or below natural ground level.

Landslide

A general, encompassing term for most types of mass movement landforms and processes involving the downslope transport and outward deposition of soil and rock materials caused by gravitational forces; the movement may or may not involve saturated materials. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones

Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Lava flow (map symbol)

A solidified, commonly lobate body of rock formed through lateral, surface outpouring of molten lava from a vent or fissure.

Leaching

The removal of soluble material from soil or other material by percolating water.

Levee (map symbol)

An embankment that confines or controls water, especially one built along the banks of a river to prevent overflow onto lowlands.

Linear extensibility

Refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. Linear extensibility is used to determine the shrink-swell potential of soils. It is an expression of the volume change between the water content of the clod at $^{1}/_{3}$- or $^{1}/_{10}$-bar tension (33kPa or 10kPa tension) and oven dryness. Volume change is influenced by the amount and type of clay minerals in the soil. The volume change is the percent change for the whole soil. If it is expressed as a fraction, the resulting value is COLE, coefficient of linear extensibility.

Liquid limit

The moisture content at which the soil passes from a plastic to a liquid state.

Loam

Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess

Material transported and deposited by wind and consisting dominantly of silt-sized particles.

Low strength

The soil is not strong enough to support loads.

Low-residue crops

Such crops as corn used for silage, peas, beans, and potatoes. Residue from these crops is not adequate to control erosion until the next crop in the rotation is established. These crops return little organic matter to the soil.

Marl

An earthy, unconsolidated deposit consisting chiefly of calcium carbonate mixed with clay in approximately equal proportions; formed primarily under freshwater lacustrine conditions but also formed in more saline environments.

Marsh or swamp (map symbol)

A water-saturated, very poorly drained area that is intermittently or permanently covered by water. Sedges, cattails, and rushes are the dominant vegetation in marshes, and trees or shrubs are the dominant vegetation in swamps. Not used in map units where the named soils are poorly drained or very poorly drained.

Mass movement

A generic term for the dislodgment and downslope transport of soil and rock material as a unit under direct gravitational stress.

Masses

See Redoximorphic features.

Meander belt

The zone within which migration of a meandering channel occurs; the flood-plain area included between two imaginary lines drawn tangential to the outer bends of active channel loops.

Meander scar

A crescent-shaped, concave or linear mark on the face of a bluff or valley wall, produced by the lateral erosion of a meandering stream that impinged upon and undercut the bluff.

Meander scroll

One of a series of long, parallel, close-fitting, crescent-shaped ridges and troughs formed along the inner bank of a stream meander as the channel migrated laterally down-valley and toward the outer bank.

Mechanical treatment

Use of mechanical equipment for seeding, brush management, and other management practices.

Medium textured soil

Very fine sandy loam, loam, silt loam, or silt.

Mesa

A broad, nearly flat topped and commonly isolated landmass bounded by steep slopes or precipitous cliffs and capped by layers of resistant, nearly horizontal rocky material. The summit width is characteristically greater than the height of the bounding escarpments.

Metamorphic rock

Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement at depth in the earth's crust. Nearly all such rocks are crystalline.

Mine or quarry (map symbol)

An open excavation from which soil and underlying material have been removed and in which bedrock is exposed. Also denotes surface openings to underground mines.

Mine spoil

An accumulation of displaced earthy material, rock, or other waste material removed during mining or excavation. Also called earthy fill.

Mineral soil

Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage

Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area

A kind of map unit that has little or no natural soil and supports little or no vegetation.

Miscellaneous water (map symbol)

Small, constructed bodies of water that are used for industrial, sanitary, or mining applications and that contain water most of the year.

Moderately coarse textured soil

Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil

Clay loam, sandy clay loam, or silty clay loam.

Mollic epipedon

A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include the upper part of the subsoil.

Moraine

In terms of glacial geology, a mound, ridge, or other topographically distinct accumulation of unsorted, unstratified drift, predominantly till, deposited primarily by the direct action of glacial ice in a variety of landforms. Also, a general term for a landform composed mainly of till (except for kame moraines, which are composed mainly of stratified outwash) that has been deposited by a glacier. Some types of moraines are disintegration, end, ground, kame, lateral, recessional, and terminal.

Morphology, soil

The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil

Irregular spots of different colors that vary in number and size. Descriptive terms are as follows: abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

Mountain

A generic term for an elevated area of the land surface, rising more than 1,000 feet (300 meters) above surrounding lowlands, commonly of restricted summit area (relative to a plateau) and generally having steep sides. A mountain can

occur as a single, isolated mass or in a group forming a chain or range. Mountains are formed primarily by tectonic activity and/or volcanic action but can also be formed by differential erosion.

Muck

Dark, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Mucky peat

See Hemic soil material.

Mudstone

A blocky or massive, fine grained sedimentary rock in which the proportions of clay and silt are approximately equal. Also, a general term for such material as clay, silt, claystone, siltstone, shale, and argillite and that should be used only when the amounts of clay and silt are not known or cannot be precisely identified.

Munsell notation

A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Natric horizon

A special kind of argillic horizon that contains enough exchangeable sodium to have an adverse effect on the physical condition of the subsoil.

Neutral soil

A soil having a pH value of 6.6 to 7.3. (See Reaction, soil.)

Nodules

See Redoximorphic features.

Nose slope (geomorphology)

A geomorphic component of hills consisting of the projecting end (laterally convex area) of a hillside. The overland waterflow is predominantly divergent. Nose slopes consist dominantly of colluvium and slope-wash sediments (for example, slope alluvium).

Nutrient, plant

Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter

Plant and animal residue in the soil in various stages of decomposition. The content of organic matter in the surface layer is described as follows:

Very low: Less than 0.5 percent
Low: 0.5 to 1.0 percent
Moderately low: 1.0 to 2.0 percent
Moderate: 2.0 to 4.0 percent
High: 4.0 to 8.0 percent
Very high: More than 8.0 percent

Outwash

Stratified and sorted sediments (chiefly sand and gravel) removed or “washed out” from a glacier by meltwater streams and deposited in front of or beyond the end moraine or the margin of a glacier. The coarser material is deposited nearer to the ice.

Outwash plain

An extensive lowland area of coarse textured glaciofluvial material. An outwash plain is commonly smooth; where pitted, it generally is low in relief.

Paleoterrace

An erosional remnant of a terrace that retains the surface form and alluvial deposits of its origin but was not emplaced by, and commonly does not grade to, a present-day stream or drainage network.

Pan

A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material

The unconsolidated organic and mineral material in which soil forms.

Peat

Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped

An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedisediment

A layer of sediment, eroded from the shoulder and backslope of an erosional slope, that lies on and is being (or was) transported across a gently sloping erosional surface at the foot of a receding hill or mountain slope.

Pedon

The smallest volume that can be called “a soil.” A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation

The movement of water through the soil.

Perennial water (map symbol)

Small, natural or constructed lakes, ponds, or pits that contain water most of the year.

Permafrost

Ground, soil, or rock that remains at or below 0 degrees C for at least 2 years. It is defined on the basis of temperature and is not necessarily frozen.

pH value

A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Phase, soil

A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and flooding.

Piping

Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Pitting

Pits caused by melting around ice. They form on the soil after plant cover is removed.

Plastic limit

The moisture content at which a soil changes from semisolid to plastic.

Plasticity index

The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plateau (geomorphology)

A comparatively flat area of great extent and elevation; specifically, an extensive land region that is considerably elevated (more than 100 meters) above the adjacent lower lying terrain, is commonly limited on at least one side by an abrupt descent, and has a flat or nearly level surface. A comparatively large part of a plateau surface is near summit level.

Playa

The generally dry and nearly level lake plain that occupies the lowest parts of closed depressions, such as those on intermontane basin floors. Temporary flooding occurs primarily in response to precipitation and runoff. Playa deposits are fine grained and may or may not have a high water table and saline conditions.

Plinthite

The sesquioxide-rich, humus-poor, highly weathered mixture of clay with quartz and other diluents. It commonly appears as red mottles, usually in platy, polygonal, or reticulate patterns. Plinthite changes irreversibly to an ironstone hardpan or to irregular aggregates on repeated wetting and drying, especially if it is exposed also to heat from the sun. In a moist soil, plinthite can be cut with a spade. It is a form of laterite.

Plowpan

A compacted layer formed in the soil directly below the plowed layer.

Ponding

Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poorly graded

Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Pore linings

See Redoximorphic features.

Potential native plant community

See Climax plant community.

Potential rooting depth (effective rooting depth)

Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

Prescribed burning

Deliberately burning an area for specific management purposes, under the appropriate conditions of weather and soil moisture and at the proper time of day.

Productivity, soil

The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil

A vertical section of the soil extending through all its horizons and into the parent material.

Proper grazing use

Grazing at an intensity that maintains enough cover to protect the soil and maintain or improve the quantity and quality of the desirable vegetation. This practice increases the vigor and reproduction capacity of the key plants and

promotes the accumulation of litter and mulch necessary to conserve soil and water.

Rangeland

Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Reaction, soil

A measure of acidity or alkalinity of a soil, expressed as pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Ultra acid: Less than 3.5
Extremely acid: 3.5 to 4.4
Very strongly acid: 4.5 to 5.0
Strongly acid: 5.1 to 5.5
Moderately acid: 5.6 to 6.0
Slightly acid: 6.1 to 6.5
Neutral: 6.6 to 7.3
Slightly alkaline: 7.4 to 7.8
Moderately alkaline: 7.9 to 8.4
Strongly alkaline: 8.5 to 9.0
Very strongly alkaline: 9.1 and higher

Red beds

Sedimentary strata that are mainly red and are made up largely of sandstone and shale.

Redoximorphic concentrations

See Redoximorphic features.

Redoximorphic depletions

See Redoximorphic features.

Redoximorphic features

Redoximorphic features are associated with wetness and result from alternating periods of reduction and oxidation of iron and manganese compounds in the soil. Reduction occurs during saturation with water, and oxidation occurs when the soil is not saturated. Characteristic color patterns are created by these processes. The reduced iron and manganese ions may be removed from a soil if vertical or lateral fluxes of water occur, in which case there is no iron or manganese precipitation in that soil. Wherever the iron and manganese are oxidized and precipitated, they form either soft masses or hard concretions or nodules. Movement of iron and manganese as a result of redoximorphic processes in a soil may result in redoximorphic features that are defined as follows:

1. Redoximorphic concentrations.—These are zones of apparent accumulation of iron-manganese oxides, including:
   A. Nodules and concretions, which are cemented bodies that can be removed from the soil intact. Concretions are distinguished from nodules on the basis of internal organization. A concretion typically has concentric layers that are visible to the naked eye. Nodules do not have visible organized internal structure; *and*
   B. Masses, which are noncemented concentrations of substances within the soil matrix; *and*
   C. Pore linings, i.e., zones of accumulation along pores that may be either coatings on pore surfaces or impregnations from the matrix adjacent to the pores.
2. Redoximorphic depletions.—These are zones of low chroma (chromas less than those in the matrix) where either iron-manganese oxides alone or both iron-manganese oxides and clay have been stripped out, including:
   A. Iron depletions, i.e., zones that contain low amounts of iron and manganese oxides but have a clay content similar to that of the adjacent matrix; *and*
   B. Clay depletions, i.e., zones that contain low amounts of iron, manganese, and clay (often referred to as silt coatings or skeletans).
3. Reduced matrix.—This is a soil matrix that has low chroma *in situ* but undergoes a change in hue or chroma within 30 minutes after the soil material has been exposed to air.

Reduced matrix

See Redoximorphic features.

Regolith

All unconsolidated earth materials above the solid bedrock. It includes material weathered in place from all kinds of bedrock and alluvial, glacial, eolian, lacustrine, and pyroclastic deposits.

Relief

The relative difference in elevation between the upland summits and the lowlands or valleys of a given region.

Residuum (residual soil material)

Unconsolidated, weathered or partly weathered mineral material that accumulated as bedrock disintegrated in place.

Rill

A very small, steep-sided channel resulting from erosion and cut in unconsolidated materials by concentrated but intermittent flow of water. A rill generally is not an obstacle to wheeled vehicles and is shallow enough to be smoothed over by ordinary tillage.

Riser

The vertical or steep side slope (e.g., escarpment) of terraces, flood-plain steps, or other stepped landforms; commonly a recurring part of a series of natural, steplike landforms, such as successive stream terraces.

Road cut

A sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.

Rock fragments

Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rock outcrop (map symbol)

An exposure of bedrock at the surface of the earth. Not used where the named soils of the surrounding map unit are shallow over bedrock or where “Rock outcrop” is a named component of the map unit.

Root zone

The part of the soil that can be penetrated by plant roots.

Runoff

The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil

A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Saline spot (map symbol)

An area where the surface layer has an electrical conductivity of 8 mmhos/cm more than the surface layer of the named soils in the surrounding map unit. The surface layer of the surrounding soils has an electrical conductivity of 2 mmhos/cm or less.

Sand

As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone

Sedimentary rock containing dominantly sand-sized particles.

Sandy spot (map symbol)

A spot where the surface layer is loamy fine sand or coarser in areas where the surface layer of the named soils in the surrounding map unit is very fine sandy loam or finer.

Sapric soil material (muck)

The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Saturated hydraulic conductivity (Ksat)

The ease with which pores of a saturated soil transmit water. Formally, the proportionality coefficient that expresses the relationship of the rate of water movement to hydraulic gradient in Darcy's Law, a law that describes the rate of water movement through porous media. Commonly abbreviated as "Ksat." Terms describing saturated hydraulic conductivity are:

Very high: 100 or more micrometers per second (14.17 or more inches per hour)

High: 10 to 100 micrometers per second (1.417 to 14.17 inches per hour)

Moderately high: 1 to 10 micrometers per second (0.1417 inch to 1.417 inches per hour)

Moderately low: 0.1 to 1 micrometer per second (0.01417 to 0.1417 inch per hour)

Low: 0.01 to 0.1 micrometer per second (0.001417 to 0.01417 inch per hour)

Very low: Less than 0.01 micrometer per second (less than 0.001417 inch per hour).

To convert inches per hour to micrometers per second, multiply inches per hour by 7.0572. To convert micrometers per second to inches per hour, multiply micrometers per second by 0.1417.

Saturation

Wetness characterized by zero or positive pressure of the soil water. Under conditions of saturation, the water will flow from the soil matrix into an unlined auger hole.

Scarification

The act of abrading, scratching, loosening, crushing, or modifying the surface to increase water absorption or to provide a more tillable soil.

Sedimentary rock

A consolidated deposit of clastic particles, chemical precipitates, or organic remains accumulated at or near the surface of the earth under normal low temperature and pressure conditions. Sedimentary rocks include consolidated equivalents of alluvium, colluvium, drift, and eolian, lacustrine, and marine deposits. Examples are sandstone, siltstone, mudstone, claystone, shale, conglomerate, limestone, dolomite, and coal.

Sequum

A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil

A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Severely eroded spot (map symbol)

An area where, on the average, 75 percent or more of the original surface layer has been lost because of accelerated erosion. Not used in map units in which “severely eroded,” “very severely eroded,” or “gullied” is part of the map unit name.

Shale

Sedimentary rock that formed by the hardening of a deposit of clay, silty clay, or silty clay loam and that has a tendency to split into thin layers.

Sheet erosion

The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Short, steep slope (map symbol)

A narrow area of soil having slopes that are at least two slope classes steeper than the slope class of the surrounding map unit.

Shoulder

The convex, erosional surface near the top of a hillslope. A shoulder is a transition from summit to backslope.

Shrink-swell

The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Shrub-coppice dune

A small, streamlined dune that forms around brush and clump vegetation.

Side slope (geomorphology)

A geomorphic component of hills consisting of a laterally planar area of a hillside. The overland waterflow is predominantly parallel. Side slopes are dominantly colluvium and slope-wash sediments.

Silica

A combination of silicon and oxygen. The mineral form is called quartz.

Silica-sesquioxide ratio

The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

Silt

As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone

An indurated silt having the texture and composition of shale but lacking its fine lamination or fissility; a massive mudstone in which silt predominates over clay.

Similar soils

Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Sinkhole (map symbol)

A closed, circular or elliptical depression, commonly funnel shaped, characterized by subsurface drainage and formed either by dissolution of the surface of underlying bedrock (e.g., limestone, gypsum, or salt) or by collapse of underlying caves within bedrock. Complexes of sinkholes in carbonate-rock terrain are the main components of karst topography.

Site index

A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75.

Slickensides (pedogenic)

Grooved, striated, and/or glossy (shiny) slip faces on structural peds, such as wedges; produced by shrink-swell processes, most commonly in soils that have a high content of expansive clays.

Slide or slip (map symbol)

A prominent landform scar or ridge caused by fairly recent mass movement or descent of earthy material resulting from failure of earth or rock under shear stress along one or several surfaces.

Slope

The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope alluvium

Sediment gradually transported down the slopes of mountains or hills primarily by nonchannel alluvial processes (i.e., slope-wash processes) and characterized by particle sorting. Lateral particle sorting is evident on long slopes. In a profile sequence, sediments may be distinguished by differences in size and/or specific gravity of rock fragments and may be separated by stone lines. Burnished peds and sorting of rounded or subrounded pebbles or cobbles distinguish these materials from unsorted colluvial deposits.

Slow refill

The slow filling of ponds, resulting from restricted water transmission in the soil.

Slow water movement

Restricted downward movement of water through the soil. See Saturated hydraulic conductivity.

Sodic (alkali) soil

A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Sodic spot (map symbol)

An area where the surface layer has a sodium adsorption ratio that is at least 10 more than that of the surface layer of the named soils in the surrounding map unit. The surface layer of the surrounding soils has a sodium adsorption ratio of 5 or less.

Sodicity

The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium adsorption ratio (SAR) of a saturation extract, or the ratio of Na^{+} to Ca^{++} + Mg^{++}. The degrees of sodicity and their respective ratios are:

Slight: Less than 13:1
Moderate: 13-30:1
Strong: More than 30:1

Sodium adsorption ratio (SAR)

A measure of the amount of sodium (Na) relative to calcium (Ca) and magnesium (Mg) in the water extract from saturated soil paste. It is the ratio of the Na concentration divided by the square root of one-half of the Ca + Mg concentration.

Soft bedrock

Bedrock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

Soil

A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief and by the passage of time.

Soil separates

Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand: 2.0 to 1.0
Coarse sand: 1.0 to 0.5
Medium sand: 0.5 to 0.25
Fine sand: 0.25 to 0.10
Very fine sand: 0.10 to 0.05
Silt: 0.05 to 0.002
Clay: Less than 0.002

Solum

The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the material below the solum. The living roots and plant and animal activities are largely confined to the solum.

Spoil area (map symbol)

A pile of earthy materials, either smoothed or uneven, resulting from human activity.

Stone line

In a vertical cross section, a line formed by scattered fragments or a discrete layer of angular and subangular rock fragments (commonly a gravel- or cobble-sized lag concentration) that formerly was draped across a topographic surface and was later buried by additional sediments. A stone line generally caps material that was subject to weathering, soil formation, and erosion before burial. Many stone lines seem to be buried erosion pavements, originally formed by sheet and rill erosion across the land surface.

Stones

Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony

Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stony spot (map symbol)

A spot where 0.01 to 0.1 percent of the soil surface is covered by rock fragments that are more than 10 inches in diameter in areas where the surrounding soil has no surface stones.

Strath terrace

A type of stream terrace; formed as an erosional surface cut on bedrock and thinly mantled with stream deposits (alluvium).

Stream terrace

One of a series of platforms in a stream valley, flanking and more or less parallel to the stream channel, originally formed near the level of the stream; represents the remnants of an abandoned flood plain, stream bed, or valley floor produced during a former state of fluvial erosion or deposition.

Stripcropping

Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to wind erosion and water erosion.

Structure, soil

The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are:

Platy: Flat and laminated

Prismatic: Vertically elongated and having flat tops

Columnar: Vertically elongated and having rounded tops

Angular blocky: Having faces that intersect at sharp angles (planes)

Subangular blocky: Having subrounded and planar faces (no sharp angles)

Granular: Small structural units with curved or very irregular faces

Structureless soil horizons are defined as follows:

Single grained: Entirely noncoherent (each grain by itself), as in loose sand

Massive: Occurring as a coherent mass

Stubble mulch

Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind erosion and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil

Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling

Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum

The part of the soil below the solum.

Subsurface layer

Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summer fallow

The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Summit

The topographically highest position of a hillslope. It has a nearly level (planar or only slightly convex) surface.

Surface layer

The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the “plow layer,” or the “Ap horizon.”

Surface soil

The A, E, AB, and EB horizons, considered collectively. It includes all subdivisions of these horizons.

Talus

Rock fragments of any size or shape (commonly coarse and angular) derived from and lying at the base of a cliff or very steep rock slope. The accumulated mass of such loose broken rock formed chiefly by falling, rolling, or sliding.

Taxadjuncts

Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior. Soils are recognized as taxadjuncts only when one or more of their characteristics are slightly outside the range defined for the family of the series for which the soils are named.

Terminal moraine

An end moraine that marks the farthest advance of a glacier. It typically has the form of a massive arcuate or concentric ridge, or complex of ridges, and is underlain by till and other types of drift.

Terrace (conservation)

An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field

generally is built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geomorphology)

A steplike surface, bordering a valley floor or shoreline, that represents the former position of a flood plain, lake, or seashore. The term is usually applied both to the relatively flat summit surface (tread) that was cut or built by stream or wave action and to the steeper descending slope (scarp or riser) that has graded to a lower base level of erosion.

Terracettes

Small, irregular steplike forms on steep hillslopes, especially in pasture, formed by creep or erosion of surficial materials that may be induced or enhanced by trampling of livestock, such as sheep or cattle.

Texture, soil

The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying “coarse,” “fine,” or “very fine.”

Thin layer

Otherwise suitable soil material that is too thin for the specified use.

Till

Dominantly unsorted and nonstratified drift, generally unconsolidated and deposited directly by a glacier without subsequent reworking by meltwater, and consisting of a heterogeneous mixture of clay, silt, sand, gravel, stones, and boulders; rock fragments of various lithologies are embedded within a finer matrix that can range from clay to sandy loam.

Till plain

An extensive area of level to gently undulating soils underlain predominantly by till and bounded at the distal end by subordinate recessional or end moraines.

Tilth, soil

The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toeslope

The gently inclined surface at the base of a hillslope. Toeslopes in profile are commonly gentle and linear and are constructional surfaces forming the lower part of a hillslope continuum that grades to valley or closed-depression floors.

Topsoil

The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements

Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Tread

The flat to gently sloping, topmost, laterally extensive slope of terraces, flood-plain steps, or other stepped landforms; commonly a recurring part of a series of natural steplike landforms, such as successive stream terraces.

Tuff

A generic term for any consolidated or cemented deposit that is 50 percent or more volcanic ash.

Upland

An informal, general term for the higher ground of a region, in contrast with a low-lying adjacent area, such as a valley or plain, or for land at a higher elevation than the flood plain or low stream terrace; land above the footslope zone of the hillslope continuum.

Valley fill

The unconsolidated sediment deposited by any agent (water, wind, ice, or mass wasting) so as to fill or partly fill a valley.

Variegation

Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Varve

A sedimentary layer or a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by meltwater streams, in a glacial lake or other body of still water in front of a glacier.

Very stony spot (map symbol)

A spot where 0.1 to 3.0 percent of the soil surface is covered by rock fragments that are more than 10 inches in diameter in areas where the surface of the surrounding soil is covered by less than 0.01 percent stones.

Water bars

Smooth, shallow ditches or depressional areas that are excavated at an angle across a sloping road. They are used to reduce the downward velocity of water and divert it off and away from the road surface. Water bars can easily be driven over if constructed properly.

Weathering

All physical disintegration, chemical decomposition, and biologically induced changes in rocks or other deposits at or near the earth's surface by atmospheric or biologic agents or by circulating surface waters but involving essentially no transport of the altered material.

Well graded

Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wet spot (map symbol)

A somewhat poorly drained to very poorly drained area that is at least two drainage classes wetter than the named soils in the surrounding map unit.

Wilting point (or permanent wilting point)

The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Windthrow

The uprooting and tipping over of trees by the wind.

APPENDIX E: PID Calibration Certificate

FIELD ENVIRONMENTAL INSTRUMENTS, INC.
www.fieldenvironmental.com

301 Brushton Avenue
Suite A
Pittsburgh PA 15221
800-393-4009 Toll Free
(412) 436-2600 Local
(412) 436-2616 Fax

Photo-Ionization Detector Calibration Certificate

	Lot #	Expiration
Isobutylene Gas	17-5910	11/11/2018

Cal Standard	Reading	Acceptable Range
100 ppm	100.1	(98 - 102)

	Pump Flow mL/min	Acceptable Range
☑ T.H.P. Sensor Check	465	(450+)

Response Factor
1.0

Model	MiniRae 3000
Lamp	10.6 eV
S/N	~592-912117
Barcode	~U76597X
Order #	353515

Calibrated By: Gift Mrema

Date of Calibration: 10/27/17

All calibrations performed by FEI conform to manufacturer's specifications. Please report any issues within 24 hours of receiving equipment.
All calibration gas used is traceable to NIST. Additional documentation is available upon request.

APPENDIX F: Sampling and Analysis Plan (SAP), and EPA Reception and Approval Communications.

From: Nowak, Joseph <Nowak.Joseph@epa.gov>
Sent: Monday, October 23, 2017 2:44 PM
To: Doug Skowron; Cesar Simon
Cc: Holly Hudson; Frederick Douglas; David Puchi
Subject: Hill District Scattered Sites – Parcels D, E, and F SAP

Hi Cesar,

If your submitted SAP is final, OK to proceed with sampling.

Thanks.
Joe

Joseph Nowak
Brownfields & Land Revitalization Branch
USEPA Region 3
1650 Arch Street (3HS51)
Philadelphia, PA 19103-2029

Phone: **215-814-3303**
Fax: 215-814-3002
E-Mail: **nowak.joseph@epa.gov**

From: Nowak, Joseph <Nowak.Joseph@epa.gov>
Sent: Tuesday, October 17, 2017 1:29 PM
To: Cesar Simon
Subject: RE: EPA Brownfield Phase II

Cesar – yes, I got it. Thanks. joe

Joseph Nowak

Brownfields & Land Revitalization Branch

USEPA Region 3

1650 Arch Street (3HS51)

Philadelphia, PA 19103-2029

Phone: **215-814-3303**

Fax: 215-814-3002

E-Mail: **nowak.joseph@epa.gov**

From: Cesar Simon [mailto:CSimon@cosmostechnologiesinc.com]
Sent: Friday, October 13, 2017 6:07 PM
To: Nowak, Joseph <Nowak.Joseph@epa.gov>
Subject: RE: EPA Brownfield Phase II

Hi Joseph,

Please, Could you confirm me if you received the CD?

Thank you,

Cesar A. Simon

Civil Engineer

From: Cesar Simon [mailto:CSimon@cosmostechnologiesinc.com]
Sent: Friday, October 06, 2017 12:16 PM
To: Nowak, Joseph <Nowak.Joseph@epa.gov>
Cc: Holly Hudson <hhudson@cosmostechnologiesinc.com>; Frederick Douglas <frederickdouglas@cosmostechnologiesinc.com>; doug@djsventure.com; David Puchi <dpuchi@cosmostechnologiesinc.com>
Subject: RE: EPA Brownfield Phase II

Hello, Joe,

Thank you for the R3 SAP template. Following the template, I want to send you the *Sample and Analysis Plan for PGH Scattered Sites Residential Project*. Due to the size of the file, I am sending the following Dropbox file link:

https://www.dropbox.com/s/mfrmu68n4o4q7tp/091517_EPA_SAP_Final_v4.pdf?dl=0

I would appreciate if you could confirm that you received the document.

If you have any question or concern, please, do not hesitate to contact me.

Thanks in advance,

Cesar A. Simon

Civil Engineer

Cosmos Technologies Inc.

PHASE II

SAMPLE AND ANALYSIS PLAN

FOR

Hill District Scattered Sites – Parcels D, E, and F

CLIFF STREET, CITY OF PITTSBURGH, ALLEGHENY COUNTY, PENNSYLVANIA

Cesar A. Simon, Cosmos Technologies, Inc.
700 River Avenue, Suite 412
Pittsburgh, PA 15212

02 October 2017

Cooperative Agreement Recipient: _____
Signature

Juan Garrett 10/6/17
Printed Name/Date

Project QA Officer: _____
Signature

Cesar A. Simon 10/6/2017
Printed Name/Date

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Appendix B: Laboratory Standard Operating Precedures
Appendix C: Laboratory Certification
Appendix D: Maps

This Site-Specific Sampling and Analysis Plan is a companion document to the Quality Assurance Project Plan for *Hill District Scattered Sites – Parcels D, E, and F*. All of the policies and procedures specified in the *Hill District Scattered Sites – Parcels D, E, and F* Quality Assurance Project Plan will be followed for this project.

A PROJECT MANAGEMENT

A1 SITE INFORMATION/BACKGROUND

A Phase I Environmental Site Assessment (ESA) was conducted on October 12, 2016 by Rettew Associates. The report assessed 27 parcels of land totaling 1.08-acres located on Cliff Street, Monaca Place, Cassatt Street, Bedford Avenue, Webster Avenue, and Trent Street in the City of Pittsburgh, Allegheny County, Pennsylvania. These parcels are collectively known as the PGH Scattered Sites Residential Project. During this investigation, several areas of recognized environmental conditions (RECs) were identified, specifically the presence of historic cleaners and auto stations. In addition, fill material was present at 25 of the 27 parcels.

Cosmos Technologies, Inc. (Cosmos) was subsequently contracted to provide a Phase II ESA for three (3) Cliff Street Units – D, E and F shown in Table I. Historic concerns adjacent to the scattered sites as well as the direction of groundwater flow to these sites warrant additional investigation. In close proximity to these sites were dry cleaners and gas stations.

We are providing this subsurface sampling and analysis plan (SAP) to delineate our anticipated sampling scheme for the Phase II ESA. The objective is to investigate the presence of subsurface contamination in the three (3) Units – D, E, and F delineated in Table I. The Units are in the Hill District, City of Pittsburgh, Allegheny County, Pennsylvania. Historically, these Units were residential housing complexes.

TABLE I

PARCELS GROUPED BY UNITS

Unit	Street Address	Parcel ID Number	Total Area
D	1835 CLIFF STREET	9-M-143, 9-M-146, 9-M-1`47	0.11 acres
E	1850 CLIFF STREET	9-M-186, 9-M-186-A, 9-M-187, 9-M-188	0.14 acres
F	33 CLIFF STREET	9-M-194	0.16 acres

A2 PROJECT DESCRIPTION

Cosmos plans to investigate for the presence of potential subsurface contamination that could affect the future development at these areas. The contaminants to be sampled are shown in Table III.

The following activities will be conducted:

- **1. Direct Push Soil Boring:** One (1) soil boring per Unit will be advanced to depths of up to 12 feet using a Geoprobe Macro Core Sampler. Collection of soil samples will follow specifications located in Section B1 of this report. Upon sample completion, the borings will be abandoned by backfilling with drill cuttings or granular bentonite.
- **2. Temporary Wells:** If water is encountered, two (2) of the borings will be completed as 1" PVC temporary wells. Sampling protocol is described in Section B1. After obtaining the samples, Cosmos will direct pull the wells and backfill with granular bentonite and drill cuttings.
- **3. Decontamination:** All drilling and sampling tools will be thoroughly cleaned before project start and between drilling locations.
- **4. Waste Handling:** Soil (drill cuttings) will be used as boring backfill.

A3 PROJECT TIME LINE

The project shall begin within two (2) weeks of acceptance of this Sampling and Analysis Plan. The progress of the project will then be tracked from its inception through implementation to ensure all sampling and analytical activities are performed in a correct and cost-effective manner. Each step in this process will be scheduled in an objective and realistic time frame to assure that adequate attention is devoted to the minimization of effort and the maximization of information. Quality Assurance (QA) Procedures are included for each phase of this project. Table II provides a project time line for this project.

TABLE II

PROJECT TIME LINE

Activities *(Includes Products and/or Services)*	**Dates *(MM/DD/YY)***	
	Activity Start Date	**Activity End Date**
Submit SAP to EPA	10/06/17	10/06/17
Drill Soil Bore Holes	10/12/17	10/13/17
Submit Samples for Analysis	10/13/17	10/13/17
Receipt of Lab Test Results	10/16/17	10/27/17
Final Report and Recommendations	10/30/17	10/31/17

A4 MEASUREMENT QUALITY OBJECTIVES

Table III provides the measurement quality indicators for this project. Verification of quality indicators will be observed in the quality control samples to monitor accuracy and confirm that no contamination of the samples has occurred.

TABLE III

MEASUREMENT QUALTIY INDICATORS

Compound	Matrix	Action Limit	Precision	Accuracy	Completeness
Benzene	Soil & Water	5 ug/Kg	0.005 ug/Kg	15%	100%
Toluene	Soil & Water	5 ug/Kg	0.005 ug/Kg	18%	100%
Xylenes, Total	Soil & Water	10 ug/Kg	0.005 ug/Kg	15%	100%
m-Xylene & p-Xylene	Soil & Water	5 ug/Kg	0.005 ug/Kg	16%	100%
o-Xylene	Soil & Water	5ug/Kg	0.005 ug/Kg	15%	100%
Naphthalene	Soil & Water	5 ug/Kg	0.005 ug/Kg	24%	100%
Perchloroethylene	Soil & Water	5 ug/Kg	0.005 ug/Kg	20%	100%
Percent Moisture	Soil	0.1 %	0.0001 g	0.05 g or 4%	100%
Percent Solids	Soil	0.1 %	0.0001 g	0.05 g or 4%g	100%
DRO (C10-C28)	Soil & Water	50 mg/Kg	0.05 mg/Kg	40%	100%
ORO (C28-C44)	Soil & Water	50 mg/Kg	0.05 mg/Kg		100%

B MEASUREMENT/DATA ACQUISITION

B1 SAMPLE DESIGN

Due the small area covered by each unit, Cosmos believes that one boring well per unit is enough to characterize the site. In each Soil Bore, soil samples will be collected at 4-feet intervals, in 2”x4” plastic liners, or as directed by EPA. As each soil sample is extracted, it will be analyzed using a PID monitor to determine presence of volatiles. High volatile samples will be composited and submitted for analyses. Three (3) samples from each of the Units will be submitted for analysis. In the absence of a volatile footprint, the Samples will consist of a composite from each 4 feet bore core. Samples will be placed in a TerraCore Kits container with a chain of custody and submitted to the laboratory for analysis.

Water samples will be collected by placing a 1" PVC screen and riser in each borehole. A dedicated sample tubing will be connected to a peristaltic pump to extract the water samples. One (1) water sample per borehole will be taken, assuming groundwater is find. Three well volumes per borehole will be purged prior to the collection of water samples.

All sample collection and handling procedures are designed to comply with U.S. Environmental Protection Agency (USEPA) and Pennsylvania Department of Environmental Protection Agency (PADEP) sampling protocols. All drilling equipment and sampling tools shall be decontaminated between borings to minimize cross-contamination. Quality control samples will be submitted with the collected samples.

B2 SAMPLING METHODS REQUIREMENTS

Table IV provides information about the geophysical and sampling techniques that will be used for this project. For specific details about the sampling procedures referenced in Table IV, refer to the appropriate section of Appendix A. All samples will be collected and preserved in accordance with procedures found in Appendix A. Field Quality Control Requirements for this sampling activity are found in Appendix A.

B3 ANALYTICAL METHODS REQUIREMENTS

Table IV provides information about the analytical methods (including any extraction or digestion methods) being used for this project. Additional information about analytical methods requirements (MDL, PQL, etc.), laboratory quality control requirements and laboratory equipment calibration procedures can be found in Appendix A.

Samples will be submitted to TestAmerica Laboratory. TestAmerica is a National Environmental Laboratory (NELAP) certified Laboratory. A copy of the accreditation is included in Appendix C.

TABLE IV

MEASUREMENT QUALTIY INDICATORS

Matrix	Parameter	Number of samples	Sampling Procedure	Sample Preparation/Extraction Method Number	Analytical Method Number
Soil	Benzene	9	PT-MS-010 Rev. 4	5035FP_Calc	8260C
Soil	Toluene	9	PT-MS-010 Rev. 4	5035FP_Calc	8260C
Soil	Xylenes, Total	9	PT-MS-010 Rev. 4	5035FP_Calc	8260C
Soil	m-Xylene & p-Xylene	9	PT-MS-010 Rev. 4	5035FP_Calc	8260C
Soil	o-Xylene	9	PT-MS-010 Rev. 4	5035FP_Calc	8260C
Soil	Naphthalene	9	PT-MS-010 Rev. 4	5035FP_Calc	8260C
Soil	Perchloroethylene	9	PT-MS-010 Rev. 4	5035FP_Calc	8260C
Soil	Percent Moisture	2	PT-WC-020 Rev. 7		2540G
Soil	Percent Solids	2	PT-WC-020 Rev. 7		2540G
Soil	DRO (C10-C28)	9	NC-GC-043 Rev. 1	3546	8015D
Soil	ORO (C28-C44)	9	NC-GC-043 Rev. 1	3546	8015D
Water	Benzene	2	PT-MS-010 Rev. 4	5030C	8260C
Water	Toluene	2	PT-MS-010 Rev. 4	5030C	8260C
Water	Xylenes, Total	2	PT-MS-010 Rev. 4	5030C	8260C
Water	m-Xylene & p-Xylene	2	PT-MS-010 Rev. 4	5030C	8260C
Water	o-Xylene	2	PT-MS-010 Rev. 4	5030C	8260C
Water	Naphthalene	2	PT-MS-010 Rev. 4	5030C	8260C
Water	Perchloroethylene	2	PT-MS-010 Rev. 4	5030C	8260C
Water	DRO (C10-C28)	2	PT-MS-010 Rev. 4	3520C_LVI	8015D
Water	ORO (C28-C44)	2	PT-MS-010 Rev. 4	3520C_LVI	8015D

C DATA USABILITY

C1 RECONCILIATION WITH USER REQUIREMENTS

The analytical results will determine which units have the presence of contaminant above EPA threshold levels. The comparison with EPA limits will consider the accuracy of the test. In case accuracy limitations do establish if results are above or below EPA limits, a second test will be required. The Laboratory will be required to keep samples for re-testing in case re-testing becomes necessary. Laboratory test result values above EPA limits will trigger remediation cleanup. Upon Approval of the client, a remediation and cleanup plan will be prepared and reported to EPA.

APPENDIX A: LABORATORY QUALIFICATIONS PACKAGE

(COSMOS is attaching the Laboratory QA Manual in this appendix)

Quality Assurance Manual

TestAmerica Pittsburgh
301 Alpha Drive
Pittsburgh, PA 15238
Phone No. 412-963-7058
Fax No. 412-963-2468

www.testamericainc.com

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Title Page:

Quality Assurance Manual
Approval Signatures

	6/16/2015
Laboratory Director - Deborah L. Lowe	Date
	6/5/2015
Quality Assurance Manager – Virginia Zusman	Date
	6/10/2015
Health and Safety Coordinator - Steve Jackson	Date
	6/16/2015
Technical Director - Larry Matko	Date
	6/6/2015
Department Manager (Organics) - Sharon Bacha	Date
	6/12/2015
Department Manager (Inorganics) - Roseann Ruyechan	Date
	6/6/2015
Technical Supervisor (Metals) - Bill Reinheimer	Date
	6/10/2015
Department Manager (Sample Management) - Chris Kovitch	Date

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REFERENCED CORPORATE SOPs AND POLICIES

SOP / Policy Reference	Title
CA-Q-S-001	Acid & Solvent Lot Testing and Approval
CA-Q-S-002	Acceptable Manual Integration Practices
CA-Q-S-006	Detection Limits
CA-Q-S-009	Root Cause Analysis
CW-Q-S-001	Corporate Document Control and Archiving
CW-Q-S-002	Writing a Standard Operating Procedure (SOPs)
CW-Q-S-003	Internal Auditing
CW-Q-S-004	Management Systems Review
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	Company-Wide Authorization Matrix
CW-F-P-004	Procurement and Contracts Policy
CA-C-S-001	Work Sharing Process

SOP / Policy Reference	Title
CA-T-P-001	Qualified Products List
CW-F-S-007	Capital Expenditure, Controlled Purchase Requests and Fixed Asset Capitalization
CA-Q-M-002	Corporate Quality Management Plan
CW-E-M-001	Corporate Environmental Health & Safety Manual
CA-I-P-002	Electronic Reporting and Signature Policy

REFERENCED LABORATORY DOCUMENTS

SOP Reference	Title
PT-QA-001	Employee Orientation and Training (DOCs)
PT-QA-002	Internal Auditing
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 and Barometer Verification and Temperature Monitoring
PT-QA-010	Document and Spreadsheet Development & Control
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 Management, Retention and Archive
PT-QA-020	Report Production
PT-QA-021	Laboratory Quality Control Program
PT-QA-022	Equipment Maintenance
PT-QA-024	Subsampling
PT-QA-WI-002	SOP List

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 and Congeners)
- 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

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 and Congeners)
- 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)

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 biannually 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 Vice President of Operations (VPO)

Each VP of operations reports directly to the Executive VP of Operations and is part of the Executive Committee. Each VP of operations is responsible for the overall administrative and operational management of their respective laboratories. The VP's responsibilities include allocation of personnel and resources, long-term planning, goal setting, and achieving the financial, business, and quality objectives of TestAmerica. The VP's ensure timely compliance with Corporate Management directives, policies, and management systems reviews. The VP's are 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:

- Providing one or more technical managers 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.
- Ensuring 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.
- Ensuring that personnel are free from any commercial, financial and other undue pressures which might adversely affect the quality of their work.
- Ensuring TestAmerica's human resource policies are adhered to and maintained.
- Ensuring that sufficient numbers of qualified personnel are employed to supervise and perform the work of the laboratory.
- Ensuring 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.
- Reviewing and approving all SOPs prior to their implementation and ensures all approved SOPs are implemented and adhered to.
- Pursuing and maintaining appropriate laboratory certification and contract approvals. Supports ISO 17025 requirements.
- Ensuring client specific reporting and quality control requirements are met.
- Captaining 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.
- Providing training and development programs to applicable laboratory staff as new hires and, 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. The QA Manager reports directly to the Laboratory Director and their Corporate Quality 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:

- Serving as the focal point for QA/QC in the laboratory.
- Having functions independent from laboratory operations for which he/she has quality assurance oversight.
- Maintaining and updating the QAM.
- Monitoring and evaluating laboratory certifications; scheduling proficiency testing samples.

- Monitoring and communicating regulatory changes that may affect the laboratory to management.
- Training and advising the laboratory staff on quality assurance/quality control procedures that are pertinent to their daily activities.
- Having 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.
- Maintaining records of all ethics-related training, including the type and proof of attendance.
- Maintaining improving, and evaluating 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 monitoring standards of performance in quality control and quality assurance without outside (e.g., managerial) influence.
- Having the responsibility and final authority to accept or reject data and to stop work in progress in the event that procedures and practices compromise the validity and integrity of analytical data.
- Coordinating of document control of SOPs, MDLs, control limits, and miscellaneous forms and information. Controlling distribution of controlled documents.
- Reviewing a percentage of all final data reports for internal consistency, including Chain of Custody (COC), correspondence with the analytical request, batch QC status, completeness of any corrective action statements, 5% of calculations, format, holding time, sensibility and completeness of the project file contents.
- Reviewing of external audit reports and data validation requests.
- Following-up with audits to ensure client QAPP requirements are met.
- Establishing reporting schedule and preparation of various quality reports for the Laboratory Director, clients and/or Corporate QA.
- Approving quality control reference data in TALS.
- Developing suggestions and recommendations to improve quality systems.
- Researching current state and federal requirements and guidelines.
- Captaining the QA team to enable communication and to distribute duties and responsibilities.
- Ensuring Communication & monitoring standards of performance to ensure that systems are in place to produce the level of quality as defined in this document.
- Evaluating the thoroughness and effectiveness of training.
- Ensuring Compliance with ISO 17025.

4.2.5 Technical Director

The Technical Director serves as a technical resource for TestAmerica's personnel and clients in their field of expertise. The Technical Director reports directly to the Laboratory Director. Specific responsibilities include, but are not limited to:

- Managing technical projects and evaluating technologies, reviewing technical data
- Solving technical problems in the laboratory including troubleshooting instruments and developing or modifying methods as needed to meet customer requirements.
- Maintaining and repairing analytical instruments to reduce downtime.
- Consulting with clients, regulators, and others regarding technical aspects of analyses.
- Suggesting and implementing process improvements to maximize productivity, save costs, and decrease turn-around time.
- Participating in TestAmerica's best practice process to spread best technical practices and developing TestAmerica Standard Operating Procedures (SOPs). Leads the implementation and follow-up of the best practices and SOPs in the laboratory.
- Evaluating and adapting 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.
- Training analysts and technicians in area of expertise.
- Assisting with the development of health and safety protocols.
- Consulting with Project Managers and sales staff regarding analytical techniques and capabilities.
- Investigating issues raised by clients, QA, sales, and other departments to find root cause and implement corrective action and proper response.
- Contributing technical information and evaluation for deciding major new equipment purchases and capital expenditures.
- Ensuring compliance with ISO 17025.

4.2.6 Quality Assurance Specialist

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

- Assisting 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.
- Facilitating 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.
- Assisting the QA Manager in the preparation of new SOPs and in the maintenance of existing SOPs, coordinating annual reviews and updates.
- Managing 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.
- Assisting with review and maintenance of training records.
- Assisting 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.
- Assisting with management of and applications for certifications and accreditations.

- Monitoring 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.
- Performing Technical Data Audits and the Mint-miner data file review process for organic instrumentation. Maintain tracking of reviews.
- Assisting with 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:

- Exercising day-to-day supervision of laboratory operations for the appropriate field of accreditation and reporting of results. Coordinating, writing, and reviewing preparation of all test methods, i. e., SOPs, with regard to quality, integrity, regulatory and optimum and efficient production techniques, and subsequent analyst training and interpretation of the SOPs for implementation and unusual project samples. He/she insures that the SOPs are properly managed and adhered to at the bench. He/she develops standard costing of SOPs to include supplies, labor, overhead, and capacity (design vs. demonstrated versus first-run yield) utilization.
- 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.
- Coordinating sample management from "cradle to grave," insuring that no time is lost in locating samples.
- Scheduling all QA/QC-related requirements for compliance, e.g., MDLs, etc..

- Captaining department personnel to communicate quality, technical, personnel, and instrumental issues for a consistent team approach.
- Coordinating audit responses with the QA Manager.
- Ensuring compliance with ISO 17025.

4.2.8 Client Service Manager (CSM)

The Client Services Manager reports directly to the Client Services Director with dotted line reporting to the Laboratory Director. He/She has signature authority for contracts for laboratory services, as detailed in TestAmerica policy, and for laboratory reports. The responsibilities of the CSM include, but are not limited to:

- Defining customer requirements through project definition.
- Assessing and assuring customer satisfaction.
- Providing feedback to management on changing customer needs.
- Bringing together resources necessary to ensure customer satisfaction.

4.2.9 Manger of Project Management

The Manager of Project Management reports directly to the Client Services Director with dotted line reporting to the Laboratory Director. There is an entire staff of Project Managers that makes up the Project Management team. With the overall goal of total client satisfaction. In addition to the responsibilities of the Project Manager, listed in section 4.2.10, the MPM's responsibilities include, but are not limited to:

- Training project managers in technical procedures and promoting the growth of the Project Management Team.
- Acting as liaison between laboratory management and the Project Management Team.
- Managing human resources for the Project Management Team.

4.2.10 Project Manager

The PM reports to the Manager of Project Management and serves as the interface between the laboratory's technical departments and the laboratory's clients. The responsibilities of this position include, but are not limited to:

- Ensuring that clients receive the proper sampling supplies.
- Responding to client inquiries concerning sample status.
- Assisting clients with the resolution of problems concerning COC.
- Ensuring that client specifications, when known, are met by communicating project and quality assurance requirements to the laboratory.
- Notifying the supervisors of incoming projects and sample delivery schedules.
- Maintaining communication with clients on sample progress from daily status meeting with agreed-upon due dates.
- Discussing with client any project-related problems, resolving service issues, and coordinating technical details with the laboratory staff.

- Familiarizing laboratory staff with specific quotes, sample log-in review, and final report completeness.
- Informing QA Manager of special client requests that are outside of standard operating procedure.
- Monitoring the status of all data package projects in-house to ensure timely and accurate delivery of reports.
- Informing clients of data package-related problems and resolve service issues.
- Coordinating requests for sample containers and other services.

4.2.11 Project Manager Assistant (PMA)

The PMA reports to the Manager of Project Management and serves as the interface between the laboratory's technical departments and the laboratory's clients. The responsibilities of this position include, but are not limited to:

- Collating data reports, expanded deliverables and CLP data packages for delivery to clients and reviews for accuracy.
- Assisting the CSMs and PMs in the reporting process.
- Printing reports as needed for Project Managers.
- Monitoring report due dates for timely delivery.
- Providing clerical support to the CSMs, PMs and other laboratory staff as needed
- Generating credit or debit invoices to ensure proper payment in compliance with client requirements as established and communicated.
- Sending final data to clients via email or courier.

4.2.12 Department Manager

The Organics Manager oversees the GC and GCMS and Organic Preparation groups. The Inorganics Manager oversees the Metals and Wet Chemistry groups. Department Managers report directly to the Laboratory Director or designee. The responsibilities of a Department Manager include, but are not limited to:

- Ensuring that analysts in their department adhere to applicable SOPs and the QA Manual.
- Performing frequent SOP review to determine if analysts are in compliance and if new, modified, and optimized measures are feasible and should be added to these documents, and approving revised SOPs.
- Participating in the interview and selection of, and overseeing, training, development of performance objectives and standards of performance, appraisal (measurement of objectives), scheduling, counseling, discipline, and motivation of analysts and documenting these activities in accordance with systems developed by the QA and Personnel Departments. Evaluating staffing sufficiency and overtime needs.
- Ensuring sufficient training of analysts to meet the requirements of the SOP and the QA system.
- Encouraging 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.
- Providing 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.

- Ensuring all logbooks are maintained, current, and properly labeled or archived.
- Reporting all non-conformance conditions to the QA Manager, Technical Managers and/or Laboratory Director.
- Ensuring 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.
- Maintaining adequate and valid inventory of reagents, standards, spare parts, and other relevant resources required to perform daily analysis.
- Determining ways to achieve optimum turnaround time on analyses and compliance with holding times.
- Conducting 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.
- Assisting QA department with root cause investigations and corrective action proposals for responses to external and internal audit issues, system failures and client complaints.

4.2.13 Team Leader/Supervisor

The Team Leader/Supervisor reports directly to the Organics or Inorganics Manager and/or Laboratory Director or designee. The responsibilities of this position include, but are not limited to:

- Ensuring that analysts in their department adhere to applicable SOPs and the QA Manual. He/she performs frequent SOP review to determine if analysts are in compliance and if new, modified, and optimized measures are feasible and should be added to these documents.
- Overseeing 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.
- Providing 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.
- Ensuring that all logbooks are maintained, current, and properly labeled or archived.
- Ensuring that all data is properly entered into the LIMS system and is reviewed and approved as required by laboratory documentation policy.
- Reporting all non-conformance conditions to the QA Manager and Department Manager.
- Ensuring 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.
- Maintaining adequate and valid inventory of reagents, standards, spare parts, and other relevant resources required to perform daily analysis.

- Achieving optimum turnaround time on analyses and compliance with holding times.
- Assisting QA department with root cause investigations and corrective action proposals for responses to external and internal audit issues, system failures and client complaints.

4.2.14 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 include, but are not limited to:

- Performing 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.
- Ensuring sample and data integrity by adhering to internal chain-of-custody procedures.
- Documenting 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.
- Reporting all non-conformance situations, instrument problems, matrix problems and QC failures, which might affect the reliability of the data, to their supervisor, Department Manager, and/or the QA Manager or member of QA staff.
- Performing 100% review of the data generated prior to entering and submitting for secondary level review. Performs data processing using available tools/software.
- Suggesting 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.
- Working 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.
    - A “work cell” is considered to be all those individuals who see a sample through the complete process of preparation, extraction, and analysis. To ensure that the entire preparation, extraction, and analysis process is completed by a group of capable individuals, the laboratory shall ensure that each member of the work cell (including a new member entering an already existing work cell) demonstrates capability in his/her area of responsibility in the sequence. Even though the work cell operates as a “team,” the demonstration of capability at each individual step in the sequence, as performed by each individual analyst/team member, remains of utmost importance. A work cell may NOT be defined as a group of analysts who perform the same step in the same process (for example, extractions for Method 8270), represented by one analyst who has demonstrated capability for that step.

4.2.15 Sample Management/Log-in Manager

The Sample Receiving/Login Manager reports to the Laboratory Director and Client Services Manager. The responsibilities of this position include, but are not limited to:

- Ensuring implementation of proper sample receipt procedures, including maintenance of chain-of-custody.
- Reporting nonconformances associated with condition-upon-receipt of samples.
- Ensuring accurate login of samples into the LIMS.

- Ensuring that all samples are stored in the proper environment.
- Assisting Environmental Health and Safety staff with sample disposal.

4.2.16 Field Service Technician

The Field Service Technicians report to the Sample Management Department Manager. The responsibilities of the Field Service Technician include, but are not limited to:

- Performing sample collection and sample pick-up
- Ensuring sample containers are prepared for sampling
- Performing field tests and measurements and operating and maintaining equipment used for those purposes.

4.2.17 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 :

- 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.

4.2.18 Hazardous Waste Coordinator

The Hazardous Waste Coordinator reports directly to the Laboratory Director. The duties include, but are not limited to:

- Staying current with the hazardous waste regulations.
- Continuing training on hazardous waste issues.
- Reviewing and updating annually the Hazardous Waste Contingency Plan in the Environmental Health & Safety Manual.
- Auditing the staff with regard to compliance with the Hazardous Waste Contingency Plan.
- Contacting the hazardous waste subcontractors for review of procedures and opportunities for minimization of waste.

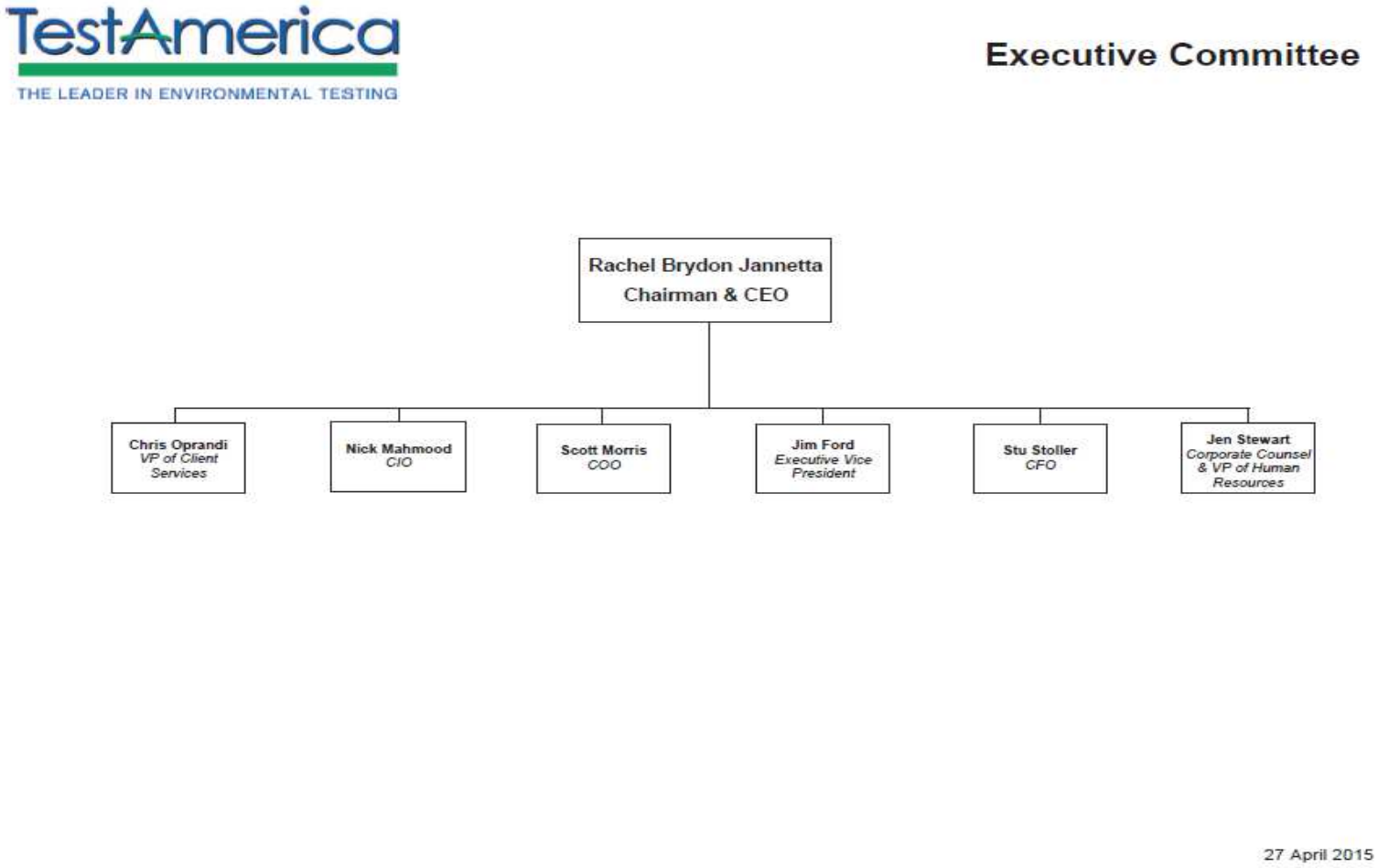
4.3 DEPUTIES

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: Virginia Zusman	Quality Assurance Specialist: Pam Dudeck	
Technical Manager: Larry Matko	Laboratory Director: Deborah Lowe	NELAP Technical Manager (Lipids & 8141)
Organics Department Manager: Sharon Bacha	Designated Senior 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	NELAP Technical Manager (Inorganics)
Wet Chemistry Supervisor: Mike Wesoloski	Designated Senior Wet Chemistry Analyst	NELAP Technical Manager (Inorganics, Non-metals)
Organic Prep Team Leader: Sharon Bacha/Larry Matko	Designated Senior Organic Prep Analyst	
Sample Receiving Department Manager: Christina 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. Corporate and Laboratory Organization Charts



Note: Organization Charts are subject to change, contact the laboratory for the most recent version

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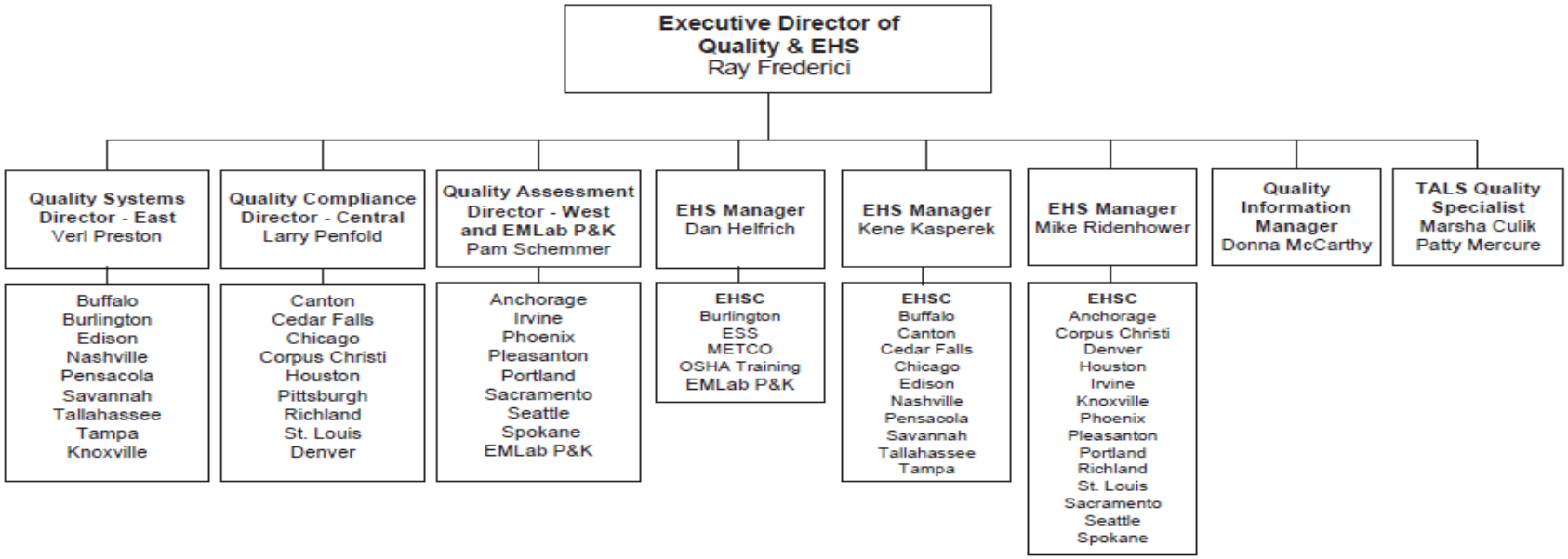
Quality & EHS



1 Jan 2015

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

Note: Organization Charts are subject to change, contact the laboratory for the most recent version

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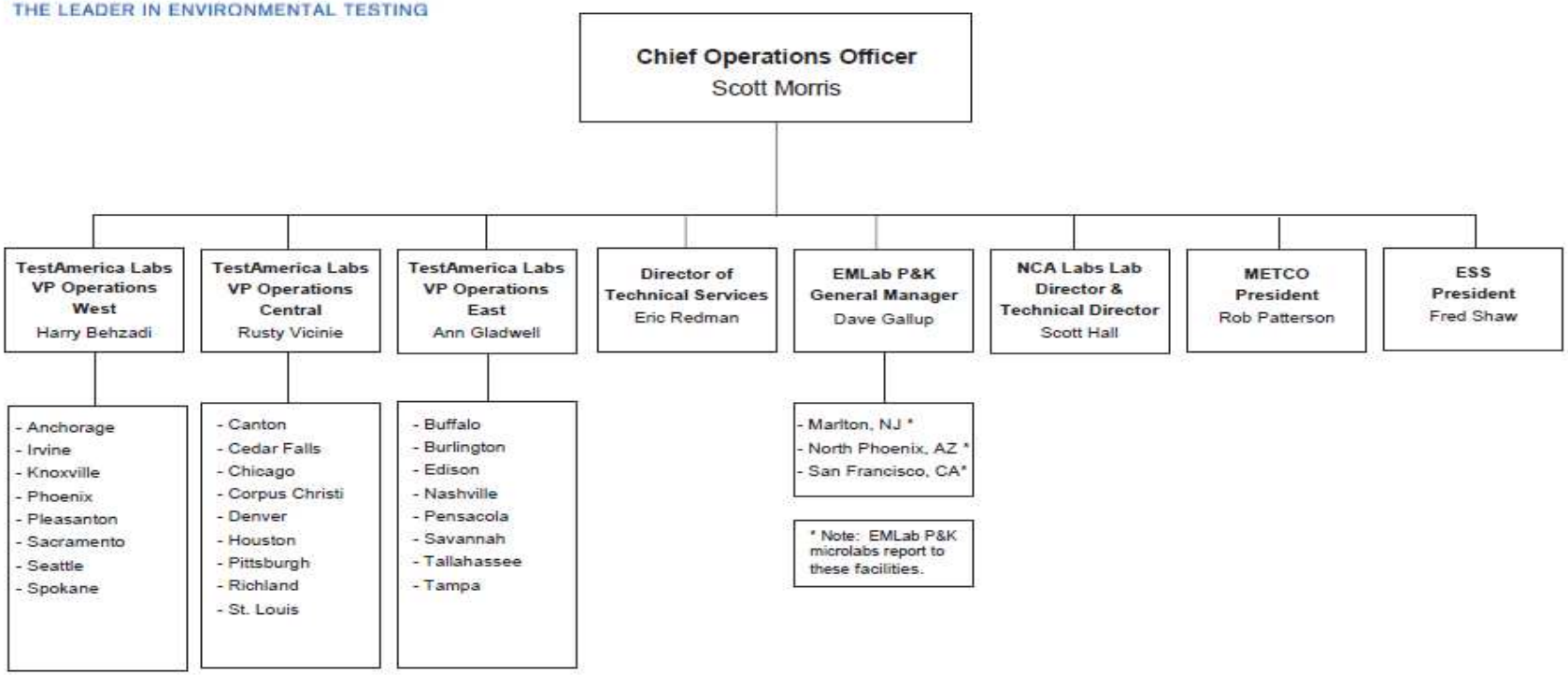
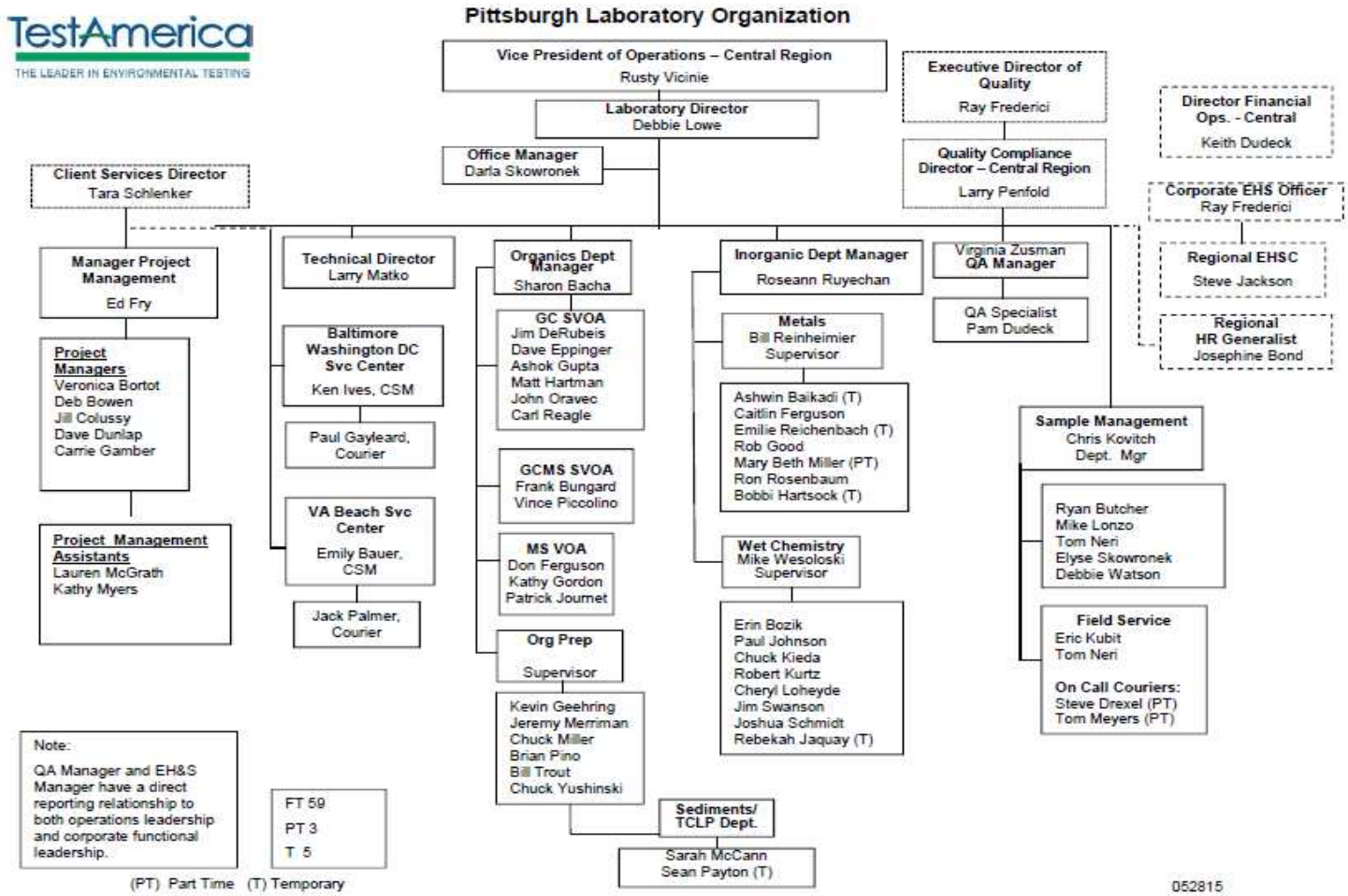
Operations



20 April 2015

Note: Organization Charts are subject to change, contact the laboratory for the most recent version



Note: Organization Charts are subject to change, contact the laboratory for the most recent version

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 (QAM)
- 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. 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) as 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 defines the QC limits, the method limits are used, unless laboratory developed limits are tighter.

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, Laboratory Quality Control Program.

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.

5.8 Laboratory Certification/Accreditation

The Laboratory Quality System is designed to meet the requirements of all governing bodies through which it holds certification / accreditation.

- A list of certifications and accredited scopes is maintained by the QA Department, and current certificates are posted in the laboratory lobby. Expired certificates are maintained in the QA archive.
- Certification renewal is completed on an annual basis for most state agencies.
- The laboratory indicates clearly in its reports which certifications it holds. This list can include which test methods and analytes are not covered under the applicable certification.
- If certification is lost or suspended, the laboratory shall update the reporting information to reflect this immediately.

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
- Logbooks and Calculation Spreadsheets
- Corporate Policies and Procedures distributed outside the intranet
- External 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.

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 laboratory SharePoint website by lab area as pdf. Editable copies are stored on a restricted access drive. Uncontrolled, editable copies are issued as drafts for review and revision, and are then stored on the restricted access drive.

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 revising SOPs.

Controlled documents are marked as such, and posted to the intranet (OASIS SharePoint site) 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. All forms used in the laboratory are tracked in the controlled documents 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, “Document and Spreadsheet Development and Control”.

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 Client Relationship Manager or Proposal Team, 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
- 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 (L:\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.

Technical or Department Managers, or their designees, 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. Both complaints and compliments are tracked in the monthly quality status report.

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 SOPs on Subcontracting Procedures (CA-L-S-002).

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, 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.

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.

Figure 8-1

Example - Subcontracted Sample Form

Date/Time: _____

Subcontracted Laboratory Information:

- Subcontractor's Name: _____
- Subcontractor Point of Contact: _____
- Subcontractor's Address: _____
- Subcontractor's Phone: _____
- Analyte/Method: _____
- Certified for State of Origin: _____
- TNI Certified: Yes_____No_____
- **USDA Permit (__Domestic __ Foreign)** **Yes**_____**No**_____
- A2LA (or ISO 17025) Certified: Yes_____No_____
- CLP-like Required: Yes_____No_____
  (Full doc required)
- Requested Sample Due Date: _____
  (Must be put on COC)
- **Client POC Approval on-file to Subcontract Samples to Sub Laboratory:** **Yes**_____**No**_____

Project Manager: _____

Laboratory Sample # Range: _____
(Only of Subcontracted Samples)

Laboratory Project Number (Billing Control #): _____

All subcontracted samples are to be sent via bonded carrier and Priority Overnight. Please attach tracking number below and maintain these records in the project files.

PM Signature_____**Date**_____

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 and TestAmerica Pittsburgh SOP No. PT-QA-006, Procurement of Standards and Materials.

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 Department Managers by completing the Purchase Requisition Form (Figure 9-1). The Department Manager will enter the orders into the JD Edwards system (JDE). The Department Manager or designated personnel also places the orders for rush items 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 or laboratory area designee who ordered the materials to document the date the materials were received. Once the ordered reagents or materials are received, the analyst or designee compares the information on the label or packaging to the original order to ensure that the purchase meets the quality level specified. The analyst or designee dates and initials the packing slip and returns it to Sample Receiving for filing. Safety Data Sheets (SDSs) 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.

NOTE: Each bottleware type must be documented as clean down to the laboratory MDL for all target analytes for use with samples from Wisconsin.

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 in the laboratory in a designated area or near the instrument.

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 available on OASIS.

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 Technical Services 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 Quality 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), Executive Director of Quality & EHS 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 must 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 VP of Operations 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, 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:

- 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
- Anomalies that occur during sample receipt, preparation or analysis

12.2.2 Corrective Action Report (CAR) - is used to document the following types of corrective actions:

- Questionable trends that are found in the review of NCMs
- Internal and external audit findings
- Unacceptable PT results
- Corrective actions that cross multiple departments in the laboratory
- Systematic reporting / calculation errors.
- Client complaints
- 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 and CAR 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.

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.
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.

QC Activity ***(Individual Responsible for Initiation/Assessment)***	**Acceptance Criteria**	**Recommended Corrective Action**
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 common lab contaminants, no analytes detected at greater than and equal to RL.	- 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.
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.

QC Activity ***(Individual Responsible for Initiation/Assessment)***	**Acceptance Criteria**	**Recommended Corrective Action**
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, the laboratory continually strives to improve customer service and client satisfaction through continuous improvements to laboratory systems.

Opportunities for improvement may be discovered during management system reviews, review of the monthly QA Metrics Report, evaluation of internal or external audits, results and evaluation of proficiency testing (PT) performance, review of control charts and QC results, 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. The metrics report is reviewed monthly by laboratory management, Corporate QA and TestAmerica's Executive Committee. 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.

Items identified as continuous improvement opportunities to the management system may be issued as goals from the annual management systems review, recommendations from internal audits, white papers, Lesson Learned, Technical Services audit report, Technical Best Practices, or as Corporate or management initiatives.

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 and nonconformances provides a valuable mechanism for identifying preventive action opportunities.

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

- Identification of an opportunity for preventive action or process improvement.
- Process for the preventive action or improvement.
- Define the measurements of the effectiveness of the process once undertaken.
- Execution of the preventive action or improvement.
- Evaluation of the plan using the defined measurements.
- Verification of the effectiveness of the preventive action or improvement.

- Close-Out by documenting any permanent changes to the Quality System as a result of the Preventive Action or Process Improvement. Documentation of Preventive Action/ Process Improvement is incorporated into the monthly QA reports, corrective action process and management review.

13.1.2 Any Preventive Actions/ Process Improvements 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 is designed to manage significant events and changes that occur within the laboratory. Through these procedures, 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

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, HR and the QA department and 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*

	Record Types [1]:	Retention Time:
Administrative Records	Finance and Accounting	10 years
	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. CW-Q-S-003. 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
QA Technical Audits	Joint responsibility: a) QA Manager or designee b) Technical Manager or Designee (Refer to CW-Q-S-003)	50% of methods annually
SOP Method Compliance	Joint responsibility: c) QA Manager or designee d) Technical Manager or Designee (Refer to CW-Q-S-003)	Every 2 years
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 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, Technical Director, and Department Managers) 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 VP of Operation 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 Executive Director of Quality & EHS summarizing any current data integrity or data recall investigations. The VP's of Operation 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
Technical Managers - **Microbiology**	Bachelor's degree in applied science with at least 16 semester hours in general microbiology and biology An advanced (MS, PhD.) degree may substitute for one year of experience	And 2 years of 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. Systems are controlled and monitored to assure constant and consistent test conditions.

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 Pittsburgh SOP No. PT-QA-010, Document and Spreadsheet Development and Control.
- SOPs are reviewed at a minimum of every 2 years, 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; Analysis and Sampling Procedures; 40CFR Part 136 as amended by Method Update Rule; May 18, 2012*
- *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). The IDOC must meet the control limits specified in the reference method, if any, or meet method LCS criteria if no IDOC specific controls are provided.

Note: The laboratory shall have a DOC for all analytes included in the methods that the laboratory performs, and proficiency DOCs for each analyst shall include all analytes that the laboratory routinely performs. Addition of non-routine analytes does not require new DOCs for all analysts if those analysts are already qualified for routine analytes tested using identical chemistry and instrument conditions.

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-001.

A certification statement (Figure 19-1) 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. Validation of a method is a planned activity. A coordinator is designated for the process, who's responsibility it is to communicate the process and progress to all involved personnel.

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. All instruments used for analysis of client samples are included in the MDL study and verification. 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.

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.

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. If IDL is > than the MDL, it may be used as the reported MDL.

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 Detection Limit (DL) as being equal to the MDL. TestAmerica also defines the 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. 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 Limit of Quantitation (LOQ), which is at a concentration equal to or greater than the lowest non-zero calibration standard. 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, 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 section Supervisor/ or Department Manager and QA Manager at the facility.
  - Any cells that perform calculations must have the calculation verified and the cell locked so that the formula cannot be changed.
  - 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 Log-In Review - The data review process starts at the sample receipt stage. Sample control personnel review chain-of-custody forms and project instructions from the project management group. This is the basis of the sample information and analytical instructions entered into the LIMS. The log-in instructions are reviewed by the personnel entering the information, and a second level review is conducted by the project management staff.

19.14.4.2 First Level Data Review - The next level of data review occurs with the analysts. As data are generated, analysts review their work to ensure that the results meet project and SOP requirements. First level reviews include inspection of all raw data (e.g., instrument output for continuous analyzers, chromatograms, spectra, and manual integrations), evaluation of calibration/calibration verification data in the day's analytical run, evaluation of QC data, documentation of standards and reagents, and reliability of sample results. The analyst transfers data into LIMS, data qualifiers are added as needed. All first level reviews are documented.

19.14.4.3 Second Level Data Review – All analytical data are subject to review by a second qualified analyst or supervisor. Second level reviews include inspection of all raw data (e.g., instrument output, chromatograms, and spectra) including 100% of data associated with any changes made by the primary analyst, such as manual integrations or reassignment of peaks to different analytes, or elimination of false negative analytes. The second review also includes evaluation of initial

calibration/calibration verification data in the day's analytical run, evaluation of QC data, documentation of standards and reagents, reliability of sample results, qualifiers and NCM narratives. Manual calculations are checked in second level review. All second level reviews are documented.

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

19.14.4.4 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 Director, Department Manager or section Supervisor for further investigation. Corrective action is initiated whenever necessary.

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

19.14.4.6 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.

19.14.4.7 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.

19.14.4.8 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 <u>Manual Integrations</u>

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 principles 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.

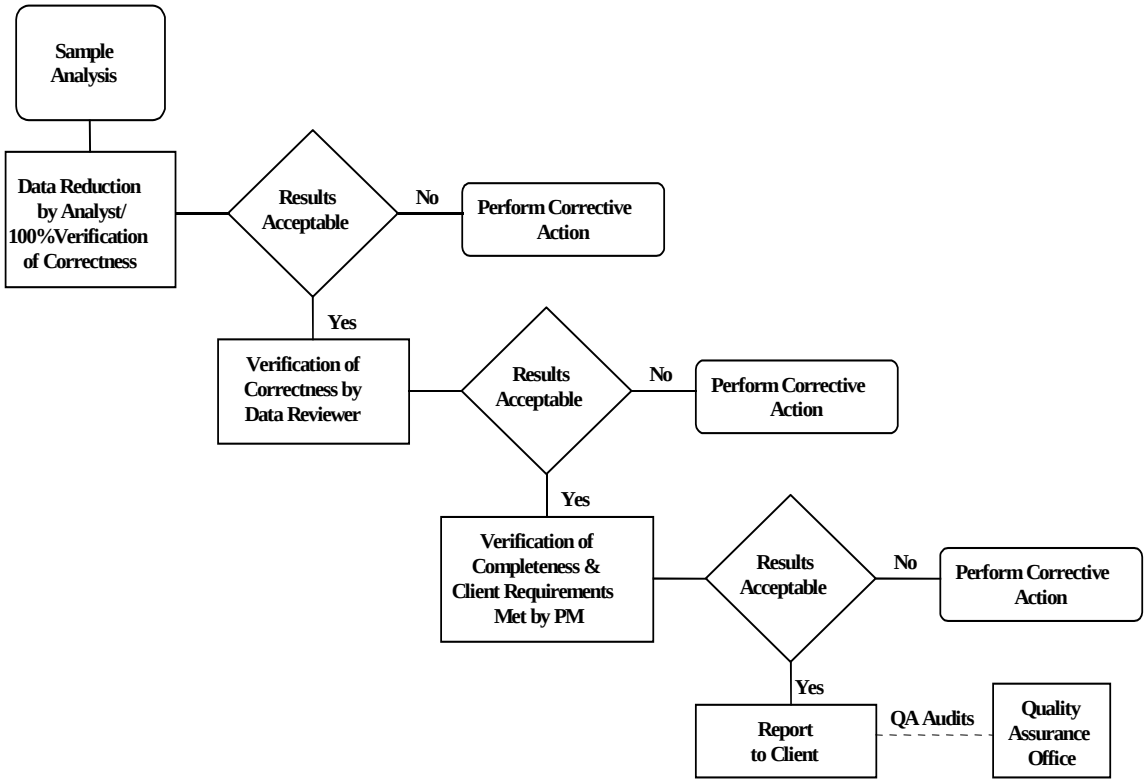
_____ _____
Analyst Signature Date

_____ _____
Technical Manager 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.

All instrumentation and support equipment is designated by a unique laboratory ID.

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 lists examples of scheduled routine maintenance. It is the responsibility of each Department Manager and Supervisor 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 and individual analytical SOPs. (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.

Support equipment that provides quantitative results are calibrated or calibration verified to a recognized national metrology standard, such as NIST, where available, over the expected range of use. The acceptability for use shall be according to the needs of the analysis or application for which the equipment is being used.

Calibration and calibration verification scheduling and documentation for support equipment is maintained by the QA department. All equipment is labeled with the most recent calibration information and the next verification due date.

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 $\pm$ 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. IR thermometers are checked daily for calibration accuracy against an NIST thermometer daily before use.

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 or device-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 temperatures are monitored continuously (24/7).

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.

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/ICP-MS 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 (GCMS methods, for example) 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 unacceptable calibration verification may be fully useable and may be reported, **based upon discussion and approval of the client**, under the following special conditions:

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.

Note: Some state programs require additional verification steps for linear and quadratic calibration – i.e. reading the low level standard against the curve, or verification at a low and a high concentration. See analytical SOPs and project notes for details.

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
TestAmerica Pittsburgh Equipment List
(see PT-QA-WI-045 for the most current listing)

Instrument Type	Manufacturer	Instrument Software	Model Number	Serial Number	Year Put into Service	Condition When Received
GC w/ Dual ECD	Hewlett-Packard Lab ID: GC1	Chem Station Rev. A 09.03 [1417]	6890	US00024872	--	
GC w/ Dual ECD with EPC	Hewlett-Packard Lab ID: GC2	Real-Time Plot Version 4.1 ZF12	5890A	3235A48356	1991	New
GC w/ Dual FID	Hewlett-Packard Lab ID: GC3	Real-Time Plot Version 4.1 ZF12	5890 Series II	2921A23920		
GC w/ Dual NPD	Hewlett-Packard Lab ID: GC5	Chem Station Rev. A 09.03 [1417]	6890A	US00025516	1998	New
GC w/ Dual FPD	Hewlett-Packard Lab ID: GC6	Chem Station Rev. A 09.03 [1417]	6890N	US10145113	2001	New
GC w/ Dual ECD	Hewlett-Packard Lab ID: GC8	Chem Station Rev. A 06.03 [509]	6890	US00023401	1998	New
GC w/ Dual ECD	Hewlett-Packard Lab ID: GC10	Chem Station Rev. A 09.01 [1206]	6890N	US10145114	2001	New
GC w/ Dual ECD	Hewlett-Packard Lab ID: GC12	Chem Station Rev. A 09.01 [1206]	6890N	US10237038	2002	New
GC w/ Dual ECD	Hewlett-Packard Lab ID: GC14	Chem Station Rev. A 07.01 [682]	6890	US00026141	2005	Used
GC w/ Dual ECD	Hewlett-Packard Lab ID: GC15	Chem Station B.04.03 (16)	7890	CN10441121	2011	New
GC w/ Dual ECD	Hewlett-Packard Lab ID: GC16	Chem Station D.02.00.275	6890N	CN10435031	2013	Used
Balance	AND Lab ID: 14234838	N.A.	GR120	14234838	2010	Used
Hydrogen Generator	Parker Balston	N.A.	H2-800	H2800104C	2006	New
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	N.A.	Eclipse	D617466100P	2006	New

Instrument Type	Manufacturer	Instrument Software	Model Number	Serial Number	Year Put into Service	Condition When Received
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	N.A.	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 Version B.01.001	6890 (GC) 5973 (MSD)	US00028345 (GC) US91411730 (MSD)	2005	Used
Concentrator	OI Analytical	N.A.	Eclipse	D617466098P	2006	New
Autosampler	EST Analytical	N.A.	Centurion: CENT WS	CENTS136020 110	2010	New
GC/MS	Hewlett-Packard Lab ID: HP8		6890 FID	US00001295 (GC) 3526I01420 (Headspace)	2001	New
GC/MS	Hewlett-Packard Lab ID: HP9	HP Chem Station 275 Version 0.20	HP6980N (GC) 5973 (MS)	CN10505083 (GC) US44831792 (MS)	2012	Used
Concentrator	Encon	N.A.	ENCO	372061604E	2012	Used
Autosampler	EST Analytical	N.A.	Archon 8100	14178	2012	Used
Oven	Fisher Scientific Lab ID: VOA Glassware Oven	N.A.	625G	503N0042	2005	New
Balance	AND Lab ID: 14234771	N.A.	GR120	14234771	2010	
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	6890 (GC) 5973 (MSD)	US00029396 (GC) US91922512	1999	New

Instrument Type	Manufacturer	Instrument Software	Model Number	Serial Number	Year Put into Service	Condition When Received
		B.01.00		(MSD)		
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)	US65135379 (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: 6500-2	ITEVA	6500	ICP-20074713	2014	Used
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
Metals Digestion Block	Environmental Express Lab ID: H_2O #1	N.A.	Hot Block		2003	New
Metals Digestion Block	Environmental Express Lab ID: H_2O #3	N.A.	Hot Block		2000	New
Metals Digestion Block	Environmental Express Lab ID: H_2O #4	N.A.	Hot Block		2003	New
Metals Digestion	Environmental Express	N.A.	Hot Block		2003	New

Instrument Type	Manufacturer	Instrument Software	Model Number	Serial Number	Year Put into Service	Condition When Received
Block	Lab ID: H_2O #5					
Metals Digestion Block	Environmental Express Lab ID: H_2O #6	N.A.	Hot Block		2000	New
Metals Digestion Block	Environmental Express Lab ID: Soil #10	N.A.	Hot Block		2003	New
Metals Digestion Block	Environmental Express Lab ID: Soil #9	N.A.	Hot Block		2003	New
Metals Digestion Block	Environmental Express Lab ID: Soil #8	N.A.	Hot Block		2003	New
Metals Digestion Block	Environmental Express Lab ID: Soil #7	N.A.	Hot Block		2003	New
Mercury Digestion Block	Environmental Express Lab ID: Soil #35114	N.A.	Hot Block		2003	New
Mercury Digestion Block	Environmental Express Lab ID: Soil #35113	N.A.	Hot Block		2003	New
Mercury Digestion Block	Environmental Express Lab ID: Soil #35112	N.A.	Hot Block		2003	New
Mercury Digestion Block	Environmental Express Lab ID: Soil #35111	N.A.	Hot Block		2003	New
Balance	AND Lab ID: P1856710	N.A.	EK-610I	P1856710	2008	New
Balance	OHAUS Lab ID: B417532814	N.A.	SP602	B417532814	2015	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

Instrument Type	Manufacturer	Instrument Software	Model Number	Serial Number	Year Put into Service	Condition When Received
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	5/21/2010	New
Astoria 2 Analyzer Sampler 311, XYZ, Diluter	Astoria Pacific International	FASPAC II Flow Analyzer Software Version 2.1.2	311-A100-03	4940A14695	5/21/2010	New
Astoria 2 Analyzer 322 Two Channel Auxiliary Pump	Astoria Pacific International	FASPAC II Flow Analyzer Software Version 2.1.2	322-A100-00	322199	5/21/2010	New
Astoria Analyzer Diluter Module 312-M2, 5 ml Syringe	Astoria Pacific International	FASPAC II Flow Analyzer Software Version 2.1.2	312-A200-5ML	4803A12911	5/21/2010	New
Diluter Module: Valve Module, 312 Diluter	Astoria Pacific International	FASPAC II Flow Analyzer Software Version 2.1.2	312-B002-00	300971	5/21/2010	New
Autoanalyzer (ALPKEM1)	OI Analytical (Test: 353.2)	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: MBAS)	N.A.	GENESYS 10 335900-000	2D5K278001	2007	New
UV/VIS	Thermo Electron Corp. (Test: 3060A/7196A)	N.A.	GENESYS 10SVIS	2D9P070001	2011	New
Midi Distillation Blocks	Westco Scientific	N.A.	Easy Dist		2000	New
Midi Distillation Blocks	Westco Scientific	N.A.	Easy Dist		2001	New
Midi Distillation Blocks	Westco Scientific	N.A.	Easy Dist		2005	New
pH meter	Fisher Scientific	N.A.	AR25	AR93315378	2004	New

Instrument Type	Manufacturer	Instrument Software	Model Number	Serial Number	Year Put into Service	Condition When Received
pH meter	Fisher Scientific	N.A.	XL15	XL 94102132	2012	New
pH meter	Oakton	N.A.	pH110 Series	927836	2012	New
MultiMeter	Myron L Co.	N.A.	Ultrameter II 6Psi	6205309		New
Oven	Thermolyne	N.A.	6000			New
Oven	Blue M Electric Co. Lab ID: Oven #2	N.A.	OV-18A	OV1-15300		New
Oven	Fisher Scientific Lab ID: OV02	N.A.	Isotemp 630G	001O0035		New
Oven	Precision Scientific Lab ID: OV08	N.A.	18EG	10AV-9		New
Oven	Fisher Lab ID: ZHE Oven	N.A.	Isotemp Oven Model 301			
COD Reactor A	HACH	N.A.	45600	8911011228		New
COD Reactor B	Bioscience	N.A.	COD T432	163-4667	2013	Used
TOC Analyzer	OI Analytical Lab ID: 1030	N.A.	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 (ALPKEM3)	OI Analytical FS3000	WINFLOW v 4.03	A0001604 A000989 (autosampler)	135804017 135898017 (autosampler)	2007	Used

Instrument Type	Manufacturer	Instrument Software	Model Number	Serial Number	Year Put into Service	Condition When Received
Method 1677 Autoanalyzer (ALPKEM2)	OI Analytical FS3000	WINFLOW v 4.03	A0001604 A000952 (autosampler)	120804293 120898293 (autosampler)	2001	New
BOD Meter - Automated	YSI	BODAssay PLUS V. 3.0	52	03L0794	2004	New
BOD Meter - Manual	YSI	N.A.	50B	91K033593	2003	New
Flashpoint Tester	Rapid Tester Lab ID: SETA-1	N.A.	RT-00001	024149	2002	New
Flashpoint Tester	Petrotest Pensky Martin	N.A.	PMA-4	0741043006	2004	New
Flashpoint Tester	Fisher Scientific	N.A.	K-16200	2501		
Turbidimeter	HF Scientific Inc.	N.A.	Micro 100	105034		
Speed Vap II	Horizon	N.A.	Speed Vap # 9000	01-0333	2001	New
Speed Vap II	Horizon	N.A.	Speed Vap # 9000	01-0332	2001	New
Hotplate	Thermolyne Lab ID: #3	N.A.	Cimarec 3	1073390872634		Used
Hotplate	Thermolyne Lab ID: #1	N.A.	Cimarec 3	1073010868578	2005	New
Hotplate	Thermolyne Lab ID: #14	N.A.	Cimarec 3	1073010868561		New
Hotplate	Thermolyne Lab ID: #4B	N.A.	Cimarec 3	1073980593891		New
Waterbath	Thermo Electron Corp.	N.A.	Precision 2872	202471	2007	New
Centrifuge	Damon/IEC Division Lab ID: CENT-3	N.A.	CU-5000	33473227		
Balance	Mettler Lab ID: 1126472457	N.A.	PB602	1126472457	2005	New
Balance	Mettler Lab ID: G76383	N.A.	AE240	G76383		
Balance	Fisher Lab ID: 25606	N.A.	S-400	25606		
Balance	Mettler Lab ID: AB204S	N.A.	AB204S	1126020829	2005	New
Balance	A & D Lab ID: GR-200	N.A.	GR-200	14224939	2007	New
Balance	A & D Lab ID: FZ1200i	N.A.	FZ1200i	15900520		

Instrument Type	Manufacturer	Instrument Software	Model Number	Serial Number	Year Put into Service	Condition When Received
Sonicator	Fisher Scientific	N.A.	550 Sonic Dismembrator	F2099	1985	
Concentrator	Meyer	N.A.	N-Evap 112	5376		
Concentrator	Meyer	N.A.	N-Evap 115	9217		
Concentrator	Horizon Lab ID: 1	N.A.	Dry Vap	227253	2006	New
Concentrator	Horizon Lab ID: 2	N.A.	Dry Vap	227254	2006	New
Concentrator	Horizon Lab ID: 3	N.A.	Dry Vap	227255	2006	New
Concentrator	Horizon Lab ID: 4	N.A.	Dry Vap	227256	2006	New
Soxtherm Extractor	Gerhardt Lab ID: 1	N.A.	SE-3A/S306A	4012404	2002	New
Soxtherm Extractor	Gerhardt Lab ID: 7	N.A.	SE-3A/S306A	4012399	2002	New
Soxtherm Extractor	Gerhardt Lab ID: 6	N.A.	SE-3A/S306A	4012398	2002	New
Soxtherm Extractor	Gerhardt Lab ID: 5	N.A.	SE-3A/S306A	4012403	2002	New
Soxtherm Extractor	Gerhardt Lab ID: 4	N.A.	SE-3A/S306A	4012402	2002	New
Soxtherm Extractor	Gerhardt Lab ID: 2	N.A.	SE-3A/S306A	4012401	2002	New
Soxtherm Extractor	Gerhardt Lab ID: 3	N.A.	SE-3A/S306A	4012400	2002	New
Soxtherm Extractor	Gerhardt Lab ID: 8	N.A.	SE-3A/S306A	4002039	2002	New
Electric Kiln	Cress	N.A.	FTX-27P	46053	1992	
Electric Oven	Wilt Industries	N.A.	A85		1999	
TCLP Tumbler	Associated Design & Manufacturing Co. Lab ID: T-8	N.A.	6004-0590	1788		
ZHE Rotator	Associated Design & Manufacturing Co. Lab ID: Z1	N.A.	3740-8-BRE	1223		
ZHE Rotator	Bodine (Associated Design) Lab ID: Z2	N.A.	362RA9018			

Instrument Type	Manufacturer	Instrument Software	Model Number	Serial Number	Year Put into Service	Condition When Received
ZHE Rotator	Bodine Electric Co. Lab ID: Z3/Z5	N.A.	42R5BFC1 -E3			
ZHE Rotator	Bodine (Associated Design) Lab ID: Z4	N.A.	34R4BFC1 -5R			
TCLP Tumbler	Environmental Express Lab ID: T6	N.A.		3209-12-466		
TCLP Tumbler	Environmental Express Lab ID: T7	N.A.		3209-12-467		
TCLP Tumbler	Environmental Express Lab ID: T9	N.A.		3209-12-463		
TCLP Tumbler	Dayton (motor) Lab ID: T1	N.A.	2Z794D			
TCLP Tumbler	Dayton (motor) Lab ID: T2	N.A.	5K939E			
TCLP Tumbler	Dayton (motor) Lab ID: T3	N.A.	5K939B			
TCLP Tumbler	Dayton (motor) Lab ID: T5	N.A.	5K939B			
pH Meter	Thermo Orion	N.A.	STARA111 5	J00634	2012	New
Balance	A & D Lab ID: 14628771	N.A.	GF6000	14628771		
Balance	A & D Lab ID: 11684	N.A.	GX4000	14536813		
Balance	Mettler Lab ID: 1120122641	N.A.	PB8001S	1120122641		
Hot Plate	Thermodyne Lab ID: TCLP Hot Plate	N.A.	2200			
Centrifuge	Beckman	N.A.	J6-M	8749	2007	New
Centrifuge	Beckman	N.A.	J6-M	8551	2007	New
Centrifuge	Thermo Electron Corp. Lab ID: Cent-1	N.A.	K	71654833		
Centrifuge	Thermo Electron Corp Lab ID: Cent-2	N.A.	K	71654125		
Method 1664A UCT Cartridge	Enviro-Clean	N.A.	ENUCNIO GXF	UCT #1	2009	New

Instrument Type	Manufacturer	Instrument Software	Model Number	Serial Number	Year Put into Service	Condition When Received
Oil-Less Vacuum Pump for UCT Cartridge System	Rocker (110V, 60 Hz)	N.A.	400	1R400TLTA076	2012	New
Oil-Less Vacuum Pump for UCT Cartridge System	Rocker (110V, 60 Hz)	N.A.	400	1R400TLTA069	2012	New
GPC – AccuPrep (GPC2)	J2 Scientific	N.A.	MPS	GPC-1022-1.0-DI	2009	New
GPC - AccuVap Concentrator System	J2 Scientific	N.A.	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	N.A.	253.28052803	WB91633867	2009	New
Digital Barometer	Fisher Scientific	N.A.	02-401	91116011	2009	New
Digital Buret	Brand	N.A.	4761161 TM (catalogue #)	11G38510	2010	New
IR Thermometer	EXTECH Instruments	N.A.	42511	SR IR#1	2010	New
IR Thermometer	EXTECH Instruments	N.A.	42511	SR IR#2	2010	New
IR Thermometer	EXTECH Instruments	N.A.	42511	WC IR#1	2010	New
IR Thermometer	EXTECH Instruments	N.A.	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
Autosampler	Hewlett-Packard GC15	N.A.	7693	10390085	2010	New
Freezer	Kenmore Lab ID: WC Freezer #2	N.A.	253.28052806	WB02643189	2010	New
Freezer	Frigidaire Lab ID: Tissue	N.A.	FKFH21F7WB	WB02442941	2010	New

Instrument Type	Manufacturer	Instrument Software	Model Number	Serial Number	Year Put into Service	Condition When Received
	Freezer #3					
Freezer	Frigidaire Lab ID: Tissue Freezer #4	N.A.	FKCH17F7WC	WB02851917	2010	New
Freezer	Frigidaire Lab ID: Tissue Freezer #5	N.A.	253.28092801	WB92436406	2010	New
Freezer	Frigidaire Lab ID: Tissue Freezer #9	N.A.	LFFH20F3QWA	WB43855947	2014	New
Freezer	Frigidaire Lab ID: Tissue Freezer #10	N.A.	LFFH21F7HWK	WB43160650	2014	New
Muffle Furnace	Thermo Fisher	N.A.	F6010	0152978801110621	6/21/2011	New
pH Meter	Fisher Scientific	N.A.	Accumet XL15	XL94102132	4/4/2012	New
Refrigerator	Thermo Scientific	N.A.	3566-10A	2017081210718	2012	New
pH Meter	Accumet	N.A.	XL15	XL94102803	2012	New
Balance	AND Lab ID: 14239603	N.A.	GR-200	14239603	2013	New
pH Meter	Fisher Scientific	N.A.	Accumet AR20	AR81206163	2013	Used
Discrete Analyzer	SEAL Analytical	AQ2 Series Software V4	AQ2	090364	2013	Used
Discrete Analyzer	SEAL Analytical	AQ2 Series Software V4	AQ2	090413	2013	Used
Oil-less Vacuum Pump		N.A.	400	167400-11-AB2363	2013	New
Method 1664A UCT Cartridge		N.A.	ENUCN10GXF	UCT#2	2013	New
Incubator	Fisher Scientific	N/A	6500	60300058	2014	Used (Dayton)
BOD2 – BOD autosampler	Gilson	PC-BOD version 3.0.0.142	AutoMax122 PBM-1000-688	261E4N113	2014	New
Stirrer & Level Sensor Control Box	Gilson	PC-BOD version 3.0.0.142	PB-10030	MT-1C4-174	2014	New
BOD autosampler Interface	Gilson	PC-BOD version 3.0.0.142	PC-1085-00	MT-1H4-219	2014	New
DO Meter	YSI		5100	13J101062	2014	New

Tables 20-2
Example - Schedule of Routine Maintenance
(See SOP No. PT-QA-022 for more instrument specific information)

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.					

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.

Additional details can be found in SOP No.'s PT-QA-008 – Thermometer and Barometer Verification and Temperature Monitoring, and PT-QA-012 – Selection and Calibration of Balances and Weights.

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. All reference standards from commercial vendors shall be accompanied by a certificate that includes at least the following information:

- Manufacturer
- Analytes or parameters calibrated

- Identification or lot number
- Calibration method
- Concentration with associated uncertainties
- 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 contingency procedures for re-verifying expired standards is documented in SOP No. PT-QA-006 – Procurement of Standards and Materials, Labeling and Traceability.

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 L:\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 included:

- 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
- Wastewater
- Potable Water
- Wastes
- Soil and Sediment

The laboratory also offers the following services:

- Flow Monitoring
- Field Parameter Analysis

Field Analyses are address in TestAmerica Pittsburgh SOP No.s:

- PT-FS-001 – Field Measurement of Dissolved Oxygen (DO)
- PT-FS-002 – Field Measurement of Total Residual Chlorine
- PT-FS-003 – Field Measurement of pH

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. Certificates of cleanliness for bottles and preservatives are provided by the supplier and are maintained at the laboratory. For detailed information regarding container/bottle order, refer to laboratory SOP No. PT-SR-002 - Bottle Order Preparation and Shipping.

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), Trace-Metals Grade or equivalent
- Sodium Hydroxide – AR Select (ACS) or equivalent
- Sulfuric Acid – AR Select (ACS) or equivalent
- Sodium Thiosulfate – ACS Grade or equivalent
- Sodium Bisulfate – ACS Grade 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. 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.

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 No. 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 >0 to ≤6℃; Samples for Microbiological testing must be received at ≥1 to ≤10°C.
- 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 on the chain-of-custody 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-SR-001 – Sample Receipt and Login.

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 other types of 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)

[redacted]
Chain of Custody Record

TestAmerica
[redacted]
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)
Project Name and Location (State)	Carrier/Waybill Number		Special Instructions/ Conditions of Receipt
Contract/Purchase Order/Quote No.			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H_2SO_4	HNO_3	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)

	Date	Time		Date	Time
1. Relinquished By			1. Received By		
2. Relinquished By			2. Received By		
3. Relinquished By			3. Received By		

Comments

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

Figure 23-2

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).

- Water samples that require ortho-phosphorus must be filtered in the field within 15 minutes of sampling. Samples received without indication of filtration in the field will have results flagged for improper preservation.

- Samples for coliform analysis must be in sterile containers and must be free of residual chlorine. The bottle must be filled to <u>above</u> the 100mL mark.

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) 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

052111
TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Custody Seal

DATE

SIGNATURE

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING
052111

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	04/29/10 15:52
280-2756	1	J19WL7	Solid	280-126043	280-2756-C-1	Soil jar 4oz	OP Dpt	Skrip, Sean P	I	280-9812	04/29/10 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, filtration, 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.

24.3.1 **Negative Controls for Microbiological Methods** – Microbiological Methods utilize a variety of negative controls throughout the process to ensure that false positive results are not obtained. These controls are critical to the validity of the microbiological analyses. Some of these negative controls are:

Table 24-2. Negative Controls for Microbiology

Control Type	Details
Sterility Checks (Media)	are analyzed for each lot of pre-prepared media, ready-to-use media and for each batch of medium prepared by the laboratory.
Filtration Blanks	blanks are run at the beginning and end for each sterilized filtration unit used in a filtration series. For pre-sterilized single use funnels a sterility check is performed on at least one funnel per lot.
Sterility checks (Sample Containers)	are performed on at least one container per lot of purchased, pre-sterilized containers. If containers are prepared and sterilized by the laboratory, one container per sterilization batch is checked. Container sterility checks are performed using non-selective growth media.

Sterility Checks (Dilution Water)	are performed on each batch of dilution water prepared by the laboratory and on each batch of pre-prepared dilution water. All checks are performed using non-selective growth media.
Sterility Checks (Filters)	are also performed on at least one filter from each new lot of membrane filters using non-selective growth media.

Negative culture controls demonstrate that a media does not support the growth of non-target organisms and ensures that there is not an atypical positive reaction from the target organisms. Prior to the first use of the media, each lot of pre-prepared selective media or batch of laboratory prepared selective media is analyzed with at least one known negative culture control as appropriate to the method.

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.

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 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 24-3 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.

Table 24-3 Sample Matrix Control

Control Type	Details	
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 ± 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 effect 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.

24.6.5.3 For TNI work, there are an allowable number of Marginal Exceedances (ME):

<11 analytes	0 marginal exceedances are allowed.
11 – 30 Analytes	1 marginal exceedance is allowed
31-50 Analytes	2 marginal exceedances are allowed
51-70 Analytes	3 marginal exceedances are allowed
71-90 Analytes	4 marginal exceedances are allowed
> 90 Analytes	5 marginal exceedances are allowed

- Marginal exceedances are recovery exceedances between 3 SD and 4 SD from the mean recovery limit (TNI).

- Marginal exceedances must be random. If the same analyte exceeds the LCS control limit repeatedly, it is an indication of a systematic problem. The source of the error must be located and corrective action taken. The laboratory has a system to monitor marginal exceedances to ensure that they are random.

Though marginal exceedences may be allowed, the data must still be qualified to indicate it is outside of the normal limits.

24.6.6 If the MS/MSDs do not meet acceptance limits, the MS/MSD and the associated parent sample are 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 SOP No. PT-QA-021 – Laboratory Quality Control Program, analytical method SOPs and in Section 12 of this document.

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.

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: It is required by the PA DEP that non-accredited parameters be clearly identified on the sample results.

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 in addition to the test report as described in section 25.2. When NELAP accreditation is required and both a test report and

EDD are provided to the client, the official version of the test report will be the combined information of the report and the EDD. Data qualifiers appearing on the test report must be included in the EDD.
Pittsburgh offers a variety of EDD formats including Excel, Equis, Giskey, CSV or others 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.

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

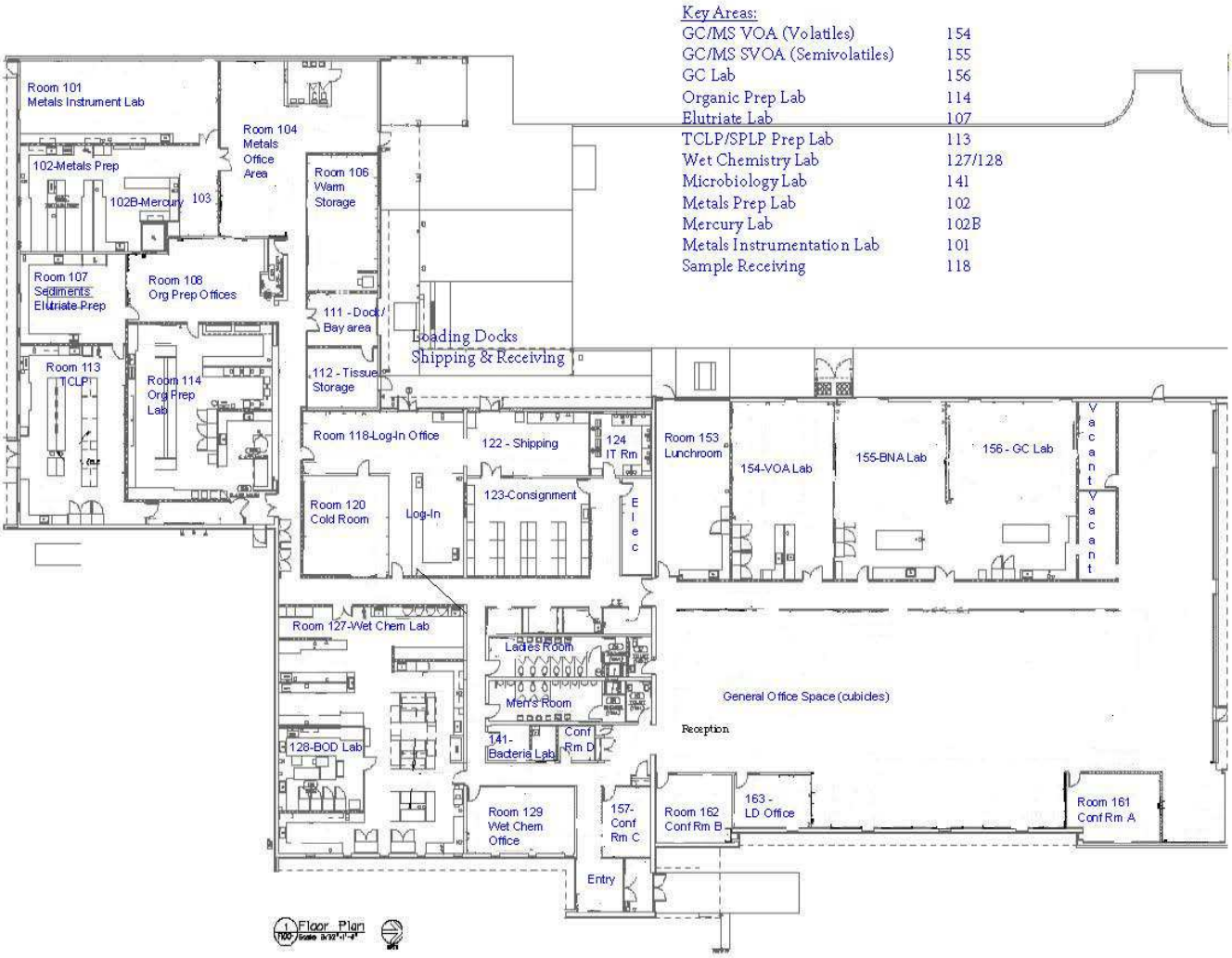
Fundamentally, our policy is simply to not omit previously reported results (including data qualifiers) or to not raise reporting limits and report sample results as ND. This policy has few exceptions. Exceptions are:

- 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 job 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



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)

Anomaly: A condition or event, other than a deficiency, that may affect the quality of the data, whether in the laboratory's control or not.

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), whether in the laboratory's control or not.

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 $\pm$ 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, or more frequently if so required by the reference method, except for analytes for which spiking solutions are not available such as, total volatile solids, odor, temperature, or dissolved oxygen. 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.

Observation: A record of phenomena that (1) may assist in evaluation of the sample data; (2) may be of importance to the project manager and/or the client, and yet not at the time of the observation have any known effect on quality.

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 ELAP	2891
Connecticut	PH-0688
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
Texas	T104704528
Utah	STLP
USDA	P330-10-00139
USDA	P-Soil -01
Virginia VELAP	460189
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

CA- and CW- indicate TestAmerica Corporate documents
PT- documents are specific to TestAmerica Pittsburgh

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-WI-015	Work Instruction for Electronic Chromatography File Surveillance using Mint Miner Manual Integration Data Mining Tool
CA-T-P-001	Qualified Products List

Document No.	Title
CA-T-P-002	Selection of Calibration Points
CA-T-P-003	Reporting Results for Methods that Require Second Column Confirmation
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 Analysis of Herbicides, SW-846 Method 8151A
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) and PCBs as Congeners by GC/ECD - Method: SW-846 8082 and 8082A
PT-GC-006	Chlorinated Pesticides - Method: SW-846 8081A/B
PT-GC-007	Organophosphorus Pesticides by Gas Chromatography - Method: SW-846 8141A and 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 – 8015C/D
PT-GC-WI-001	IC Dilution Table Based on Conductivity
PT-GC-WI-002	GC Data Review Checklist
PT-GC-WI-003	IC Data Review Checklist
PT-GC-WI-004	Safety Kleen Waste Dilution (GC-ECD)
PT-GC-WI-005	Silica Gel Cleanup Work Instruction for PCB Extracts – Method 3630C
PT-HS-001	Pittsburgh Facility Addendum to TestAmerica Corporate Environmental Health & Safety Manual (CW-E-M-001)
PT-HS-002	Bloodborne Pathogen Exposure Control Path
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-W-001	Metals Prep Guide - TA Pittsburgh
PT-IP-W-002	Metals pH Check

Document No.	Title
PT-IT-001	Data Backup Procedures
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-010	Determination of Volatile Organics by GC/MS Method: SW-846 8260C
PT-BNA-WI-001	BNA ICAL Review Checklist
PT-BNA-WI-002	BNA Data Review Checklist
PT-VOA-WI-001	GCMS VOA Backflushing OI Eclipse
PT-VOA-WI-002	GCMS VOA Encore Prep Procedure
PT-VOA-WI-003	GCMS VOA Low Level Soil Extraction Logsheet
PT-VOA-WI-004	GCMS VOA Medium Level Soil Extraction Logsheet
PT-VOA-WI-005	Soil Volatiles – Training Aid and Work Instruction for Data Entry
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-WI-001	Mercury Data Review Checklist
PT-MT-WI-002	HYDRA II Operating Instructions
PT-MT-WI-003	ICP Data Review Checklist
PT-MT-WI-004	ICPMS Data Review Checklist
PT-MT-WI-005	6800 Data Review Checklist
PT-MT-WI-006	Metals Calculated Methods Data Review Checklist
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
PT-OP-002	Simplified Laboratory Runoff Procedure (SLRP)

Document No.	Title
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-011	Extractable Residue (Lipids) from Animal Tissue
PT-OP-015	Modified Multiple Extraction Procedure Method: SW-846 1320
PT-OP-016	Porewater Generation
PT-OP-017	Liquid-Solid Partitioning as a Function of Extract pH in Solid Materials using a Parallel Batch Procedure SW-846 Method 1313
PT-OP-018	Liquid-Solid Partitioning as a Function of Liquid-to-Solid Ratio in Solid Materials using a Parallel Batch Procedure SW-846 Method 1316
PT-OP-019	Mass Transfer Rates of Constituents in Monolithic or Compacted Granular Materials using a Semi-Dynamic Tank Leaching Procedure SW-846 Method 1315
PT-OP-020	Standard Test Method for 24-h Batch-Type Measurement of Contaminant Sorption by Soils and Sediments ASTM D4646-03
PT-OP-021	Liquid-Solid Partitioning as a Function of Liquid-to-Solid Ratio for Constituents in Solid Materials using an Up-Flow Percolation Column Procedure SW-846 Method 1314
PT-OP-022	Low Volume Extraction and Cleanup of Organic Compounds from Waters Method: SW846 3500 Series
PT-OP-023	Measurement of the Leachability of Solidified Wastes by a Short Term Test Procedure Modified ANSI/ANS-16.1-2003
PT-OP-025	Soil/Sediment Amendment Procedure
PT-LP-W-001	TCLP Amber Glass Extraction Blank Vessel Tracking Logbook
PT-LP-W-002	TCLP Zero Headspace (ZHE) Extraction Blank Vessel Tracking Logbook
PT-LP-WI-003	TCLP/ZHE Tumbler RPM Logsheet
PT-PM-001	Project Information Requirements
PT-PM-W-001	Bottle Kit Preservation Guide
PT-PM-WI-002	QAPP Review Checklist
PT-PM-WI-003	QAPP Review Instructions

Document No.	Title
PT-PM-WI-004	Shipping Reports
PT-PM-WI-005	Report Completeness Checks
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
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

Document No.	Title
PT-QA-026	Container Accuracy Verification – Gravimetric
PT-QA-030	Sample Management and Tracking for Cold and Warm Storage
PT-QA-031	Internal Chain of Custody
PT-QA-WI-002	Master Document List
PT-QA-WI-003	BNA Dilution Calculation Table
PT-QA-WI-004	VOA Dilution Calculation Table
PT-QA-WI-005	GC Dilution Calculation Table
PT-QA-WI-006	Metals Dilution Calculation Table
PT-QA-WI-007	Wet Chem Dilution Calculation Table
PT-QA-WI-008	Work Instruction for Vial Calibration for Sample Extracts
PT-QA-WI-009	RSK Dilution Calculation Table
PT-QA-WI-010	Work Instruction for the MiniiiIR Thermometer
PT-QA-WI-011	Work Instruction for the BASF Monaca PA Facility
PT-QA-WI-012	Work Instruction for the Ergon Newell WV Facility
PT-QA-WI-013	Work Instruction for the Mountain State Carbon Follansbee WV Facility
PT-QA-WI-014	Work Instruction for the Ohio Coatings Yorkville OH Facility
PT-QA-WI-015	Work Instruction for the Ormet Reduction Mill Hannibal Ohio Facility
PT-QA-WI-016	Work Instruction for the TIMET Toronto Ohio Facility
PT-QA-WI-017	Work Instruction for Hotblock Thermomemter Rotation - Diagram 1
PT-QA-WI-018	Work Instruction for Hotblock MB Rotation - Diagram 2
PT-QA-WI-019	Work Instruction for Hotblock MB Rotation - Diagram 3
PT-QA-WI-020	Work Instruction for Hotblock MB Rotation - Diagram 4
PT-QA-WI-021	Work Instruction for Temperature Probe Rotation - Sulfide Distillation Block Diagram
PT-QA-WI-022	Analytical SOP Review Checklist
PT-QA-WI-023	SOP Change Form (Amendment Form)
PT-QA-WI-024	PT Corrective Action/Preventative Action Narrative Checklist

Document No.	Title
PT-QA-WI-025	Non-Analytical SOP Review Checklist
PT-QA-WI-026	Sample Receiving Short-Hold Parameter
PT-QA-WI-027	Temperature Logbook
PT-QA-WI-028	Management of Change Request form
PT-QA-WI-029	Spreadsheet Validation Form
PT-QA-WI-030	Signature Log
PT-QA-WI-031	Corrective Action Report (for external use)
PT-QA-WI-032	Work Instruction for Data Recall Notification
PT-QA-WI-033	DOC Certification Statement (No Spikes)
PT-QA-WI-034	Work Instruction: Annual Working Weight Calibration Report
PT-QA-WI-035	QA Technical Data Review
PT-QA-WI-036	IDOC Limits
PT-QA-WI-037	QA Orientation Checklist
PT-QA-WI-038	QA Training Acknowledgement Form
PT-QA-WI-039	Employee Record of Training Form
PT-QA-WI-040	One on One Cross-Training Form
PT-QA-WI-041	Employee Record of SOP Training Review Form
PT-QA-WI-042	Training Attendence Roster
PT-QA-WI-043	Thermocouple Calibration Form
PT-QA-WI-044	DOC Form with LCS
PT-QA-WI-045	TestAmerica Pittsburgh Equipment List
PT-QA-WI-046	Instrument Information Form
PT-QA-WI-047	Proficiency Testing Procedures
PT-QA-WI-048	QA Data Package Review Form
PT-QA-WI-049	Non-Conformance & Corrective Action Tracking
PT-QA-WI-050	Organics "D" Qualifier Dilution Levels

Document No.	Title
PT-QA-WI-051	Analytical Balance Calibration Verification Limits
PT-QA-WI-052	Top-Loader Balance Calibration Verification Limits
PT-QA-WI-053	MDL/MDLV Login
PT-QA-WI-054	Meeting Attendance Roster
PT-QA-WI-055	Control Chart Creation
PT-QA-WI-056	Manual Integration Training Quiz
PT-QA-WI-057	Monthly Balance Verification
PT-QA-WI-058	Manual Data Qualification in TALS AD
PT-QA-WI-059	Glassware Clean-Up for Organic Prep Procedures
PT-QA-WI-060	Glassware Clean-Up for VOA's
PT-QA-WI-061	Glassware Clean-Up for Metals
PT-QA-WI-062	Glassware Clean-Up for General Chemistry
PT-QA-WI-063	Glassware Clean-Up of ZHE's
PT-SR-001	Sample Receipt & Login
PT-SR-002	Bottle Order Preparation and Shipping
PT-SC-WI-001	VOA Freezing Log
PT-SR-WI-001	Cooler Temperature
PT-SR-WI-002	Work Instruction for Bottle Order Creation in TALS
PT-SR-WI-003	Sample Send Outs
PT-SR-WI-004	Pike-Up/Delivery Request Form
PT-SR-WI-005	TestAmerica Pittsburgh Sample Acceptance Policy
PT-SR-WI-006	Metals Analyte List
PT-SR-WI-007	Short Hold Parameters
PT-SR-WI-008	Wet Chemistry QC – MS/MSD NOT Required
PT-SR-WI-009	How to log in Safety Kleen Recycle
PT-SR-WI-010	How to log in Safety Kleen Recharacterization

Document No.	Title
PT-SR-WI-011	International Shipping Guidance Documents
PT-SR-WI-012	Work Instruction for Screening Samples for Radioactivity
PT-SR-WI-013	PM to Login Job notes
PT-WC-001	Determination of Total and Total Volatile Solids in Waters and Wastes (Methods EPA160.4 and SM 2540B & 2540E)
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-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
PT-WC-026	PH Electrometric by SM 4500 H+B and SW-846 Methods: 9045C/D and 9040B/C

Document No.	Title
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-WC-042	Acid Titration of Samples for Bechtel Bettis (NaOH Solution for Caustic and Na2CO3 Concentration), Bechtel-Bettis SOP - WAPD-MT(CAC)-2141,
PT-WC-043	Determination of Total and Volatile Suspended Solids in Waters and Wastes - EPA 160.4 and SM 2540D & 2540E
PT-WC-044	Determination of Settleable Solids in Water SM 2540F
PT-WC-045	Determination of Total Dissolved and Volatile Dissolved Solids in Water and Wastes, SM 2540C & 2540E
PT-WC-WI-001	UV-Absorbing Constituents Method SM5910B
PT-WC-WI-002	ORP Form - Eh/pH Phase Diagram
PT-WC-WI-003	Manual BOD Log Sheet Method: SM 5210B
PT-WC-WI-004	MBAS ICAL Extraction Worksheet
PT-WC-WI-005	MBAS Daily Extraction Worksheet
PT-WC-WI-006	Wet Chemistry Data Review Checklist
PT-WC-WI-007	Waste Visual Compatibilty Test @ Ambient Temperature Worksheet
PT-WC-WI-008	UV/Vis Spectrophotometer Performance Validation Worksheet

Document No.	Title
PT-WC-WI-009	OIA-1677 Instrument Stability Check Worksheet
PT-WC-WI-010	Gravimetric-Solids Methods Data Review Checklist
PT-WC-WI-011	Gravimetric-Oil & Grease Data Review Checklist
PT-WC-WI-012	Automated BOD Log Sheet
PT-MICRO-WI-001	Incubator Temperature Log
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-WI-001	Work Instruction for Courier Service

Note: The SOPs are subject to change, refer to PT-QA-WI-002 for current list of SOPs and revision numbers.

APPENDIX B: LABORATORY STANDARD OPERATING PRECEDURES

Title: DETERMINATION OF VOLATILE ORGANICS BY GC/MS

Method: SW-846 8260B and 8260C

Approvals (Signature/Date):

3/8/2017 Sharon Bacha Date Organics Department Manager	3/10/2017 Steve Jackson Date Regional Safety Coordinator
3/8/2017 Virginia Zusman Date Quality Assurance Manager	3/8/2017 Deborah L. Lowe Date Laboratory Director

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1. SCOPE AND APPLICATION

1.1. This method is applicable to the determination of Volatile Organic Compounds in waters, wastewater, soils, sludges and other solid matrices. Standard and Appendix IX analytes are listed in Table 1.

1.2. This SOP is applicable to method 8260C for both aqueous (5030C) and solid (5035 and 5035A) analysis.

1.3. This method can be used to quantify most volatile organic compounds that have boiling points below 200°C and are insoluble or sli ghtly soluble in water. Volatile water soluble compounds can be included in this analytical technique; however, for more soluble compounds, quantitation limits are approximately ten times higher because of poor purging efficiency.

1.4. The method is based upon a purge and trap, gas chromatograph/mass spectrometric (GC/MS) procedure. The approximate working range is 5 to 250 µg/L for 5 mL standard level waters, 1 to 50 µg/L for low level waters, 5 to 250 µg/kg for low-level soils, and 250 to 25,000 µg/kg for medium-level soils. Reporting limits are listed in Table 1.

1.5. Method performance is monitored through the use of surrogate compounds, matrix spike/matrix spike duplicates, and laboratory control spike samples.

1.6. Certain clients may require specific project or program QC, which may supersede these method requirements. Quality Assurance Summaries should be developed by the Project Manager to address these requirements.

1.7. On occasion clients may request slight modifications to this SOP. These modifications are handled as indicated in PT-QA-M-001, the Quality Assurance Manual.

2. SUMMARY OF METHOD

2.1. Volatile compounds are introduced into the gas chromatograph by the purge and trap method. The components are separated via the chromatograph and detected using a mass spectrometer, which is used to provide both qualitative and quantitative information.

2.2. Aqueous samples are purged directly. Generally, soils are preserved by extracting the volatile analytes into methanol. If especially low detection limits are required, soil samples may be frozen and purged directly.

2.3. In the purge and trap process, an inert gas is bubbled through the solution at ambient temperature or at 40°C (temperature required for low level soils) and the volatile components are efficiently transferred from the aqueous phase to the vapor phase. The vapor is swept through a sorbant column where the volatile components

are trapped. After purging is completed, the sorbant column (trap) is heated and back flushed with inert gas to desorb the components onto a gas chromatographic column. The gas chromatographic column is then heated to elute the components, which are detected with a mass spectrometer.

2.4. Qualitative identifications are confirmed by analyzing standards under the same conditions used for samples, and comparing the resultant mass spectra and GC retention times. Each identified component is quantified by relating the MS response for an appropriate selected ion produced by that compound to the MS response for another ion produced by an internal standard.

3. DEFINITIONS

3.1. TALS – TestAmerica Laboratory Information Management System

3.2. NCM – Non-Conformance Memo – a system within TALS for the lab to communicate to project management and others when there is an anomaly seen with the samples or batch, or a QC failure.

3.3. Definitions of terms used in this SOP may be found in the glossary of the Pittsburgh Laboratory Quality Assurance Manual (PT-QA-M-001).

4. INTERFERENCES

4.1. Method interferences may be caused by contaminants in solvents, reagents, glassware, and other processing apparatus that lead to discrete artifacts. All of these materials must be routinely demonstrated to be free from interferences under conditions of the analysis by running laboratory method blanks as described in the Quality Control section. The use of ultra high purity gases, pre-purged purified reagent water, and approved lots of purge and trap grade methanol will greatly reduce introduction of contaminants. In extreme cases the purging vessels may be pre-purged to isolate the instrument from laboratory air contaminated by solvents used in other parts of the laboratory.

4.2. Samples can be contaminated by diffusion of volatile organics (particularly methylene chloride and fluorocarbons) into the sample through the septum seal during shipment and storage. A field blank prepared from reagent water and carried through the sampling and handling protocol can serve as a check on such contamination.

4.3. Matrix interferences may be caused by non-target contaminants that are coextracted from the sample. The extent of matrix interferences will vary considerably from source to source depending upon the nature and diversity of the site being sampled.

4.4. Cross-contamination can occur whenever high-level and low-level samples are analyzed sequentially or in the same purge position on an autosampler. Whenever an unusually concentrated sample is analyzed, it should be followed by one or more blanks to check for cross-contamination. The purge and trap system may require extensive bake-out and cleaning after a high-level sample.

4.5. Some samples may foam when purged due to surfactants present in the sample. When this kind of sample is encountered an antifoaming agent (Dow Corning Antifoam C) can be used. A blank spiked with this agent must be analyzed with the sample to show there is no target interferences induced by this agent. The antifoaming agent is not used routinely. If it needs to be used, approval from Project Manager is obtained, unless prior client approval has been obtained.

4.6. 2-Chloroethyl vinyl ether is adversely affected by low pH. Samples that require analysis for this compound must not be preserved with HCl as this may result in concentrations that are biased low.

5. SAFETY

5.1. Employees must abide by the policies and procedures in the Corporate Environmental Health and Safety Manual (CW-E-M-001), the Pittsburgh Facility Addendum EH&S Manual (PT-HS-001) and this document. This procedure may involve hazardous material, operations and equipment. This SOP does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of the method to follow appropriate safety, waste disposal and health practices under the assumption that all samples and reagents are potentially hazardous. Safety glasses, gloves, lab coats and closed-toe, nonabsorbent shoes are a minimum.

5.2. The gas chromatograph contains zones that have elevated temperatures. The analyst needs to be aware of the locations of those zones, and must cool them to room temperature prior to working on them.

5.3. There are areas of high voltage in the gas chromatograph. Depending on the type of work involved, either turn the power to the instrument off, or disconnect it from its source of power.

5.4. The mass spectrometer is under deep vacuum. The mass spectrometer must be brought to atmospheric pressure prior to working on the source.

5.5. The following is a list of the materials used in this method, which have a serious or significant hazard rating. This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the SDS for each of the materials listed in the table. A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the SDS for each material before using it for the first time or when there are major changes to the SDS.

Material (1)	Hazards	OSHA Exposure Limit (2)	Signs and symptoms of exposure/Unusual Hazards
Methanol	Flammable Poison Irritant	200 ppm-TWA	A slight irritant to the mucous membranes. Toxic effects exerted upon nervous system, particularly the optic nerve. Symptoms of overexposure may include headache, drowsiness and dizziness. Methyl alcohol is a defatting agent and may cause skin to become dry and cracked. Skin absorption can occur; symptoms may parallel inhalation exposure. Irritant to the eyes.
1 – Always add acid to water to prevent violent reactions.			
2 – Exposure limit refers to the OSHA regulatory exposure limit.			

5.6. Eye protection that protects against splash, laboratory coat, and appropriate gloves must be worn while samples, standards, solvents, and reagents are being handled. Cut resistant gloves must be worn doing any other task that presents a strong possibility of getting cut. Disposable gloves that have become contaminated will be removed and discarded, other gloves will be cleaned immediately.

5.7. Exposure to chemicals must be maintained **as low as reasonably achievable**, therefore, unless they are known to be non-hazardous, all samples should be opened, transferred, and prepared in a fume hood, or under other means of mechanical ventilation. Solvent and waste containers will be kept closed unless transfers are being made.

5.8. The preparation of standards and reagents will be conducted in a fume hood with the sash closed as far as the operations will permit.

5.9. All work must be stopped in the event of a known or potential compromise to the health and safety of a TestAmerica associate. The situation must be reported **immediately** to a laboratory supervisor or Regional Safety coordinator.

6. EQUIPMENT AND SUPPLIES

The following items are recommended for performing this procedure. Equivalent items should only be used or when they result in an improvement in quality, efficiency, productivity, or cost. An item can be considered equivalent if with its use, the analytical and QA/QC requirements in this SOP can be met.

6.1. Microsyringes: 10 uL and larger, 0.006 inch ID needle

6.2 Syringe: 5 or 25 mL glass with luerlok tip, if applicable to the purging device

6.2. Balance: Top-loading balance capable of weighing 0.01 g

6.3. Glassware:

6.8.1 Vials: 40 mL with screw caps and Teflon liners

6.8.2 Volumetric flasks: 10 mL, 50 mL and 100 mL, class A with ground-glass stoppers

6.4. Spatula: Stainless steel

6.5. Disposable pipettes: Pasteur

6.6. pH paper: 0-14 range

6.7. Gases: Helium, Ultra high purity, gr. 99.999%
Nitrogen*, Ultra high purity grade
*If N is used as the purge gas, not all compounds can be reported – see Table 1 for details.

6.8. Purge and Trap Device: The purge and trap device consists of the sample purger, the trap, and the desorber.

6.8.1 Sample Purger: The recommended purging chamber is designed to accept 5 mL samples with a water column at least 3 cm deep. The purge gas must pass through the water column as finely divided bubbles, each with a diameter of less than 3 mm at the origin. The purge gas must be introduced no more than 5 mm from the base of the water column. Alternative sample purge devices may be used provided equivalent performance is demonstrated. Low level soils are purged directly from a VOA vial.

6.8.2 Trap: OI # 10 (8cm Tenax, 8cm silica gel, 8cm carbonized molecular sieve)

6.8.3 Desorber: The desorber should be capable of rapidly heating the trap to at least 180°C. Many such devices are commercially available.

6.8.4 Sample Heater: A heater capable of maintaining the purge device at 40°C is necessary for low level soil analysis.

6.9 Gas Chromatograph/Mass Spectrometer System:

6.9.1 Gas Chromatograph: The gas chromatograph (GC) system must be capable of temperature programming.

6.9.2 Gas Chromatographic Columns: Capillary columns are used. Some typical columns are listed below:

6.9.2.1 Column 1: 20m x 0.18 ID J&W DB-624 or Restek 502.2 with 1 µm film thickness.

6.9.3 Mass Spectrometer: The mass spectrometer must be capable of scanning 35-300 AMU every two seconds or less, using 70 volts electron energy in the electron impact mode and capable of producing a mass spectrum that meets the required criteria when 50 ng or 25 ng of 4-Bromofluorobenzene (BFB) are injected onto the gas chromatograph column inlet.

6.9.4 Data System: A computer system that allows the continuous acquisition and storage on machine-readable media of all mass spectra obtained throughout the duration of the chromatographic program. The computer must have software that allows searching any GC/MS data file for ions of a specified mass and plotting such ion abundances versus time or scan number. This type of plot is defined as an Extracted Ion Current Profile (EICP). Software must also be available that allows integrating the abundances in any EICP between the specified time or scan-number limits. Also, for the non-target compounds, software must be available that allows for the comparison of sample spectra against reference library spectra. The most recent release of the NIST/EPA mass spectral library should be used as the reference library. The computer system must also be capable of backing up data for long-term off-line storage.

7. REAGENTS AND STANDARDS

The following items are recommended for performing this procedure. Equivalent items should only be used when they result in an improvement in quality, efficiency, productivity, or cost. An item can be considered equivalent if with its use, the analytical and QA/QC requirements in this SOP can be met.

7.1 Reagents

7.1.1 Methanol: Purge and Trap Grade, High Purity

7.1.2 Reagent Water: High purity water that meets the requirements for a method blank when analyzed. (See section 9.2) Reagent water is obtained from Millipore system. Other methods of preparing reagent water are acceptable, provided that the water produced meets MB criteria.

7.1.3 Ottawa sand: 20-30 mesh, certified clean for use as blank solid matrix – bake at >100°C prior to use.

7.2 Standards

7.2.1 Calibration Standard

7.2.1.1 Stock Solutions: Stock solutions may be purchased as certified solutions in sealed ampules from commercial sources or prepared from pure standard materials as appropriate. These standards are prepared in methanol and stored in Teflon-sealed screw-cap bottles with minimal headspace at -10° to -20°C. Purchased stock soluti ons in sealed ampules use the manufacturer's documented expiration date and storage requirements. Once the ampule is opened, the standard is assigned an expiration date of 1-year from the opened date, not to exceed the manufacturer's assigned date.

7.2.1.2 Stock standards from a second source are required for verification of the primary stock standards. These standards must follow all requirements for the primary stocks. Verification standards are prepared at the mid-range of the initial calibration (ICV) and at the reporting limit level (LOQV), following the instructions below for Working and Calibration standards.

7.2.1.3 Working standards: A working solution containing the compounds of interest, or internal standards or surrogates are prepared from the stock solution(s) in methanol. The working standard solutions will be prepared monthly with the exceptions of the gases and 2-chloroethylvinyl ether solutions, which will be prepared on a weekly basis. These standards are stored in the freezer below -10°C.

7.2.1.4 Aqueous Calibration Standards are prepared in reagent water using the secondary dilution standards. These aqueous standards must be prepared daily.

7.2.2 Internal Standards: Internal standards are added to all samples, standards, and blank analyses. Refer to Table 4 for internal standard components.

7.2.3 Surrogate Standards: Refer to Table 5 for surrogate standard components and spiking levels.

7.2.4 Laboratory Control Sample/Matrix Spike Spiking Solutions: All regular list target compounds are include in the LCS and MS/MSD spiking mix. See Table 6 for spike compounds and spiking levels. Acrolein and 2-Chloroethyl vinyl ether are added when part of the required reporting list. Other Appendix IX and client requested extra compounds are added as required by client QAPP or at least once every 2 years.

7.2.5 Tuning Standard: A standard is made up that will deliver up to 50 ng on column upon injection. A recommended concentration of 25 ng/mL of 4-Bromofluoro-benzene in methanol is prepared.

8 SAMPLE COLLECTION, PRESERVATION, SHIPMENT AND STORAGE

8.1 Several different approaches to sample preservation and storage are presented below. The appropriate procedure selection is subject to project or program specific requirements.

Matrix	Sample Container	Min. Sample Size	Preservation	Holding Time	Reference
Water*	40 mL VOA vials with Teflon-lined lids	40 mL	pH < 2 with 1:1 HCl, >0 but $\leq 6^{o}C$	14 days from collection to analysis	SW- 846 Chapter 4
Water*	40 mL VOA vials with Teflon-lined lids	40 mL	>0 but $\leq 6^{o}C$ without chemical preservation	7 days from collection to analysis	SW- 846 Chapter 4
Soil	Glass with Teflon-lined lids.	5 g	Water/MeOH extracted and Frozen within 48 hours of collection	14 days from collection to analysis	SW-846 Chapter 4

*See section 8.4.1 for water holding time discussion for 2-Chloroethylvinyl ether

8.2 There are several methods of sampling soil. The recommended method, which provides the minimum of field difficulties, is to take samples using an EnCore™ sampler or using a Terra Core™ sampling kit. At specific client request, unpreserved soil samples in 4oz jars may be accepted. For EnCore and Terra Core sampling, a separate jar is required for percent solids/moisture determination, unless one is supplied for another analysis.

8.2.1 For EnCore™ samplers, the 5g sample is extruded into a pre-weighed 40mL vial containing 5mL of methanol (medium level analysis) or reagent water (for low level, <50 µg/kg, analysis). The exact samples weight is determined as the difference between the vial + preservative weight and weight after the sample is added.

- Samples must be transferred (extruded from the sampler) and preserved within 48 hours of sampling.
- Water preserved samples are then frozen at <10°C. Methanol preserved samples may be stored at > 0.0 °C but ≤ 6°C, or frozen.
- Methanol preserved samples are shaken for at least 2 minutes, and a portion of the methanol extract after settling may be transferred to a smaller Teflon-lined capped vial for storage below 6°C.
- Normally 1 medium level and 2 low-level samples are taken and preserved.
- One vial of each preservation is prepared at the same time as samples, to be used for LCS analysis. Spikes are not added until the time of analysis.
- Samples are spiked with internal standards and surrogates at the time of analysis.

8.2.2 Terra Core™ sampling kits are pre-preserved for use and immediate samples preservation in the field. Kits are shipped that include 1 methanol preserved and 2 reagent water preserved vials, along with a 4oz jar for solids/moisture analysis volume.

- Terra Core™ vials are immediately placed in the freezer (<-10°C) upon receipt at the lab. Methanol preserved vials are shaken for at least 2 minutes to break up the solid and create the methanol extract.

- Terra Core™ vials are labeled with the weight of the vial and preservative. The vials are re-weighed prior to analysis to determine the weight of the solid sample added. It is important that labels NOT be added to these vials prior to weighing, because the weight of the label will add to the sample weight. Vials may be marked with indelible marker, or placed in a labeled, sectioned box until ID labels can be added after weighing.

8.2.3 When sample vials are labeled, the label must not cover the neck of the vial, or it will not work on the autosampler.

8.3 Unpreserved soils - At specific client request unpreserved soils packed into glass jars or brass tubes may be accepted and subsampled in the lab. A 5g portion of the sample is transferred to a 40mL vial and mixed with reagent water for analysis. This is the old procedure based on SW-846 Method 5030A. It is no longer included in SW-846 and is likely to generate results that are biased low, possibly by more than an order of magnitude.

8.4 Aqueous samples are stored in 40mL glass vials with Teflon lined septa at >0 and ≤ 6.0℃, no headspace larger than a small pea.

8.4.1 Regulatory requirements for 2-Chloroethyl vinyl ether:

- 2-Chloroethyl vinyl ether: The stability of this compound is reduced when subjected to low pH, therefore samples for analysis to include 2-CEVE must be taken without acid preservation. Unpreserved samples must be analyzed within 7 days. If samples are received for this analysis that are preserved, this is documented and narrated using the “Preservation – Incompatible; 8260 VOA” NCM.

- SW846 Update V removed special preservation requirements for Acolein and Acylonitrile. These compounds may be analyzed for using a preserved sample vial.

8.5 Medium level solid methanol extracts, if taken at the time of preservation, are aliquoted into 4 mL glass vials with Teflon lined caps and stored at > 0.0 °C but ≤ 6.0℃ or frozen. The extracts are stored with mini mum headspace.

8.6 Soil samples and water samples preserved to pH <2 with HCl have a maximum holding time is 14 days from sampling until the sample is analyzed. If water samples are known to be unpreserved, the holding time is 7 days from sampling to analysis.

8.6.1 Preserved water samples are checked to confirm the preservation pH AFTER analysis because the vials must not be opened prior to analysis. If the pH is found to be >2, this must be addressed in the case narrative.

8.7 A holding blank is stored with the samples. This is analyzed and replaced if any of the trip blanks show any contamination. Otherwise it is replaced every 7 days.

8.8 Compositing of water samples for volatiles analysis is not recommended, however, if samples must be composited by the lab, there are three options:

8.8.1 Individual grab samples, properly collected in 40mL vials, are combined in a 300-500mL round-bottom flask immersed in an ice bath to maintain the sample temperature < 6°C. After mixing, multiple aliquots of the composite sample are poured into 40mL vials, without headspace, and sealed for subsequent analysis.

8.8.2 Equal volumes of individual grab samples are added to the purge device to total 5mL. (A larger volume may be used, however the instrument calibration must be carried out with the same volume.)

8.8.3 Equal volumes of individual grab samples are aspirated into a 25mL syringe while maintaining zero headspace. Either the whole volume, or a 5mL volume is then immediately analyzed. Alternatively, multiple 5mL syringes may be filled with equal portions of individual grab samples and then injected into the 25mL syringe (or a syringe of the appropriate volume for the number of grab samples to be composited).

9 QUALITY CONTROL

9.1 The following quality control samples are prepared with each batch of samples.

Quality Controls	Frequency	Acceptance Limits
Method Blank (MB)	1 per preparation batch[1]	<RL
Laboratory Control Sample (LCS)[2]	1 per preparation batch[1]	Statistical limits are maintained in TALS
Matrix Spike (MS)[2,3]	1 per preparation batch[1]	Statistical limits are maintained in TALS. MS is not used for batch control.
Matrix Spike Duplicate (MSD)[2,3]	1 per preparation batch[1]	Statistical limits are maintained in TALS. MSD is not used for batch control.
Surrogates	All samples and QC	Statistical limits are maintained in TALS
Internal Standards	All samples and QC	50 – 200% Response in mid-level of ICAL

[1]A preparation batch is limited to 20 samples

[2]Statistical control limits will are developed and updated as per SOP PT-QA-021. LCS for batches with samples from South Carolina must meet 70-130% recovery limits for all target compounds, 60-140% for poor performers.

[3]The sample for MS/MSD analysis is randomly selected, unless specifically requested by a client.

Analytical QC	Frequency	Acceptance Limits
Tune check (BFB)	1 per 12 hr clock, prior to any standards or samples	See Table 7
Initial Calibration	Every 6 months or more often as needed, minimum 5 points	≤ 15% RSD for 8260B, ≤ 20%RSD for 8260C, see section 10.4
Calibration Verification Standard	1 per 12 hr clock, prior to any samples	< 20%D, see section 10.5.2

9.2 In-house statistical control limits based on historical data are determined annually for surrogates, matrix spikes, and laboratory control samples (LCS). See SOP PT-QA-021 for details of how limits are determined and set. These control limits are maintained in TALS and are available for viewing upon request.

9.3 For the BFB Tune check, Initial and Continuing Calibration requirements and corrective actions, see sections 10.3, 10.4 and 10.5 below.

9.4 One Method Blank (MB) is analyzed along with each batch of 20 or fewer samples of the same matrix. MBs associated with aqueous batches are prepared with 5mL of laboratory reagent water. MBs for solid batches are prepared with 5g of baked Ottawa sand with reagent water for low-level and 4.9mL reagent water plus 0.10mL methanol for medium level solids. MBs are spiked with surrogates and internal standards.

9.4.1 The MB must not contain any analyte of interest at or above the reporting limit. For any analyte detected above the MDL in the MB, associated samples results will be reported with a “B” qualifier. If the initial MB is contaminated, a second MB may be run to verify instrument contamination. If the second MB fails as well, corrective action must be taken. Reanalysis of samples associated with a contaminated method blank is required unless one of the following situations exists:

- If the analyte is a common laboratory contaminant (methylene chloride, acetone, 2-butanone) the data may be reported with qualifiers if the concentration of the analyte is not more than 5x the reporting limit. Results are reported using the “Method Blank – Report, Common Lab Contaminant < 5x RL” NCM.

- If the affected compound is not detected above the RL in the samples associated with an unacceptable method blank, the data may be reported with qualifiers and using the “Method Blank – Report, ND” NCM.

- If the sample concentrations are greater than 10x the concentration seen in the MB, results may be reported with qualifiers and using the “Method Blank – Report, 10X” NCM.

- If reanalysis of the batch is not possible due to limited sample volume or other constraints, the PM should be contacted for direction on how to proceed. If the data must be reported, affected compounds are qualified with a "B" in the associated samples, and appropriate comments are made in the case narrative.

9.4.2 The MB must have acceptable surrogate recoveries. If surrogate recoveries are not acceptable, the data must be evaluated to determine if the method blank has served the purpose of demonstrating that the sample analysis is free of contamination. All non-conforming blanks will be documented in an NCM and, if reported, the reasons for reporting the data will be summarized. For example, if surrogate recoveries are low, re-extraction and/or reanalysis of the blank and affected samples will normally be required. If the surrogate recoveries are high and there are target compounds found in the associated

sample the samples will require re-extraction and/or reanalysis. The PM must be contacted and consultation with the client should take place for how to proceed.

9.5 One Laboratory Control Samples (LCS) is analyzed along with each batch of 20 or fewer samples of the same matrix. The matrix of the LCS matches that of the MB. The LCS contains all common analytes of interest (See Table 6). Appendix IX or other non-common analytes are added as required by client poject, and at least once every 2 years. If any target analyte or surrogate is outside established control limits, the system is out of control and corrective action must occur (see marginal exceedance allowance in section 9.5.4). Samples associated with a failed LCS must be reanalyzed unless one of the following situations exists:

9.5.1 If the LCS recovers above the control limits, and the affected compound is not detected above the RL in the associated samples, results may be reported with qualification and using the “LCS/LCSD - %R High” NCM.

9.5.2 If reanalysis of the batch is not possible due to limited sample volume or will be past the analytical holding time, the PM must be notified and the client input sought on how to proceed. If the data must be reported, all associated sample results are qualified, and appropriate comments are made in a narrative to document the situation.

9.5.3 For SW846 methods, when there are more than 11 target analytes in the LCS, NELAC allows a specified number of results to fall beyond the LCS control limit (3 standard deviations), but within the marginal exceedance (ME) limits, which are set at 4 standard deviations around the mean of historical data. The number of marginal exceedances allowed is based on the number of analytes in the LCS, as shown in the following table:

Allowed Marginal Exceedances

# of Analytes in LCS	# of Allowed MEs
> 90	5
71 – 90	4
51 – 70	3
31 – 50	2
11 – 30	1
< 11	0

- If more analytes exceed the LCS control limits than is allowed, or if any analyte exceeds the ME limits, the LCS fails and corrective action is necessary. Marginal exceedances must be sporadic and random, which is defined as no more than 2 failures in 3 consecutive batches. If the same analyte repeatedly fails the LCS control limits, it is an indication of a systematic problem, and this is tracked through the review of LCS control charts. The source of the error must be identified and corrective action taken.
- ME limits are determined using the same annual control charts as the LCS control limits.
- Use of marginal exceedances is not permitted in association with samples from South Carolina.

NOTE: Due to the nature of Safety Kleen samples, an LCS/LCSD will always be analyzed for QC purposes, as per client/PM instruction.

9.6 One Matrix Spike / Matrix Spike Duplicate (MS/MSD) pair is required to be analyzed with every batch of 20 or fewer samples. The sample used for MS/MSD analysis is chosen at random from the batch unless a client specifies a sample for QC. Spiked compounds and recovery limits are the same as those established for the LCS. Precision limits are calculated from control charts run on an annual basis.

9.6.1 Batch quality is not controlled on the MS/MSD acceptance alone because the sample matrix is being tested. The initial corrective action for MS/MSD failures will be to check the recovery of that analyte in the Laboratory Control Sample (LCS). If the recovery of the analyte in the LCS is within limits, then the laboratory operation is in control and analysis may proceed. Only parent sample results will be qualified associated with MS/MSD failures.

9.6.2 If the recovery for any control component is outside QC limits for both the MS/MSD and the LCS, the laboratory operation is out of control and corrective action must be taken according to the LCS section above.

9.6.3 If a MS/MSD is not possible due to limited sample, it is acceptable to run only an MS, or the LCS may be analyzed in duplicate. RPD of the LCS and LCSD are compared to the matrix spike limits. Document this situation using the “MS/MSD/DUP – Insufficient Volume” NCM.

9.6.4 The matrix spike/duplicate must be analyzed at the same dilution as the unspiked or parent sample, even if some matrix spike compounds will be diluted out.

NOTE: If a Calgon sample is selected to be analyzed as an MS/MSD and the parent sample requires a 5X dilution or greater, as per instruction from the client/PM, an LCS/LCSD will be analyzed instead.

9.7 Surrogates are spiked into all samples and QC to monitor both the analytical system and the effect of the sample matrix on it. Surrogate compounds and spiking levels are provided in Table 5. Surrogate recovery limits are determined annually using historical data. If recovery of any surrogate is outside limits, corrective action is required.

9.7.1 If surrogate recovery is above the control limits, and none of the associated compounds are detected above the RL, results may be reported using the "Surrogate – High, ND" NCM.

9.7.2 Samples that have major matrix interference, which is obvious from the chromatogram, will not be rerun for confirmation of matrix interference. Results will be reported using the "Surrogate – Matrix" NCM.

9.7.3 The decision to reanalyze or flag the data should be made in consultation with the PM and client if neither of the above applies. It is only necessary to reprepare/reanalyze a sample once to demonstrate that poor surrogate recovery is due to matrix effect.

9.7.4 If the surrogates are out of control for the sample, matrix spike, and matrix spike duplicate, then matrix effect has been demonstrated for that sample and repreparation is not necessary. If the sample is out of control and the MS and/or MSD is in control, then reanalysis or flagging of the data is required.

NOTE: When Calgon samples are analyzed for GC/MS Volatiles, as per the client, no re-extraction or reanalysis will take place when surrogates recovery outside of control limits. These samples are carbon, and surrogate recoveries are known to be poor when analyzing this matrix.

NOTE: The surrogate, Dibromofluoromethane, recovers poorly under basic conditions. In this situation, reanalysis to confirm matrix effect is not required if the pH of the sample is above 7. Documentation of the basic condition is required using an NCM as well as in the TALS batch.

9.8 Internal standards (IS) are added to all QC and samples to monitor system performance and adjust for minor changes over time and from sample matrices. The response of the IS must be within 50 – 200% of the response seen in the mid-level standard of the Initial Calibration Curve. If IS response is outside this range, it

indicates either a drift in instrument response, or an adverse effect of the sample matrix and corrective action is required.

9.8.1 The internal standard compounds and spike levels are provided in Table 4. The target compounds associated with each IS are listed in Table 4A.

9.8.2 If IS response falls outside the acceptance range in a MB or LCS, this may indicate a drift in instrument response from the ICAL, and a new initial calibration curve must be analyzed if the failures repeats.

9.8.3 IS failure in a sample or MS/MSD may be caused by the matrix. If volume is available, the sample should be reanalyzed to confirm, unless the matrix interference is obvious. If the bad matrix is obvious, results for the associates compounds are considered as estimated and may be reported along with the "ISTD – Matrix" NCM.

9.8.4 If the sample matrix effect is not obvious, and the sample cannot be reanalyzed due to limited volume or holding time, results for the associates compounds are considered as estimated and may be reported along with the "ISTD – No RX/Rerun" NCM.

9.8.5 Internal standards Dioxane-d8 and TBA-d9 apply to only 1 or 2 target analytes that are not always included in the list being reported. If these ISs are outside the control limits, and the associated compounds are not reported, the "ISTD – Non-Targets Affected" NCM may be applied, and results reported without qualification.

9.8.6 Internal standards are also used to monitor for retention time shifts. See section 10.6.9 for details.

10 PROCEDURE

CALIBRATION AND STANDARDIZATION

10.1 Summary

Prior to the analysis of samples and blanks, each GC/MS system must be tuned and calibrated. Hardware tuning is checked through the analysis of 4-Bromofluorobenzene (BFB) to establish that a given GC/MS system meets the standard mass spectral abundance criteria. The GC/MS system must be calibrated initially at a minimum of seven concentrations (analyzed under the same BFB tune), to determine the linearity of the response utilizing target calibration standards. Once the system has been calibrated, the calibration must be verified each twelve hour time period for each

GC/MS system. Both soil and regular level water matrices are analyzed in the same manner, using a heated purge. Low-level water analysis does not use heated purge and requires a separate calibration.

10.2 Recommended Instrument Conditions

10.2.1 General

Electron Energy:	70 volts (nominal)
Mass Range:	35–300 AMU
Scan Time:	to give at least 5 scans/peak, but not to exceed 2 second/scan
Injector Temperature:	200–250℃
Source Temperature:	According to manufacturer's specifications
Transfer Line	Temperature: 250–300℃
Purge Flow:	40 mL/minute
Carrier Gas	Flow: 15 mL/minute
Make-up Gas Flow:	25–30 mL/minute

10.2.2 Gas chromatograph suggested temperature program

Parameter	Sample Analysis	BFB Analysis
Initial Temperature:	35℃	35℃
Initial Hold Time:	4 minutes	2 min
Temperature Program:	15℃/minute	20℃/minute
Final Temperature:	200℃	200℃
Final Hold Time:	1.1 minutes	1.0 min.

10.3 Instrument Tuning

Each GC/MS system must be hardware-tuned to meet the abundance criteria listed in Table 7 for a maximum of a 50 ng injection or purging of BFB. Analysis must not begin until these criteria are met. These criteria must be met for each twelve-hour time period. The twelve-hour time period begins at the moment of injection of BFB.

Tune evaluations are performed utilize the “Autofind” function and are set up to look at the apex + or - 1 scan and average the three scans. Background correction is required prior to the start of the peak but no more than 20 scans before. Background correction cannot include any part of the target peak.

10.3.1 Adjustments, such as those to the repeller and the ion focus lenses, EM Voltage, etc., may be made prior to tune verification as long as all of the subsequent injections in the 12 hour tune cycle are analyzed under the same MS tune settings and it is documented in the run sequence log and/or maintenance log that an adjustment was made. Excessive adjusting (more than 2 tries) without clear documentation is not allowed. Necessary maintenance is performed and documented in the instrument maintenance log.A single scan at the apex (only) may also be used for the evaluation of the tune. For SW-846 series methods, background correction is still required.

10.3.2 Tune evaluation printouts must include the chromatogram and spectra as well as the tune evaluation information. In addition, the verifications must be sent directly to the printer of pdf file (NO screen prints for BFB tunes).

10.3.2.2 If the instrument has a built in macro that checks the BFB, use of this macro with no manual manipulation is acceptable. (It must be confirmed that the correct ion ratios are being checked according to Table 7.)

10.3.2.3 If the background scan selected includes significant ions at 95 or 174 or 176, then the scan is almost certainly part of the BFB peak and is not acceptable.

10.4 Initial Calibration

10.4.1 A series of seven (or 8 for low level) initial calibration standards is prepared and analyzed for the target compounds and each surrogate compound. Calibration levels are listed in Table 2. Other calibration levels may be used depending on the capabilities of the specific instrument. The volume of standard purged for all analyses is 5mL. (If samples require analysis at a volume other than 5mL, a calibration curve must be analyzed with the standards purged at the same volume as the samples.) The low level standard of the calibration curve must be at or below the reporting limit.

10.4.2 It may be necessary to analyze more than one set of calibration standards to encompass all of the analytes required for same tests. For example, the Appendix IX list requires the Primary standard and the Appendix IX standard.

10.4.3 Internal standard calibration is used. The internal standards are listed in Table 4. Target compounds should reference the nearest internal standard (see Table 4A). Each calibration standard is analyzed and the response factor (RF) for each compound is calculated using the area response of the characteristic ions against the concentration for each compound and internal standard. See Section 11.3.1, for calculation of response factor.

10.4.3.1 Alternate ISTD (not necessarily those closest in Retention Time) may be assigned for poor responders. Once established, ISTD assignments must not be altered without re-performing initial method validation studies.

10.4.4 For Method 8260B, Calibration Check Compounds (CCCs) from the initial calibration curves are used to evaluate the integrity of the system. High variability for these compounds may be indicative of system leaks or reactive sites on the column. Meeting the CCC criteria is not a substitute for successful calibration as discussed in section 10.4.6 below. The six CCCs are 1,1-Dichloroethene, 1,2-Dichloropropane, Chloroform, Ethylbenzene, Toluene, and Vinyl chloride. Each of these compounds must have %RSD $\leq$ 30%, or corrective action must be taken before analysis may continue.

10.4.5 For Method 8260C, the results of the initial calibration are evaluated against the requirements in Section 11.3.4.2 of the reference method: "If more than 10% of the compounds included in the initial calibration exceed 20% RSD and do not meet the minimum correlation coefficient (0.990) for alternate curve fits, the chromatographic system is considered too imprecise for analysis to begin. Adjust moisture control parameters, replace analytical trap or column, replace moisture trap or adjust desorb time, then repeat the calibration". Compounds that fail to meet criteria, within the 10% allowance, must be qualified as estimated in sample results if detected above the RL.

10.4.6 <u>Selection of calibration curve fit type (in order of preference)</u>

10.4.6.1 Average Response Factor

- Each target compound is evaluated for linearity. If the %RSD of the target compound is less than or equal to 15% for Method 8260B or 20% for Method 8260C, the average response factor can be used for quantitation of samples. A minimum of 5 points is required, 7 points are routinely used.

- If the %RSD of the target compound is greater than 15% for 8260B, or 20% for 8260C, a regression curve (linear or quadratic) must be used for the quantitation of samples. If a quadratic curve is selected, a minimum of six points, not including the origin, must be used.

- If the %RSD is <15% for 8260B, or 20% for 8260C, alternative curve fits may still be considered.

10.4.6.2 Linear Regression (weighted)

- A weighted linear regression may be used even if the average response factor curve fit is acceptable.

- If weighted linear regression is used 1/(Amt) or $1/(Amt)^2$ a minimum of 5 points are required. The coefficient of determination (r^2) must be ≥ 0.990.

10.4.6.3 Quadratic Regression

- In some cases the response/concentration relationship may be non-linear. In these cases quadratic regression may be used.

- Quadratic fits must only be used where an average or weighted linear fit is clearly inappropriate.

- Force through zero is allowed, but should be necessary only rarely.

- A minimum of 6 points are required for a quadratic curve, and the coefficient of determination (r2) must be > to 0.990. Additional checks are required to ensure that a quadratic fit is appropriate:

  - The calibration plot must be inspected to ensure that the curve does not flatten out (i.e., slope = 0) or become negative within the range of the calibration

  - Where a quadratic curve fit is applied- all chromatograms for all samples must be inspected for off scale peaks in the retention time range of the analyte.

- **Quadratic curve fits are not allowed for South Carolina samples**

10.4.6.4 Linear Regression (unweighted)

Unweighted linear should be used only where other available fits are clearly inappropriate

- If unweighted linear regression is used a minimum of 5 points are required. The coefficient of determination (r^2) must be > 0.990.

10.4.7 If the correlation coefficient of the regression curve is $\geq$ 0.990, the curve can be used to quantify samples. Regression curves may be forced through zero but it is recommended that the curve be evaluated without forcing through zero first and then with the curve forced through the origin.

10.4.8 The analyst must ensure that the type of regression curve selected accurately defines the concentration/response relationship over the entire calibration range. Other curve options, such as weighted linear fit, are available, allowed, and encouraged. Calibration curve characteristics such as evaluation of the residuals (the "distance" of each point from the plotted curve) and evaluation of the relative standard error should be employed to determine the actual best curve for each target analyte. Calibration procedures are discussed in detail in Corporate SOP CA-Q-S-005, Calibration Curves.

10.4.9 The average RF must be calculated for each compound. If the minimum response factors listed in Table 8 are not met, the system may lack sufficient sensitivity to meet project requirements. (NOTE: for Method 8260B, five System Performance Check Compounds are monitored, rather than the full list. These compounds are noted in Table 8.) Each compound must be evaluated with project objectives in mind. If the minimum RF is below the required level, non-detect results may still be reportable if the low level standard has a response above 3x the background noise level.

10.4.10 Calibration Point Read-back Criteria

Whichever calibration model above is selected, it should be subjected to an additional check to establish the representativeness of the data that were used to produce it. This check is the refitting of each calibration point response back to the calibration model, or the comparison of the calculated amount of the standard against the expected amount.

- CHROM software provides an Initial Calibration %Drift report which shows the % Error for each calibration point. This report must be reviewed in addition to the %RSD / Linear Response Factor.

- The absolute value of the % Error for each calibration point should be $\leq$ 30%. For the lowest calibration point, the % Error may be $\leq$ 50%.

10.4.11 Removal of calibration points and/or levels

10.4.11.1 Certain analytes that have particularly high or low sensitivity may need to have the high or low calibration points removed in order to optimize the calibration curve. Removal of high or low calibration points is allowed, but the working range of the calibration must be adjusted accordingly. The reporting limit must be supported by the lowest point remaining in the calibration and any samples with concentrations above the highest point in the calibration must be diluted and reanalyzed.

10.4.11.2 Points for individual compounds from the interior levels of the calibration may not be removed. A complete level may be removed only if the laboratory can document a clear reason for incorrect response in the standard (for example, analysis of the incorrect level, failure to add internal standards or instrument malfunction).

10.4.12 Non-standard analytes are sometimes requested. Where it is acceptable to the client, it may be is possible to analyze a single standard at the reporting limit (to screen for the compounds) with each continuing calibration rather than a full initial calibration curve. If the analyte is detected in any of the samples, a six point initial calibration must be generated and the sample(s) reanalyzed for quantitation. However, if the analyte is not detected, the non-detect may be reported and no further action is necessary. This is not an acceptable procedure for compliance work.

10.4.13 All ICALs will be verified by the analysis of a Second Source Standard (ICV). The acceptance criteria are 70-130% for most compounds and 50-150% for poor method performers. The poor performers are footnoted in Table 2. Any compound not listed will fall into the 50-150% criteria until knowledge of the compound can be developed.

NOTE: Any compound that uses a minimum RRF of 0.001 must have an LODICV analyzed. The LODICV standard concentration is at the reporting limit to demonstrate the compound can be reliably detected at that level. The LODICV must be detected above 3x the background noise level to be acceptable.

Note: For South Carolina, all compounds must meet 70-130% with the exception of the identified poor purging compounds for this program, which are defined as carbon tetrachloride, cis-1,3-dichloropropene and trans-1,3-dichloropropene. Any compounds outside of the 70-130% range (or 40% for

poor purgers) must be qualified as estimated in the sample results and narrated.

10.4.14 Outliers will be evaluated on a project by project basis and narrated in the case narrative, if necessary.

10.5 Continuing Calibration: The initial calibration must be verified every twelve hours.

10.5.1 Continuing calibration begins with analysis of BFB as described in Section 10.3. If the system tune is acceptable, the continuing calibration standard(s) are analyzed. The level 3 calibration standard is used as the continuing calibration for low level waters. The level 4 calibration standard is used as the continuing calibration for soils and regular level waters.

10.5.2 Each compound is evaluated for %D for an Average RF curve type or %Drift for Linear, weighted and unweighted, and Quadratic curve types. The acceptance criterion is ≤ 20%D or ≤ 20%Drift for each compound. If more than 20% of the compounds do not meet the criterion, a new CCV analyzed.

- Sample results for compounds that fail in the CCV, within the 20% limit, must be qualified as estimated, or the sample reanalyzed with an acceptable CCV for that compound unless one of the following conditions exists:

- Sample results that are non-detect for compounds were the CCV recovery is high may be reported without qualification using the “CCV - %D High, Sample ND” NCM.

- Sample results that are non-detect for compounds failing low in the CCV, for which adequate sensitivity has been demonstrated, may be reported using the “CCV – Low Biased, ND, RL Check Passes” NCM. Adequate sensitivity may be demonstrated by analysis of a reporting-level standard (the low standard from the curve) with a recovery within 30% of the true concentration. If the compound is detected above the RL, the sample must be reanalyzed with an acceptable CCV.

- If the sample cannot be reanalyzed due to limited volume or holding time, the PM must be contacted and the client’s instructions sought for reporting. If results must be reported, the “CCV – Outside Criteria; Estimated Value (EPA 8270D/8260C)” NCM is used.

10.5.3 The RF data from the continuing calibration standards are compared with the average RF from the initial seven-point calibration to determine the percent drift or percent deviation of the CCC compounds. The calculations are given in Sections 11.3.4 and 11.3.5.

10.5.4 Each compound listed in Table 8 is evaluated for minimum response factor. The minimum RF must be met even if the regression curve option is used for quantitation. If these criteria are not met, corrective action must be taken. The corrective action may include reanalysis of the continuing calibration verification standard or preparation of a new secondary stock standard and reanalysis of the continuing calibration verification standard. If subsequent analysis of the standard is still out of criteria, a new initial calibration curve must be analyzed and evaluated.

10.5.5 The continuing calibration verification standard (CCV) must also be evaluated for internal standard retention time and response.

10.5.5.1 If the retention time of any internal standard changes by more than 30 seconds from the retention times of the internal standards in the initial calibration, the analytical system must be inspected for problems and corrective action instituted.

10.5.5.2 If the extracted ion current profile (EICP) area for any of the internal standards changes by more than a factor of two (50% to 200%) from the initial calibration, the analytical system must be inspected for problems and corrective action instituted.

10.5.5.3 Compare the ISTD response to the corresponding level in the ICAL. (See section 10.5.1.)

10.6 Sample Analysis

10.6.1 All analysis conditions for samples must be the same as for the continuing calibration standards (including purge time and flow, desorb time and temperature, column temperatures, multiplier setting etc.).

10.6.2 All samples must be analyzed as part of a batch. The batch is a set of up to 20 samples of the same matrix processed using the same procedures and reagents within the same time period. The batch also must contain the QC covered in section 9.

10.6.2.1 If there is insufficient time in the 12-hour tune period to analyze 20 samples, the batch may be continued into the next 12 hour tune period. However, if any instrument corrective action is required, or if a period of greater than 12 hours from the preceding BFB tune has passed, a new batch must be started. In other words a QC batch may be kept open for two adjacent and uninterrupted tune periods where both pass all BFB, CCAL, blank and LCS criteria up to a maximum of 24 hours. For medium level soils the batch is defined at the sample preparation stage.

10.6.2.2 Laboratory generated QC samples (Blank, LCS, MS/MSD) do not count towards the maximum 20 samples in a batch. Field QC samples are included in the batch count.

10.6.2.3 It is not necessary to reanalyze batch QC with the reanalyses of samples. However, any reruns must be as part of a valid batch, with its own QC.

10.6.3 For manual integration practices refer to TestAmerica corporate SOP, CA-Q-S-002, Acceptable Manual Integration Practices. When manual integrations are performed, raw data records shall include a complete audit trail for those manipulations, raw data output showing the results of manual integration (i.e., chromatograms of manually integrated peaks), and notation of rationale, date, and name or initials of person performing manual integration operation (electronic signature is acceptable).

10.6.4 Retention time criteria for samples

Retention time windows must be established and verified once per ICAL and at the beginning of the analytical shift. If the retention time for any internal standard changes by more than 0.5 minutes from the last continuing calibration standard, the chromatographic system must be inspected for malfunctions and corrected. Reanalysis of samples analyzed while the system was malfunctioning is required.

10.6.9.1 If the retention time of any internal standard in any sample varies by more than 0.1 minute from the preceding continuing calibration standard, the data must be carefully evaluated to ensure that no analytes have shifted outside their retention time windows.

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria
Retention Time window position establishment for each analyte and surrogate	Once per ICAL	Position shall be set using the midpoint standard of the initial calibration curve.	NA	NA
Evaluation of relative retention times (RRT)	With each sample	RRT of each target analyte in each calibration standard within ± 0.06 RRT units	Correct problem, then rerun ICAL.	Flagging criteria are not appropriate.

10.7 Water Sample Analysis

10.7.1 All samples and standard solutions must be at ambient temperature before analysis. For low-level water analysis, samples are prepared to 25mL and 5mL is used for purging. For regular level waters, samples are prepared to 5mL volume. (If samples require analysis at a volume other than 5mL, a calibration curve must be analyzed with the standards purged at the same volume as the samples.)

10.7.2 Fill a syringe with the sample. If a dilution is necessary it may be made in the syringe if the sample aliquot is ≥ 5 µL. Check and document the pH of the remaining sample.

10.7.3 Add 250 ng of each internal and surrogate standard (10 µL of a 25 µg/mL solution, refer to Tables 4 and 5). The internal standards and the surrogate standards may be mixed and added as one spiking solution (this results in a 50 µg/L solution for a standard 5 mL sample, and a 10 µg/L solution for low level analyses, when added to a 25 mL sample aliquot). Inject the sample into the purging chamber. Note: Low level analyses on instruments that sample directly from the VOA vial (i.e., Archons) use a 5 ml sample volume. Therefore, 1.0 µL of a 250 µg/mL solution of internal standards and surrogates are added to the sample for the regular 5 mL waters and 1uL of a 50 ug/mL solution is added for low level waters.

10.7.3.1 For TCLP samples use 125 uL of TCLP leachate with 4.875 mL reagent water and spike with 8 µL of the 25 µg/mL spiking solution. (Note that TCLP reporting limits will be 40 times higher than the corresponding aqueous limits).

10.7.4 Purge the sample for eleven minutes. For solid and regular level-water samples, the purging vessel is heated to 40°C while purging. Heating is not performed for low-level water analysis.

10.7.5 After purging is complete, desorb the sample, start the GC temperature program, and begin data acquisition. After desorption, bake the trap for 5-10 minutes to condition it for the next analysis. When the trap is cool (≤ 35°C), it is ready for the next sample.

10.7.6 Desorb and bake time and temperature are optimized for the type of trap in use. The same conditions must be used for samples and standards.

10.8 Methanol Extracted Soils

10.8.1 Rinse a gas-tight syringe with organic free water. Fill the syringe with the same volume of organic free water as used in the calibrations. Add 100 µL methanol extract (from Section 8.2.1 or 8.2.2) to the syringe. Add 10ul internal standard and surrogate spike. Load the sample onto the purge and trap device and analyze the same as for aqueous samples. If less than 5µL of methanol extract is to be added to the water, dilute the methanol extract such that a volume greater than 5µL will be added to the water in the syringe.

10.9 Liquid wastes that are soluble in methanol and insoluble in water.

10.9.1 Pipette 1 mL of the sample into a tared vial. Use a top-loading balance. Record the weight to the nearest 0.01 gram. In order to produce an accurate weight to volume relationship take the weight of the liquid sample divided by 1.0 grams to determine a dilution factor which will be applied to reflect this relationship accurately.

10.9.2 Quickly add 9 mL of methanol to bring the final volume to 10 mL. Cap the vial and shake for 2 minutes to mix thoroughly.

10.9.3 NOTE: For carbon samples from Calgon, weigh 4g of carbon, then add 9mL of methanol and 1mL of surrogate spike to bring the final volume to 10mL. Cap the vial and shake for 2 minutes to mix thoroughly. For MS/MSD, use 8mL methanol and 1mL each of the surrogate and matrix spike solution.

10.9.4 Rinse a gas-tight syringe with organic free water. Fill the syringe with the same volume of organic free water as used in the calibrations. Add 100 µL for a 5 mL purge methanol extract to the syringe. Add internal standard and surrogate (surrogate not added at this step for carbon samples). Load the

sample onto the purge and trap device and analyze the same as for aqueous samples. If less than 5µL of methanol extract is to be added to the water, dilute the methanol extract such that a volume greater than 5µL will be added to the water in the syringe.

10.10 Aqueous and Low level Soil Sample Analysis (Purge and Trap units that sample directly from the VOA vial)

10.10.1 Units which sample from the VOA vial should be equipped with a module which automatically adds surrogate and internal standard solution to the sample prior to purging the sample.

10.10.2 If the autosampler uses automatic IS/SS injection, no further preparation of the VOA vial is needed. Otherwise the internal and surrogate standards must be added to the vial. Note: Aqueous samples with high amounts of sediment present in the vial may not be suitable for analysis on this instrumentation, or they may need to be analyzed as soils.

10.10.3 Sample remaining in the vial after sampling with one of these mechanisms is no longer valid for further analysis. A fresh VOA vial must be used for further sample analysis.

10.10.4 For aqueous samples, check the pH of the sample remaining in the VOA vial after analysis is completed with narrow range pH paper. If the pH is greater than 2, a nonconformance memo should be initiated.

10.11 Low-Level Solids Analysis using discrete autosamplers:

Note: This technique may seriously underestimate analyte concentration and must not be used **except** at specific client request for the purpose of comparability with previous data. It is no longer part of SW-846 and is not permitted within a number of programs including the PADEP programs.

This method is based on purging a heated sediment/soil sample mixed with reagent water containing the surrogates, internal standards, and if applicable, the matrix spiking standards. Analyze all reagent blanks and standards under the same conditions as the samples (e.g., heated). The calibration curve is also heated during analysis. Purge temperature is 40°C.

10.11.1 Do not discard any supernatant liquids. Mix the contents of the container with a narrow metal spatula.

10.11.2 Weigh out 5 g (or other appropriate aliquot) of sample into a disposable culture tube or other purge vessel. Record the weight to the nearest 0.01 g. If method sensitivity is demonstrated, a smaller aliquot may be used. Do not use aliquots less than 1.0 g. If the sample is contaminated with analytes such that a purge amount less than 1.0 g is appropriate, use the medium level method described in section 10.8.

10.11.3 Connect the purge vessel to the purge and trap device.

10.11.4 Rinse a 5 mL gas-tight syringe with organic free water, and fill. Compress to 5 mL. Add surrogate/internal standard (and matrix spike solutions if required.). Add directly to the sample from 10.7.2.

10.11.5 The above steps should be performed rapidly and without interruption to avoid loss of volatile organics.

10.11.6 Add the heater jacket or other heating device and start the purge and trap unit.

10.11.7 Soil samples that have low IS recovery when analyzed (<50%) should be reanalyzed once to confirm matrix effect.

10.12 Dilutions

If the response for any compound exceeds the working range of the GC/MS system, a dilution of the extract is prepared and analyzed. An appropriate dilution should be in the upper half of the calibration range. Samples may be screened to determine the appropriate dilution for the initial run. If the initial diluted run has no hits or hits below 20% of the calibration range and the matrix allows for analysis at a lesser dilution, then the sample must be reanalyzed at a dilution targeted to bring the largest hit above 50% of the calibration range.

10.12.1 Guidance for Dilutions Due to Matrix: If the sample is initially run at a dilution and the baseline rise is less than half the height of the internal standards, or if individual non target peaks are less than twice the height of the internal standards, then the sample should be reanalyzed at a more concentrated dilution. This requirement is approximate and subject to analyst judgment.

10.12.2 Reporting Dilutions: The most concentrated dilution with no target compounds above the calibration range will be reported. Other dilutions will only be reported at client request.

11 CALCULATIONS / DATA REDUCTION

11.1 Qualitative identification

An analyte is identified by retention time and by comparison of the sample mass spectrum with the mass spectrum of a standard of the suspected compound (standard reference spectrum). Mass spectra for standard reference may be obtained on the user's GC/MS by analysis of the calibration standards, from the hardcopy printout of the “clean” reference spectrum book or from the NIST Library. Two criteria must be satisfied to verify identification: (1) elution of sample component at the same GC retention time as the standard component; and (2) correspondence of the sample component and the standard component characteristic ions. (Note: Care must be taken to ensure that spectral distortion due to co-elution is evaluated.)

11.1.1 The sample component retention time must compare to within ±0.06 RRT units of the retention time of the standard (CCV) component. For reference, the standard must be run within the same twelve hours as the sample (CCVIS).

- **Relative Retention Time (RRT)** – is the ratio of the retention time of a compound to that of a standard (such as an internal standard).

$$RRT = \frac{RT_C}{RT_{is}}$$

Where,

RT_C = Retention time for the volatile target compounds in the continuing calibration.

RT_{is} = Retention time for the internal standard in calibration standard or in a sample.

11.1.2 All ions present in the standard mass spectra at a relative intensity greater than 10% (most abundant ion in the spectrum equals 100%) should be present in the sample spectrum.

11.1.3 The relative intensities of ions should agree to within ±30% between the standard and sample spectra. (Example: For an ion with an abundance of 50% in the standard spectra, the corresponding sample abundance must be between 20 and 80 percent.)

11.1.4 If a compound cannot be verified by all the above criteria, but in the technical judgment of the analyst, the identification is correct, then the analyst shall report that identification and proceed with quantitation.

11.1.5 The characteristic ions of a compound must maximize in the same scan or within one scan of each other.

11.2 Tentatively Identified Compounds (TICs)

If the client requests components not associated with the calibration standards, a search of the NIST library may be made for the purpose of tentative identification. Guidelines are:

11.2.1 Relative intensities of major ions in the reference spectrum (ions > 10% of the most abundant ion) should be present in the sample spectrum.

11.2.2 The relative intensities of the major ions should agree to within 20%. (Example: If an ion shows an abundance of 50% in the standard spectrum, the corresponding sample ion abundance must be between 30% and 70%).

11.2.3 Molecular ions present in the reference spectrum should be present in the sample spectrum.

11.2.4 Ions present in the sample spectrum but not in the reference spectrum should be reviewed for possible background contamination or presence of coeluting compounds.

11.2.5 Ions present in the reference spectrum but not in the sample spectrum should be reviewed for possible subtraction from the spectrum because of background contamination or coeluting peaks. (Data system reduction programs can sometimes create these discrepancies.)

11.2.6 Computer-generated library search routines should not use normalization routines that would misrepresent the library or unknown spectra when compared to each other. Only after visual inspection of the sample with the nearest library searches should the analyst assign a tentative identification.

11.3 Quantitative - Calculations

11.3.1 Response factor (RF): $$RF = \frac{A_x C_{is}}{A_{is} C_x}$$

Where:
A_x = Area of the characteristic ion for the compound to be measured
A_{is} = Area of the characteristic ion for the specific internal standard
C_{is} = Concentration of the specific internal standard, ng
C_x = Concentration of the compound being measured, ng

11.3.2 Standard deviation (SD):

$$SD = \sqrt{\sum_{i=1}^{N} \frac{(Xi - X)^2}{N - 1}}$$

Where:
X_i = Value of X at i through N
N = Number of points
X = Average value of **X_i**

11.3.3 Percent relative standard deviation (%RSD):

$$\%RSD = \frac{\text{Standard Deviation}}{\overline{RF_i}} \times 100$$

$\overline{RF_i}$ **= Mean of RF values in the curve**

11.3.4 Percent deviation between the initial calibration and the continuing calibration (%D):

$$\% \text{ Deviation} = \frac{RRFic - RRFcc}{RRFic} \times 100$$

Where:
RRFic = Relative Response Factor in the ICAL standard
RRFcc = Relative Response Factor in the CCV

11.3.5 Percent drift between the initial calibration and the continuing calibration:

$$\% \text{ Drift} = \frac{C_{expected} - C_{found}}{C_{expected}} \times 100$$

Where
$C_{expected}$ = Known concentration in standard
C_{found} = Measured concentration using selected quantitation method

11.3.6 Target compound and surrogate concentrations:
Concentrations in the sample may be determined from linear or second order (quadratic) curve fitted to the initial calibration points, or from the average response factor of the initial calibration points. Average response factor may only be used when the % RSD of the response factors in the initial calibration is ≤ 15% for 8260B or 20% for 8260C.

- Calculation of concentration using Average Response Factors

$$\text{Concentration } \mu g / L = \frac{x}{RF}$$

Where x = compound peak response*

- Calculation of concentration using Linear fit

$$\text{Concentration } \mu g / L = A + Bx$$

Where:
A = the y-axis intercept
B **=** the slope of the line
x **=** the compound peak response*

- Calculation of concentration using Quadratic fit

$$\textbf{Concentration } \mu g / L = A + Bx + Cx^2$$

Where:
A = the y-axis intercept
B **=** the slope of the curve
C = the curvature
x **=** the compound peak response*

- ***Calculation of x for Water and water-miscible waste**:

$$x = \frac{(A_x)(I_s)(D_f)}{(A_{is})(V_o)}$$

Where:
A_x = Area of characteristic ion for the compound being measured (secondary ion quantitation is allowed only when there are sample interferences with the primary ion)
A_{is} = Area of the characteristic ion for the internal standard
I_s = Amount of internal standard added in ng

$$\text{Dilution Factor} = D_f = \frac{\text{Total volume purged (mL)}}{\text{Volume of original sample used (mL)}}$$

$\mathbf{V_o}$ = Volume of water purged, mL

- ***Calculation of x for Medium level soils:**

$$x = \frac{(A_x)(I_s)(V_t)(1000)(D_f)}{(A_{is})(V_a)(W_s)(D)}$$

Where:
$\mathbf{A_x}$, $\mathbf{I_s}$, $\mathbf{D_f}$, $\mathbf{A_{is}}$, same as for water.
$\mathbf{V_t}$ = Volume of total extract, mL
$\mathbf{V_a}$ = Volume of extract added for purging, µL
$\mathbf{W_s}$ = Weight of sample extracted, g

$$\mathbf{D} = \frac{100 - \%\text{moisture}}{100}$$

- **<u>*Calculation of x for Low level soils:</u>**

$$x = \frac{(A_x)(I_s)}{(A_{is})(W_s)(D)}$$

Where:
A_x, I_s, A_{is}, same as for water.
D is as for medium level soils
W_s = Weight of sample added to the purge vessel, g

- Calculation of TICs: The calculation of TICs (tentatively identified compounds) is identical to the above calculations with the following exceptions:

  A_x = Area in the total ion chromatogram for the compound being measured
  A_{is} = Area of the total ion chromatogram for the nearest internal standard without interference
  RF = 1

11.3.7 MS/MSD Recovery and RPD Calculation:

$$\textbf{Matrix Spike Recovery, \%} = \frac{SSR - SR}{SA} \times 100$$

SSR = Spike sample result

SR = Sample result

SA = Spike added

Relative % Difference calculation for the MS/MSD

$$\text{RPD} = \frac{|\text{MSR - MSDR}|}{\frac{1}{2}(\text{MSR} + \text{MSDR})} \times 100$$

Where:
RPD = Relative percent difference
MSR = Matrix spike result
MSDR = Matrix spike duplicate result

12 METHOD PERFORMANCE

12.1 The supervisor has responsibility to ensure that an analyst who performs this procedure is properly trained in its use and has the required experience. Performance is monitored through internal QC and outside performance evaluation samples. Please refer to the QA Manual for additional information concerning Precision and Accuracy.

12.2 Demonstration of Capabilities – Prior to the analysis of samples, a Demonstration of Capabilities (DOC) as described in the QA Manual and SOP PT-QA-001, must be performed initially, annually and any time a significant change is made to the analytical system.

12.3 Method Detection Limit Study – A Method Detection Limit (MDL) study, as described in the QA Manual and SOP PT-QA-007, must be performed initially, annually and any time a significant change is made to the analytical system.

12.4 Lower Limit of Quantitation Verification - The lowest calibration standard analyzed establishes the LLOQ or Reporting Limit. The capability to reliably detect this concentration through the preparation, clean-up and analytical procedure is verified through the annual analysis of a standard at the LLOQ/RL. The LLOQ verification shall also be performed whenever significant changes are made to the preparation and/or analytical procedure.

12.4.1 The LLOQ verification standard shall be prepared at a concentration 0.5-2 times the LLOQ/RL, and be taken through all preparation step that samples would be.

12.4.2 The LLOQ verification standard for aqueous matrix shall be prepared using laboratory deionized water and for the solid matrix using clean Ottawa sand. Other clean matrices may be used in addition, for project specific requirements.

12.4.3 The LLOQ shall be verified annually on each instrument used for client sample analysis.

12.4.4 Recovery of each analyte must meet the laboratory established LCS recovery limits ± 20%. (For example, if the LCS recovery limits are 70-130%, the LLOQ verification must meet recovery limits of 50-150%.) Once sufficient points have been generated, LLOQ based statistical limits may be used in place of limits based on LCS recovery.

NOTE: The lower recovery limit for the LLOQ can be no lower than 10%.

12.4.5 If the LLOQ cannot be verified, it will be necessary to raise the RL to a concentration level that can be carried through the preparation and clean-up steps to meet recovery limits.

13 POLLUTION PREVENTION

13.4 It is TestAmerica's policy to evaluate each method and look for opportunities to minimize waste generated (i.e., examine recycling options, ordering chemicals based on quantity needed, preparation of reagents based on anticipated usage and reagent stability). Employees must abide by the policies in Section 13 of the Corporate Environmental Health and Safety Manual (CW-E-M-001) for "Waste Management and Pollution Prevention" and the Pittsburgh Facility Addendum EH&S Manual (PT-HS-001).

13.5 All waste will be disposed of in accordance with Federal, State and Local regulations. Where feasible, technological changes have been implemented to minimize the potential for pollution of the environment. Employees will abide by this method and the policies in section 13 of the Corporate Safety Manual for "Waste Management and Pollution Prevention."

13.6 This method does not contain any specific modifications that serve to minimize or prevent pollution.

14 WASTE MANAGEMENT

14.4 Waste management practices are conducted consistent with all applicable rules and regulations. Excess reagents, samples and method process wastes are disposed of in an accepted manner. Waste description rules and land disposal restrictions are followed. Waste disposal procedures are incorporated by reference to PT-HS-001. The following waste streams are produced when this method is carried out.

14.4.1 Aqueous waste generated from analysis - This material may have a pH of less than 2.0. This waste is collected in containers identified as "Acid Waste", Waste #33. It is neutralized to a pH between 6 and 9 and disposed down a lab sink.

14.4.2 Solvent waste generated from analysis - This waste is placed in containers identified as "Vials & Extracts", Waste #7.

14.4.3 Solid waste generated from analysis - This waste is placed in trash containers and disposed with other building trash.

14.4.4 Expired Standards - This waste is placed in container identified as “Mixed Flammable Solvent Waste”, Waste #3.

15 REFERENCES

15.4 SW-846, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Update V, Method 8000D, Determinative Chromatographic Separations, Revision 4, October 2012

15.5 SW-846, Test Method for Evaluating Solid Waste, Third Edition, Gas Chromatography /Mass Spectrometry for Volatile Organics, Method 8260B, Revision 2, December 1996

15.6 SW-846, Test Methods for Evaluating Solid Waste, Third Edition, Gas Chromatography/Mass Spectrometry for Volatile Organics, Method 8260C, Revision 3, August 2006

15.7 SW-846, method 5030B, Purge-And-Trap for Aqueous Samples, Revision 2, December 1996

15.8 SW-846, Method 5030C Purge-And-Trap for Aqueous Samples, Revision 3, May 2003

15.9 SW-846, Method 5035 Closed-System Purge-And-Trap And Extraction For Volatile Organics In Soil And Waste Samples, Revision 0, December 1996

15.10 SW-846, Method 5035A, Closed-System Purge-And-Trap And Extraction For Volatile Organics In Soil and Waste Samples, Rev.1, July 2002

15.11 Corporate SOP CA-Q-S-002, Acceptable Manual Integration Practices

15.12 Corporate SOP CA-Q-S-005, Calibration Curves

15.13 Corporate Policy Memorandum CA-Q-QM-009, Quality Control Requirements for SW-846 Methods 8270D and 8260C, November 11, 2013

15.14 Pittsburgh Laboratory Quality Assurance Manual, PT-QA-M-001

15.15 PT-QA-007, Detection Limits

15.16 PT-QA-016, Nonconformance and Corrective Action

15.17 PT-QA-021, Quality Assurance Program

15.18 PT-QA-022, Equipment Maintenance

15.19 PT-QA-031, Internal Chain of Custody

15.20 PT-VOA-WI-002, TestAmerica Pittsburgh GCMS VOA Encore Prep Procedure

15.21 PT-HS-001, Pittsburgh Facility Addendum EH&S Manual to the Corporate Environmental Health and Safety Manual (CW-E-M-001) for "Waste Management and Pollution Prevention

16 METHOD MODIFICATIONS

16.4 Modifications from Method 8260B:

16.4.1 Ion 119 is used as the quantitation ion for chlorobenzene-d5.

16.4.2 A relative retention time window of ± 0.06 RT units is used for all compounds.

16.4.3 The quantitation and qualifier ions for some compounds have been added to the list of those which are recommended in SW-846 in order to improve the reliability of qualitative identification.

16.5 Modifications from Method 5035:

16.5.1 The presence of residual chlorine is not tested for in water samples because treated water samples are not analyzed for using these methods.

16.5.2 Soil samples are not preserved with sodium bisulfate unless this is requested by the client or required by regulation.

17 ATTACHMENTS

Tables:

Table 1 - Reporting Limits for SW846 Method 8260C

Table 2 –Standard Calibration Levels for SW846 Method 8260C

Table 3 - Calibration Standard Concentration and Preparation

Table 4 - Internal Standards

Table 4A – Internal Standards with Corresponding Assigned Analytes for Quantitation

Table 5 - Surrogate Standards

Table 6 - Matrix Spike / LCS Standards

Table 7 - BFB Tune Criteria

Table 8 - Minimum Response Factors for Method 8260C

Table 9 - Characteristic Ions

Table 10 – VOA Dilution Calculation Table

18 REVISION HISTORY

18.4 Revision 0, 08/21/2013
18.5 Revision 1, 10/30/2015
18.6 Revision 2, 10/17/2016
18.7 Revision 3, 12/9/2016
18.8 Changes to current revision

SOP section	Change from	Change to	Reason
10.4.10	Individual read-back criteria per calibration mode	Read-back criteria for all calibration modes	SW-846 8000D requirement
12.4		Added requirement for annual LLOQ verification	SW-846 8000D requirement

Table 1
Reporting Limits for SW846 8260C

Compound	CAS #	Low Level Water (µg/L)	5 mL Water (µg/L)	Low Soil (µg/kg)	Medium Soil (µg/kg)	Waste (µg/kg)	Wipe (µg/wipe)
1,1,1,2-Tetrachloroethane	630-20-6	1.0	5.0	5.0	250	2.5	2.5
1,1,1-Trichloroethane	71-55-6	1.0	5.0	5.0	250	2.5	2.5
1,1,2,2-Tetrachloroethane	79-34-5	1.0	5.0	5.0	250	2.5	2.5
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	1.0	5.0	5.0	250	2.5	2.5
1,1,2-Trichloroethane	79-00-5	1.0	5.0	5.0	250	2.5	2.5
1,1-Dichloroethane	75-34-3	1.0	5.0	5.0	250	2.5	2.5
1,1-Dichloroethene	75-35-4	1.0	5.0	5.0	250	2.5	2.5
1,1-Dichloropropene	563-58-6	1.0	5.0	5.0	250	2.5	2.5
1,2,3-Trichlorobenzene	87-61-6	1.0	5.0	5.0	250	2.5	2.5
1,2,3-Trichloropropane	96-18-4	1.0	5.0	5.0	250	2.5	2.5
1,2,4-Trichlorobenzene	120-82-1	1.0	5.0	5.0	250	2.5	2.5
1,2,4-Trimethylbenzene	95-63-6	1.0	5.0	5.0	250	2.5	2.5
1,2-Dibromo-3-Chloropropane	96-12-8	1.0	5.0	5.0	250	2.5	2.5
1,2-dichloro-4-(trifluoromethyl)benzene (3,4-Dichlorobenzotrifluoride)	328-84-7	1.0	5.0	5.0	250	2.5	2.5
1,2-Dichlorobenzene	95-50-1	1.0	5.0	5.0	250	2.5	2.5
1,2-Dichloroethane	107-06-2	1.0	5.0	5.0	250	2.5	2.5
1,2-Dichloroethene, Total	540-59-0	1.0	5.0	5.0	250	2.5	2.5
1,2-Dichloropropane	78-87-5	1.0	5.0	5.0	250	2.5	2.5
1,3,5-Trichlorobenzene*	108-70-3	1.0	5.0	5.0	250	2.5	2.5
1,3,5-Trimethylbenzene	108-67-8	1.0	5.0	5.0	250	2.5	2.5
1,3-Dichlorobenzene	541-73-1	1.0	5.0	5.0	250	2.5	2.5
1,3-Dichloropropane	142-28-9	1.0	5.0	5.0	250	2.5	2.5
1,3-Dichloropropene, Total	542-75-6	2.0	10.0	10.0	500	5.0	5.0
1,4-Dichlorobenzene	106-46-7	1.0	5.0	5.0	250	2.5	2.5
1,4-Dioxane*	123-91-1	200	1000	1000	50,000	500	500
2,2-Dichloropropane	594-20-7	1.0	5.0	5.0	250	2.5	2.5
2,3- & 3,4- Dichlorotoluene*	STL01556	2.0	10.0	10.0	500	5.0	5.0

Compound	CAS #	Low Level Water (µg/L)	5 mL Water (µg/L)	Low Soil (µg/kg)	Medium Soil (µg/kg)	Waste (µg/kg)	Wipe (µg/wipe)
2,3,6-Trichlorotoluene	2077-46-5	1.0	5.0	5.0	250	2.5	2.5
2,4- & 2,5- & 2,6- Dichlorotoluene*	STL01557	3.0	15.0	15.0	750	7.5	7.5
2,4,5-Trichlorotoluene	6639-30-1	1.0	5.0	5.0	250	2.5	2.5
2,4-Dichloro-1-(triflouromethyl)-benzene (2,4-Dichlorobenzotrifluoride)	320-60-5	1.0	5.0	5.0	250	2.5	2.5
2,5-Dichlorobenzotrifluoride	320-50-3	1.0	5.0	5.0	250	2.5	2.5
2-Butanone (MEK)	78-93-3	5.0	25.0	25.0	1250	12.5	12.5
2-Chloro-1,3-butadiene (Chloroprene)*	126-99-8	1.0	5.0	5.0	250	2.5	2.5
2-Chlorobenzotrifluoride	88-16-4	1.0	5.0	5.0	250	2.5	2.5
2-Chloroethyl vinyl ether*	110-75-8	2.0	10.0	10.0	500	5.0	5.0
2-Chlorotoluene	95-49-8	1.0	5.0	5.0	250	2.5	2.5
2-Hexanone	591-78-6	5.0	25.0	25.0	1250	12.5	12.5
2-Methyl-2-propanol (tert-Butyl Alcohol)*	75-65-0	40.0	50.0	200.0	10,000	25.0	25.0
2-Methylnaphthalene*	91-57-6	1.0	5.0	5.0	250	2.5	2.5
2-Nitropropane*	79-46-9	2.0	10.0	10.0	500	5.0	5.0
3-Chloro-1-propene (Allyl chloride)	107-05-1	1.0	5.0	5.0	250	2.5	2.5
3-Chlorobenzotrifluoride	98-15-7	1.0	5.0	5.0	250	2.5	2.5
3-Chlorotoluene	108-41-8	1.0	5.0	5.0	250	2.5	2.5
4-Chlorobenzotrifluoride*	98-56-6	1.0	5.0	5.0	250	2.5	2.5
4-Chlorotoluene	106-43-4	1.0	5.0	5.0	250	2.5	2.5
4-Isopropyltoluene	99-87-6	1.0	5.0	5.0	250	2.5	2.5
4-Methyl-2-pentanone (MIBK)	108-10-1	5.0	25.0	25.0	1250	12.5	12.5
Acetone	67-64-1	5.0	25.0	25.0	1250	12.5	12.5
Acetonitrile*	75-05-8	10.0	50.0	50.0	2500	25.0	25.0
Acrolein*	107-02-8	20.0	100.0	100.0	5000	50.0	50.0
Acrylonitrile*	107-13-1	20	100.0	100.0	5000	50.0	50.0
Benzene	71-43-2	1.0	5.0	5.0	250	2.5	2.5
Benzyl chloride*	100-44-7	1.0	5.0	5.0	250	2.5	2.5
Bromobenzene	108-86-1	1.0	5.0	5.0	250	2.5	2.5
Bromoform	75-25-2	1.0	5.0	5.0	250	2.5	2.5
Bromomethane	74-83-9	1.0	5.0	5.0	250	2.5	2.5

Compound	CAS #	Low Level Water (µg/L)	5 mL Water (µg/L)	Low Soil (µg/kg)	Medium Soil (µg/kg)	Waste (µg/kg)	Wipe (µg/wipe)
Butadiene (1,3-Butadiene)	106-99-0	1.0	5.0	5.0	250	2.5	2.5
Carbon disulfide	75-15-0	1.0	5.0	5.0	250	2.5	2.5
Carbon tetrachloride	56-23-5	1.0	5.0	5.0	250	2.5	2.5
Chlorobenzene	108-90-7	1.0	5.0	5.0	250	2.5	2.5
Chlorobromomethane	74-97-5	1.0	5.0	5.0	250	2.5	2.5
Chlorodibromomethane	124-48-1	1.0	5.0	5.0	250	2.5	2.5
Chloroethane	75-00-3	1.0	5.0	5.0	250	2.5	2.5
Chloroform	67-66-3	1.0	5.0	5.0	250	2.5	2.5
Chloromethane	74-87-3	1.0	5.0	5.0	250	2.5	2.5
cis-1,2-Dichloroethene	156-59-2	1.0	5.0	5.0	250	2.5	2.5
cis-1,3-Dichloropropene	10061-01-5	1.0	5.0	5.0	250	2.5	2.5
Cyclohexane	110-82-7	1.0	5.0	5.0	250	2.5	2.5
Cyclohexanone*	108-94-1	20.0	100.0	100.0	5000	50.0	50.0
Dibromomethane	74-95-3	1.0	5.0	5.0	250	2.5	2.5
Dichlorobromomethane	75-27-4	1.0	5.0	5.0	250	2.5	2.5
Dichlorodifluoromethane	75-71-8	1.0	5.0	5.0	250	2.5	2.5
Dichlorofluoromethane	75-43-4	1.0	5.0	5.0	250	2.5	2.5
Ethanol*	64-17-5	40.0	200.0	200.0	10,000	100.0	100.0
Ethyl Acetate*	141-78-6	2.0	10.0	10.0	500	5.0	5.0
Ethyl acrylate*	140-88-5	1.0	5.0	5.0	250	2.5	2.5
Ethyl ether	60-29-7	1.0	5.0	5.0	250	2.5	2.5
Ethyl methacrylate	97-63-2	1.0	5.0	5.0	250	2.5	2.5
Ethylbenzene	100-41-4	1.0	5.0	5.0	250	2.5	2.5
Ethylene Dibromide (1,2-Dibromoethane)	106-93-4	1.0	5.0	5.0	250	2.5	2.5
Hexachlorobutadiene	87-68-3	1.0	5.0	5.0	250	2.5	2.5
Hexane	110-54-3	1.0	5.0	5.0	250	2.5	2.5
Iodomethane	74-88-4	1.0	5.0	5.0	250	2.5	2.5
Isobutyl alcohol*	78-83-1	40	200.0	200.0	10,000	100.0	100.0
Isopropyl alcohol *	67-63-0	10.0	50.0	50.0	2500	25.0	25.0
Isopropyl ether *	108-20-3	1.0	5.0	5.0	250	2.5	2.5

Compound	CAS #	Low Level Water (µg/L)	5 mL Water (µg/L)	Low Soil (µg/kg)	Medium Soil (µg/kg)	Waste (µg/kg)	Wipe (µg/wipe)
Isopropylbenzene	98-82-8	1.0	5.0	5.0	250	2.5	2.5
Methacrylonitrile*	126-98-7	10.0	50.0	50.0	2500	25.0	25.0
Methyl acetate	79-20-9	5.0	25.0	25.0	1250	12.5	12.5
Methyl methacrylate*	80-62-6	2.0	10.0	10.0	500	5.0	5.0
Methyl tert-butyl ether	1634-04-4	1.0	5.0	5.0	250	2.5	2.5
Methylcyclohexane	108-87-2	1.0	5.0	5.0	250	2.5	2.5
Methylene Chloride	75-09-2	1.0	5.0	5.0	250	2.5	2.5
m-Xylene & p-Xylene	179601-23-1	1.0	5.0	5.0	250	2.5	2.5
Naphthalene	91-20-3	1.0	5.0	5.0	250	2.5	2.5
n-Butanol*	71-36-3	40.0	50.0	50.0	2500	25.0	25.0
n-Butyl acetate*	123-86-4	1.0	5.0	5.0	250	2.5	2.5
n-Butylbenzene	104-51-8	1.0	5.0	5.0	250	2.5	2.5
n-Heptane	142-82-5	1.0	5.0	5.0	250	2.5	2.5
N-Propylbenzene	103-65-1	1.0	5.0	5.0	250	2.5	2.5
o-Xylene	95-47-6	1.0	5.0	5.0	250	2.5	2.5
Pentachloroethane	76-01-7	1.0	5.0	5.0	250	2.5	2.5
Propionitrile	107-12-0	10.0	50.0	50.0	2500	25.0	25.0
sec-Butylbenzene	135-98-8	1.0	5.0	5.0	250	2.5	2.5
Styrene	100-42-5	1.0	5.0	5.0	250	2.5	2.5
Tert-amyl methyl ether*	994-05-8	1.0	5.0	5.0	250	2.5	2.5
Tert-butyl ethyl ether*	637-92-3	1.0	5.0	5.0	250	2.5	2.5
tert-Butylbenzene	98-06-6	1.0	5.0	5.0	250	2.5	2.5
Tetrachloroethene	127-18-4	1.0	5.0	5.0	250	2.5	2.5
Tetrahydrofuran	109-99-9	2.0	10.0	10.0	500	5.0	5.0
Toluene	108-88-3	1.0	5.0	5.0	250	2.5	2.5
trans-1,2-Dichloroethene	156-60-5	1.0	5.0	5.0	250	2.5	2.5
trans-1,3-Dichloropropene	10061-02-6	1.0	5.0	5.0	250	2.5	2.5
trans-1,4-Dichloro-2-butene*	110-57-6	1.0	5.0	5.0	250	2.5	2.5
Trichloroethene	79-01-6	1.0	5.0	5.0	250	2.5	2.5
Trichlorofluoromethane	75-69-4	1.0	5.0	5.0	250	2.5	2.5
Vinyl acetate*	108-05-4	1.0	5.0	5.0	250	2.5	2.5
Vinyl chloride	75-01-4	1.0	5.0	5.0	250	2.5	2.5
Xylenes, Total	1330-20-7	2.0	10.0	10.0	500	5.0	5.0

* Compound cannot be reported from instrument using Nitrogen as purge gas

Table 2
Standard Calibration Levels for 5mL and (Low Level) Purge

Compound	CAS #	Calibration Level (µg/L)							
		Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8
1,1,1,2-Tetrachloroethane	630-20-6	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
1,1,1-Trichloroethane	71-55-6	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
1,1,2,2-Tetrachloroethane	79-34-5	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
1,1,2-Trichloroethane	79-00-5	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
1,1-Dichloroethane	75-34-3	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
1,1-Dichloroethene	75-35-4	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
1,1-Dichloropropene	563-58-6	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
1,2,3-Trichlorobenzene	87-61-6	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
1,2,3-Trichloropropane	96-18-4	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
1,2,4-Trichlorobenzene	120-82-1	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
1,2,4-Trimethylbenzene	95-63-6	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
1,2-Dibromo-3-Chloropropane	96-12-8	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
1,2-dichloro-4-(trifluoromethyl)benzene (3,4-Dichlorobenzotrifluoride)**	328-84-7	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
1,2-Dichlorobenzene	95-50-1	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
1,2-Dichloroethane	107-06-2	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
1,2-Dichloroethene, Total	540-59-0	10 (2)	20 (10)	50 (20)	80 (30)	100 (40)	125 (70)	500 (80)	(100)
1,2-Dichloropropane	78-87-5	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
1,2,3-Trimethylbenzene*	526-73-8	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
1,3,5-Trichlorobenzene	108-70-3	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
1,3,5-Trimethylbenzene	108-67-8	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
1,3-Dichlorobenzene	541-73-1	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
1,3-Dichloropropane	142-28-9	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
1,3-Dichloropropene, Total	542-75-6	10 (2)	20 (10)	50 (20)	80 (30)	100 (40)	125 (70)	500 (80)	(100)
1,4-Dichlorobenzene	106-46-7	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
1,4-Dioxane *	123-91-1	1000 (200)	2000 (1000)	5000 (2000)	8000 (3000)	10,000 (4000)	12,500 (7000)	50,000 (8000)	(10000)

Compound	CAS #	Calibration Level (µg/L)							
		Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8
2,2-Dichloropropane	594-20-7	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
2,3- & 3,4- Dichlorotoluene ** (Low Level only)	STL01556	(2)	(10)	(20)	(30)	(40)	(70)	(80)	(100)
2,3,6-Trichlorotoluene	2077-46-5	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
2,4- & 2,5- & 2,6 Dichlorotoluene**	STL01557	(3)	(15)	(30)	(45)	(60)	(105)	(120)	(150)
2,4,5-Trichlorotoluene **	6639-30-1	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
2,4-Dichloro-1-(triflouromethyl)-benzene** (2,4-Dichlorobenzotrifluoride)	320-60-5	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
2,5-Dichlorobenzotrifluoride **	320-50-3	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
2-Butanone (MEK)	78-93-3	5 (2)	10 (10)	25 (20)	40 (30)	50 (40)	125 (70)	250 (80)	(100)
2-Chloro-1,3-butadiene (Chloroprene) *	126-99-8	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
2-Chlorobenzotrifluoride**	88-16-4	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
2-Chloroethyl vinyl ether *	110-75-8	10 (2)	20 (10)	50 (20)	80 (30)	100 (40)	125 (70)	500 (80)	(100)
2-Chlorotoluene	95-49-8	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
2-Hexanone	591-78-6	5 (2)	10 (10)	25 (20)	40 (30)	50 (40)	125 (70)	250 (80)	(100)
2-Methyl-2-propanol * (tert-Butyl Alcohol)	75-65-0	50 (40)	100 (50)	250 (100)	400 (150)	500 (200)	1250 (350)	2500 (400)	(500)
2-Methylnaphthalene*	91-57-6	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
2-Nitropropane*	79-46-9	10 (2)	20 (10)	50 (20)	80 (30)	100 (40)	125 (70)	500 (80)	(100)
3-Chloro-1-propene * (Allyl chloride)	107-05-1	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
3-Chlorobenzotrifluoride**	98-15-7	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
3-Chlorotoluene	108-41-8	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
4-Chlorobenzotrifluoride **	98-56-6	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
4-Chlorotoluene	106-43-4	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
4-Isopropyltoluene	99-87-6	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
4-Methyl-2-pentanone (MIBK)	108-10-1	5 (2)	10 (10)	25 (20)	40 (30)	50 (40)	125 (70)	250 (80)	(100)
Acetone	67-64-1	5 (2)	10 (10)	25 (20)	40 (30)	50 (40)	125 (70)	250 (80)	(100)
Acetonitrile *	75-05-8	50 (10)	100 (50)	250 (100)	400 (150)	500 (200)	1250 (350)	2500 (400)	(500)
Acrolein *	107-02-8	100 (20)	200 (100)	500 (200)	800 (300)	1000 (400)	1250 (700)	5000 (800)	(1000)
Acrylonitrile*	107-13-1	100 (20)	200 (100)	500 (200)	800 (300)	1000 (400)	2500 (700)	5000 (800)	(1000)

Compound	CAS #	Calibration Level (µg/L)							
		Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8
Benzene	71-43-2	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Benzyl chloride*	100-44-7	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Bromobenzene	108-86-1	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Bromoform	75-25-2	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Bromomethane	74-83-9	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Butadiene (1,3-Butadiene)*	106-99-0	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Carbon disulfide	75-15-0	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Carbon tetrachloride	56-23-5	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Chlorobenzene	108-90-7	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Chlorobromomethane	74-97-5	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Chlorodibromomethane	124-48-1	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Chloroethane	75-00-3	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Chloroform	67-66-3	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Chloromethane	74-87-3	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
cis-1,2-Dichloroethene	156-59-2	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
cis-1,3-Dichloropropene	10061-01-5	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Cyclohexane	110-82-7	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Cyclohexanone *	108-94-1	100 (20)	200 (100)	500 (200)	800 (300)	1000 (400)	1250 (700)	5000 (800)	(1000)
Dibromomethane	74-95-3	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Dichlorobromomethane	75-27-4	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Dichlorodifluoromethane	75-71-8	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Dichlorofluoromethane	75-43-4	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Ethanol *	64-17-5	200 (40)	400 (80)	1000(200)	1600 (320)	2000 (400)	5000 (1000)	10000 (2000)	(2500)
Ethyl Acetate*	141-78-6	10 (2)	20 (10)	50 (20)	80 (30)	100 (40)	125 (70)	500 (80)	(100)
Ethyl acrylate*	140-88-5	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Ethyl ether*	60-29-7	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Ethyl methacrylate*	97-63-2	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Ethylbenzene	100-41-4	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Ethylene Dibromide (1,2-Dibromoethane)	106-93-4	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)

Compound	CAS #	Calibration Level (µg/L)							
		Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8
Hexachlorobutadiene	87-68-3	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Hexane	110-54-3	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Iodomethane*	74-88-4	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Isobutyl alcohol *	78-83-1	125 (25)	250 (125)	625 (250)	1000 (375)	1250 (500)	3125 (875)	6250 (1000)	(1250)
Isopropyl alcohol*	67-63-0	50 (10)	100 (50)	250 (100)	400 (150)	500 (200)	1250 (350)	2500 (400)	(500)
Isopropyl ether*	108-20-3	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Isopropylbenzene	98-82-8	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Methacrylonitrile *	126-98-7	50 (10)	100 (50)	250 (100)	400 (150)	500 (200)	1250 (350)	2500 (400)	(500)
Methyl acetate	79-20-9	25 (5)	125 (25)	250 (50)	375 (75)	500 (100)	875 (175)	1000 (200)	(250)
Methyl methacrylate*	80-62-6	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Methyl tert-butyl ether	1634-04-4	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Methylcyclohexane	108-87-2	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Methylene Chloride	75-09-2	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
m-Xylene & p-Xylene	179601-23-1	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Naphthalene	91-20-3	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
n-Butanol *	71-36-3	50 (10)	100 (50)	250 (100)	400 (150)	500 (200)	1250 (350)	2500 (400)	(500)
n-Butyl acetate*	123-86-4	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
n-Butylbenzene	104-51-8	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
n-Heptane*	142-82-5	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
N-Propylbenzene	103-65-1	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
o-Xylene	95-47-6	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Pentachloroethane *	76-01-7	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Propionitrile *	107-12-0	50 (10)	100 (50)	250 (100)	400 (150)	500 (200)	1250 (350)	2500 (400)	(500)
sec-Butylbenzene	135-98-8	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Styrene	100-42-5	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Tert-amyl methyl ether*	994-05-8	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Tert-butyl ethyl ether*	637-92-3	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
tert-Butylbenzene	98-06-6	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Tetrachloroethene	127-18-4	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)

Compound	CAS #	Calibration Level (µg/L)							
		Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8
Tetrachloroethene	127-18-4	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Tetrahydrofuran*	109-99-9	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Toluene	108-88-3	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
trans-1,2-Dichloroethene	156-60-5	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
trans-1,3-Dichloropropene	10061-02-6	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
trans-1,4-Dichloro-2-butene *	110-57-6	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Trichloroethene	79-01-6	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Trichlorofluoromethane	75-69-4	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Vinyl acetate	108-05-4	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Vinyl chloride	75-01-4	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Xylenes, Total	1330-20-7	10 (2)	20 (10)	50 (20)	80 (30)	100 (40)	125 (70)	500 (80)	(100)
1,2-Dichloroethane-d4 (Surr)	17060-07-0	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
4-Bromofluorobenzene (Surr)	460-00-4	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Dibromofluoromethane (Surr)	1868-53-7	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)
Toluene-d8 (Surr)	2037-26-5	5 (1)	10 (5)	25 (10)	40 (15)	50 (20)	125 (35)	250 (40)	(50)

*Appendix IX compounds and **CRAEE Special Compounds – designated as Poor Method Performers

Table 3 – Calibration Standard Concentration and Preparation

Standard Level Water or Soil in 5mL syringe

STD	INT (25ug/mL)	SURR (25ug/mL)	VOA & Vinyl Acetate (25ug/mL)	Acrolein (25ug/mL)	Methanol Added (µl)
5ppb	10ul	1ul	1ul	20ul	180
10ppb	10ul	2ul	2ul	25ul	170
25ppb	10ul	5ul	5ul	30ul	155
40ppb	10ul	8ul	8ul	35ul	140
50ppb	10ul	10ul	10ul	40ul	130
125ppb	10ul	25ul	25ul	45ul	80
250ppb	10ul	50ul	50ul	50ul	0

App IX Water/Soil in 5mL syringe

STD	INT 25ug/mL	App IX 25ug/mL	2CEVE 50ug/mL
5ppb	10ul	1ul	1ul
10ppb	10ul	2ul	2ul
25ppb	10ul	5ul	5ul
40ppb	10ul	8ul	8ul
50ppb	10ul	10ul	10ul
125ppb	10ul	25ul	25ul
250ppb	10ul	50ul	50ul

Table 3A – Calibration Standard Concentration & Preparation Cont.

Low Level Water in 25mL syringe

STD	INT 25ug/mL	SURR (25ug/mL)	VOA (25ug/mL)	Acrolein (25ug/mL)	Ketone 25ug/mL	Methanol Added
1ppb	10ul	1ul	1ul	20ul	4ul	140ul
5ppb	10ul	5ul	5ul	25ul	5ul	120ul
10ppb	10ul	10ul	10ul	30ul	10ul	105ul
15ppb	10ul	15ul	15ul	35ul	15ul	88ul
20ppb	10ul	20ul	20ul	40ul	20ul	70ul
35ppb	10ul	35ul	35ul	45ul	35ul	17.5ul
40ppb	10ul	40ul	40ul	50ul	40ul	0
50ppb	10ul	50ul	50ul	55ul	50ul	0

Low Level App IX Water in 25mL syringe

STD	INT 25ug/mL	App IX (Various)	2CEVE 50ug/mL
1ppb	10ul	1ul	1ul
5ppb	10ul	5ul	5ul
10ppb	10ul	10ul	10ul
15ppb	10ul	15ul	15ul
20ppb	10ul	20ul	20ul
35ppb	10ul	35ul	35ul
40ppb	10ul	40ul	40ul
50ppb	10ul	50ul	50ul

Table 4
Internal Standards

Internal Standard Compound	Standard Concentration µg/mL	Quantitation ion (m/z)
Fluorobenzene	25	96
Chlorobenzene-d5	25	119
1,4-Dichlorobenzene-d4	25	152
Dioxane-d8	500	96
TBA-d9	500	65

Notes:

1) 10 µL of the internal standard is added to the sample. This results in a concentration of each internal in the sample of 50µg/L for a standard 5 mL purge Method 8260C, or 10 µg/L for low level Method 8260C waters (which uses a 25 ml sample aliquot). For instruments that sample directly from the VOA vial, 10 µL of a 5 µg/mL internal standard solution is added to low level Method 8260C waters.
2) Except for medium level soils, the surrogate and internal standards may be combined in one solution.
3) The new oxygenated internal standards Dioxane-d8 and TBA-d9 are primarily used to calculate the following compounds: 1,4-Dioxane, Ethanol and tert-Butyl alcohol. When these compounds are not requested for by the client these internal standards will be disabled and not reported with the TALS data. Thus, an internal standard recovery failure will not trigger the need for a nonconformance (NCM) in TALS.

Table 4A
Internal Standards with Corresponding Assigned Analytes for Quantitation

1st Internal - Fluorobenzene

1,1,1-Trichloroethane
1,1,2-Trichloro-1,2,2-trifluoromethane
1,1--Dichloroethane
1,1-Dichloroethene
1,1-Dichloropropene
1,2-Dichloroethane
1,2-Dichloroethane-d4 (Surrogate)
1,2-Dichloroethene (total)
1,2-Dichloropropane
1,3-Dichloropropene, Total
2,2-Dichloropropane
2-Butanone (MEK)
2-Chloroethyl vinyl ether
Acetone
Acetonitrile
Acrolein
Acrylonitrile
Allyl chloride
Benzene
Bromochloromethane
Bromodichloromethane
Bromomethane
Butadiene
Carbon disulfide
Carbon tetrachloride
Chloroethane
Chloroform
Chloromethane
Chloroprene
cis-1,2-Dichloroethene
cis-1,3-Dichloropropane
Cyclohexane
Dibromofluoromethane (Surrogate)
Dibromomethane
Dichlorodifluoromethane
Ethyl acetate
Ethyl ether
Hexane
Iodomethane
Isobutyl alcohol
Iso-octane
Isopropyl alcohol
Isopropyl ether
Methacrylonitrile
Methyl acetate
Methyl methacrylate
Methyl tert-butyl ether
Methylcyclohexane
Methylene chloride
n-Butanol
n-Heptane
Propionitrile
tert-Amyl ethyl ether
tert-Butyl ethyl ether
Tetrahydrofuran
trans-1,2-Dichloroethene
Trichloroethene
Trichlorofluoromethane
Vinyl acetate
Vinyl chloride

2nd Internal -Chlorobenzene-d5

1,1,1,2-Tetrrachloroethane
1,1,2,2-Tetrachloroethane
1,1,2-Trichloroethane
1,2-Dibromoethane
1,3-Dichloropropane
2-Chlorobenzotrifluoride
2-Nitropropane
3-Chlorobenzotrifluoride
2-Hexanone
4-Bromofluorobenzene (Surrogate)
4-Chlorobenzotrifluoride
4-Methyl-2-pentanone (MIBK)
Bromoform
Chlorobenzene
Chlorodibromomethane
Cyclohexanone
Ethyl acrylate
Ethyl methacrylate
Ethylbenzene
Isopropylbenzene
m-Xylene & p-Xylene
n-Butyl acetate
o-Xylene
Styrene
Tetrachloroethene
Toluene
trans-1,3-Dichloropropene
Xylenes (total)

3rd Internal - 1,2-Dichlorobenzene-d4

1,1,2,2-Tetrachloroethane
1,2,3-Trichlorobenzene
1,2,3-Trichloropropane
1,2,3-Trimethylbenzene
1,2,4-Trichlorobenzene
1,2,4-Trimethylbenzene
1,2-Dibromo-3-chloropropane
1,2-Dichlorobenzene
1,2-Dichloro-4-(trifluoromethyl)benzene
1,3,5-Trichlorobenzene
1,3,5-Trimethylbenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
2,3,6-Trichlorotoluene
2,4,5-Trichlorotoluene
2,4-Dichloro-1-(trifluoromethyl)benzene
2,5-Dichlorobenzotrifluoride
2-Chlorotoluene
2-Methylnaphthalene
3-Chlorotoluene
4-Chlorotoluene
4-Isopropyltoluene
Benzyl Chloride
Bromobenzene
Hexachlorobutadiene
Naphthalene
n-Butylbenzene
n-Propylbenzene
Pentachloroethane
sec-Butylbenzene
trans-1,4-Dichloro-2-butene
tert-Butylbenzene

4th Internal - Dioxane-d8

1,4-Dioxane

5th Internal - TBA-d9

Ethanol
2-Methyl-2-propanol (tert-Butyl alcohol)

Table 5
Surrogate Standards

Surrogate Compounds	Standard Concentration µg/mL
1,2-Dichloroethane-d_4	25
Dibromofluoromethane	25
Toluene-d_8	25
4-Bromofluorobenzene	25

Notes:

1) 10 µL of the surrogate standard is added to the sample. This results in a concentration of each surrogate in the sample of 50µg/L for a standard 5 mL purge Method 8260C, or 10 µg/L for low level Method 8260C waters (which uses a 25 ml sample aliquot). For instruments that sample directly from the VOA vial, 10 µL of a 5 µg/mL surrogate solution is added to low level Method 8260C waters.
2) Except for medium level soils, the surrogate and internal standards may be combined in one solution.
3) Recovery limits for surrogates are generated from historical data and are maintained by the QA department.

Table 6
Matrix Spike / LCS Compounds

Compound	Standard Concentration µg /mL
1,1,1,2-Tetrachloroethane	25
1,1,1-Trichloroethane	25
1,1,2,2-Tetrachloroethane	25
1,1,2-Trichloro-1,2,2-trifluoroethane	25
1,1,2-Trichloroethane	25
1,1-Dichloroethane	25
1,1-Dichloroethene	25
1,1-Dichloropropene	25
1,2,3-Trichlorobenzene	25
1,2,3-Trichloropropane	25
1,2,4-Trichlorobenzene	25
1,2,4-Trimethylbenzene	25
1,2-Dibromo-3-Chloropropane	25
1,2-Dichlorobenzene	25
1,2-Dichloroethane	25
1,2-Dichloroethene, Total	50
1,2-Dichloropropane	25
1,2,3-Trimethylbenzene	25
1,3,5-Trimethylbenzene	25
1,3-Dichlorobenzene	25
1,3-Dichloropropane	25
1,3-Dichloropropene, Total	50
1,4-Dichlorobenzene	25
1,4-Dioxane	500
2,2-Dichloropropane	25
2-Butanone (MEK)	25
2-Chlorotoluene	25
2-Hexanone	25
2-Methyl-2-propanol (tert-Butyl Alcohol)	250
3-Chloro-1-propene (Allyl chloride)	25
3-Chlorotoluene	25
4-Isopropyltoluene	25
4-Methyl-2-pentanone (MIBK)	25
Acetone	25
Acrylonitrile	25

Benzene	25
Bromobenzene	25
Bromoform	25
Bromomethane	25
Butadiene (1,3-Butadiene)	25
Carbon disulfide	25
Carbon tetrachloride	25
Chlorobenzene	25
Chlorobromomethane	25
Chlorodibromomethane	25
Chloroethane	25
Chloroform	25
Chloromethane	25
cis-1,2-Dichloroethene	25
cis-1,3-Dichloropropene	25
Cyclohexane	25
Dibromomethane	25
Dichlorobromomethane	25
Dichlorodifluoromethane	25
Dichlorofluoromethane	25
Ethyl ether	25
Ethyl methacrylate	25
Ethylbenzene	25
Ethylene Dibromide (1,2-Dibromoethane)	25
Hexachlorobutadiene	25
Hexane	25
Iodomethane	25
Isobutyl alcohol	625
Isopropylbenzene	25
Methyl acetate	125
Methyl tert-butyl ether	25
Methylcyclohexane	25
Methylene Chloride	25
m-Xylene & p-Xylene	25
Naphthalene	25
n-Butylbenzene	25
n-Heptane	25
N-Propylbenzene	25
o-Xylene	25
Sec-Butylbenzene	25
Styrene	25

tert-Butylbenzene	25
Tetrachloroethene	25
Tetrachloroethene	25
Tetrahydrofuran	50
Toluene	25
trans-1,2-Dichloroethene	25
trans-1,3-Dichloropropene	25
trans-1,4-Dichloro-2-butene *	25
Trichloroethene	25
Trichlorofluoromethane	25
Vinyl chloride	25
Xylenes, Total	50
Acrolein*	25
2-Chloroethyl vinyl ether*	50

Notes:

1) 10 µL of the standard is added to the LCS or matrix spiked sample. This results in a concentration of each spike analyte in the sample of 50µg/L for a standard 5 mL purge Method 8260C water or 10 µg/L for a low level Method 8260C sample when added to a 25 ml sample aliquot.
2) * Acrolein and 2-Chloroethyl vinyl ether are prepared as individual standards
3) Other compounds (Appendix IX and client specific) are spiked as required by client QAPP or at least once every 2 years.
4) Recovery and precision limits for LCS and MS/MSD are generated from historical data and are maintained by the QA department.

Table 7
BFB Key Ion Abundance Criteria

Mass	Ion Abundance Criteria
50	15% to 40% of Mass 95
75	30% to 60% of Mass 95
95	Base Peak, 100% Relative Abundance
96	5% to 9% of Mass 95
173	Less Than 2% of Mass 174
174	Greater Than 50% of Mass 95
175	5% to 9% of Mass 174
176	Greater Than 95%, But Less Than 101% of Mass 174
177	5% to 9% of Mass 176

Table 8
Method Recommended and Lab-Specific Minimum Response Factor Criteria (ICAL and CCAL)

Compound	CAS #	Minimum RF
1,1,1,2-Tetrachloroethane [2]	630-20-6	0.010
1,1,1-Trichloroethane	71-55-6	0.100
1,1,2,2-Tetrachloroethane [1]	79-34-5	0.300
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	0.100
1,1,2-Trichloroethane	79-00-5	0.100
1,1-Dichloroethane [1]	75-34-3	0.100
1,1-Dichloroethene	75-35-4	0.100
1,1-Dichloropropene [2]	563-58-6	0.010
1,2,3-Trichlorobenzene [2]	87-61-6	0.010
1,2,3-Trichloropropane [2]	96-18-4	0.010
1,2,4-Trichlorobenzene	120-82-1	0.200
1,2,4-Trimethylbenzene [2]	95-63-6	0.010
1,2-Dibromo-3-Chloropropane	96-12-8	0.050
1,2-dichloro-4-(trifluoromethyl)benzene (3,4-Dichlorobenzotrifluoride) [2]	328-84-7	0.010
1,2-Dichlorobenzene	95-50-1	0.400
1,2-Dichloroethane	107-06-2	0.100
1,2-Dichloroethene, Total [2]	540-59-0	0.010
1,2-Dichloropropane	78-87-5	0.100
1,3,5-Trichlorobenzene [2]	108-70-3	0.010
1,3,5-Trimethylbenzene [2]	108-67-8	0.010
1,3-Dichlorobenzene	541-73-1	0.600
1,3-Dichloropropane [2]	142-28-9	0.010
1,3-Dichloropropene, Total [2]	542-75-6	0.010
1,4-Dichlorobenzene	106-46-7	0.500
1,4-Dioxane [2]	123-91-1	0.010
2,2-Dichloropropane [2]	594-20-7	0.010
2,3- & 3,4- Dichlorotoluene [2]	STL01556	0.010
2,3,6-Trichlorotoluene [2]	2077-46-5	0.010
2,4- & 2,5- & 2,6- Dichlorotoluene [2]	STL01557	0.010
2,4,5-Trichlorotoluene [2]	6639-30-1	0.010
2,4-Dichloro-1-(triflouromethyl)-benzene (2,4-Dichlorobenzotrifluoride) [2]	320-60-5	0.010
2,5-Dichlorobenzotrifluoride [2]	320-50-3	0.010
2-Butanone (MEK)	78-93-3	0.050
2-Chloro-1,3-butadiene (Chloroprene) [2]	126-99-8	0.010

Compound	CAS #	Minimum RF
2-Chlorobenzotrifluoride [2]	88-16-4	0.010
2-Chloroethyl vinyl ether [2]	110-75-8	0.010
2-Chlorotoluene [2]	95-49-8	0.010
2-Hexanone	591-78-6	0.100
2-Methyl-2-propanol (tert-Butyl Alcohol) [2]	75-65-0	0.010
2-Methylnaphthalene [2]	91-57-6	0.010
2-Nitropropane [2]	79-46-9	0.010
3-Chloro-1-propene (Allyl chloride) [2]	107-05-1	0.010
3-Chlorobenzotrifluoride [2]	98-15-7	0.010
3-Chlorotoluene [2]	108-41-8	0.010
4-Chlorobenzotrifluoride [2]	98-56-6	0.010
4-Chlorotoluene [2]	106-43-4	0.010
4-Isopropyltoluene [2]	99-87-6	0.010
4-Methyl-2-pentanone (MIBK)	108-10-1	0.100
Acetone	67-64-1	0.050
Acetonitrile [2]	75-05-8	0.010
Acrolein [2]	107-02-8	0.010
Acrylonitrile [2]	107-13-1	0.010
Benzene	71-43-2	0.500
Benzyl chloride [2]	100-44-7	0.010
Bromobenzene [2]	108-86-1	0.010
Bromoform [1]	75-25-2	0.100
Bromomethane	74-83-9	0.050
Butadiene (1,3-Butadiene) [2]	106-99-0	0.010
Carbon disulfide	75-15-0	0.100
Carbon tetrachloride	56-23-5	0.100
Chlorobenzene [1]	108-90-7	0.500
Chlorobromomethane [2]	74-97-5	0.010
Chlorodibromomethane	124-48-1	0.100
Chloroethane	75-00-3	0.050
Chloroform	67-66-3	0.200
Chloromethane [1]	74-87-3	0.100
cis-1,2-Dichloroethene	156-59-2	0.100
cis-1,3-Dichloropropene	10061-01-5	0.200
Cyclohexane	110-82-7	0.100
Cyclohexanone [2]	108-94-1	0.010
Dibromomethane [2]	74-95-3	0.010
Dichlorobromomethane	75-27-4	0.200

Compound	CAS #	Minimum RF
Dichlorodifluoromethane	75-71-8	0.100
Dichlorofluoromethane [2]	75-43-4	0.010
Ethanol [2]	64-17-5	0.010
Ethyl Acetate [2]	141-78-6	0.010
Ethyl acrylate [2]	140-88-5	0.010
Ethyl ether [2]	60-29-7	0.010
Ethyl methacrylate [2]	97-63-2	0.010
Ethylbenzene	100-41-4	0.100
Ethylene Dibromide (1,2-Dibromoethane)	106-93-4	0.100
Hexachlorobutadiene [2]	87-68-3	0.010
Hexane [2]	110-54-3	0.010
Iodomethane [2]	74-88-4	0.010
Isobutyl alcohol [2]	78-83-1	0.010
Isopropyl alcohol [2]	67-63-0	0.010
Isopropyl ether [2]	108-20-3	0.010
Isopropylbenzene	98-82-8	0.100
Methacrylonitrile [2]	126-98-7	0.010
Methyl acetate	79-20-9	0.100
Methyl methacrylate [2]	80-62-6	0.010
Methyl tert-butyl ether	1634-04-4	0.100
Methylcyclohexane	108-87-2	0.100
Methylene Chloride	75-09-2	0.100
m-Xylene & p-Xylene	179601-23-1	0.100
Naphthalene [2]	91-20-3	0.010
n-Butanol [2]	71-36-3	0.010
n-Butyl acetate [2]	123-86-4	0.010
n-Butylbenzene [2]	104-51-8	0.010
n-Heptane [2]	142-82-5	0.010
N-Propylbenzene [2]	103-65-1	0.010
o-Xylene	95-47-6	0.300
Pentachloroethane [2]	76-01-7	0.010
Propionitrile [2]	107-12-0	0.010
sec-Butylbenzene [2]	135-98-8	0.010
Styrene	100-42-5	0.300
Tert-amyl methyl ether [2]	994-05-8	0.010
Tert-butyl ethyl ether [2]	637-92-3	0.010
tert-Butylbenzene [2]	98-06-6	0.010
Tetrachloroethene	127-18-4	0.200

Compound	CAS #	Minimum RF
Tetrahydrofuran [2]	109-99-9	0.010
Toluene	108-88-3	0.400
trans-1,2-Dichloroethene	156-60-5	0.100
trans-1,3-Dichloropropene	10061-02-6	0.100
trans-1,4-Dichloro-2-butene [2]	110-57-6	0.010
Trichloroethene	79-01-6	0.200
Trichlorofluoromethane	75-69-4	0.100
Vinyl acetate [2]	108-05-4	0.010
Vinyl chloride	75-01-4	0.100
Xylenes, Total [2]	1330-20-7	0.010

[1] SPCC compound for method 8260B
[2] These compounds do not appear on Table 4 of Method 8260C, a default Minimum RF of 0.010 will be used.

Table 9
Characteristic ions

Compound	Primary*	Secondary	Tertiary
1,1,1,2-Tetrachloroethane	131	133	119
1,1,1-Trichloroethane	97	99	117
1,1,2,2-Tetrachloroethane	83	85	131, 133
1,1,2-Trichloro-1,2,2-trifluoroethane	101	151	
1,1,2-Trichloroethane	97	83	85, 99
1,1-Dichloroethane	63	65	83
1,1-Dichloroethene	96	61	98
1,1-Dichloropropene	75	110	77
1,2,3-Trichlorobenzene	180	182	145
1,2,3-Trichloropropane	75	110	77, 112, 97
1,2,3-Trimethylbenzene	105	120	
1,2,4-Trichlorobenzene	180	182	145
1,2,4-Trimethylbenzene	105	120	
1,2-Dibromo-3-chloropropane	157	155	75
1,2-Dibromoethane	107	109	
1,2-Dichlorobenzene	146	148	111
1,2-Dichloroethane	62	64	98
1,2-Dichloroethane-d_4 (Surrogate)	65	102	
1,2-Dichloroethene, Total	96	61	98
1,2-Dichloropropane	63	65	41
1,2-Dichloro-4-(trifluoromethyl)benzene	214	216	179
1,3,5-Trichlorobenzene	180	182	
1,3,5-Trimethylbenzene	105	120	
1,3-Dichlorobenzene	146	148	111
1,3-Dichloropropane	76	78	
1,3-Dichloropropene, Total		110	
1,4-Dichlorobenzene	146	148	111
1,4-Dioxane	88	58	
2,2-Dichloropropane	77	97	

Compound	Primary*	Secondary	Tertiary
2,3,6-Trichlorotoluene	159	194	
2,4,5-Trichlorotoluene	159	194	
2,4-Dichloro-1-(trifluoromethyl)benzene	214	216	179
2,5-Dichlorobenzotrifluoride	214	216	179
2-Butanone (MEK)	43	57	72**
2-Chlorobenzotrifluoride	180	145	161
2-Chloroethyl vinyl ether	63	65	106
2-Chlorotoluene	126	91	
2-Hexanone	43	58	57, 100
2-Methylnaphthalene	142	141	115
2-Nitropropane	41	43	46
3-Chlorobenzotrifluoride	180	145	161
3-Chlorotoluene	126	91	
4-Bromofluorobenzene (Surrogate)	95	174	176
4-Chlorobenzotrifluoride	180	145	161
4-Chlorotoluene	126	91	
4-Isopropyltoluene	119	134	
4-Methyl-2-pentanone (MIBK)	43	58	57, 100
Acetone	43	58	
Acetonitrile	40	41	
Acrolein	56	55	58
Acrylonitrile	53	52	51
Allyl Chloride (3-Chloro-1-propene)	76	41	78
Benzene	78	52	77
Benzyl Chloride	91	65	39
Bromobenzene	156	158	77
Bromochloromethane	128	49	130
Bromodichloromethane	83	85	129
Bromoform	173	171	175, 252
Bromomethane (Methyl bromide)	94	96	79
Butadiene	39	54	53
Carbon disulfide	76	78	
Carbon tetrachloride	117	119	121

Compound	Primary*	Secondary	Tertiary
Chlorobenzene	112	114	
Chlorodibromomethane	129	127	131
Chloroethane	64	66	49
Chloroform	83	85	47
Chloromethane (Methyl chloride)	50	52	49
Chloroprene (2-Chloro-1,3-butadiene)	53	88	90
cis-1,2-Dichloroethene	96	61	98
cis-1,3-Dichloropropene	75	77	39
Cyclohexane	56	69	84
Cyclohexanone	55	42	98
Dibromofluoromethane (surrogate)	113	111	
Dibromochloromethane	129	208	
Dibromomethane (Methylene bromide)	93	174	95, 172, 176
Dichlorodifluoromethane	85	87	50, 101,103
Ethanol	45	46	
Ethyl acrylate	55	56	
Ethyl Acetate	43	88	61
Ethyl ether	59	74	
Ethyl methacrylate	69	41	99, 86, 114
Ethylbenzene	106	91	
Hexachlorobutadiene	225	260	227
Hexane	57	43	
Iodomethane (Methyl iodide)	142	127	141
Isobutanol (Isobutyl alcohol)	41	43	74
Isopropyl alcohol	45	59	
Isopropyl ether	87	59	45
Isopropylbenzene	105	120	
Methacrylonitrile	41	67	52
Methyl acetate	43	74	
Methyl methacrylate	41	69	100
Methyl tert butyl ether (MTBE)	73	41	
Methylcyclohexane	83	55	

Compound	Primary*	Secondary	Tertiary
Methylene chloride	84	49	51, 86
m-Xylene & p-Xylene	106	91	
Naphthalene	128		
	43	56	73
n-Butanol	56	41	42
n-Butylbenzene	91	134	
n-Heptane	41		
n-Propylbenzene	120	91	
o-Xylene	106	91	
Pentachloroethane	167	165	169
Propionitrile	54	52	55
sec-Butylbenzene	105	134	
Styrene	104	103	78, 51, 77
tert-Amyl ethyl ether	73	55	87
tert-Butyl ethyl ether	59	87	57
tert-Butyl alcohol (2-Methyl-2-propanol)	59	74	
tert-Butylbenzene	119	91	134
Tetrachloroethene	164	166	131
Tetrahydrofuran (THF)	42	71	
Toluene	91	92	65
Toluene-d_8 (Surrogate)	98	70	100
trans 1,4-Dichloro-2-butene	53	75	89, 77, 124
trans-1,2-Dichloroethene	96	61	98
trans-1,3-Dichloropropene	75	77	39
Trichloroethene	130	95	97, 132
Trichlorofluoromethane	101	103	66
Vinyl acetate	43	86	
Vinyl chloride	62	64	61
Xylenes	106	91	

*The primary ion should be used for quantitation unless interferences are present, in which case a secondary ion may be used.

**m/z 43 may be used for quantitation of 2-Butanone, but m/z 72 must be present for positive identification

Table 10 - VOA Dilution Calculation Table

Matrix	Dilution Required	Dilution Formula
Soil	1.25	4.00g/5mL
	1.67	3.00g/5mL
	2	2.50g/5mL
	2.5	2.00g/5mL
	4	1.25g/5mL
	5	1.00g/5mL
Methanol	2	50uL(5.00g/5mL)/5mL P&T
	4	25uL(5.00g/5mL)/5mL P&T
	5	20uL(5.00g/5mL)/5mL P&T
	10	10uL(5.00g/5mL)/5mL P&T
	20	5uL(5.00g/5mL)/5mL P&T
	25	100uL(1mL(5.00g/5mL)/25mL)/5mL P&T
	50	50uL(1mL(5.00g/5mL)/25mL)/5mL P&T
	100	25uL(1mL(5.00g/5mL)/25mL)/5mL P&T
25mL Water	2	(12.5mL/25mL)/5mL P&T
	4	(6.25mL/25mL)/5mL P&T
	5	(5 mL/25mL)/5mL P&T
	10	(2.5mL/25mL)/5mL P&T

Matrix	Dilution Required	Dilution Formula
	12.5	(2 mL/25mL)/5mL P&T
	20	(1.25mL/25mL)/5mL P&T
	40	(625uL/25mL)/5mL P&T
	50	(500uL/25mL)/5mL P&T
	100	(250uL/25mL)/5mL P&T
	125	(200uL/25mL)/5mL P&T
	150	(500uL(5mL/15mL)/25mL)/5mL P&T
	200	(125uL/25mL)/5mL P&T
	250	(100uL/25mL)/5mL P&T
	400	(62.5uL/25mL)/5mL P&T
	500	(50uL/25mL)/5mL P&T
	1000	(25uL/25mL)/5mL P&T
	1250	(20uL/25mL)/5mL P&T
	1500	(50uL(5mL/15mL)/25mL)/5mL P&T
	2000	(12.5uL/25mL)/5mL P&T
	2500	(10uL/25mL)/5mL P&T
	4000	(25uL/100mL)/5mL P&T
	5000	(5uL/25mL)/5mL P&T
	8000	(12.5uL/100mL)/5mL P&T
	10000	(2.5mL(25uL/25mL)/25mL)/5mL P&T

Matrix	Dilution Required	Dilution Formula
	12500	(2.5mL(20uL/25mL)/25mL)/5mL P&T
	15000	(2.5mL(500uL(100uL/5mL)/15mL)/25mL)/5mL P&T
	20000	(2.5mL(12.5uL/25mL)/25mL)/5mL P&T
	25000	(2.5mL(10uL/25mL)/25mL)/5mL P&T
	50000	(2.5mL(5uL/25mL)/25mL)/5mL P&T
	100000	(2.5mL(10uL/100mL)/25mL)/5mL P&T
5mL Water	2	(2.5mL/5mL)/5mL P&T
	4	(1.25mL/5mL)/5mL P&T
	5	(1mL/5mL)/5mL P&T
	8	(625uL/5mL)/5mL P&T
	10	(500uL/5mL)/5mL P&T
	12.5	(2mL/25mL)/5mL P&T
	20	(250uL/5mL)/5mL P&T
	40	(125uL/5mL)/5mL P&T
	50	(100uL/5mL)/5mL P&T
	80	(62.5uL/5mL)/5mL P&T
	100	(50uL/5mL)/5mL P&T
	125	(200uL/25mL)/5mL P&T
	150	(5mL(100uL/5mL)/15mL)/5mL P&T
	200	(25uL/5mL)/5mL P&T

Matrix	Dilution Required	Dilution Formula
	250	(100uL/25mL)/5mL P&T
	400	(25uL/10mL)/5mL P&T
	500	(50uL/25mL)/5mL P&T
	800	(12.5uL/10mL)/5mL P&T
	1000	(25uL/25mL)/5mL P&T
	1250	(20uL/25mL)/5mL P&T
	1500	(500uL(100uL/5mL)/15mL)/5mL P&T
	2000	(12.5uL/25mL)/5mL P&T
	2500	(10uL/25mL)/5mL P&T
	4000	(25uL/100mL)/5mL P&T
	5000	(5uL/25mL)/5mL P&T
	8000	(12.5uL/100mL)/5mL P&T
	10000	(2.5mL(25uL/25mL)/25mL)/5mL P&T
	12500	(2.5mL(20uL/25mL)/25mL)/5mL P&T
	15000	(2.5mL(500uL(100uL/5mL)/15mL)/25mL)/5mL P&T
	20000	(2.5mL(12.5uL/25mL)/25mL)/5mL P&T
	25000	(2.5mL(10uL/25mL)/25mL)/5mL P&T
	50000	(2.5mL(5uL/25mL)/25mL)/5mL P&T
	100000	(500uL(10uL/100mL)/5mL)/5mL P&T

NOTE: Primary dilutions are contained within the innermost parentheses. Secondary and/or Tertiary dilutions bracket the primary dilutions.

Title: Percent Moisture, Solids, Ash, Organic Matter in Soil Samples

Methods: SM 2540G and ASTM D2974-07a

Approvals (Signature/Date):

8/27/2014	8/28/2014
Roseann Ruyechan Date	Steve Jackson Date
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8/27/2014	8/27/2014
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1.0 Scope and Application

1.1 This method is applicable to the determination of the moisture content of soil, rock and soil-aggregate mixtures, and products. This method is also used to determine the ash content in oil, liquid (non-aqueous, i.e. sludges) and petroleum samples.

1.2 On occasion clients may request slight modifications to this SOP. These modifications are handled as indicated in PT-QA-M-001, Quality Assurance Manual.

2.0 Summary of Method

2.1 A homogenous sample is dried at 103℃ to 105℃ (to determine moisture), and 500 ± 50°C (to determine Ash). The weight loss of the sample at 103-105°C represents the moisture content and the residue the total solids.

2.2 The Ash content is the percentage of the total solids that remain after burning at 450-550°C.

2.3 Percent organic matter, or volatile solids, is equal to 100% (of the total solids) - the % ash. Therefore the % organic matter is defined as the percentage of combustible material found in the sample based on dry weight.

3.0 Definitions

3.1 Please refer to the glossary in the Quality Assurance Manual- PT-QA-M-001 for additional definitions.

3.2 TALS – TestAmerica LIMS

4.0 Interferences

4.1 Method interferences may be caused by contaminants in solvents, reagents, glassware, and other processing apparatus that lead to discrete artifacts. All of these materials must be routinely demonstrated to be free from interferences under conditions of the analysis by running laboratory method blanks as described in the Quality Control section. Specific selection of reagents may be required to avoid introduction of contaminants.

4.2 Non-homogeneous samples may give erratic results.

5.0 Safety

Employees must abide by the policies and procedures in the Corporate Environmental Health and Safety Manual (CW-E-M-001), the Pittsburgh Facility Addendum EH&S Manual (PT-HS-001), and this document. This procedure may involve hazardous material, operations and equipment. This SOP does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of the method to follow appropriate safety, waste disposal and health practices under the assumption that all samples and reagents are potentially hazardous. Safety glasses, gloves, lab coats and closed-toe, nonabsorbent shoes are a minimum.

5.1 Specific Safety Concerns or Requirements

5.1.1 After heating, sample containers will present a burn hazard. Tongs or heat resistant gloves must be used when handling samples after heating in the oven or muffle furnace.

5.2 Primary Materials Used

5.2.1 There are no materials used in this method that have a serious or significant hazard rating.

5.3 Eye protection that protects against splash, laboratory coat, and appropriate gloves must be worn while samples, standards, solvents, and reagents are being handled. Cut resistant gloves must be worn doing any other task that presents a strong possibility of getting cut. Disposable gloves that have been contaminated will be removed and discarded; other gloves will be cleaned immediately.

5.4 All work must be stopped in the event of a known or potential compromise to the health and safety of a TestAmerica associate. The situation must be reported **immediately** to a laboratory supervisor and/or the EHSC.

6.0 Equipment and Supplies

The following items are recommended for performing this procedure. Equivalent items should only be used when they result in an improvement in quality, efficiency, productivity, or cost. An item can be considered equivalent if with its use, the analytical and QA/QC requirements in this sop can be met.

6.1 Analytical balance: capable of accurately weighing ± 0.0001 g

6.2 Drying Oven, 103°C ± 2°C

6.3 Muffle furnace, 550°C ± 50°C

6.4 Desiccators

6.5 Evaporating dishes, various sizes, capable of being heated above 550°C

6.6 Wooden Spatula

6.7 Aluminum pans

7.0 Reagents and Standards

7.1 Not Applicable

8.0 Sample Collection, Preservation, Shipment and Storage

8.1 Samples are not chemically preserved.

8.2 Samples are stored in plastic or glass containers at ≥0.0°C but ≤ 6.0°C.

8.3 There is no method recommended holding time for solid samples for these tests. The lab will assign a 28 day holding time internally.

9.0 Quality Control

9.1 A duplicate sample is analyzed with every set of 10 or fewer samples.

9.1.1 The acceptable range between the sample and sample duplicate is %RPD less than or equal to 20 percent.

9.1.2 If the %RPD is outside criteria, check calculations and verify balance calibration. Reanalyze the samples once and evaluate results vs the initial sample/duplicate. If the failure repeats, report data with an NCM and narrative description of the initial and second data sets.

10.0 Procedure

10.1 Calibration and Standardization

10.1.1 Balances are calibrated as needed, and proper balance operation is verified daily, prior to sample analysis, bracketing the range of weights used. See SOP PT-QA-012 for balance calibration and verification details.

10.1.2 Oven temperature must be checked daily and recorded in the oven temperature log. Oven and muffle furnace temperatures at the time of analysis are documented in the batch information in TALS.

10.2 Total Solids – 2540G

10.2.1 Preparation of evaporating dish: If volatile solids or ash content are to be measured, ignite a clean evaporating dish at 500± 50℃ for one hour in a muffle furnace. If only total solids is being measured, an aluminum pan baked at 103-105°C may be used. Cool dishes to room temperature in desiccator before use. Dishes may be store in desiccator until ready for use.

10.2.2 Preparation of sample: Rocks, stones, twigs, leaves, or other foreign matter which interfere with homogenizing the sample must be carefully removed and the remaining sample mixed thoroughly so that a representative sample will be obtained. Where it has been necessary to remove artifacts, the action taken and artifacts removed from the sample must be adequately described by the analyst in a narrative provided with the sample data. If there is doubt concerning the proper handling of sample artifacts (due to the nature of the particular sample or project), the laboratory supervisor and project manager must determine the procedure to be followed, and the resulting actions must be documented in a narrative provided with the sample data. For volatile solid samples and samples analyzed for percent dry solids, supernatant liquids are mixed into the sample.

10.2.3 Place weighing dish plus 5 - 10g sample in a drying oven maintained at 103℃ ± 2°C. If samples contain enough liquid to flow readily, use 25 to 50 g of sample for analysis. Sample handling and drying must be conducted in a well ventilated area.

10.2.4 Dry the sample for a minimum of 12 hours. Remove the sample from the oven and cool in a dessicator at least 30 minutes. If dried less than 12 hours, it must be documented that constant weight was attained by repeating the dry/desiccate/weight cycle, with a minimum of one hour drying time in each cycle, until a change in weight of no greater than 0.05g or 4% (whichever is greater), is seen between start weight and final weight of last cycle.

10.3 Ash (Fixed) and Volatile Solids:

10.3.1 Transfer the dried residue from Section 10.2.4 to a muffle furnace at 500± 50℃ and ignite for one hour. (If the residue contains large amounts of organic matter, first ignite it over a gas burner and under a fume hood in the presence of adequate air to lessen losses due to reducing conditions and to avoid odors in the laboratory.) Cool in desiccator to room temperature and weigh.

10.3.2 Return the sample to the muffle furnace for an additional 30 minutes. Cool in a desiccator to room temperature and weigh. Repeat burning, cooling and weighing until a constant weight is obtained. Constant weight is defined as a change in weight of no greater than 0.05g or 4% (whichever is greater), between start weight and final weight of last cycle.

10.4 Any deviations from this procedure must be documented as a nonconformance, with a cause and corrective action described.

10.5 Organic matter is determined by subtracting percent ash content from one hundred.

11.0 Calculations / Data Reduction

11.1 Percent Total Solids:

$$\frac{(A - B)}{(C - B)} \times 100$$

Percent Volatile Solids or Organic Matter:

$$\frac{(A - D)}{(A - B)} \times 100$$

Percent Ash (Fixed) Solids:

$$\frac{(D - B)}{(A - B)} \times 100$$

Where:

A = Weight of dried residue and dish, mg

B = Weight of dish

C = Weight of wet sample and dish, mg

D = Weight of residue and dish after ignition, mg

11.2 Percent Moisture

%Moisture = 100% - % Total Solids

11.3 Report all results to the nearest 0.1 percent. Report furnace temperature used for ash content determinations.

11.4 Duplicate Sample, Relative Percent Difference (RPD):

$$RPD = \frac{|X_1 - X_2|}{\left(\frac{X_1 + X_2}{2}\right)} \times 100$$

Where:

X_1 = Original Result

X_2 = Duplicate Result

12.0 Method Performance

12.1 The supervisor has the responsibility to ensure that this procedure is performed by an analyst who has been properly trained in its use and has the required experience. Performance is monitored through internal QC and outside performance evaluation samples. Please refer to the QA Manual for additional information concerning Precision and Accuracy.

13.0 Pollution Control

13.1 It is TestAmerica's policy to evaluate each method and look for opportunities to minimize waste generated (i.e., examine recycling options, ordering chemicals based on quantity needed, preparation of reagents based on anticipated usage and reagent stability). Employees must abide by the policies in Section 13 of the Corporate Environmental Health and Safety Manual (CW-E-M-001) for "Waste Management and Pollution Prevention."

13.2 All waste will be disposed of in accordance with Federal, State and Local regulations. Where reasonably feasible, technological changes have been implemented to minimize the potential for pollution of the environment. Employees will abide by this method and the policies in section 13 of the Corporate Safety Manual for "Waste Management and Pollution Prevention.

13.3 This method does not contain any specific modifications that serve to minimize or prevent pollution.

14.0 Waste Management

14.1 Waste management practices are conducted consistent with all applicable rules and regulations. Excess reagents, samples and method process wastes are disposed of in an accepted manner. Waste description rules and land disposal restrictions are followed. Waste disposal procedures are incorporated by reference to PT-HS-001. The following waste streams are produced when this method is carried out.

14.1.1 Used Soil Samples – This waste is collected in containers identified as "Lab Trash", Waste #12.

15.0 References / Cross-References

15.1 Standard Methods for the Examination of Water and Waste Water, Method 2540G, 2011

15.2 ASTM Standard D 2974-07a, Standard Test Methods for Moisture, Ash, and Organic Matter of Peat Materials, 2008

15.3 PT-QA-012, Selection and Calibration of Balances and Weights

15.4 PT-QA-016, Nonconformance & Corrective Action System

15.5 PT-QA-021, Quality Assurance Program

15.6 PT-QA-024, Subsampling

15.7 PT-QA-M-001, Pittsburgh Laboratory Quality Assurance Manual

15.8 PT-HS-001, Pittsburgh Facility Addendum EH&S Manual

16.0 Method Modifications

16.1 The ash/organic content temperature (550±50°C) requirement from SM2540G is used in place of either method C (440°C) or D (750°C) from ASTM D 2974-07a.

17.0 Attachments

17.1 All sample preparation and analysis information will be documented electronically in TALS LIMS. All the documents associated with an analysis will be electronically available for inclusion in the final report.

17.2 Organic Matter Worksheet

18.0 Revision History

18.1 Revision 4, 11/7/08

18.2 Revision 5, 10/14/2009

18.3 Revision 6, 1/21/2012

18.4 Revision 7, 8/28/2014

SOP section	Change from	Change to	Reason
Cover	Technical Analyst – Mike Wesoloski Steve Jackson – Health & Safety Manager/ Coordinator QAM – Nasreen DeRubeis	Inorganics Department Manager – Roseann Ruyechan Regional Safety Coordinator QAM –Virginia Zusman	Change in personnel
Entire SOP	Removed Updated	DoD references PT-LQAM to PT-QA-M-001	Voluntarily withdrew from the program SOP numbering change
1.1	Added	Added “and products” to the end of the first sentence	Clarification
1.2	Added	SOP Checklist text on modifications	SOP Review Sheet format
3.1	Sample Duplicate definition	Reference for glossary in QA Manual	SOP Review Sheet format
3.2	QC Batch definition	TALS – TestAmerica LIMS	Clarification
5.1	Removed	Radiation Safety Manual	Does not pertain to this facility
5.2	Changed	MSDS to SDS	Due to change in industry standard language
5.2.1	Removed statement for VITON gloves		Clarification
6	Added	Text from SOP Review Checklist for this section	SOP Review Sheet format
6.6	Removed Top-loader balance		Clarification
8	Updated	≤6˚C to ≥0.0˚C but ≤6.0 ˚C	Correction

9.1.2	Added	Verify balance calibration…. If failure repeats, NCM and narrative	Clarification
10.1.1	Added	Balances are calibrated as needed…verified bracketing the range of weights used. See SOP PT-QA-012.	Clarification
10.2.3	Added	If samples contain enough liquid to flow readily, use 25 to 50g of sample for analysis	To match method weights (SM2540G)
10.2.4	change in weight of no greater than 0.01g	change in weight of no greater than 0.05g, or a change of less than 4% of the sample weight	To match method requirement (SM2540G)
10.3.2	Added	Requirement for repeated heating, cooling and weighing to constant weight	To match method requirement (SM2540G)
12.1	Added	Supervisor responsibility text from SOP Checklist	SOP Review Sheet format
15.2	Removed	Reference to ILM04.0	No longer perform CLP analysis
15.5, 6, 7, 9, 13, 14	Removed references to methods/SOP not used for this procedure		Clarification
15.13 (now 15.7)	PT-LQAM	PT-QA-M-001	QA Manual ID change
5 and 15.8	added	Reference to Pittsburgh EH&S Manual PT-HS-001	Clarification

General Chemistry Worksheet

Batch Number: 180-25593
Method: SM 2540G
Analyst: Cox, Chrissy M

Date Open: Jan 10 2012 10:27AM
Batch End:

Lab ID	Client ID	Method Chain	Basis	CrucibleID	Empty Dish Weight	Wt of Dish and sample prior to drying	Final weight/volume of sample	First Weighing	Second Weighing
180-7343-A-2	1311B Free Sand I12742	2540G	T	11	27.75 g	37.08 g	9.33 g	36.54 g	36.54 g
180-7343-A-2-DU		2540G	T	Z15	29.51 g	38.94 g	9.43 g	38.40 g	38.40 g

Controlled Source: Intranet

Company Confidential & Proprietary

General Chemistry Worksheet

Batch Number: 180-25593
Method: SM 2540G
Analyst: Cox, Chrissy M

Date Open: Jan 10 2012 10:27AM
Batch End:

Lab ID	Client ID	Method Chain	Basis	Third Weighing	Weight of Residue and Dish	Weight after ignition 1	Weight after ignition 2	Weight after ignition 3	Weight at 550 C
180-7343-A-2	1311B Free Sand I12742	2540G	T	36.54 g	36.54 g	36.55 g	36.54 g	36.55 g	36.55 g
180-7343-A-2-DU		2540G	T	38.40 g	38.4 g	38.40 g	38.39 g	38.40 g	38.4 g

Controlled Source: Intranet

Company Confidential & Proprietary

General Chemistry Worksheet

Batch Number: 160-25593
Method: SM 2540G
Analyst: Cox, Chrissy M

Date Open: Jan 10 2012 10:27AM
Batch End:

Lab ID	Client ID	Method Chain	Basis	Calculation Message
160-7343-A-2	1311B Free Sand I12742	2540G	T	OK
160-7343-A-2-DU		2540G	T	OK

Oven ID: 2/3
Oven, Bath or Block Temperature 1: 104/550 Celsius
Perform Calculation (0=No, 1=Yes): 1

Controlled Source: Intranet

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General Chemistry Worksheet

Batch Number: 160-25593
Method: SM 2540G
Analyst: Cox, Chrissy M

Date Open: Jan 10 2012 10:27AM
Batch End:

Comments

Lab ID	Client ID	Method Chain	Basis	Analysis comment
160-7343-A-2	1311B Free Sand I12742	2540G	T	
160-7343-A-2-DU		2540G	T	

Batch Comment: oven 2- 10:32 1/10/12 - 08:44 1/11, oven 3- 08:55-09:55 0 1/11/12

Controlled Source: Intranet

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Title: GAS CHROMATOGRAPHIC ANALYSIS OF DIESEL RANGE ORGANICS BASED ON METHODS 8015B, 8015C, and 8015D

Approvals (Signature/Date):

Technology Specialist	01/20/16 Date	Health & Safety Coordinator	01/20/16 Date
Quality Assurance Manager	02/25/16 Date	Technical Director	02/19/16 Date

This SOP was formerly known as NC-GC-043 Rev. 0 dated 12/11/13

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1. SCOPE AND APPLICATION

1.1. This SOP describes procedures to be used when SW-846 Method 8015B, 8015C, or 8015D is applied to the determination of the concentration and tentative identification of total extractable petroleum (diesel range organics) hydrocarbon mixes in waters, wastewaters, soils, and sludges. This SOP is applicable to extracts derived from any matrix which are prepared according to the appropriate sample extraction SOPs.

1.2. Table 2 lists compounds, which are routinely determined by this method, and gives the Reporting Limits (RL) for each matrix. RLs given are based on the low level standard and the sample preparation concentration factors. Matrix interferences may result in higher RLs than those listed. Other analytes may be analyzed by this method if the quality control criteria in Section 9 and the initial demonstration of method performance in Section 13 are met. Reporting limits are also listed in Table 2. The laboratory carbon range for Ohio VAP and BUSTR projects is Middle Distillates (C10-C20) and Heavy Distillates (C20-C34).

2. SUMMARY OF METHOD

2.1. This method presents conditions for the analysis of total petroleum hydrocarbons by gas chromatography. The total extractable petroleum hydrocarbon samples are injected into the column, separated, and detected by flame ionization detectors (FID). Quantitation is by external standard methods.

3. DEFINITIONS

3.1. Refer to the TestAmerica Canton Quality Assurance Manual (QAM), current version, for definitions of terms and acronyms used in this document.

4. INTERFERENCES

4.1. Contamination by carryover can occur when a low concentration sample is analyzed after a high concentration sample. Co-elution of target analytes with non-targets can occur, resulting in false positives or biased high results. In particular, this is a problem with non-selective detectors such as the Flame Ionization Detector (FID).

4.2. Interferences co-extracted from samples will vary considerably from source to source. The presence of interferences may raise quantitation limits for individual samples.

4.3. DRO analysis uses “baseline to baseline” integration. This can cause a positive bias in blanks or low level detections, or false positive results overall. It is imperative that the instrument is maintained in order to minimize this, and the data should be scrutinized accordingly.

5. SAFETY

5.1. Employees must abide by the policies and procedures in the Corporate Environmental Health and Safety Manual, the Facility Addendum to the Corporate EH&S Manual, and this document.

5.2. Eye protection that prevents splash, laboratory coat, and appropriate gloves must be worn while samples, standards, solvents, and reagents are being handled. Refer to the TestAmerica Canton Corporate Environmental Health and Safety Manual for a complete description of personal protection equipment. Cut-resistant gloves must be worn doing any other task that presents a strong possibility of getting cut. Disposable gloves that have become contaminated must be removed and discarded; other gloves must be cleaned immediately. Nitrile gloves provide adequate protection against the methylene chloride used in this method.

5.3. The following is a list of the materials used in this method, which have a serious or significant hazard rating. NOTE: This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the Safety Data Sheet (SDS) for each of the materials listed in the table. A complete list of materials used in the method can be found in the Reagents and Standards section. Employees must review the information in the SDS for each material before using it for the first time or when there are major changes to the SDS.

Material	Hazards	Exposure Limit (2)	Signs and symptoms of exposure
Acetone	Flammable	1000 ppm-TWA	Inhalation of vapors irritates the respiratory tract. May cause coughing, dizziness, dullness, and headache.
Methylene Chloride	Carcinogen Irritant	25 ppm-TWA 125 ppm-STEL	Causes irritation to respiratory tract. Has a strong narcotic effect with symptoms of mental confusion, light-headedness, fatigue, nausea, vomiting and headache. Causes irritation, redness and pain to the skin and eyes. Prolonged contact can cause burns. Liquid degreases the skin. May be absorbed through skin.
1 – Always add acid to water to prevent violent reactions.			
2 – Exposure limit refers to the OSHA regulatory exposure limit.			

5.4. It is recommended that analysts break up work tasks to avoid repetitive motion tasks, such as opening a large number of vials or containers in one time period.

5.5. Exposure to chemicals must be maintained as low as reasonably achievable. All samples with stickers that read “Caution/Use Hood!” must be opened in the hood. Contact the EH&S Coordinator if this is not possible. Solvent and waste containers must be kept closed unless transfers are being made.

5.6. Opened containers of neat standards must be handled in a fume hood.

5.7. Sample extracts and standards, which are in a flammable solvent, must be stored in an explosion-proof refrigerator.

5.8. When using hydrogen gas as a carrier, all precautions listed in the Corporate Environmental Health and Safety Manual must be observed.

5.9. Standard preparation and dilution must be performed inside an operating fume hood.

5.10. The gas chromatograph contains zones that have elevated temperatures. The analyst needs to be aware of the locations of those zones, and must cool them to room temperature prior to working on them.

5.11. There are areas of high voltage in the gas chromatograph. Depending on the type of work involved, either turn the power to the instrument off, or disconnect it from its source of power.

5.12. All work must be stopped in the event of a known or potential compromise to the health and safety of a TestAmerica associate. The situation must be reported immediately to the EH&S Coordinator and the Laboratory Supervisor.

6. EQUIPMENT AND SUPPLIES

6.1. An analytical system complete with a gas chromatograph is required.

6.2. Software: Chemstation or equivalent

6.3. A flame ionization detector (FID) is required.

6.4. Microsyringes, various sizes, for standards preparation, sample injection, and extract dilution.

6.5. Autosampler vials, inserts, and caps

7. REAGENTS AND STANDARDS

7.1. Stock Standards

7.1.1. Stock standards are purchased as certified solutions or prepared from pure solutions. Stock standard solutions are stored as recommended by the manufacturer. All stock standards must be protected from light. Stock standard solutions must be brought to room temperature before using.

7.1.2. Semivolatile stock standard solutions must be replaced after six months. Expiration times for all standards are measured from the time the standard is prepared or from the time that the standard ampoule is opened, if the standard is supplied in a sealed ampoule. If vendor-supplied standard has an earlier expiration date then that date is used.

Refer to SOP NC-QA-017, Standards and Reagents, for additional information. The standard preparation information is detailed in the LIMS standards and reagents module.

7.2. Calibration Standards

7.2.1. Semivolatile Calibration Standards

7.2.1.1. Semivolatile calibration standards are prepared as dilutions of the stock standards. Surrogates and internal standards are used as specified in this SOP. Semivolatile calibration solutions must be refrigerated at 4°C ± 2°C and protected from light. The standards must be replaced at least every six months or sooner if comparison with check standards indicates a problem.

7.3. Gases for carrier and make-up: Hydrogen, Nitrogen, Zero Air.

7.4. Methylene Chloride: reagent grade or better

7.5. The petroleum hydrocarbons (Diesel Fuel) are purchased from a chemical supplier.

7.6. Refer to Table 3 for details of calibration standards.

7.7. Surrogate Standards

7.7.1. 0-Terphenyl is the surrogate standard.

8. SAMPLE PREPARATION, PRESERVATION, AND STORAGE

8.1. The holding time for semivolatile extracts is 40 days from extraction to analysis. Extracts must be stored at <-10°C.

9. QUALITY CONTROL

9.1. Quality Control Batch

9.1.1. A batch is a group of no greater than 20 samples, excluding QC samples (LCS, MS, method blanks) which are processed similarly, with respect to the procedure. All sample setups must be initiated within a 24-hour period beginning from the initial preparation or extraction and without interruption of the process. All samples within the batch must be treated with the same lots of reagents and the same processes.

9.2. Method Blanks (MB)

9.2.1. For each batch of samples, analyze a MB. The MB consists of reagent water for aqueous semivolatile samples and sodium sulfate for

solid/waste semivolatile tests (Refer to SOPs NC-OP-037, NC-OP-038, NC-OP-039, NC-OP-040, NC-OP-045, and NC-OP-043 for details). Surrogates are added and the MB is carried through the entire analytical procedure. The MB must have acceptable surrogate recoveries for Ohio VAP samples, all analytes must meet criteria or the samples must be re-extracted if sufficient volume of sample remains.

9.2.2. Corrective Action for MBs

9.2.2.1. The MB must not contain any analyte of interest at, or above, the reporting limit or at, or above, 5% of the measured concentration of that analyte in the associated samples, whichever is higher.

9.2.2.2. Re-extraction and re-analysis of samples associated with an unacceptable MB is required when reportable concentrations are determined in the samples.

9.2.3. If there is no target analyte greater than the RL in the samples associated with an unacceptable MB, the data may be reported with qualifiers.

Note: For Ohio VAP projects, the result must be below the reporting limit or samples must be re-extracted unless the samples are non-detect.

9.2.4. Refer to TestAmerica Canton QC Program document (Policy QA-003) for further details of the corrective actions.

9.3. Laboratory Control Samples (LCS)

9.3.1. For each batch of samples, analyze an LCS. The LCS contains a representative subset of the analytes of interest, and must contain the same analytes as the matrix spike. If any analyte is outside the laboratory established historical control limits, corrective action must occur. All reported compounds must attain a recovery of 10% or greater.

Note: For Ohio VAP samples, all analytes must meet criteria or the samples must be re-extracted if sufficient volume of sample remains. The exceptions are as follows: (a) insufficient sample for re-extraction (b) expired holding times, or (c) the LCS is biased high and the samples are non-detect for TPH. Under the above circumstances, results may be reported.

9.3.2. Corrective Action for LCS

9.3.2.1. If the batch is not re-extracted and re-analyzed, the reasons for accepting the batch must be clearly presented in the project record and the report.

9.3.2.2. If the LCS is biased high, and the associated samples are non-detect for those analytes, the LCS is reported. Appropriate comments must be made in the narrative to provide further documentation in these cases.

9.3.2.3. If re-extraction and re-analysis of the batch is not possible due to limited sample volume or other constraints, the LCS is reported, all associated samples are flagged, and appropriate comments are made in a narrative to provide further documentation.

9.3.2.4. Refer to TestAmerica Canton QC Program document (Policy QA-003) for further details of the corrective action.

9.4. Matrix Spikes/Spike Duplicates (MS/MSD)

9.4.1. For each QC batch, analyze an MS/MSD. Spiking compounds and levels are given in the appendices. Compare the percent recovery and relative percent difference (RPD) to those in the laboratory-specific historically generated limits.

9.4.2. If any individual recovery or RPD falls outside the acceptable range, corrective action must occur unless samples for this compound are ND. The initial corrective action must be to check the recovery of that analyte in the LCS. Generally, if the recovery of the analyte in the LCS is within limits, then the laboratory operation is in control and analysis may proceed.

9.4.3. If the recovery for any component is outside QC limits for both the MS/MSD and the LCS, the laboratory is out of control and corrective action must be taken. Corrective action must include re-preparation and re-analysis of the batch.

9.4.4. The MS/MSD must be analyzed at the same dilution as the un-spiked sample, unless the matrix spike components would then be above the calibration range.

9.5. Surrogate

9.5.1. Surrogate recoveries in samples and QC samples must be assessed to ensure that recoveries are within established limits. Surrogate recoveries must be met in the MB and LCS. If any surrogate is outside limits, the following corrective actions must take place (except for dilutions):

9.5.1.1. Check all calculations for error.

9.5.1.2. Ensure instrument performance is acceptable.

9.5.1.3. Recalculate the data and/or re-analyze the extract if either of the above checks reveals a problem.

9.5.1.4. It is only necessary to re-prepare / re-analyze a sample once to demonstrate poor surrogate recovery is due to matrix effect, unless the analyst believes that the repeated out-of-control results are not due to matrix effect.

Note: For Ohio VAP projects, all surrogates must meet criteria.

9.5.2. If the surrogate is out of control for the sample and MS/MSD, then matrix effect has been demonstrated for that sample and re-preparation is not necessary. If the sample is out of control and the MS/MSD pair are in control, then re-preparation or flagging of the data is required. Re-preparation includes the parent sample and MS/MSD.

9.5.3. Surrogates are added to the MB and the MB is carried through the entire analytical procedure. The MB must have acceptable surrogate recoveries. If surrogate recoveries are not acceptable, the data must be evaluated to determine if the method blank has served the purpose of demonstrating that the analysis is free of contamination.

9.5.4. The LCS must have acceptable surrogate recoveries. If surrogate recoveries are not acceptable, the data must be evaluated to determine if the LCS has served the purpose of demonstrating effectiveness of the extraction process.

9.5.5. Refer to TestAmerica Canton QC Program document (Policy QA-003) for further details of the corrective actions.

Note: Ohio VAP rules require that all surrogates must be within acceptance criteria. For surrogate outliers, the analyst should either: (a) re-analyze, (b) re-prep/re-analyze, or (c) perform a dilution. When there is an obvious interference causing the surrogate outlier that the analyst knows a corrective action would not resolve the issue, flag the data with a qualifier indicating matrix interference. The exceptions for re-prep/re-analysis are as follows: (a) insufficient sample for re-extraction, or (b) the surrogates are biased high and the samples are non-detect. Under the above circumstances, results may be reported. All batch QC samples must pass surrogate criteria or the batch (samples and QC) must be re-extracted if sufficient volume and holding time remains.

9.6. Control Limits

9.6.1. All surrogate, LCS, and MS/MSD recoveries (except for dilutions) must be entered into LIMS (when available) or other database so that accurate historical control limits can be generated.

9.6.2. Refer to the QC Program document (Policy QA-003) for further details of control limits.

9.6.3. Control limits are established by the laboratory as described in SOP NC-QA-018 and are easily accessible in LIMS.

9.6.4. Laboratory control limits are internally generated and updated periodically unless method specified. Control limits are easily accessible via LIMs.

10. CALIBRATION AND STANDARDIZATION

10.1. Prepare standards containing each analyte of interest at a minimum of five concentration levels. The low-level standard must be at, or below, the reporting limit. The other standards define the working range of the detector. Recommended calibration levels for standards and surrogates are given in Table 3.

10.2. A new calibration curve must be generated after major changes to the system or when the continuing calibration criteria cannot be met. Major changes include new columns, or replacing the FID detector. A new calibration is not required after clipping the column, replacing the septum or syringe, or other minor maintenance.

10.3. With the exception of Section 10.4 below, it is NOT acceptable to remove points from a calibration curve for the purpose of meeting criteria, unless the points are the highest or lowest on the curve, AND the reporting limit and/or linear range is adjusted accordingly. In any event, at least five points must be included in the calibration curve.

10.4. A level may be removed from the calibration if the reason can be clearly documented (for example, a broken vial or no purge run). A minimum of five levels must remain in the calibration. The documentation must be retained with the initial calibration. Alternatively, if the analyst believes that a point on the curve is inaccurate, the point may be re-analyzed and the re-analysis used for the calibration. All initial calibration points in a single calibration curve must be analyzed without any changes to instrument conditions, and all points in a single calibration curve must be analyzed within 24 hours.

10.5. External Standard Calibration

10.5.1. Quantitation by the external standard method assumes a proportional relationship between the calibration run and the analyte in the sample.

Introduce each calibration standard into the GC using the technique that will be used for samples. The ratio of the sum of peak area responses to the concentration injected may be used to prepare a calibration curve.

10.5.2. Some data systems may use the inverse of this formula. This is acceptable so long as the same formula is used for standards and samples.

10.6. Calibration Curve Fits

10.6.1. Average response factor or linear regression may be used to fit the data. Average response factor may be used if the average % RSD of the calibration factors of all the analytes in the calibration standard taken together is ≤ 20%.

10.6.2. In general, for hydrocarbon analysis, average response factors are the most appropriate calibration model. Linear regression fits must only be used if the analyst has reason to believe that the average RF model does not fit the normal concentration/response behavior of the detector. Linear curve fits cannot be used to extend the calibration range for compounds that normally exhibit an average response.

10.7. The following requirements must be met for any calibration to be used.

10.7.1. Response must increase with increasing concentration.

10.7.2. If a curve is used, the calculated intercept of the curve at zero response must be less than ± the reporting limit for the analyte.

10.7.3. The average Relative Standard Error (RSD for average response factors) of the calibration points from the curve used must be ≤ 20%.

10.7.4. Some data systems will not measure the %RSE from a linear fit. For the linear case, the correlation coefficient may be used as an alternative to the % RSE, and must be greater than or **equal to 0.990.**

Note: The Relative Standard Error (RSE) is superior to the Correlation Coefficient (r) and Coefficient of Determination (r^2) for testing the fit of a set of calibration points to a line. The lower points on a curve have little effect on r. As a result, a curve may have a very good correlation coefficient (>0.995) while also having > 100% error at the low point.

10.8. Weighting of Data Points

10.8.1. In linear calibration fits, the points at the lower end of the calibration curve have less absolute variance than points at the high concentration end of the curve. This can cause severe errors in quantitation at the low end of the calibration. However, in environmental analysis, accuracy at

the low end of the curve is very important. For this reason, it is preferable to increase the weighting of the lower concentration points. 1/Concentration^2 weighting (often called 1/X^2 weighting) will improve accuracy at the low end of the curve and should be used if the data system has this capability.

10.9. Initial Calibration

10.9.1. Prior to the initial calibration, a marker solution consisting of alkanes from C10-C40 is analyzed, If additional carbon ranges are needed, a separate solution with alkane C44 can be analyzed with a modified instrument program. The apex of each alkane peak in the marker solution establishes the retention time window.

10.9.2. Analyze a diesel calibration using a minimum of five points referring to the recommended instrument conditions (Refer to Table 1 for recommended instrument conditions). The calibration concentrations are 100, 200, 500, 1000, and 2000 ng/uL. A 5000ng/uL standard may be analyzed if needed. The retention time window of C10-C28 must be used for the Diesel calibration. The low-level standard must be at or below the reporting limit. The other standards define the working range of the detector.

Note: Additional carbon ranges can be customized to suit the needs of a specific site; however, all ranges are quantitated against the diesel calibration.

10.10. Initial Calibration Verification (ICV)

10.10.1. An initial calibration verification (ICV) standard, from a second source, is analyzed immediately following the initial calibration. An acceptance criterion is ± 20%. If this is not met, a new initial calibration curve is analyzed.

10.11. Calibration Verification

10.11.1. 12-hour Retention Time Verification

10.11.1.1. The retention time (RT) marker solution contains all even-numbered alkanes from C10 to C40. Alkane C44 is in a separate solution and is analyzed as needed. Odd numbered alkanes may be analyzed for site-specific projects. The apex of each alkane peak is used to set the retention time. The RT marker must be analyzed prior to analysis of the CCV and at the start of every 12 hours of analysis time. Retention times are updated with each analysis of the marker solution.

10.11.2. Continuing Calibration Verification

10.11.2.1. The working calibration curve or RF must be verified by the analysis of a mid-point diesel calibration standard at the beginning, after every 12 hours, and at the end of the analysis sequence.

10.11.2.2. It may be appropriate to analyze a mid-point standard more frequently than every 12 hours. If these calibration verification standards are analyzed, requirements are the same as the 12-hour calibration with the exception that retention times are not updated.

10.11.2.3. A mid-range standard of diesel is used for the CCV. The acceptance criterion is ±15%. For Methods 8015C and 8015D, the CCV acceptance criteria is ± 20%

10.11.3. Corrective Actions for Continuing Calibration

10.11.3.1. If the percent drift is greater than ± 15% for method 8015B (20% for methods 8015C and D), corrective action must be taken. This may include clipping the column, changing the liner, or other minor instrument adjustments, followed by re-analyzing the standard. If the percent drift still varies by more than ± 15%, for method 8015B (20% for methods 8015C and D), a new calibration curve must be prepared.

10.11.4. Corrective Action for Samples

10.11.4.1. Samples that are not bracketed by acceptable CCVs must be re-injected; however, samples with results below the RL may be reported when the CCV exceeds criteria on the high side. This must be addressed in the case narrative.

11. PROCEDURE

11.1. One-time procedural variations are allowed only if deemed necessary in the professional judgment of QA, operations supervisor, or designee to accommodate variation in sample matrix, chemistry, sample size, or other parameters. Any variation in procedure must be completely documented using a Nonconformance Memo. The Nonconformance Memo must be filed in the project file. Procedural deviations are not allowed for Ohio VAP Projects.

11.2. Any unauthorized deviations from this procedure must also be documented as a nonconformance with a cause and corrective action described.

11.3. Extraction

11.3.1. Extraction procedures are referenced in the SOPs NC-OP-037, NC-OP-038, NC-OP-039, NC-OP-040, and NC-OP-043, current revision.

11.4. Sample Introduction

11.4.1. Semivolatile analytes are introduced by direct injection of the extract. Samples, standards, and QC must be introduced using the same procedure.

11.4.2. The column comp feature of the GC may be utilized to account for significant column bleed and resulting rise in the baseline that is common for the chromatographic conditions employed with this analysis.

11.4.2.1. The column comp feature runs the GC temperature and pressure program without an injection to determine the appropriate compensation program.

11.4.2.2. If utilized, the column comp must be consistently applied to the initial calibration and all subsequent analysis.

11.4.2.2.1. The appropriateness of the column comp must be regularly monitored by evaluating baseline rises or dips in solvent or method blanks.

11.4.2.2.2. The need for a column comp must be evaluated whenever new columns are installed. A new column comp should be performed if there is need for a column comp..

11.4.2.2.3. Whenever a new column comp is performed a new initial calibration should be performed.

11.4.3. LVI (Low Volume Initiative) may also be used for this analysis.

11.5. A suggested analytical sequence is given in Table 4.

11.6. Petroleum Hydrocarbon Identification and/or Fingerprinting

11.6.1. To identify the type of petroleum hydrocarbon, compare the chromatographic peak pattern to the patterns of known petroleum hydrocarbons analyzed under identical chromatographic conditions. Qualitative fingerprinting may be done when client requested.

11.6.2. Positive matching may not be possible, even using site-specific hydrocarbons. Degradation of the pattern can occur during environmental exposure of the fuel. See Table 2 for possible fingerprints.

11.6.3. Samples are quantified against the initial calibration of diesel on a single column.

11.6.4. If the amount of sample injected into the GC exceeds the working range of the calibration curve, an appropriate dilution is performed before reanalysis.

11.7. Qualitative Identification

11.7.1. Tentative identification occurs when the sum of peak areas found within the RT window determined by the requested alkane range occur, at a concentration above the reporting limit (or above the MDL if requested). Chromatograms are reviewed for proper integration. Manual integrations are performed if necessary and are documented by the data system. Additional information on manual integration can be found in SOP CA-Q-S-002.

11.7.2. The experience of the analyst must weigh heavily in the interpretation of the chromatogram.

11.8. Calibration Range

11.8.1. If concentrations of the requested analytical range exceed the working range as defined by the calibration standards, then the sample must be diluted and re-analyzed. Dilutions should target the upper half (at or above the mid- level standard) of the calibration range.

11.9. Dilutions

11.9.1. Samples may be screened to determine the appropriate dilution for the initial run. Samples should be re-analyzed at a dilution which targets the mid-level or higher standard of the calibration curve.

11.9.2. Reporting Dilutions

11.9.2.1. The most concentrated dilution with no target compounds above the calibration range must be reported.

12. DATA ANALYSIS AND CALCULATIONS

12.1. Calculations

12.1.1. Capabilities of individual data systems may require the use of different formulas than those presented here. When this is the case, the calculations used must be shown to be equivalent and must be documented.

12.2. External Standard Calculations

12.2.1. Average Calibration Factor (CF)

$$Average\ Calibration\ Factor = \overline{CF} = \frac{\sum_{i=1}^{n} CF_i}{n}$$

$\sum_{i=1}^{n} CF_i$ = Sum of calibration factors for each calibration level

12.2.1. Percent Difference (%D) is used for comparing the CCV to an average curve.

$$\%D = \frac{CF_c - \overline{CF}}{\overline{CF}} \times 100$$

Where: CF_c = the calibration factors from the continuing calibration

$\overline{CF}$ = the average calibration factors from the initial calibration

$$Concentration\ (mg\ /\ L) = \frac{(A_x \times V_t \times D_f)}{(CF \times V_i \times V_s)}$$

Where:
A_x = Response for the analyte in the sample
V_i = Volume of extract injected, µL
D_f = Dilution factor
V_t = Volume of total extract, µL
V_s = Volume of sample extracted or purged, mL
CF = Calibration factor, area or height/ng

12.2.1.1. Non-aqueous Samples

$$Concentration\ (mg/kg) = \frac{(A_x \times V_t \times D_f)}{(CF \times V_i \times W)}$$

Where:
W = Weight of sample extracted or purged, g

12.2.2. Linear Regression

The linear fit uses the following functions:

$$y = ax + b$$

or

$$x = \frac{(y - b)}{a}$$

Where: y = Instrument response
x= Concentration
a = Slope
b = Intercept

12.2.3. Correlation Coefficient (r)

$$r = \frac{\sum d_x d_y}{\sqrt{\sum d_x^2 \sum d_y^2}}$$

Where:

d_x = deviation of x from the mean

d_y = deviation of y from the mean

12.2.4. Percent drift (%D) is used for comparing the continuing calibration to a linear curve.

$$\%Drift = \frac{C_{actual} - C_{found}}{C_{actual}} \times 100\%$$

C_{actual} = Known concentration in standard

C_{found} = Measured concentration using selected quantitation method

12.2.5. Concentration Calculation

12.2.5.1. The concentration of samples (aqueous and solid) is calculated to include the total area (chromatographic are) integrated beginning at the RT of the apex of the peak for the alkane marker that begins the RT window and ending at the RT of the apex of the peak for the alkane marker at the end of the RT window.

12.2.5.1.1. Aqueous Samples

$$Concentration = R_i \times \frac{V_f}{V_i} \times D$$

Where R_i = The raw result from the instrument

V_f = The final extract volume

V_i = The initial sample volume prepped

D = The dilution factor

12.2.5.2. Solid Samples

$$Concentration = R_i \times \frac{V_f}{V_i} \times D \times DWC$$

Where R_i = The raw result from the instrument

V_f = The final extract volume

V_i = The initial weight of the sample extracted

D = The dilution factor

DWC = Dry Weight Correction factor

$$\text{Dry Weight} = \frac{\text{Sample Test Result x 100}}{\text{(\%) Total Solid Results}}$$

12.2.1. LCS Recovery

$$\text{\% Recovery for LCS} = \frac{Result}{LCS\ True\ Value} \times 100\%$$

12.2.2. ICV/CCV Recovery

$$\text{\% Recovery for ICV/CCV} = \frac{Result}{ICV/CCV\ True\ Value} \times 100\%$$

12.2.3. Surrogate Recovery

12.2.3.1. Concentrations of surrogate compounds are calculated using the same equations as for the target compounds. The

response factor from the initial calibration is used. Surrogate recovery is calculated using the following equation.

$$\%\ \text{Recovery} = \frac{Concentration\ (or\ amount)\ found}{Concentration\ (or\ amount)\ spiked} \times 100$$

12.2.3.2. Additional equations and calculations are listed in the following SOPs: Calibration Curves (General), CA-Q-S-005, and Selection of Calibration Points, CA-T-P-002

12.2.3.3. Surrogate recovery results are calculated and reported for o-Terphenyl. The surrogate must be within QC criteria. Corrective action is only necessary if o-Terphenyl is outside of acceptance limits, unless the surrogate is high and the sample is ND.

13. METHOD PERFORMANCE

13.1. Method Detection Limit

13.1.1. Each laboratory must generate a valid method detection limit for each analyte of interest. The MDL must be below the reporting limit for each analyte. The procedure for determination of the method detection limit is given in 40 CFR Part 136, Appendix B, and further defined in SOPs NC-QA-021 and CA-Q-S-006.

13.2. Initial Demonstration

13.2.1. Each laboratory must make a one-time initial demonstration of capability for each individual method. Demonstration of capability for both soils and water matrices is required. A QC check sample containing diesel and o-Terphenyl surrogate will be sufficient to demonstrate capability for all carbon ranges.

13.2.2. Four aliquots of the QC check sample are analyzed using the same procedures used to analyze samples, including sample preparation. The concentration of the QC check sample must be equivalent to a mid-level calibration.

13.2.3. Calculate the average recovery and standard deviation of the recovery for each analyte of interest.

13.2.4. If any analyte does not meet the acceptance criteria, the test must be repeated. Only those analytes that did not meet criteria in the first test need to be evaluated. Repeated failure for any analyte indicates the need for the laboratory to evaluate the analytical procedure and take corrective action.

13.3. Training Qualification

13.3.1. The Group/Team Leader has the responsibility to ensure an analyst who has been properly trained in its use and has the required experience performs this procedure.

14. POLLUTION PREVENTION

14.1. It is TestAmerica's policy to evaluate each method and look for opportunities to minimize waste generated (i.e., examine recycling options, ordering chemicals based on quantity needed, preparation of reagents based on anticipated usage, and reagent stability). Employees must abide by the policies in Section 13 of the Corporate Environmental Health and Safety Manual (CW-E-M-001) for "Waste Management and Pollution Prevention".

15. WASTE MANAGEMENT

15.1. All waste must be disposed of in accordance with Federal, State and Local laws and regulations. Where reasonably feasible, technological changes have been implemented to minimize the potential for pollution of the environment. Employees must abide by this method and the policies in Section 13 of the Corporate Environmental Health and Safety Manual (CW-E-M-001) for "Waste Management and Pollution Prevention."

15.2. Waste Streams Produced by the Method

15.2.1. The following waste streams are produced when this method is carried out.

15.2.1.1. Vials containing sample extracts: These vials are placed in the vial waste located in the GC/MS laboratory.

15.2.1.2. Capped tubes containing sample extracts for TPH are placed in the PCB/flammable waste container located in the GC prep laboratory.

16. REFERENCES

16.1. SW846, Method 8015B, Nonhalogenated Organics Using GC/FID, Test Methods for Evaluating Solid Waste, Revision 2, December 1996 USEPA

16.2. SW846, Method 8015C, Nonhalogenated Organics by Gas Chromatography, Test Methods for Evaluating Solid Waste, Revision 3, February 2007.

16.3. SW846, Method 8015D, Nonhalogenated Organics Using GC/FID, Revision 4, June 2003.

16.4. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW846, 3rd Edition, Final Update III, December 1996, and Section 8000B

16.5. TestAmerica Canton Quality Assurance Manual (QAM), current version

16.6. TestAmerica Corporate Environmental Health and Safety Manual, CW-E-M-001, and TestAmerica Canton Facility Addendum and Contingency Plan, current version

16.7. Corporate Quality Management Plan (CQMP), current version

16.8. Revision History

Historical File:		Revision 0: 12/11/13		

16.9. Associated SOPs and Policies, current version

16.9.1. QA Policy, QA-003

16.9.2. Statistical Evaluation of Data and Development of Control Charts, NC-QA-018

16.9.3. Method Detection Limits and Instrument Detection Limits, NC-QA-021 and CA-Q-S-006

16.9.4. Standards and Reagents, NC-QA-017

16.9.5. Cleanup Procedures for Organic Extractable Samples, NC-OP-025

16.9.6. Acceptable Manual Integration Practices, CA-Q-S-002

16.9.7. Calibration Curves (General), CA-Q-S-005

16.9.8. Section of Calibration Points, CA-T-P-002

16.9.9. Continuous Liquid / Liquid Extraction of Organic Compounds from Waters Based on Methods SW846 3520C and 600, NC-OP-037

16.9.10. Separatory Funnel Extraction of Organic Compounds from Waters Based on Methods SW846 3510C and 600 Series NC-OP-038

16.9.11. Sonication Extraction of Organic Compounds from Soils Based on Method SW846 3550C NC-OP-039

16.9.12. Soxhlet (Traditional) Extraction of Organic Compounds from Soils Based on Method SW846 3540C NC-OP-040

17. MISCELLANEOUS

17.1. Modifications from Reference Method

17.1.1. Chapter 1 of SW-846 states the method blank must not contain any analyte of interest at, or above, the Method Detection Limit. This SOP states the Method Blank must not contain any analyte of interest at, or above, the reporting limit.

TABLE 1
Recommended Instrument Conditions for TPH Analysis

Parameter	Recommended Conditions
Column	RTX-5
Initial Temperature	40°C
Initial Hold Time	4 minutes
Temperature Program	10°C/minute
Final Temperature	280°C
Final Hold Time	10 minutes
Injection	1µL
Carrier Gas	Hydrogen carrier gas – flow rate 5 – 6 mL/min
Detector Gas Mixture	Air hydrogen mixture in a 10:1 ratio, air 80 – 120 mL/min, hydrogen 8 -12 mL/min

TABLE 2
Reporting Limits for TPH Analysis

Analyte	Reporting Limits		
	Water (µg/L)	Solids (mg/kg)	Waste Dilution (mg/kg)
TPH (as Diesel)	500	16.7	200
C10-C20 (OVAP & BUSTR – Middle Distillates)	500	16.7	
C20-C34 (OVAP & BUSTR – Heavy Distillates)	500	16.7	
Fingerprint Compounds[1]			
Mineral Spirits	Kerosene	Motor Oil	
Hydraulic Oil	Jet Fuel		

[1] *This list represents most of the common petroleum hydrocarbons. The list may be expanded to include other petroleum hydrocarbons.*

TABLE 3
Calibration Levels for Methods 8015B , 8015C, and 8015D (ng/L)

	Level 1	Level 2	Level 3	Level 4	Level 5
TPH (as Diesel)	100	200	500	1000	2000
TPH (as Diesel) LVI [1]	20	40	100	200	400
o-Terphenyl (ng/uL)	8	16	40	80	160
o-Terphenyl (ng/uL) LVI[1]	1.6	3.2	8	16	32

[1] *For LVI analysis, a 5 ul injection will be used.*

TABLE 4

Suggested Analytical Sequence
Initial Calibration

Solvent blank (optional)	
Primer if needed	
Marker Solution	
Diesel Standard	All levels
ICV	
Up to 20 samples (unless 12 hours comes first)	
Mid-level Diesel Standard (Continuing calibration)	

Note: A solvent blank or primer may be analyzed at any time during the sequence when highly contaminated samples are expected. A solvent blank or primer may not be analyzed as routine immediately prior to standards.

Note: The initial

APPENDIX C: LABORATORY CERTIFICATION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

BUREAU OF LABORATORIES

LABORATORY ACCREDITATION PROGRAM

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Certifies That

02-00416

TestAmerica Laboratories Pittsburgh

301 Alpha Drive, Pittsburgh, PA 15238

Having duly met the requirement of
The act of June 29, 2002 (P.L. 596, No. 90)
dealing with Environmental Laboratories Accreditation
(27 Pa. C.S. §§4104-4113) and the
National Environmental Laboratory Accreditation Program Standard

is hereby approved as an

Accredited Laboratory

to conduct analysis within the fields of accreditations more fully described in the attached Scope of Accreditation

Expiration Date: **04/30/2018**

Certificate Number: **014**

Aaren S. Alger, Chief
Laboratory Accreditation Program
Bureau of Laboratories

Continued accreditation status depends on successful ongoing participation in the program
Certificate not transferable Surrender upon revocation
To be conspicuously displayed at the Laboratory
Not valid unless accompanied by a valid Scope of Accreditation
Shall not be used to imply endorsement by the Commonwealth of Pennsylvania
Customers are urged to verify the laboratory's current accreditation status
PA DEP is a NELAP recognized accreditation body

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DEPARTMENT OF ENVIRONMENTAL PROTECTION

Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 014-002 expiration date April 30, 2018. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 02-00416 **EPA Lab Code: PA00164** **TNI Code: TNI02151** **(412) 963-7058**
PADWIS ID: 02416

TestAmerica Laboratories Pittsburgh
301 Alpha Drive
Pittsburgh, PA 15238

Matrix: Drinking Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
SM 9223 Colilert		Total coliform & E. coli (P/A)	NELAP	PA	6/1/2016

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
ASTM D5057-90		Apparent specific gravity	NELAP	PA	9/27/2010
ASTM D5057-90		Bulk density	NELAP	PA	9/27/2010
EPA 1010	A	Ignitability	NELAP	PA	3/4/2013
EPA 120.1		Conductivity	NELAP	PA	11/15/2011
EPA 1311		Toxicity characteristic leaching procedure (TCLP)	NELAP	PA	12/5/2013
EPA 160.4		Residue, volatile	NELAP	PA	2/3/2016
EPA 1664	B	Non-polar material	NELAP	PA	1/10/2014
EPA 1664	A	Non-polar material	NELAP	PA	8/24/2005
EPA 1664	B	Oil and grease	NELAP	PA	1/10/2014
EPA 1664	A	Oil and grease	NELAP	PA	4/7/2005
EPA 180.1		Turbidity	NELAP	PA	8/26/2006
EPA 200.7	4.4	Aluminum	NELAP	PA	4/7/2005
EPA 200.7	4.4	Antimony	NELAP	PA	4/7/2005
EPA 200.7	4.4	Arsenic	NELAP	PA	4/7/2005
EPA 200.7	4.4	Barium	NELAP	PA	4/7/2005
EPA 200.7	4.4	Beryllium	NELAP	PA	4/7/2005
EPA 200.7	4.4	Boron	NELAP	PA	4/7/2005
EPA 200.7	4.4	Cadmium	NELAP	PA	4/7/2005
EPA 200.7	4.4	Calcium	NELAP	PA	4/7/2005
EPA 200.7	4.4	Chromium	NELAP	PA	4/7/2005
EPA 200.7	4.4	Cobalt	NELAP	PA	4/7/2005
EPA 200.7	4.4	Copper	NELAP	PA	4/7/2005
EPA 200.7	4.4	Iron	NELAP	PA	4/7/2005
EPA 200.7	4.4	Lead	NELAP	PA	4/7/2005
EPA 200.7	4.4	Lithium	NELAP	PA	9/5/2012
EPA 200.7	4.4	Magnesium	NELAP	PA	4/7/2005
EPA 200.7	4.4	Manganese	NELAP	PA	4/7/2005
EPA 200.7	4.4	Molybdenum	NELAP	PA	4/7/2005
EPA 200.7	4.4	Nickel	NELAP	PA	4/7/2005
EPA 200.7	4.4	Potassium	NELAP	PA	4/7/2005
EPA 200.7	4.4	Selenium	NELAP	PA	4/7/2005
EPA 200.7	4.4	Silica, as SiO2	NELAP	PA	8/24/2005

Aaron Alger

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DEP Laboratory ID: 02-00416 **EPA Lab Code: PA00164** **TNI Code: TNI02151** **(412) 963-7058**
PADWIS ID: 02416

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 200.7	4.4	Silver	NELAP	PA	4/7/2005
EPA 200.7	4.4	Sodium	NELAP	PA	4/7/2005
EPA 200.7	4.4	Strontium	NELAP	PA	3/1/2007
EPA 200.7	4.4	Thallium	NELAP	PA	4/7/2005
EPA 200.7	4.4	Tin	NELAP	PA	4/7/2005
EPA 200.7	4.4	Titanium	NELAP	PA	4/7/2005
EPA 200.7	4.4	Vanadium	NELAP	PA	4/7/2005
EPA 200.7	4.4	Zinc	NELAP	PA	4/7/2005
EPA 200.8	5.4	Aluminum	NELAP	PA	4/7/2005
EPA 200.8	5.4	Antimony	NELAP	PA	4/7/2005
EPA 200.8	5.4	Arsenic	NELAP	PA	3/21/2012
EPA 200.8	5.4	Barium	NELAP	PA	4/7/2005
EPA 200.8	5.4	Beryllium	NELAP	PA	4/7/2005
EPA 200.8	5.4	Boron	NELAP	PA	8/24/2005
EPA 200.8	5.4	Cadmium	NELAP	PA	4/7/2005
EPA 200.8	5.4	Calcium	NELAP	PA	8/24/2005
EPA 200.8	5.4	Chromium	NELAP	PA	4/7/2005
EPA 200.8	5.4	Cobalt	NELAP	PA	4/7/2005
EPA 200.8	5.4	Copper	NELAP	PA	11/15/2011
EPA 200.8	5.4	Iron	NELAP	PA	8/24/2005
EPA 200.8	5.4	Lead	NELAP	PA	4/7/2005
EPA 200.8	5.4	Lithium	NELAP	PA	3/24/2017
EPA 200.8	5.4	Magnesium	NELAP	PA	8/24/2005
EPA 200.8	5.4	Manganese	NELAP	PA	1/22/2007
EPA 200.8	5.4	Molybdenum	NELAP	PA	4/7/2005
EPA 200.8	5.4	Nickel	NELAP	PA	4/7/2005
EPA 200.8	5.4	Phosphorus, total	NELAP	PA	1/21/2010
EPA 200.8	5.4	Potassium	NELAP	PA	8/24/2005
EPA 200.8	5.4	Selenium	NELAP	PA	4/7/2005
EPA 200.8	5.4	Silica, as SiO2	NELAP	PA	4/18/2006
EPA 200.8	5.4	Silver	NELAP	PA	4/7/2005
EPA 200.8	5.4	Sodium	NELAP	PA	8/24/2005
EPA 200.8	5.4	Strontium	NELAP	PA	3/1/2007
EPA 200.8	5.4	Thallium	NELAP	PA	4/7/2005
EPA 200.8	5.4	Thorium	NELAP	PA	3/24/2017
EPA 200.8	5.4	Tin	NELAP	PA	8/24/2005
EPA 200.8	5.4	Titanium	NELAP	PA	8/24/2005
EPA 200.8	5.4	Uranium, total	NELAP	PA	3/24/2017
EPA 200.8	5.4	Vanadium	NELAP	PA	4/7/2005
EPA 200.8	5.4	Zinc	NELAP	PA	4/7/2005
EPA 245.1	3.0	Mercury	NELAP	PA	4/7/2005
EPA 300.0	2.1	Bromide	NELAP	PA	8/24/2005
EPA 300.0	2.1	Chloride	NELAP	PA	4/7/2005
EPA 300.0	2.1	Fluoride	NELAP	PA	8/24/2005
EPA 300.0	2.1	Nitrate as N	NELAP	PA	4/7/2005

Karen Alger

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DEP Laboratory ID: 02-00416 **EPA Lab Code: PA00164** **TNI Code: TNI02151** **(412) 963-7058**
PADWIS ID: 02416

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 300.0	2.1	Nitrite as N	NELAP	PA	4/7/2005
EPA 300.0	2.1	Orthophosphate as P	NELAP	PA	4/7/2005
EPA 300.0	2.1	Sulfate	NELAP	PA	4/7/2005
EPA 3005	A	Preconcentration under acid	NELAP	PA	8/26/2006
EPA 3010	A	Hot plate acid digestion (HNO3 + HCl)	NELAP	PA	8/26/2006
EPA 3060	A	Alkaline digestion of Cr(VI)	NELAP	PA	8/26/2006
EPA 350.1		Ammonia as N	NELAP	PA	7/11/2016
EPA 3500B		Organics extraction and sample preparation	NELAP	PA	8/26/2006
EPA 3510	C	Separatory funnel liquid-liquid extraction	NELAP	PA	8/26/2006
EPA 3520	C	Continuous liquid-liquid extraction	NELAP	PA	8/26/2006
EPA 353.2		Total nitrate-nitrite	NELAP	PA	8/26/2006
EPA 3535	A	Solid-phase extraction (SPE)	NELAP	PA	4/13/2009
EPA 3620	C	Florisil cleanup	NELAP	PA	3/16/2009
EPA 3620	B	Florisil cleanup	NELAP	PA	8/26/2006
EPA 3640	A	Gel permeation cleanup (GPC)	NELAP	PA	8/26/2006
EPA 3660	B	Sulfur cleanup	NELAP	PA	8/26/2006
EPA 410.4		Chemical oxygen demand (COD)	NELAP	PA	4/7/2005
EPA 420.1		Total phenolics	NELAP	PA	4/8/2008
EPA 5030	B	Aqueous-phase purge-and-trap	NELAP	PA	3/4/2013
EPA 5030	C	Aqueous-phase purge-and-trap	NELAP	PA	12/5/2013
EPA 6010		Aluminum	NELAP	PA	8/26/2006
EPA 6010		Antimony	NELAP	PA	8/26/2006
EPA 6010		Arsenic	NELAP	PA	8/26/2006
EPA 6010		Barium	NELAP	PA	8/26/2006
EPA 6010		Beryllium	NELAP	PA	8/26/2006
EPA 6010		Boron	NELAP	PA	8/26/2006
EPA 6010		Cadmium	NELAP	PA	8/26/2006
EPA 6010		Calcium	NELAP	PA	8/26/2006
EPA 6010		Chromium	NELAP	PA	8/26/2006
EPA 6010		Cobalt	NELAP	PA	8/26/2006
EPA 6010		Copper	NELAP	PA	8/26/2006
EPA 6010		Iron	NELAP	PA	8/26/2006
EPA 6010		Lead	NELAP	PA	8/26/2006
EPA 6010		Lithium	NELAP	PA	8/26/2006
EPA 6010		Magnesium	NELAP	PA	8/26/2006
EPA 6010		Manganese	NELAP	PA	8/26/2006
EPA 6010	C	Metals by ICP/AES	NELAP	PA	3/16/2009
EPA 6010	B	Metals by ICP/AES	NELAP	PA	4/8/2009
EPA 6010		Molybdenum	NELAP	PA	8/26/2006
EPA 6010		Nickel	NELAP	PA	8/26/2006
EPA 6010		Potassium	NELAP	PA	8/26/2006
EPA 6010		Selenium	NELAP	PA	8/26/2006
EPA 6010		Silica, as SiO2	NELAP	PA	4/18/2006
EPA 6010		Silicon	NELAP	PA	6/3/2010
EPA 6010		Silver	NELAP	PA	8/26/2006

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DEPARTMENT OF ENVIRONMENTAL PROTECTION

Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 014-002 expiration date April 30, 2018. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 02-00416 **EPA Lab Code: PA00164** **TNI Code: TNI02151** **(412) 963-7058**

PADWIS ID: 02416

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 6010		Sodium	NELAP	PA	8/26/2006
EPA 6010		Strontium	NELAP	PA	8/26/2006
EPA 6010		Thallium	NELAP	PA	8/26/2006
EPA 6010		Tin	NELAP	PA	8/26/2006
EPA 6010		Titanium	NELAP	PA	8/26/2006
EPA 6010		Vanadium	NELAP	PA	8/26/2006
EPA 6010		Zinc	NELAP	PA	8/26/2006
EPA 6020		Aluminum	NELAP	PA	8/26/2006
EPA 6020		Antimony	NELAP	PA	8/26/2006
EPA 6020		Arsenic	NELAP	PA	3/21/2012
EPA 6020		Barium	NELAP	PA	8/26/2006
EPA 6020		Beryllium	NELAP	PA	8/26/2006
EPA 6020		Boron	NELAP	PA	8/26/2006
EPA 6020		Cadmium	NELAP	PA	8/26/2006
EPA 6020		Calcium	NELAP	PA	8/26/2006
EPA 6020		Chromium	NELAP	PA	8/26/2006
EPA 6020		Cobalt	NELAP	PA	8/26/2006
EPA 6020		Copper	NELAP	PA	11/15/2011
EPA 6020		Iron	NELAP	PA	8/26/2006
EPA 6020		Lead	NELAP	PA	8/26/2006
EPA 6020		Lithium	NELAP	PA	3/24/2017
EPA 6020		Magnesium	NELAP	PA	8/26/2006
EPA 6020		Manganese	NELAP	PA	1/22/2007
EPA 6020	A	Metals by ICP/MS	NELAP	PA	3/16/2009
EPA 6020		Molybdenum	NELAP	PA	8/26/2006
EPA 6020		Nickel	NELAP	PA	8/26/2006
EPA 6020		Phosphorus, total	NELAP	PA	1/21/2010
EPA 6020		Potassium	NELAP	PA	8/26/2006
EPA 6020		Selenium	NELAP	PA	8/26/2006
EPA 6020		Silica, as SiO2	NELAP	PA	4/18/2006
EPA 6020		Silicon	NELAP	PA	6/3/2010
EPA 6020		Silver	NELAP	PA	8/26/2006
EPA 6020		Sodium	NELAP	PA	8/26/2006
EPA 6020		Strontium	NELAP	PA	8/26/2006
EPA 6020		Thallium	NELAP	PA	8/26/2006
EPA 6020		Thorium	NELAP	PA	3/24/2017
EPA 6020		Tin	NELAP	PA	8/26/2006
EPA 6020		Titanium	NELAP	PA	8/26/2006
EPA 6020		Uranium, total	NELAP	PA	3/24/2017
EPA 6020		Vanadium	NELAP	PA	8/26/2006
EPA 6020		Zinc	NELAP	PA	8/26/2006
EPA 608		4,4'-DDD	NELAP	PA	4/7/2005
EPA 608		4,4'-DDE	NELAP	PA	4/7/2005
EPA 608		4,4'-DDT	NELAP	PA	4/7/2005
EPA 608		Aldrin (HHDN)	NELAP	PA	4/7/2005

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DEP Laboratory ID: 02-00416 **EPA Lab Code: PA00164** **TNI Code: TNI02151** **(412) 963-7058**
PADWIS ID: 02416

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 608		Aroclor-1016 (PCB-1016)	NELAP	PA	4/7/2005
EPA 608		Aroclor-1221 (PCB-1221)	NELAP	PA	4/7/2005
EPA 608		Aroclor-1232 (PCB-1232)	NELAP	PA	4/7/2005
EPA 608		Aroclor-1242 (PCB-1242)	NELAP	PA	4/7/2005
EPA 608		Aroclor-1248 (PCB-1248)	NELAP	PA	4/7/2005
EPA 608		Aroclor-1254 (PCB-1254)	NELAP	PA	4/7/2005
EPA 608		Aroclor-1260 (PCB-1260)	NELAP	PA	4/7/2005
EPA 608		Aroclor-1262 (PCB-1262)	NELAP	PA	4/8/2009
EPA 608		Aroclor-1268 (PCB-1268)	NELAP	PA	4/8/2009
EPA 608		Chlordane (tech.)	NELAP	PA	4/7/2005
EPA 608		Dieldrin	NELAP	PA	4/7/2005
EPA 608		Endosulfan I	NELAP	PA	4/7/2005
EPA 608		Endosulfan II	NELAP	PA	4/7/2005
EPA 608		Endosulfan sulfate	NELAP	PA	4/7/2005
EPA 608		Endrin	NELAP	PA	4/7/2005
EPA 608		Endrin aldehyde	NELAP	PA	11/7/2006
EPA 608		Endrin ketone	NELAP	PA	3/1/2007
EPA 608		Heptachlor	NELAP	PA	4/7/2005
EPA 608		Heptachlor epoxide	NELAP	PA	4/7/2005
EPA 608		Methoxychlor	NELAP	PA	4/18/2006
EPA 608		Toxaphene (Chlorinated camphene)	NELAP	PA	4/7/2005
EPA 608		alpha-BHC (alpha-Hexachlorocyclohexane)	NELAP	PA	4/7/2005
EPA 608		alpha-Chlordane	NELAP	PA	4/18/2006
EPA 608		beta-BHC (beta-Hexachlorocyclohexane)	NELAP	PA	11/4/2016
EPA 608		delta-BHC (delta-Hexachlorocyclohexane)	NELAP	PA	4/7/2005
EPA 608		gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	NELAP	PA	4/7/2005
EPA 608		gamma-Chlordane	NELAP	PA	4/18/2006
EPA 624		1,1,1-Trichloroethane	NELAP	PA	4/7/2005
EPA 624		1,1,2,2-Tetrachloroethane	NELAP	PA	4/7/2005
EPA 624		1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	NELAP	PA	4/8/2009
EPA 624		1,1,2-Trichloroethane	NELAP	PA	4/7/2005
EPA 624		1,1-Dichloroethane	NELAP	PA	4/7/2005
EPA 624		1,1-Dichloroethene (1,1-Dichloroethylene)	NELAP	PA	4/7/2005
EPA 624		1,1-Dichloropropene	NELAP	PA	4/8/2009
EPA 624		1,2,3-Trichlorobenzene	NELAP	PA	4/8/2009
EPA 624		1,2,3-Trichloropropane (1,2,3-TCP)	NELAP	PA	4/8/2009
EPA 624		1,2,4-Trichlorobenzene	NELAP	PA	4/8/2009
EPA 624		1,2,4-Trimethylbenzene	NELAP	PA	4/8/2009
EPA 624		1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane)	NELAP	PA	4/8/2009
EPA 624		1,2-Dibromoethane (EDB, Ethylene dibromide)	NELAP	PA	4/8/2009
EPA 624		1,2-Dichlorobenzene (o-Dichlorobenzene)	NELAP	PA	4/7/2005
EPA 624		1,2-Dichloroethane	NELAP	PA	4/7/2005

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Laboratory Scope of Accreditation

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DEP Laboratory ID: 02-00416 **EPA Lab Code: PA00164** **TNI Code: TNI02151** **(412) 963-7058**
PADWIS ID: 02416

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 624		1,2-Dichloropropane	NELAP	PA	4/7/2005
EPA 624		1,3,5-Trichlorobenzene	NELAP	PA	4/8/2009
EPA 624		1,3,5-Trimethylbenzene	NELAP	PA	4/8/2009
EPA 624		1,3-Dichlorobenzene (m-Dichlorobenzene)	NELAP	PA	4/7/2005
EPA 624		1,3-Dichloropropane	NELAP	PA	4/8/2009
EPA 624		1,4-Dichlorobenzene (p-Dichlorobenzene)	NELAP	PA	4/7/2005
EPA 624		1,4-Dioxane (1,4-Diethyleneoxide)	NELAP	PA	4/8/2009
EPA 624		2,2-Dichloropropane	NELAP	PA	4/8/2009
EPA 624		2,3,6-Trichlorotoluene	NELAP	PA	4/8/2009
EPA 624		2,3-Dichlorotoluene	NELAP	PA	4/8/2009
EPA 624		2,4,5-Trichlorotoluene	NELAP	PA	4/8/2009
EPA 624		2,4-Dichlorobenzotrifluoride	NELAP	PA	4/8/2009
EPA 624		2,4-Dichlorotoluene	NELAP	PA	4/8/2009
EPA 624		2,5-Dichlorobenzotrifluoride	NELAP	PA	4/8/2009
EPA 624		2,5-Dichlorotoluene	NELAP	PA	4/8/2009
EPA 624		2,6-Dichlorotoluene	NELAP	PA	4/8/2009
EPA 624		2-Butanone (Methyl ethyl ketone, MEK)	NELAP	PA	3/1/2007
EPA 624		2-Chlorobenzotrifluoride	NELAP	PA	4/8/2009
EPA 624		2-Chloroethyl vinyl ether	NELAP	PA	4/7/2005
EPA 624		2-Hexanone	NELAP	PA	4/8/2008
EPA 624		3,4-Dichlorobenzotrifluoride	NELAP	PA	4/8/2009
EPA 624		3,4-Dichlorotoluene	NELAP	PA	4/8/2009
EPA 624		3-Chlorobenzotrifluoride	NELAP	PA	4/8/2009
EPA 624		3-Chlorotoluene	NELAP	PA	4/8/2009
EPA 624		4-Chlorobenzotrifluoride	NELAP	PA	4/8/2009
EPA 624		4-Chlorotoluene	NELAP	PA	4/8/2009
EPA 624		4-Methyl-2-pentanone (MIBK)	NELAP	PA	4/8/2008
EPA 624		Acetone	NELAP	PA	4/8/2008
EPA 624		Acetonitrile	NELAP	PA	4/8/2009
EPA 624		Acrolein (Propenal)	NELAP	PA	4/7/2005
EPA 624		Acrylonitrile	NELAP	PA	4/7/2005
EPA 624		Benzene	NELAP	PA	4/7/2005
EPA 624		Bromobenzene	NELAP	PA	4/8/2009
EPA 624		Bromochloromethane	NELAP	PA	3/1/2007
EPA 624		Bromodichloromethane	NELAP	PA	4/7/2005
EPA 624		Bromoform	NELAP	PA	4/7/2005
EPA 624		Carbon disulfide	NELAP	PA	4/8/2009
EPA 624		Carbon tetrachloride	NELAP	PA	4/7/2005
EPA 624		Chlorobenzene	NELAP	PA	4/7/2005
EPA 624		Chloroethane	NELAP	PA	4/7/2005
EPA 624		Chloroform	NELAP	PA	4/7/2005
EPA 624		Cyclohexane	NELAP	PA	4/8/2009
EPA 624		Cyclohexanol	NELAP	PA	4/8/2009
EPA 624		Dibromochloromethane	NELAP	PA	4/7/2005
EPA 624		Dibromomethane	NELAP	PA	4/8/2009

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Laboratory Scope of Accreditation

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DEP Laboratory ID: 02-00416 **EPA Lab Code: PA00164** **TNI Code: TNI02151** **(412) 963-7058**
PADWIS ID: 02416

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 624		Dichlorodifluoromethane (Freon 12)	NELAP	PA	4/8/2009
EPA 624		Ethyl methacrylate	NELAP	PA	4/8/2009
EPA 624		Ethylbenzene	NELAP	PA	4/7/2005
EPA 624		Hexachlorobutadiene (1,3-Hexachlorobutadiene)	NELAP	PA	4/8/2009
EPA 624		Iodomethane (Methyl iodide)	NELAP	PA	4/8/2009
EPA 624		Isobutyl alcohol (2-Methyl-1-propanol)	NELAP	PA	4/8/2009
EPA 624		Isopropylbenzene (Cumene)	NELAP	PA	4/8/2009
EPA 624		Methacrylonitrile	NELAP	PA	4/8/2009
EPA 624		Methyl acetate	NELAP	PA	4/8/2009
EPA 624		Methyl bromide (Bromomethane)	NELAP	PA	11/7/2006
EPA 624		Methyl chloride (Chloromethane)	NELAP	PA	4/7/2005
EPA 624		Methyl tert-butyl ether (MTBE)	NELAP	PA	4/8/2008
EPA 624		Methylcyclohexane	NELAP	PA	4/8/2009
EPA 624		Methylene chloride (Dichloromethane)	NELAP	PA	4/7/2005
EPA 624		Methylmethacrylate	NELAP	PA	4/8/2009
EPA 624		Naphthalene	NELAP	PA	4/8/2009
EPA 624		Propionitrile (Ethyl cyanide)	NELAP	PA	4/8/2009
EPA 624		Styrene	NELAP	PA	4/8/2009
EPA 624		Tetrachloroethene (PCE, Perchloroethylene)	NELAP	PA	4/7/2005
EPA 624		Toluene	NELAP	PA	4/7/2005
EPA 624		Trichloroethene (TCE, Trichloroethylene)	NELAP	PA	4/7/2005
EPA 624		Trichlorofluoromethane (Freon 11)	NELAP	PA	4/7/2005
EPA 624		Vinyl acetate	NELAP	PA	4/8/2009
EPA 624		Vinyl chloride (Chloroethene)	NELAP	PA	4/7/2005
EPA 624		Xylenes, total	NELAP	PA	4/7/2005
EPA 624		cis-1,2-Dichloroethene	NELAP	PA	4/8/2009
EPA 624		cis-1,3-Dichloropropene	NELAP	PA	4/7/2005
EPA 624		m+p-Xylene	NELAP	PA	8/24/2005
EPA 624		n-Butylbenzene	NELAP	PA	4/8/2009
EPA 624		n-Hexane	NELAP	PA	4/20/2011
EPA 624		n-Propylbenzene	NELAP	PA	4/8/2009
EPA 624		o-Xylene	NELAP	PA	8/24/2005
EPA 624		p-Isopropyltoluene (4-Isopropyltoluene)	NELAP	PA	4/8/2009
EPA 624		sec-Butylbenzene	NELAP	PA	4/8/2009
EPA 624		tert-Butyl alcohol (2-Methyl-2-propanol)	NELAP	PA	4/8/2009
EPA 624		tert-Butylbenzene	NELAP	PA	4/8/2009
EPA 624		trans-1,2-Dichloroethene	NELAP	PA	4/7/2005
EPA 624		trans-1,3-Dichloropropene	NELAP	PA	4/7/2005
EPA 624		trans-1,4-Dichloro-2-butene	NELAP	PA	4/8/2009
EPA 625		1,1'-Biphenyl (Biphenyl, Lemonene)	NELAP	PA	4/8/2009
EPA 625		1,2,3,4-Tetrahydronaphthalene	NELAP	PA	4/8/2009
EPA 625		1,2,4,5-Tetrachlorobenzene	NELAP	PA	4/8/2009
EPA 625		1,2,4-Trichlorobenzene	NELAP	PA	4/7/2005
EPA 625		1,2-Dichlorobenzene (o-Dichlorobenzene)	NELAP	PA	4/7/2005
EPA 625		1,2-Diphenylhydrazine	NELAP	PA	4/8/2009

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DEP Laboratory ID: 02-00416 **EPA Lab Code: PA00164** **TNI Code: TNI02151** **(412) 963-7058**
PADWIS ID: 02416

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 625		1,3-Dichlorobenzene (m-Dichlorobenzene)	NELAP	PA	4/7/2005
EPA 625		1,3-Dinitrobenzene (1,3-DNB)	NELAP	PA	4/8/2009
EPA 625		1,4-Dichlorobenzene (p-Dichlorobenzene)	NELAP	PA	4/7/2005
EPA 625		1,4-Dioxane (1,4-Diethyleneoxide)	NELAP	PA	4/8/2009
EPA 625		1-Methylnaphthalene	NELAP	PA	4/8/2009
EPA 625		2,2'-Oxybis(1-chloropropane) (bis(2-Chloro-1-methylethyl) ether)	NELAP	PA	4/8/2009
EPA 625		2,2'-oxybis(1-Chloropropane)	NELAP	PA	4/7/2005
EPA 625		2,3,4,6-Tetrachlorophenol	NELAP	PA	4/8/2009
EPA 625		2,3,5,6-Tetrachlorophenol	NELAP	PA	4/8/2009
EPA 625		2,3-Dichloroaniline	NELAP	PA	4/8/2009
EPA 625		2,4,5-Trichlorophenol	NELAP	PA	8/24/2005
EPA 625		2,4,6-Trichlorophenol	NELAP	PA	4/7/2005
EPA 625		2,4-Dichlorophenol	NELAP	PA	4/7/2005
EPA 625		2,4-Dimethylphenol	NELAP	PA	4/7/2005
EPA 625		2,4-Dinitrophenol	NELAP	PA	4/7/2005
EPA 625		2,4-Dinitrotoluene (2,4-DNT)	NELAP	PA	4/7/2005
EPA 625		2,6-Dinitrotoluene (2,6-DNT)	NELAP	PA	4/8/2009
EPA 625		2-Bromonaphthalene	NELAP	PA	4/8/2009
EPA 625		2-Chloronaphthalene	NELAP	PA	4/7/2005
EPA 625		2-Chlorophenol	NELAP	PA	4/7/2005
EPA 625		2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	NELAP	PA	4/7/2005
EPA 625		2-Methylnaphthalene	NELAP	PA	8/24/2005
EPA 625		2-Methylphenol (o-Cresol)	NELAP	PA	4/18/2006
EPA 625		2-Nitroaniline	NELAP	PA	4/18/2006
EPA 625		2-Nitrophenol	NELAP	PA	4/7/2005
EPA 625		3+4-Methylphenol (m+p-Cresol)	NELAP	PA	3/1/2007
EPA 625		3,3'-Dichlorobenzidine	NELAP	PA	4/7/2005
EPA 625		3-Chloroaniline	NELAP	PA	4/8/2009
EPA 625		3-Nitroaniline	NELAP	PA	4/18/2006
EPA 625		4,4'-Methylenebis(2-chloroaniline)	NELAP	PA	4/8/2009
EPA 625		4-Bromophenyl phenyl ether	NELAP	PA	4/7/2005
EPA 625		4-Chloro-3-methylphenol	NELAP	PA	4/7/2005
EPA 625		4-Chloroaniline	NELAP	PA	4/8/2009
EPA 625		4-Chlorophenyl phenyl ether	NELAP	PA	4/7/2005
EPA 625		4-Nitroaniline	NELAP	PA	4/18/2006
EPA 625		4-Nitrobiphenyl	NELAP	PA	4/8/2009
EPA 625		4-Nitrophenol	NELAP	PA	4/7/2005
EPA 625		6-Methylchrysene	NELAP	PA	4/8/2009
EPA 625		Acenaphthene	NELAP	PA	4/7/2005
EPA 625		Acenaphthylene	NELAP	PA	10/27/2010
EPA 625		Acetophenone	NELAP	PA	8/24/2005
EPA 625		Aniline	NELAP	PA	8/24/2005
EPA 625		Anthracene	NELAP	PA	4/7/2005
EPA 625		Aramite	NELAP	PA	4/8/2009

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DEP Laboratory ID: 02-00416 **EPA Lab Code: PA00164** **TNI Code: TNI02151** **(412) 963-7058**
PADWIS ID: 02416

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 625		Atrazine	NELAP	PA	4/8/2009
EPA 625		Benzaldehyde	NELAP	PA	4/8/2009
EPA 625		Benzidine	NELAP	PA	4/7/2005
EPA 625		Benzo[a]anthracene	NELAP	PA	4/7/2005
EPA 625		Benzo[a]pyrene	NELAP	PA	4/7/2005
EPA 625		Benzo[b]fluoranthene	NELAP	PA	11/15/2011
EPA 625		Benzo[ghi]perylene	NELAP	PA	4/7/2005
EPA 625		Benzo[k]fluoranthene	NELAP	PA	11/15/2011
EPA 625		Benzoic acid	NELAP	PA	4/8/2009
EPA 625		Benzotrichloride	NELAP	PA	4/8/2009
EPA 625		Benzyl alcohol	NELAP	PA	4/8/2009
EPA 625		Butyl benzyl phthalate (Benzyl butyl phthalate)	NELAP	PA	4/7/2005
EPA 625		Caprolactam	NELAP	PA	4/8/2009
EPA 625		Carbaryl (Sevin)	NELAP	PA	4/8/2009
EPA 625		Carbazole	NELAP	PA	4/8/2009
EPA 625		Chrysene (Benzo[a]phenanthrene)	NELAP	PA	4/7/2005
EPA 625		Cresols (total)	NELAP	PA	4/18/2006
EPA 625		Di-n-butyl phthalate	NELAP	PA	4/7/2005
EPA 625		Di-n-octyl phthalate	NELAP	PA	11/15/2011
EPA 625		Diallate (cis or trans)	NELAP	PA	4/8/2009
EPA 625		Dibenz[a,h]acridine	NELAP	PA	4/8/2009
EPA 625		Dibenzo[a,h]anthracene	NELAP	PA	4/7/2005
EPA 625		Dibenzofuran	NELAP	PA	4/8/2009
EPA 625		Diethyl phthalate	NELAP	PA	4/7/2005
EPA 625		Dimethoate	NELAP	PA	4/8/2009
EPA 625		Dimethyl phthalate	NELAP	PA	4/7/2005
EPA 625		Fluoranthene	NELAP	PA	4/7/2005
EPA 625		Fluorene	NELAP	PA	4/7/2005
EPA 625		Hexachlorobenzene	NELAP	PA	4/7/2005
EPA 625		Hexachlorobutadiene (1,3-Hexachlorobutadiene)	NELAP	PA	4/7/2005
EPA 625		Hexachlorocyclopentadiene	NELAP	PA	4/7/2005
EPA 625		Hexachloroethane	NELAP	PA	4/7/2005
EPA 625		Indeno(1,2,3-cd)pyrene	NELAP	PA	4/7/2005
EPA 625		Isodrin	NELAP	PA	4/8/2009
EPA 625		Isophorone	NELAP	PA	4/7/2005
EPA 625		Kepone	NELAP	PA	4/8/2009
EPA 625		Methyl parathion (Parathion, methyl)	NELAP	PA	4/8/2009
EPA 625		N-Nitrosodi-n-propylamine	NELAP	PA	4/7/2005
EPA 625		N-Nitrosodiethylamine	NELAP	PA	4/8/2009
EPA 625		N-Nitrosodimethylamine	NELAP	PA	4/7/2005
EPA 625		N-Nitrosodiphenylamine	NELAP	PA	4/7/2005
EPA 625		Naphthalene	NELAP	PA	4/7/2005
EPA 625		Nitrobenzene	NELAP	PA	4/7/2005
EPA 625		Parathion, ethyl (Ethyl parathion, Parathion)	NELAP	PA	4/8/2009

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Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 014-002 expiration date April 30, 2018. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 02-00416 **EPA Lab Code: PA00164** **TNI Code: TNI02151** **(412) 963-7058**
PADWIS ID: 02416

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 625		Pentachlorobenzene	NELAP	PA	4/8/2009
EPA 625		Pentachlorophenol (PCP)	NELAP	PA	4/7/2005
EPA 625		Phenanthrene	NELAP	PA	4/7/2005
EPA 625		Phenol	NELAP	PA	4/7/2005
EPA 625		Pyrene	NELAP	PA	4/7/2005
EPA 625		Pyridine	NELAP	PA	4/8/2009
EPA 625		Trifluralin (Treflan)	NELAP	PA	4/8/2009
EPA 625		bis(2-Chloroethoxy)methane	NELAP	PA	4/7/2005
EPA 625		bis(2-Chloroethyl) ether	NELAP	PA	4/7/2005
EPA 625		bis(2-Ethylhexyl) phthalate (DEHP)	NELAP	PA	4/7/2005
EPA 625		n-Octadecane	NELAP	PA	4/8/2009
EPA 625		o-Toluidine (2-Toluidine, 2-Methylaniline)	NELAP	PA	4/8/2009
EPA 7196	A	Chromium VI	NELAP	PA	8/26/2006
EPA 7470	A	Mercury	NELAP	PA	8/26/2006
EPA 8011		1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane)	NELAP	PA	4/18/2006
EPA 8011		1,2-Dibromoethane (EDB, Ethylene dibromide)	NELAP	PA	4/18/2006
EPA 8081		2,4'-DDD	NELAP	PA	4/18/2006
EPA 8081		2,4'-DDE	NELAP	PA	4/18/2006
EPA 8081		2,4'-DDT	NELAP	PA	4/18/2006
EPA 8081		4,4'-DDD	NELAP	PA	8/26/2006
EPA 8081		4,4'-DDE	NELAP	PA	8/26/2006
EPA 8081		4,4'-DDT	NELAP	PA	8/26/2006
EPA 8081		Aldrin (HHDN)	NELAP	PA	8/26/2006
EPA 8081		Chlorbenside	NELAP	PA	4/18/2006
EPA 8081		Chlordane (tech.)	NELAP	PA	8/26/2006
EPA 8081		Chlorobenzilate	NELAP	PA	8/26/2006
EPA 8081		Dacthal (DCPA)	NELAP	PA	8/26/2006
EPA 8081		Diallate (cis or trans)	NELAP	PA	8/26/2006
EPA 8081		Dieldrin	NELAP	PA	8/26/2006
EPA 8081		Endosulfan I	NELAP	PA	8/26/2006
EPA 8081		Endosulfan II	NELAP	PA	8/26/2006
EPA 8081		Endosulfan sulfate	NELAP	PA	8/26/2006
EPA 8081		Endrin	NELAP	PA	8/26/2006
EPA 8081		Endrin aldehyde	NELAP	PA	11/7/2006
EPA 8081		Endrin ketone	NELAP	PA	1/6/2006
EPA 8081		Heptachlor	NELAP	PA	8/26/2006
EPA 8081		Heptachlor epoxide	NELAP	PA	8/26/2006
EPA 8081		Hexachlorobenzene	NELAP	PA	5/20/2011
EPA 8081		Isodrin	NELAP	PA	8/26/2006
EPA 8081		Methoxychlor	NELAP	PA	1/6/2006
EPA 8081		Mirex	NELAP	PA	8/26/2006
EPA 8081	B	Organochlorine pesticides by GC/ECD	NELAP	PA	1/1/2013
EPA 8081	A	Organochlorine pesticides by GC/ECD	NELAP	PA	4/8/2009
EPA 8081		Oxychlordane	NELAP	PA	4/8/2009

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Laboratory Scope of Accreditation

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DEP Laboratory ID: 02-00416 **EPA Lab Code: PA00164** **TNI Code: TNI02151** **(412) 963-7058**
PADWIS ID: 02416

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8081		Toxaphene (Chlorinated camphene)	NELAP	PA	8/26/2006
EPA 8081		alpha-BHC (alpha-Hexachlorocyclohexane)	NELAP	PA	8/26/2006
EPA 8081		alpha-Chlordane	NELAP	PA	1/6/2006
EPA 8081		beta-BHC (beta-Hexachlorocyclohexane)	NELAP	PA	11/4/2016
EPA 8081		cis-Nonachlor	NELAP	PA	4/18/2006
EPA 8081		delta-BHC (delta-Hexachlorocyclohexane)	NELAP	PA	8/26/2006
EPA 8081		gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	NELAP	PA	8/26/2006
EPA 8081		gamma-Chlordane	NELAP	PA	1/6/2006
EPA 8081		trans-Nonachlor	NELAP	PA	4/18/2006
EPA 8082		2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ 206)	NELAP	PA	8/26/2006
EPA 8082		2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ 195)	NELAP	PA	4/13/2009
EPA 8082		2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ 170)	NELAP	PA	8/26/2006
EPA 8082		2,2',3,3',4,4'-Hexachlorobiphenyl (BZ 128)	NELAP	PA	8/26/2006
EPA 8082		2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ 187)	NELAP	PA	8/26/2006
EPA 8082		2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ 183)	NELAP	PA	8/26/2006
EPA 8082		2,2',3,4,4',5'-Hexachlorobiphenyl (BZ 138)	NELAP	PA	8/26/2006
EPA 8082		2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ 180)	NELAP	PA	8/26/2006
EPA 8082		2,2',3,4,4',6,6'-Heptachlorobiphenyl (BZ 184)	NELAP	PA	4/13/2009
EPA 8082		2,2',3,4,5'-Pentachlorobiphenyl (BZ 87)	NELAP	PA	8/26/2006
EPA 8082		2,2',3,5'-Tetrachlorobiphenyl (BZ 44)	NELAP	PA	8/26/2006
EPA 8082		2,2',4,4',5,5'-Hexachlorobiphenyl (BZ 153)	NELAP	PA	8/26/2006
EPA 8082		2,2',4,5'-Tetrachlorobiphenyl (BZ 49)	NELAP	PA	8/26/2006
EPA 8082		2,2',4,5,5'-Pentachlorobiphenyl (BZ 101)	NELAP	PA	8/26/2006
EPA 8082		2,2',5,5'-Tetrachlorobiphenyl (BZ 52)	NELAP	PA	8/26/2006
EPA 8082		2,2',5-Trichlorobiphenyl (BZ 18)	NELAP	PA	8/26/2006
EPA 8082		2,3',4,4',5'-Pentachlorobiphenyl (BZ 123)	NELAP	PA	4/25/2014
EPA 8082		2,3',4,4',5,5'-Hexachlorobiphenyl (BZ 167)	NELAP	PA	4/25/2014
EPA 8082		2,3',4,4',5-Pentachlorobiphenyl (BZ 118)	NELAP	PA	8/26/2006
EPA 8082		2,3',4,4'-Tetrachlorobiphenyl (BZ 66)	NELAP	PA	8/26/2006
EPA 8082		2,3,3',4,4',5'-Hexachlorobiphenyl (BZ 157)	NELAP	PA	4/25/2014
EPA 8082		2,3,3',4,4',5,5'-Heptachlorobiphenyl (BZ 189)	NELAP	PA	4/25/2014
EPA 8082		2,3,3',4,4',5-Hexachlorobiphenyl (BZ 156)	NELAP	PA	4/13/2009
EPA 8082		2,3,3',4,4'-Pentachlorobiphenyl (BZ 105)	NELAP	PA	4/13/2009
EPA 8082		2,3,4,4',5-Pentachlorobiphenyl (BZ 114)	NELAP	PA	4/25/2014
EPA 8082		2,4'-Dichlorobiphenyl (BZ 8)	NELAP	PA	4/13/2009
EPA 8082		2,4,4'-Trichlorobiphenyl (BZ 28)	NELAP	PA	4/13/2009
EPA 8082		3,3',4,4',5,5'-Hexachlorobiphenyl (BZ 169)	NELAP	PA	4/13/2009
EPA 8082		3,3',4,4',5-Pentachlorobiphenyl (BZ 126)	NELAP	PA	9/6/2012

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DEP Laboratory ID: 02-00416 EPA Lab Code: PA00164 TNI Code: TNI02151 (412) 963-7058
PADWIS ID: 02416

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8082		3,3',4,4'-Tetrachlorobiphenyl (BZ 77)	NELAP	PA	4/13/2009
EPA 8082		3,4,4',5-Tetrachlorobiphenyl (BZ 81)	NELAP	PA	4/25/2014
EPA 8082		Aroclor-1016 (PCB-1016)	NELAP	PA	8/26/2006
EPA 8082		Aroclor-1221 (PCB-1221)	NELAP	PA	8/26/2006
EPA 8082		Aroclor-1232 (PCB-1232)	NELAP	PA	8/26/2006
EPA 8082		Aroclor-1242 (PCB-1242)	NELAP	PA	8/26/2006
EPA 8082		Aroclor-1248 (PCB-1248)	NELAP	PA	8/26/2006
EPA 8082		Aroclor-1254 (PCB-1254)	NELAP	PA	8/26/2006
EPA 8082		Aroclor-1260 (PCB-1260)	NELAP	PA	8/26/2006
EPA 8082		Aroclor-1262 (PCB-1262)	NELAP	PA	4/8/2008
EPA 8082		Aroclor-1268 (PCB-1268)	NELAP	PA	4/8/2008
EPA 8082		Decachlorobiphenyl	NELAP	PA	8/26/2006
EPA 8082	A	PCBs by GC/ECD	NELAP	PA	4/8/2009
EPA 8141		Azinphos-methyl (Guthion)	NELAP	PA	8/26/2006
EPA 8141		Bolstar (Sulprofos)	NELAP	PA	8/26/2006
EPA 8141		Chlorpyrifos	NELAP	PA	8/26/2006
EPA 8141		Coumaphos	NELAP	PA	8/26/2006
EPA 8141		Demeton	NELAP	PA	4/8/2009
EPA 8141		Demeton-O	NELAP	PA	8/26/2006
EPA 8141		Demeton-S	NELAP	PA	8/26/2006
EPA 8141		Diazinon (Spectracide)	NELAP	PA	8/26/2006
EPA 8141		Dichlorovos (DDVP, Dichlorvos)	NELAP	PA	8/26/2006
EPA 8141		Dimethoate	NELAP	PA	8/26/2006
EPA 8141		Disulfoton	NELAP	PA	8/26/2006
EPA 8141		EPN (Santox)	NELAP	PA	8/26/2006
EPA 8141		Ethoprop (Prophos)	NELAP	PA	8/26/2006
EPA 8141		Famphur	NELAP	PA	8/26/2006
EPA 8141		Fensulfothion	NELAP	PA	8/26/2006
EPA 8141		Fenthion	NELAP	PA	8/26/2006
EPA 8141		Malathion	NELAP	PA	8/26/2006
EPA 8141		Methyl parathion (Parathion, methyl)	NELAP	PA	8/26/2006
EPA 8141		Mevinphos	NELAP	PA	8/26/2006
EPA 8141		O,O,O-Triethyl phosphorothioate	NELAP	PA	3/1/2007
EPA 8141	A	Organophosphorus compounds by GC/NPD	NELAP	PA	4/8/2009
EPA 8141	B	Organophosphorus compounds by GC/NPD	NELAP	PA	4/8/2009
EPA 8141		Parathion, ethyl (Ethyl parathion, Parathion)	NELAP	PA	8/26/2006
EPA 8141		Phorate (Thimet)	NELAP	PA	8/26/2006
EPA 8141		Ronnel	NELAP	PA	8/26/2006
EPA 8141		Stirophos (Tetrachlorovinphos)	NELAP	PA	8/26/2006
EPA 8141		Sulfotepp (Tetraethyl dithiopyrophosphate)	NELAP	PA	8/26/2006
EPA 8141		Thionazine (Thionazin, Zinophos)	NELAP	PA	8/26/2006
EPA 8141		Tokuthion (Prothiophos)	NELAP	PA	8/26/2006
EPA 8141		Trichloronate	NELAP	PA	8/26/2006
EPA 8141		Triphenyl phosphate	NELAP	PA	4/22/2010
EPA 8151		2,4,5-T	NELAP	PA	8/26/2006

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DEP Laboratory ID: 02-00416 **EPA Lab Code: PA00164** **TNI Code: TNI02151** **(412) 963-7058**
PADWIS ID: 02416

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8151		2,4,5-TP (Silvex)	NELAP	PA	8/26/2006
EPA 8151		2,4-D	NELAP	PA	8/26/2006
EPA 8151		2,4-DB (Butoxon)	NELAP	PA	8/26/2006
EPA 8151	A	Chlorinated herbicides by GC/ECD	NELAP	PA	4/8/2009
EPA 8151		Dalapon (2,2-Dichloropropionic acid)	NELAP	PA	8/26/2006
EPA 8151		Dicamba	NELAP	PA	8/26/2006
EPA 8151		Dichloroprop (Dichlorprop)	NELAP	PA	8/26/2006
EPA 8151		Dinoseb (2-sec-Butyl-4,6-dinitrophenol, DNBP)	NELAP	PA	8/26/2006
EPA 8151		MCPA	NELAP	PA	8/26/2006
EPA 8151		MCPP (Mecoprop)	NELAP	PA	8/26/2006
EPA 8151		Pentachlorophenol (PCP)	NELAP	PA	8/26/2006
EPA 8260		1,1,1,2-Tetrachloroethane	NELAP	PA	4/18/2006
EPA 8260		1,1,1-Trichloroethane	NELAP	PA	8/26/2006
EPA 8260		1,1,2,2-Tetrachloroethane	NELAP	PA	8/26/2006
EPA 8260		1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	NELAP	PA	4/18/2006
EPA 8260		1,1,2-Trichloroethane	NELAP	PA	8/26/2006
EPA 8260		1,1-Dichloroethane	NELAP	PA	8/26/2006
EPA 8260		1,1-Dichloroethene (1,1-Dichloroethylene)	NELAP	PA	8/26/2006
EPA 8260		1,1-Dichloropropene	NELAP	PA	8/26/2006
EPA 8260		1,2,3-Trichlorobenzene	NELAP	PA	8/26/2006
EPA 8260		1,2,3-Trichloropropane (1,2,3-TCP)	NELAP	PA	8/26/2006
EPA 8260		1,2,4-Trichlorobenzene	NELAP	PA	8/26/2006
EPA 8260		1,2,4-Trimethylbenzene	NELAP	PA	8/26/2006
EPA 8260		1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane)	NELAP	PA	4/18/2006
EPA 8260		1,2-Dibromoethane (EDB, Ethylene dibromide)	NELAP	PA	8/26/2006
EPA 8260		1,2-Dichlorobenzene (o-Dichlorobenzene)	NELAP	PA	8/26/2006
EPA 8260		1,2-Dichloroethane	NELAP	PA	8/26/2006
EPA 8260		1,2-Dichloroethene (total)	NELAP	PA	3/1/2007
EPA 8260		1,2-Dichloropropane	NELAP	PA	8/26/2006
EPA 8260		1,3,5-Trichlorobenzene	NELAP	PA	4/8/2009
EPA 8260		1,3,5-Trimethylbenzene	NELAP	PA	8/26/2006
EPA 8260		1,3-Dichlorobenzene (m-Dichlorobenzene)	NELAP	PA	8/26/2006
EPA 8260		1,3-Dichloropropane	NELAP	PA	8/26/2006
EPA 8260		1,4-Dichlorobenzene (p-Dichlorobenzene)	NELAP	PA	8/26/2006
EPA 8260		1,4-Dioxane (1,4-Diethyleneoxide)	NELAP	PA	8/26/2006
EPA 8260		2,2,4-Trimethylpentane (Iso-octane)	NELAP	PA	12/5/2007
EPA 8260		2,2-Dichloropropane	NELAP	PA	8/26/2006
EPA 8260		2,3,6-Trichlorotoluene	NELAP	PA	4/8/2009
EPA 8260		2,3-Dichlorotoluene	NELAP	PA	4/8/2009
EPA 8260		2,4,5-Trichlorotoluene	NELAP	PA	4/8/2009
EPA 8260		2,4-Dichlorobenzotrifluoride	NELAP	PA	4/8/2009
EPA 8260		2,4-Dichlorotoluene	NELAP	PA	4/8/2009

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DEP Laboratory ID: 02-00416 **EPA Lab Code: PA00164** **TNI Code: TNI02151** **(412) 963-7058**
PADWIS ID: 02416

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8260		2,5-Dichlorobenzotrifluoride	NELAP	PA	4/8/2009
EPA 8260		2,5-Dichlorotoluene	NELAP	PA	4/8/2009
EPA 8260		2,6-Dichlorotoluene	NELAP	PA	4/8/2009
EPA 8260		2-Butanone (Methyl ethyl ketone, MEK)	NELAP	PA	4/18/2006
EPA 8260		2-Chlorobenzotrifluoride	NELAP	PA	4/8/2009
EPA 8260		2-Chloroethyl vinyl ether	NELAP	PA	8/26/2006
EPA 8260		2-Chlorotoluene	NELAP	PA	8/26/2006
EPA 8260		2-Hexanone	NELAP	PA	1/6/2006
EPA 8260		2-Nitropropane	NELAP	PA	8/26/2006
EPA 8260		3,4-Dichlorobenzotrifluoride	NELAP	PA	4/8/2009
EPA 8260		3,4-Dichlorotoluene	NELAP	PA	4/8/2009
EPA 8260		3-Chlorobenzotrifluoride	NELAP	PA	4/8/2009
EPA 8260		3-Chlorotoluene	NELAP	PA	4/22/2010
EPA 8260		4-Chlorobenzotrifluoride	NELAP	PA	4/8/2009
EPA 8260		4-Chlorotoluene	NELAP	PA	8/26/2006
EPA 8260		4-Methyl-2-pentanone (MIBK)	NELAP	PA	8/26/2006
EPA 8260		Acetone	NELAP	PA	1/6/2006
EPA 8260		Acetonitrile	NELAP	PA	8/26/2006
EPA 8260		Acrolein (Propenal)	NELAP	PA	8/26/2006
EPA 8260		Acrylonitrile	NELAP	PA	8/26/2006
EPA 8260		Allyl chloride (3-Chloropropene)	NELAP	PA	8/26/2006
EPA 8260		Benzene	NELAP	PA	8/26/2006
EPA 8260		Benzyl chloride	NELAP	PA	8/26/2006
EPA 8260		Bromobenzene	NELAP	PA	8/26/2006
EPA 8260		Bromochloromethane	NELAP	PA	8/26/2006
EPA 8260		Bromodichloromethane	NELAP	PA	8/26/2006
EPA 8260		Bromoform	NELAP	PA	8/26/2006
EPA 8260		Carbon disulfide	NELAP	PA	1/6/2006
EPA 8260		Carbon tetrachloride	NELAP	PA	8/26/2006
EPA 8260		Chlorobenzene	NELAP	PA	8/26/2006
EPA 8260		Chloroethane	NELAP	PA	8/26/2006
EPA 8260		Chloroform	NELAP	PA	8/26/2006
EPA 8260		Chloroprene (2-Chloro-1,3-butadiene)	NELAP	PA	8/26/2006
EPA 8260		Cyclohexane	NELAP	PA	4/18/2006
EPA 8260		Cyclohexanol	NELAP	PA	4/8/2009
EPA 8260		Dibromochloromethane	NELAP	PA	8/26/2006
EPA 8260		Dibromofluoromethane	NELAP	PA	8/26/2006
EPA 8260		Dibromomethane	NELAP	PA	4/18/2006
EPA 8260		Dichlorodifluoromethane (Freon 12)	NELAP	PA	8/26/2006
EPA 8260		Dichlorofluoromethane (Freon 21)	NELAP	PA	4/8/2009
EPA 8260		Diethyl ether (Ethyl ether)	NELAP	PA	8/26/2006
EPA 8260		Ethyl acrylate	NELAP	PA	12/5/2007
EPA 8260		Ethyl methacrylate	NELAP	PA	4/18/2006
EPA 8260		Ethylbenzene	NELAP	PA	8/26/2006
EPA 8260		Heptane	NELAP	PA	4/18/2006

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Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 014-002 expiration date April 30, 2018. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 02-00416 **EPA Lab Code: PA00164** **TNI Code: TNI02151** **(412) 963-7058**
PADWIS ID: 02416

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8260		Hexachlorobutadiene (1,3-Hexachlorobutadiene)	NELAP	PA	8/26/2006
EPA 8260		Iodomethane (Methyl iodide)	NELAP	PA	8/26/2006
EPA 8260		Isobutyl alcohol (2-Methyl-1-propanol)	NELAP	PA	8/26/2006
EPA 8260		Isopropyl alcohol (2-Propanol)	NELAP	PA	8/26/2006
EPA 8260		Isopropylbenzene (Cumene)	NELAP	PA	8/26/2006
EPA 8260		Methacrylonitrile	NELAP	PA	8/26/2006
EPA 8260		Methyl acetate	NELAP	PA	4/18/2006
EPA 8260		Methyl bromide (Bromomethane)	NELAP	PA	8/26/2006
EPA 8260		Methyl chloride (Chloromethane)	NELAP	PA	8/26/2006
EPA 8260		Methyl tert-butyl ether (MTBE)	NELAP	PA	8/26/2006
EPA 8260		Methylcyclohexane	NELAP	PA	4/18/2006
EPA 8260		Methylene chloride (Dichloromethane)	NELAP	PA	8/26/2006
EPA 8260		Methylmethacrylate	NELAP	PA	4/18/2006
EPA 8260		Naphthalene	NELAP	PA	8/26/2006
EPA 8260		Propionitrile (Ethyl cyanide)	NELAP	PA	4/18/2006
EPA 8260		Styrene	NELAP	PA	1/6/2006
EPA 8260		Tetrachloroethene (PCE, Perchloroethylene)	NELAP	PA	8/26/2006
EPA 8260		Tetrahydrofuran (THF)	NELAP	PA	4/22/2010
EPA 8260		Toluene	NELAP	PA	8/26/2006
EPA 8260		Trichloroethene (TCE, Trichloroethylene)	NELAP	PA	8/26/2006
EPA 8260		Trichlorofluoromethane (Freon 11)	NELAP	PA	8/26/2006
EPA 8260	C	VOCs by GC/MS	NELAP	PA	12/5/2013
EPA 8260	B	VOCs by GC/MS	NELAP	PA	4/8/2009
EPA 8260		Vinyl acetate	NELAP	PA	1/6/2006
EPA 8260		Vinyl chloride (Chloroethene)	NELAP	PA	8/26/2006
EPA 8260		Xylenes, total	NELAP	PA	3/30/2006
EPA 8260		cis-1,2-Dichloroethene	NELAP	PA	8/26/2006
EPA 8260		cis-1,3-Dichloropropene	NELAP	PA	8/26/2006
EPA 8260		m+p-Xylene	NELAP	PA	8/24/2005
EPA 8260		m-Xylene	NELAP	PA	8/26/2006
EPA 8260		n-Butylbenzene	NELAP	PA	8/26/2006
EPA 8260		n-Hexane	NELAP	PA	12/5/2007
EPA 8260		n-Propylbenzene	NELAP	PA	8/26/2006
EPA 8260		o-Xylene	NELAP	PA	8/24/2005
EPA 8260		p-Isopropyltoluene (4-Isopropyltoluene)	NELAP	PA	8/26/2006
EPA 8260		p-Xylene	NELAP	PA	8/26/2006
EPA 8260		sec-Butylbenzene	NELAP	PA	8/26/2006
EPA 8260		tert-Butyl alcohol (2-Methyl-2-propanol)	NELAP	PA	4/8/2008
EPA 8260		tert-Butylbenzene	NELAP	PA	8/26/2006
EPA 8260		trans-1,2-Dichloroethene	NELAP	PA	8/26/2006
EPA 8260		trans-1,3-Dichloropropene	NELAP	PA	8/26/2006
EPA 8260		trans-1,4-Dichloro-2-butene	NELAP	PA	8/26/2006
EPA 8270		1,1'-Biphenyl (Biphenyl, Lemonene)	NELAP	PA	4/18/2006
EPA 8270		1,2,3,4-Tetrachlorobenzene	NELAP	PA	8/26/2006
EPA 8270		1,2,3,5-Tetrachlorobenzene	NELAP	PA	8/26/2006

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Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 014-002 expiration date April 30, 2018. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 02-00416 **EPA Lab Code: PA00164** **TNI Code: TNI02151** **(412) 963-7058**
PADWIS ID: 02416

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270		1,2,4,5-Tetrachlorobenzene	NELAP	PA	8/26/2006
EPA 8270		1,2,4-Trichlorobenzene	NELAP	PA	8/26/2006
EPA 8270		1,2-Dichlorobenzene (o-Dichlorobenzene)	NELAP	PA	8/26/2006
EPA 8270		1,2-Dinitrobenzene (1,2-DNB)	NELAP	PA	8/26/2006
EPA 8270		1,2-Diphenylhydrazine	NELAP	PA	4/18/2006
EPA 8270		1,3,5-Trichlorobenzene	NELAP	PA	8/26/2006
EPA 8270		1,3,5-Trinitrobenzene (1,3,5-TNB)	NELAP	PA	8/26/2006
EPA 8270		1,3-Dichlorobenzene (m-Dichlorobenzene)	NELAP	PA	8/26/2006
EPA 8270		1,3-Dinitrobenzene (1,3-DNB)	NELAP	PA	8/26/2006
EPA 8270		1,4-Dichlorobenzene (p-Dichlorobenzene)	NELAP	PA	8/26/2006
EPA 8270		1,4-Dioxane (1,4-Diethyleneoxide)	NELAP	PA	4/18/2006
EPA 8270		1,4-Naphthoquinone	NELAP	PA	8/26/2006
EPA 8270		1,4-Phenylenediamine	NELAP	PA	12/5/2007
EPA 8270		1-Methylnaphthalene	NELAP	PA	4/8/2009
EPA 8270		1-Naphthylamine (alpha-Naphthylamine)	NELAP	PA	8/26/2006
EPA 8270		2,2'-Oxybis(1-chloropropane) (bis(2-Chloro-1-methylethyl) ether)	NELAP	PA	4/18/2006
EPA 8270		2,2'-oxybis(1-Chloropropane)	NELAP	PA	8/26/2006
EPA 8270		2,3,4,6-Tetrachlorophenol	NELAP	PA	4/18/2006
EPA 8270		2,3,5,6-Tetrachlorophenol	NELAP	PA	8/26/2006
EPA 8270		2,3,7,8-TCDD (Dioxin) (screen)	NELAP	PA	8/26/2006
EPA 8270		2,3-Dichlorophenol (Dichlorophenol)	NELAP	PA	12/5/2007
EPA 8270		2,4,5-Trichlorophenol	NELAP	PA	8/26/2006
EPA 8270		2,4,6-Tribromophenol	NELAP	PA	4/8/2009
EPA 8270		2,4,6-Trichlorophenol	NELAP	PA	8/26/2006
EPA 8270		2,4-Dichlorophenol	NELAP	PA	8/26/2006
EPA 8270		2,4-Dimethylphenol	NELAP	PA	8/26/2006
EPA 8270		2,4-Dinitrophenol	NELAP	PA	8/26/2006
EPA 8270		2,4-Dinitrotoluene (2,4-DNT)	NELAP	PA	8/26/2006
EPA 8270		2,5-Dichlorophenol	NELAP	PA	12/5/2007
EPA 8270		2,6-Dichlorophenol	NELAP	PA	4/18/2006
EPA 8270		2,6-Dinitrotoluene (2,6-DNT)	NELAP	PA	8/26/2006
EPA 8270		2-Acetylaminofluorene	NELAP	PA	8/26/2006
EPA 8270		2-Chloronaphthalene	NELAP	PA	8/26/2006
EPA 8270		2-Chlorophenol	NELAP	PA	8/26/2006
EPA 8270		2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	NELAP	PA	4/18/2006
EPA 8270		2-Methylnaphthalene	NELAP	PA	8/26/2006
EPA 8270		2-Methylphenol (o-Cresol)	NELAP	PA	1/6/2006
EPA 8270		2-Naphthylamine (beta-Naphthylamine)	NELAP	PA	8/26/2006
EPA 8270		2-Nitroaniline	NELAP	PA	1/6/2006
EPA 8270		2-Nitrophenol	NELAP	PA	8/26/2006
EPA 8270		2-Phenylphenol	NELAP	PA	4/8/2009
EPA 8270		2-Picoline (2-Methylpyridine)	NELAP	PA	4/18/2006
EPA 8270		3+4-Methylphenol (m+p-Cresol)	NELAP	PA	1/6/2006
EPA 8270		3,3'-Dichlorobenzidine	NELAP	PA	8/26/2006

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Laboratory Scope of Accreditation

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DEP Laboratory ID: 02-00416 **EPA Lab Code: PA00164** **TNI Code: TNI02151** **(412) 963-7058**

PADWIS ID: 02416

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270		3,3'-Dimethylbenzidine	NELAP	PA	4/18/2006
EPA 8270		3-Methylcholanthrene	NELAP	PA	8/26/2006
EPA 8270		3-Nitroaniline	NELAP	PA	4/18/2006
EPA 8270		3-Nitrotoluene	NELAP	PA	8/26/2006
EPA 8270		4,4'-Methylenebis(2-chloroaniline)	NELAP	PA	4/18/2006
EPA 8270		4,4'-Methylenebis(N N-dimethylaniline)	NELAP	PA	8/26/2006
EPA 8270		4-Aminobiphenyl	NELAP	PA	8/26/2006
EPA 8270		4-Bromophenyl phenyl ether	NELAP	PA	8/26/2006
EPA 8270		4-Chloro-3-methylphenol	NELAP	PA	8/26/2006
EPA 8270		4-Chloroaniline	NELAP	PA	1/6/2006
EPA 8270		4-Chlorophenol	NELAP	PA	8/26/2006
EPA 8270		4-Chlorophenyl phenyl ether	NELAP	PA	8/26/2006
EPA 8270		4-Dimethylaminoazobenzene (Dimethylaminoazobenzene)	NELAP	PA	8/26/2006
EPA 8270		4-Nitroaniline	NELAP	PA	4/18/2006
EPA 8270		4-Nitrobiphenyl	NELAP	PA	8/26/2006
EPA 8270		4-Nitrophenol	NELAP	PA	8/26/2006
EPA 8270		4-Nitroquinoline-1-oxide	NELAP	PA	8/26/2006
EPA 8270		4-Nitrotoluene	NELAP	PA	8/26/2006
EPA 8270		5-Nitro-o-toluidine	NELAP	PA	8/26/2006
EPA 8270		6-Methylchrysene	NELAP	PA	12/5/2007
EPA 8270		7,12-Dimethylbenz(a)anthracene	NELAP	PA	8/26/2006
EPA 8270		Acenaphthene	NELAP	PA	8/26/2006
EPA 8270		Acenaphthylene	NELAP	PA	10/27/2010
EPA 8270		Acetophenone	NELAP	PA	8/26/2006
EPA 8270		Aminoazobenzene	NELAP	PA	8/26/2006
EPA 8270		Aniline	NELAP	PA	8/26/2006
EPA 8270		Anthracene	NELAP	PA	8/26/2006
EPA 8270		Aramite	NELAP	PA	4/18/2006
EPA 8270		Atrazine	NELAP	PA	4/18/2006
EPA 8270		Benzaldehyde	NELAP	PA	8/26/2006
EPA 8270		Benzidine	NELAP	PA	8/26/2006
EPA 8270		Benzo[a]anthracene	NELAP	PA	8/26/2006
EPA 8270		Benzo[a]pyrene	NELAP	PA	8/26/2006
EPA 8270		Benzo[b]fluoranthene	NELAP	PA	11/15/2011
EPA 8270		Benzo[ghi]perylene	NELAP	PA	8/26/2006
EPA 8270		Benzo[k]fluoranthene	NELAP	PA	11/15/2011
EPA 8270		Benzoic acid	NELAP	PA	8/26/2006
EPA 8270		Benzyl alcohol	NELAP	PA	8/26/2006
EPA 8270		Butyl benzyl phthalate (Benzyl butyl phthalate)	NELAP	PA	8/26/2006
EPA 8270		Caprolactam	NELAP	PA	4/18/2006
EPA 8270		Carbaryl (Sevin)	NELAP	PA	12/5/2007
EPA 8270		Carbazole	NELAP	PA	1/6/2006
EPA 8270		Chlorobenzilate	NELAP	PA	4/18/2006
EPA 8270		Chrysene (Benzo[a]phenanthrene)	NELAP	PA	8/26/2006

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Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270		Cresols (total)	NELAP	PA	4/18/2006
EPA 8270		Di-n-butyl phthalate	NELAP	PA	8/26/2006
EPA 8270		Di-n-octyl phthalate	NELAP	PA	11/15/2011
EPA 8270		Diallate (cis or trans)	NELAP	PA	4/18/2006
EPA 8270		Dibenz[a,h]acridine	NELAP	PA	12/5/2007
EPA 8270		Dibenzo[a,h]anthracene	NELAP	PA	8/26/2006
EPA 8270		Dibenzofuran	NELAP	PA	1/6/2006
EPA 8270		Diethyl phthalate	NELAP	PA	8/26/2006
EPA 8270		Dimethoate	NELAP	PA	8/26/2006
EPA 8270		Dimethyl phthalate	NELAP	PA	8/26/2006
EPA 8270		Dinoseb (2-sec-Butyl-4,6-dinitrophenol, DNBP)	NELAP	PA	8/26/2006
EPA 8270		Disulfoton	NELAP	PA	8/26/2006
EPA 8270		Ethyl methanesulfonate	NELAP	PA	8/26/2006
EPA 8270		Famphur	NELAP	PA	8/26/2006
EPA 8270		Fluoranthene	NELAP	PA	8/26/2006
EPA 8270		Fluorene	NELAP	PA	8/26/2006
EPA 8270		Hexachlorobenzene	NELAP	PA	8/26/2006
EPA 8270		Hexachlorobutadiene (1,3-Hexachlorobutadiene)	NELAP	PA	8/26/2006
EPA 8270		Hexachlorocyclopentadiene	NELAP	PA	8/26/2006
EPA 8270		Hexachloroethane	NELAP	PA	8/26/2006
EPA 8270		Hexachloropropene	NELAP	PA	4/18/2006
EPA 8270		Indene	NELAP	PA	4/8/2009
EPA 8270		Indeno(1,2,3-cd)pyrene	NELAP	PA	8/26/2006
EPA 8270		Isodrin	NELAP	PA	8/26/2006
EPA 8270		Isophorone	NELAP	PA	8/26/2006
EPA 8270		Isosafrole	NELAP	PA	8/26/2006
EPA 8270		Kepone	NELAP	PA	4/18/2006
EPA 8270		Methapyrilene	NELAP	PA	8/26/2006
EPA 8270		Methyl methanesulfonate	NELAP	PA	8/26/2006
EPA 8270		Methyl parathion (Parathion, methyl)	NELAP	PA	4/18/2006
EPA 8270		N-Nitrosodi-n-butylamine	NELAP	PA	4/18/2006
EPA 8270		N-Nitrosodi-n-propylamine	NELAP	PA	8/26/2006
EPA 8270		N-Nitrosodiethylamine	NELAP	PA	8/26/2006
EPA 8270		N-Nitrosodimethylamine	NELAP	PA	8/26/2006
EPA 8270		N-Nitrosodiphenylamine	NELAP	PA	8/26/2006
EPA 8270		N-Nitrosomethylethylamine	NELAP	PA	4/18/2006
EPA 8270		N-Nitrosomorpholine	NELAP	PA	8/26/2006
EPA 8270		N-Nitrosopiperidine	NELAP	PA	8/26/2006
EPA 8270		N-Nitrosopyrrolidine	NELAP	PA	8/26/2006
EPA 8270		Naphthalene	NELAP	PA	8/26/2006
EPA 8270		Nitrobenzene	NELAP	PA	8/26/2006
EPA 8270		O,O,O-Triethyl phosphorothioate	NELAP	PA	8/26/2006
EPA 8270		Octachlorocyclopentene (Perchlorocyclopentene)	NELAP	PA	12/5/2007

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DEP Laboratory ID: 02-00416 **EPA Lab Code: PA00164** **TNI Code: TNI02151** **(412) 963-7058**
PADWIS ID: 02416

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270		Octachlorostyrene	NELAP	PA	12/5/2007
EPA 8270		Parathion, ethyl (Ethyl parathion, Parathion)	NELAP	PA	4/18/2006
EPA 8270		Pentachlorobenzene	NELAP	PA	4/18/2006
EPA 8270		Pentachloroethane	NELAP	PA	8/26/2006
EPA 8270		Pentachloronitrobenzene (PCNB)	NELAP	PA	4/18/2006
EPA 8270		Pentachlorophenol (PCP)	NELAP	PA	8/26/2006
EPA 8270		Phenacetin	NELAP	PA	8/26/2006
EPA 8270		Phenanthrene	NELAP	PA	8/26/2006
EPA 8270		Phenol	NELAP	PA	8/26/2006
EPA 8270		Phorate (Thimet)	NELAP	PA	8/26/2006
EPA 8270		Pronamide (Kerb)	NELAP	PA	4/18/2006
EPA 8270		Pyrene	NELAP	PA	8/26/2006
EPA 8270		Pyridine	NELAP	PA	4/18/2006
EPA 8270	D	SOCs by GC/MS	NELAP	PA	4/8/2009
EPA 8270	C	SOCs by GC/MS	NELAP	PA	4/8/2009
EPA 8270		Safrole	NELAP	PA	8/26/2006
EPA 8270		Sulfotepp (Tetraethyl dithiopyrophosphate)	NELAP	PA	8/26/2006
EPA 8270		Thionazine (Thionazin, Zinophos)	NELAP	PA	8/26/2006
EPA 8270		a,a-Dimethylphenethylamine (Phentermine)	NELAP	PA	4/18/2006
EPA 8270		bis(2-Chloroethoxy)methane	NELAP	PA	8/26/2006
EPA 8270		bis(2-Chloroethyl) ether	NELAP	PA	8/26/2006
EPA 8270		bis(2-Ethylhexyl) phthalate (DEHP)	NELAP	PA	8/26/2006
EPA 8270		n-Octadecane	NELAP	PA	4/8/2009
EPA 8270		o-Toluidine (2-Toluidine, 2-Methylaniline)	NELAP	PA	4/18/2006
EPA 8270		p-(Dimethylamino)azobenzene	NELAP	PA	4/8/2009
EPA 8270		p-Chlorobenzilate (Ethyl 4,4'-dichlorobenzilate)	NELAP	PA	12/5/2007
EPA 8270		p-Phenylenediamine	NELAP	PA	4/8/2009
EPA 9010	C	Total cyanide	NELAP	PA	3/4/2013
EPA 9014		Total cyanide	NELAP	PA	12/14/2012
EPA 9030	B	Sulfide	NELAP	PA	11/15/2011
EPA 9034		Sulfide	NELAP	PA	11/15/2011
EPA 9040	C	pH	NELAP	PA	8/26/2006
EPA 9040	B	pH	NELAP	PA	4/18/2006
EPA 9050	A	Conductivity	NELAP	PA	3/16/2009
EPA 9056	A	Anions by IC	NELAP	PA	3/16/2009
EPA 9056		Bromide	NELAP	PA	8/26/2006
EPA 9056		Chloride	NELAP	PA	8/26/2006
EPA 9056		Fluoride	NELAP	PA	8/26/2006
EPA 9056		Nitrate as N	NELAP	PA	8/26/2006
EPA 9056		Nitrite as N	NELAP	PA	8/26/2006
EPA 9056		Orthophosphate as P	NELAP	PA	8/26/2006
EPA 9056		Sulfate	NELAP	PA	8/26/2006
EPA 9060		Total organic carbon (TOC)	NELAP	PA	8/26/2006
EPA 9060	A	Total organic carbon (TOC)	NELAP	PA	4/22/2010
EPA 9065		Total phenolics	NELAP	PA	4/8/2008

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DEP Laboratory ID: 02-00416 **EPA Lab Code: PA00164** **TNI Code: TNI02151** **(412) 963-7058**
PADWIS ID: 02416

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 9070	A	Oil and grease	NELAP	PA	4/4/2007
OIA 1677		Available cyanide	NELAP	PA	8/24/2005
SM 2120 B		Color	NELAP	PA	4/10/2007
SM 2310 B		Acidity as CaCO3	NELAP	PA	1/22/2007
SM 2320 B		Alkalinity as CaCO3	NELAP	PA	1/22/2007
SM 2340 C		Total hardness as CaCO3	NELAP	PA	1/22/2007
SM 2510 B		Conductivity	NELAP	PA	4/21/2010
SM 2520 B		Salinity	NELAP	PA	4/8/2008
SM 2540 B		Residue, total	NELAP	PA	4/10/2007
SM 2540 C		Residue, filterable (TDS)	NELAP	PA	10/13/2010
SM 2540 D		Residue, nonfilterable (TSS)	NELAP	PA	4/10/2007
SM 2540 E		Fixed suspended solids	NELAP	PA	4/13/2009
SM 2540 E		Residue, volatile	NELAP	PA	2/3/2016
SM 2540 E		Volatile suspended solids	NELAP	PA	4/13/2009
SM 2540 F		Residue, settleable	NELAP	PA	4/10/2007
SM 2580B		Oxidation-reduction potential	NELAP	PA	5/4/2009
SM 3500-Cr B	20-22	Chromium VI	NELAP	PA	8/24/2005
SM 4500-CN- C/E		Cyanide	NELAP	PA	12/14/2012
SM 4500-Cl G		Total residual chlorine	NELAP	PA	4/8/2008
SM 4500-H+ B		pH	NELAP	PA	4/10/2007
SM 4500-O G		Oxygen (dissolved)	NELAP	PA	3/16/2009
SM 4500-S F		Sulfide	NELAP	PA	11/15/2011
SM 5210 B		Biochemical oxygen demand (BOD)	NELAP	PA	6/24/2008
SM 5210 B		Carbonaceous BOD (CBOD)	NELAP	PA	8/26/2006
SM 5310 C		Dissolved organic carbon (DOC)	NELAP	PA	7/12/2010
SM 5310 C		Total organic carbon (TOC)	NELAP	PA	7/12/2010
SM 5540 C		Surfactants as MBAS	NELAP	PA	10/24/2012

Matrix: Solid and Chemical Materials

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
ASTM D3987-85		Shake extraction of solid waste with water	NELAP	PA	12/5/2007
ASTM D5057-90		Apparent specific gravity	NELAP	PA	9/27/2010
ASTM D5057-90		Bulk density	NELAP	PA	9/27/2010
EPA 1010	A	Ignitability	NELAP	PA	4/9/2009
EPA 1020	B	Ignitability	NELAP	PA	4/9/2009
EPA 1311		Toxicity characteristic leaching procedure (TCLP)	NELAP	PA	4/7/2005
EPA 1312		Synthetic precipitation leaching procedure (SPLP)	NELAP	PA	4/18/2006
EPA 300.0	2.1	Bromide	NELAP	PA	4/20/2011
EPA 300.0	2.1	Chloride	NELAP	PA	4/20/2011
EPA 300.0	2.1	Fluoride	NELAP	PA	4/20/2011
EPA 300.0	2.1	Nitrate as N	NELAP	PA	4/20/2011
EPA 300.0	2.1	Nitrite as N	NELAP	PA	4/20/2011

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Laboratory Scope of Accreditation

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DEP Laboratory ID: 02-00416 **EPA Lab Code: PA00164** **TNI Code: TNI02151** **(412) 963-7058**
PADWIS ID: 02416

Matrix: Solid and Chemical Materials

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 300.0	2.1	Orthophosphate as P	NELAP	PA	4/20/2011
EPA 300.0	2.1	Sulfate	NELAP	PA	4/20/2011
EPA 3005	A	Preconcentration under acid	NELAP	PA	4/7/2005
EPA 3010	A	Hot plate acid digestion (HNO3 + HCl)	NELAP	PA	4/7/2005
EPA 3050	B	Acid digestion of solids	NELAP	PA	4/7/2005
EPA 3060	A	Alkaline digestion of Cr(VI)	NELAP	PA	4/7/2005
EPA 350.1		Ammonia as N	NELAP	PA	8/26/2006
EPA 3510	C	Separatory funnel liquid-liquid extraction	NELAP	PA	4/7/2005
EPA 3520	C	Continuous liquid-liquid extraction	NELAP	PA	4/7/2005
EPA 353.2		Nitrate as N	NELAP	PA	12/5/2013
EPA 353.2		Nitrite as N	NELAP	PA	3/20/2012
EPA 353.2		Total nitrate-nitrite	NELAP	PA	4/20/2011
EPA 3541		Automated soxhlet extraction	NELAP	PA	4/7/2005
EPA 3550	B	Ultrasonic extraction	NELAP	PA	4/7/2005
EPA 3550	C	Ultrasonic extraction	NELAP	PA	4/9/2009
EPA 3580	A	Waste dilution	NELAP	PA	4/7/2005
EPA 3585		Waste dilution for VOCs	NELAP	PA	4/7/2005
EPA 3620	C	Florisil cleanup	NELAP	PA	4/9/2009
EPA 3620	B	Florisil cleanup	NELAP	PA	4/18/2006
EPA 3640	A	Gel permeation cleanup (GPC)	NELAP	PA	4/18/2006
EPA 3660	B	Sulfur cleanup	NELAP	PA	4/18/2006
EPA 3665	A	Sulfuric acid/permanganate clean-up	NELAP	PA	4/18/2006
EPA 410.4		Chemical oxygen demand (COD)	NELAP	PA	8/26/2006
EPA 5030	B	Aqueous-phase purge-and-trap	NELAP	PA	3/4/2013
EPA 5035		Closed-system purge-and-trap (bisulfate option)	NELAP	PA	4/7/2005
EPA 5035	A	Closed-system purge-and-trap (freezing option)	NELAP	PA	6/15/2012
EPA 5035		Closed-system purge-and-trap (methanol option)	NELAP	PA	4/7/2005
EPA 5035	A	Closed-system purge-and-trap (methanol option)	NELAP	PA	6/15/2012
EPA 5035	A	Closed-system purge-and-trap (unpreserved)	NELAP	PA	6/15/2012
EPA 5035		Closed-system purge-and-trap (unpreserved)	NELAP	PA	8/24/2005
EPA 6010		Aluminum	NELAP	PA	8/24/2005
EPA 6010		Antimony	NELAP	PA	4/7/2005
EPA 6010		Arsenic	NELAP	PA	4/7/2005
EPA 6010		Barium	NELAP	PA	4/7/2005
EPA 6010		Beryllium	NELAP	PA	4/7/2005
EPA 6010		Boron	NELAP	PA	4/7/2005
EPA 6010		Cadmium	NELAP	PA	4/7/2005
EPA 6010		Calcium	NELAP	PA	4/7/2005
EPA 6010		Chromium	NELAP	PA	4/7/2005
EPA 6010		Cobalt	NELAP	PA	4/7/2005
EPA 6010		Copper	NELAP	PA	4/7/2005
EPA 6010		Iron	NELAP	PA	4/7/2005

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Laboratory Scope of Accreditation

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DEP Laboratory ID: 02-00416 **EPA Lab Code: PA00164** **TNI Code: TNI02151** **(412) 963-7058**

PADWIS ID: 02416

Matrix: Solid and Chemical Materials

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 6010		Lead	NELAP	PA	4/7/2005
EPA 6010		Lithium	NELAP	PA	4/22/2010
EPA 6010		Magnesium	NELAP	PA	4/7/2005
EPA 6010		Manganese	NELAP	PA	4/7/2005
EPA 6010	C	Metals by ICP/AES	NELAP	PA	4/9/2009
EPA 6010	B	Metals by ICP/AES	NELAP	PA	4/8/2009
EPA 6010		Molybdenum	NELAP	PA	4/7/2005
EPA 6010		Nickel	NELAP	PA	4/7/2005
EPA 6010		Potassium	NELAP	PA	4/7/2005
EPA 6010		Selenium	NELAP	PA	4/7/2005
EPA 6010		Silica, as SiO2	NELAP	PA	4/7/2005
EPA 6010		Silicon	NELAP	PA	6/3/2010
EPA 6010		Silver	NELAP	PA	4/7/2005
EPA 6010		Sodium	NELAP	PA	4/7/2005
EPA 6010		Strontium	NELAP	PA	4/7/2005
EPA 6010		Thallium	NELAP	PA	4/7/2005
EPA 6010		Tin	NELAP	PA	4/7/2005
EPA 6010		Titanium	NELAP	PA	4/7/2005
EPA 6010		Vanadium	NELAP	PA	4/7/2005
EPA 6010		Zinc	NELAP	PA	4/7/2005
EPA 6020		Aluminum	NELAP	PA	4/7/2005
EPA 6020		Antimony	NELAP	PA	4/7/2005
EPA 6020		Arsenic	NELAP	PA	4/7/2005
EPA 6020		Barium	NELAP	PA	4/7/2005
EPA 6020		Beryllium	NELAP	PA	4/7/2005
EPA 6020		Boron	NELAP	PA	8/24/2005
EPA 6020		Cadmium	NELAP	PA	4/7/2005
EPA 6020		Calcium	NELAP	PA	8/24/2005
EPA 6020		Chromium	NELAP	PA	4/7/2005
EPA 6020		Cobalt	NELAP	PA	4/7/2005
EPA 6020		Copper	NELAP	PA	4/7/2005
EPA 6020		Iron	NELAP	PA	8/24/2005
EPA 6020		Lead	NELAP	PA	4/7/2005
EPA 6020		Lithium	NELAP	PA	3/24/2017
EPA 6020		Magnesium	NELAP	PA	8/24/2005
EPA 6020		Manganese	NELAP	PA	4/7/2005
EPA 6020	A	Metals by ICP/MS	NELAP	PA	4/9/2009
EPA 6020		Molybdenum	NELAP	PA	4/7/2005
EPA 6020		Nickel	NELAP	PA	4/7/2005
EPA 6020		Potassium	NELAP	PA	8/24/2005
EPA 6020		Selenium	NELAP	PA	4/7/2005
EPA 6020		Silica, as SiO2	NELAP	PA	4/18/2006
EPA 6020		Silicon	NELAP	PA	6/3/2010
EPA 6020		Silver	NELAP	PA	4/7/2005
EPA 6020		Sodium	NELAP	PA	8/24/2005

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DEP Laboratory ID: 02-00416 **EPA Lab Code: PA00164** **TNI Code: TNI02151** **(412) 963-7058**
PADWIS ID: 02416

Matrix: Solid and Chemical Materials

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 6020		Strontium	NELAP	PA	4/7/2005
EPA 6020		Thallium	NELAP	PA	4/7/2005
EPA 6020		Thorium	NELAP	PA	3/24/2017
EPA 6020		Tin	NELAP	PA	8/24/2005
EPA 6020		Titanium	NELAP	PA	8/24/2005
EPA 6020		Uranium, total	NELAP	PA	3/24/2017
EPA 6020		Vanadium	NELAP	PA	4/7/2005
EPA 6020		Zinc	NELAP	PA	4/7/2005
EPA 7196	A	Chromium VI	NELAP	PA	4/7/2005
EPA 7470	A	Mercury	NELAP	PA	8/26/2006
EPA 7471	B	Mercury	NELAP	PA	4/9/2009
EPA 7471	A	Mercury	NELAP	PA	4/7/2005
EPA 8081		2,4'-DDD	NELAP	PA	4/18/2006
EPA 8081		2,4'-DDE	NELAP	PA	4/18/2006
EPA 8081		2,4'-DDT	NELAP	PA	4/18/2006
EPA 8081		4,4'-DDD	NELAP	PA	4/7/2005
EPA 8081		4,4'-DDE	NELAP	PA	4/7/2005
EPA 8081		4,4'-DDT	NELAP	PA	4/7/2005
EPA 8081		Aldrin (HHDN)	NELAP	PA	4/7/2005
EPA 8081		Chlorbenside	NELAP	PA	4/18/2006
EPA 8081		Chlordane (tech.)	NELAP	PA	4/7/2005
EPA 8081		Chlorobenzilate	NELAP	PA	8/26/2006
EPA 8081		Dacthal (DCPA)	NELAP	PA	8/26/2006
EPA 8081		Diallate (cis or trans)	NELAP	PA	8/26/2006
EPA 8081		Dieldrin	NELAP	PA	4/7/2005
EPA 8081		Endosulfan I	NELAP	PA	4/7/2005
EPA 8081		Endosulfan II	NELAP	PA	4/7/2005
EPA 8081		Endosulfan sulfate	NELAP	PA	4/7/2005
EPA 8081		Endrin	NELAP	PA	4/7/2005
EPA 8081		Endrin aldehyde	NELAP	PA	4/7/2005
EPA 8081		Endrin ketone	NELAP	PA	4/7/2005
EPA 8081		Heptachlor	NELAP	PA	4/7/2005
EPA 8081		Heptachlor epoxide	NELAP	PA	4/7/2005
EPA 8081		Hexachlorobenzene	NELAP	PA	5/12/2011
EPA 8081		Hexachlorocyclopentadiene	NELAP	PA	8/26/2006
EPA 8081		Isodrin	NELAP	PA	8/24/2005
EPA 8081		Methoxychlor	NELAP	PA	4/7/2005
EPA 8081		Mirex	NELAP	PA	8/24/2005
EPA 8081	B	Organochlorine pesticides by GC/ECD	NELAP	PA	1/1/2013
EPA 8081	A	Organochlorine pesticides by GC/ECD	NELAP	PA	4/8/2009
EPA 8081		Oxychlordane	NELAP	PA	4/9/2009
EPA 8081		Toxaphene (Chlorinated camphene)	NELAP	PA	4/7/2005
EPA 8081		alpha-BHC (alpha-Hexachlorocyclohexane)	NELAP	PA	4/7/2005
EPA 8081		alpha-Chlordane	NELAP	PA	4/7/2005
EPA 8081		beta-BHC (beta-Hexachlorocyclohexane)	NELAP	PA	4/7/2005

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Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8081		cis-Nonachlor	NELAP	PA	4/18/2006
EPA 8081		delta-BHC (delta-Hexachlorocyclohexane)	NELAP	PA	4/7/2005
EPA 8081		gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	NELAP	PA	4/7/2005
EPA 8081		gamma-Chlordane	NELAP	PA	4/7/2005
EPA 8081		trans-Nonachlor	NELAP	PA	4/18/2006
EPA 8082		2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ 206)	NELAP	PA	8/26/2006
EPA 8082		2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ 195)	NELAP	PA	4/13/2009
EPA 8082		2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ 170)	NELAP	PA	8/26/2006
EPA 8082		2,2',3,3',4,4'-Hexachlorobiphenyl (BZ 128)	NELAP	PA	8/26/2006
EPA 8082		2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ 187)	NELAP	PA	8/26/2006
EPA 8082		2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ 183)	NELAP	PA	8/26/2006
EPA 8082		2,2',3,4,4',5'-Hexachlorobiphenyl (BZ 138)	NELAP	PA	8/26/2006
EPA 8082		2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ 180)	NELAP	PA	8/26/2006
EPA 8082		2,2',3,4,4',6,6'-Heptachlorobiphenyl (BZ 184)	NELAP	PA	4/13/2009
EPA 8082		2,2',3,4,5'-Pentachlorobiphenyl (BZ 87)	NELAP	PA	8/26/2006
EPA 8082		2,2',3,5'-Tetrachlorobiphenyl (BZ 44)	NELAP	PA	8/26/2006
EPA 8082		2,2',4,4',5,5'-Hexachlorobiphenyl (BZ 153)	NELAP	PA	8/26/2006
EPA 8082		2,2',4,5'-Tetrachlorobiphenyl (BZ 49)	NELAP	PA	8/26/2006
EPA 8082		2,2',4,5,5'-Pentachlorobiphenyl (BZ 101)	NELAP	PA	8/26/2006
EPA 8082		2,2',5,5'-Tetrachlorobiphenyl (BZ 52)	NELAP	PA	8/26/2006
EPA 8082		2,2',5-Trichlorobiphenyl (BZ 18)	NELAP	PA	8/26/2006
EPA 8082		2,3',4,4',5'-Pentachlorobiphenyl (BZ 123)	NELAP	PA	4/25/2014
EPA 8082		2,3',4,4',5,5'-Hexachlorobiphenyl (BZ 167)	NELAP	PA	4/25/2014
EPA 8082		2,3',4,4',5-Pentachlorobiphenyl (BZ 118)	NELAP	PA	8/26/2006
EPA 8082		2,3',4,4'-Tetrachlorobiphenyl (BZ 66)	NELAP	PA	8/26/2006
EPA 8082		2,3,3',4,4',5'-Hexachlorobiphenyl (BZ 157)	NELAP	PA	4/25/2014
EPA 8082		2,3,3',4,4',5,5'-Heptachlorobiphenyl (BZ 189)	NELAP	PA	4/25/2014
EPA 8082		2,3,3',4,4'-Pentachlorobiphenyl (BZ 105)	NELAP	PA	4/13/2009
EPA 8082		2,3,4,4',5-Pentachlorobiphenyl (BZ 114)	NELAP	PA	4/25/2014
EPA 8082		2,4'-Dichlorobiphenyl (BZ 8)	NELAP	PA	4/13/2009
EPA 8082		2,4,4'-Trichlorobiphenyl (BZ 28)	NELAP	PA	4/13/2009
EPA 8082		3,3',4,4',5,5'-Hexachlorobiphenyl (BZ 169)	NELAP	PA	4/13/2009
EPA 8082		3,3',4,4',5-Pentachlorobiphenyl (BZ 126)	NELAP	PA	4/13/2009
EPA 8082		3,3',4,4'-Tetrachlorobiphenyl (BZ 77)	NELAP	PA	4/13/2009
EPA 8082		3,4,4',5-Tetrachlorobiphenyl (BZ 81)	NELAP	PA	4/25/2014
EPA 8082		Aroclor-1016 (PCB-1016)	NELAP	PA	11/8/2007
EPA 8082		Aroclor-1016 (in oil)	NELAP	PA	10/19/2016
EPA 8082		Aroclor-1221 (PCB-1221)	NELAP	PA	11/8/2007

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DEP Laboratory ID: 02-00416 **EPA Lab Code: PA00164** **TNI Code: TNI02151** **(412) 963-7058**
PADWIS ID: 02416

Matrix: Solid and Chemical Materials

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8082		Aroclor-1221 (in oil)	NELAP	PA	10/19/2016
EPA 8082		Aroclor-1232 (PCB-1232)	NELAP	PA	11/8/2007
EPA 8082		Aroclor-1232 (in oil)	NELAP	PA	10/19/2016
EPA 8082		Aroclor-1242 (PCB-1242)	NELAP	PA	11/8/2007
EPA 8082		Aroclor-1242 (in oil)	NELAP	PA	10/19/2016
EPA 8082		Aroclor-1248 (PCB-1248)	NELAP	PA	11/8/2007
EPA 8082		Aroclor-1248 (in oil)	NELAP	PA	10/19/2016
EPA 8082		Aroclor-1254 (PCB-1254)	NELAP	PA	11/8/2007
EPA 8082		Aroclor-1254 (in oil)	NELAP	PA	10/19/2016
EPA 8082		Aroclor-1260 (PCB-1260)	NELAP	PA	11/8/2007
EPA 8082		Aroclor-1260 (in oil)	NELAP	PA	10/19/2016
EPA 8082		Aroclor-1262 (PCB-1262)	NELAP	PA	4/8/2008
EPA 8082		Aroclor-1268 (PCB-1268)	NELAP	PA	4/8/2008
EPA 8082		Decachlorobiphenyl	NELAP	PA	8/26/2006
EPA 8082	A	PCBs by GC/ECD	NELAP	PA	4/9/2009
EPA 8141		Azinphos-methyl (Guthion)	NELAP	PA	4/7/2005
EPA 8141		Bolstar (Sulprofos)	NELAP	PA	4/18/2006
EPA 8141		Chlorpyrifos	NELAP	PA	8/24/2005
EPA 8141		Coumaphos	NELAP	PA	8/24/2005
EPA 8141		Demeton	NELAP	PA	4/9/2009
EPA 8141		Demeton-O	NELAP	PA	4/7/2005
EPA 8141		Demeton-S	NELAP	PA	4/7/2005
EPA 8141		Diazinon (Spectracide)	NELAP	PA	4/7/2005
EPA 8141		Dichlorovos (DDVP, Dichlorvos)	NELAP	PA	8/24/2005
EPA 8141		Dimethoate	NELAP	PA	8/24/2005
EPA 8141		Disulfoton	NELAP	PA	4/7/2005
EPA 8141		EPN (Santox)	NELAP	PA	8/24/2005
EPA 8141		Ethoprop (Prophos)	NELAP	PA	8/24/2005
EPA 8141		Famphur	NELAP	PA	8/24/2005
EPA 8141		Fensulfothion	NELAP	PA	8/24/2005
EPA 8141		Fenthion	NELAP	PA	8/24/2005
EPA 8141		Malathion	NELAP	PA	4/7/2005
EPA 8141		Methyl parathion (Parathion, methyl)	NELAP	PA	4/7/2005
EPA 8141		Mevinphos	NELAP	PA	8/24/2005
EPA 8141		O,O,O-Triethyl phosphorothioate	NELAP	PA	4/18/2006
EPA 8141	B	Organophosphorus compounds by GC/NPD	NELAP	PA	4/9/2009
EPA 8141	A	Organophosphorus compounds by GC/NPD	NELAP	PA	4/8/2009
EPA 8141		Parathion, ethyl (Ethyl parathion, Parathion)	NELAP	PA	4/7/2005
EPA 8141		Phorate (Thimet)	NELAP	PA	8/24/2005
EPA 8141		Ronnel	NELAP	PA	4/18/2006
EPA 8141		Stirophos (Tetrachlorovinphos)	NELAP	PA	4/18/2006
EPA 8141		Sulfotepp (Tetraethyl dithiopyrophosphate)	NELAP	PA	8/26/2006
EPA 8141		Thionazine (Thionazin, Zinophos)	NELAP	PA	4/18/2006
EPA 8141		Tokuthion (Prothiophos)	NELAP	PA	4/18/2006
EPA 8141		Trichloronate	NELAP	PA	4/18/2006

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Matrix: Solid and Chemical Materials

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8141		Triphenyl phosphate	NELAP	PA	4/18/2006
EPA 8151		2,4,5-T	NELAP	PA	4/7/2005
EPA 8151		2,4,5-TP (Silvex)	NELAP	PA	4/7/2005
EPA 8151		2,4-D	NELAP	PA	4/7/2005
EPA 8151		2,4-DB (Butoxon)	NELAP	PA	4/7/2005
EPA 8151	A	Chlorinated herbicides by GC/ECD	NELAP	PA	4/8/2009
EPA 8151		Dalapon (2,2-Dichloropropionic acid)	NELAP	PA	8/24/2005
EPA 8151		Dicamba	NELAP	PA	4/7/2005
EPA 8151		Dichloroprop (Dichlorprop)	NELAP	PA	4/7/2005
EPA 8151		MCPA	NELAP	PA	4/7/2005
EPA 8151		MCPP (Mecoprop)	NELAP	PA	4/7/2005
EPA 8151		Pentachlorophenol (PCP)	NELAP	PA	4/7/2005
EPA 8260		1,1,1,2-Tetrachloroethane	NELAP	PA	8/24/2005
EPA 8260		1,1,1-Trichloroethane	NELAP	PA	4/7/2005
EPA 8260		1,1,2,2-Tetrachloroethane	NELAP	PA	4/7/2005
EPA 8260		1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	NELAP	PA	8/24/2005
EPA 8260		1,1,2-Trichloroethane	NELAP	PA	4/7/2005
EPA 8260		1,1-Dichloroethane	NELAP	PA	4/7/2005
EPA 8260		1,1-Dichloroethene (1,1-Dichloroethylene)	NELAP	PA	4/7/2005
EPA 8260		1,1-Dichloropropene	NELAP	PA	8/26/2006
EPA 8260		1,2,3-Trichlorobenzene	NELAP	PA	8/26/2006
EPA 8260		1,2,3-Trichloropropane (1,2,3-TCP)	NELAP	PA	4/7/2005
EPA 8260		1,2,4-Trichlorobenzene	NELAP	PA	4/7/2005
EPA 8260		1,2,4-Trimethylbenzene	NELAP	PA	8/26/2006
EPA 8260		1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane)	NELAP	PA	8/24/2005
EPA 8260		1,2-Dibromochloroethene (total)	NELAP	PA	4/18/2006
EPA 8260		1,2-Dibromoethane (EDB, Ethylene dibromide)	NELAP	PA	4/7/2005
EPA 8260		1,2-Dichlorobenzene (o-Dichlorobenzene)	NELAP	PA	4/7/2005
EPA 8260		1,2-Dichloroethane	NELAP	PA	4/7/2005
EPA 8260		1,2-Dichloroethene (total)	NELAP	PA	3/1/2007
EPA 8260		1,2-Dichloropropane	NELAP	PA	4/7/2005
EPA 8260		1,3,5-Trichlorobenzene	NELAP	PA	4/9/2009
EPA 8260		1,3,5-Trimethylbenzene	NELAP	PA	8/26/2006
EPA 8260		1,3-Dichlorobenzene (m-Dichlorobenzene)	NELAP	PA	4/7/2005
EPA 8260		1,3-Dichloropropane	NELAP	PA	8/26/2006
EPA 8260		1,4-Dichlorobenzene (p-Dichlorobenzene)	NELAP	PA	4/7/2005
EPA 8260		1,4-Dioxane (1,4-Diethyleneoxide)	NELAP	PA	8/24/2005
EPA 8260		2,2,4-Trimethylpentane (Iso-octane)	NELAP	PA	12/5/2007
EPA 8260		2,2-Dichloropropane	NELAP	PA	8/26/2006
EPA 8260		2,3,6-Trichlorotoluene	NELAP	PA	4/9/2009
EPA 8260		2,3-Dichlorotoluene	NELAP	PA	4/9/2009
EPA 8260		2,4,5-Trichlorotoluene	NELAP	PA	4/9/2009
EPA 8260		2,4-Dichlorobenzotrifluoride	NELAP	PA	4/9/2009

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Laboratory Scope of Accreditation

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DEP Laboratory ID: 02-00416 **EPA Lab Code: PA00164** **TNI Code: TNI02151** **(412) 963-7058**
PADWIS ID: 02416

Matrix: Solid and Chemical Materials

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8260		2,4-Dichlorotoluene	NELAP	PA	4/9/2009
EPA 8260		2,5-Dichlorobenzotrifluoride	NELAP	PA	4/9/2009
EPA 8260		2,5-Dichlorotoluene	NELAP	PA	4/9/2009
EPA 8260		2,6-Dichlorotoluene	NELAP	PA	4/9/2009
EPA 8260		2-Butanone (Methyl ethyl ketone, MEK)	NELAP	PA	8/24/2005
EPA 8260		2-Chlorobenzotrifluoride	NELAP	PA	4/9/2009
EPA 8260		2-Chloroethyl vinyl ether	NELAP	PA	4/7/2005
EPA 8260		2-Chlorotoluene	NELAP	PA	4/7/2005
EPA 8260		2-Hexanone	NELAP	PA	8/24/2005
EPA 8260		2-Nitropropane	NELAP	PA	8/26/2006
EPA 8260		3,4-Dichlorobenzotrifluoride	NELAP	PA	4/9/2009
EPA 8260		3,4-Dichlorotoluene	NELAP	PA	4/9/2009
EPA 8260		3-Chlorobenzotrifluoride	NELAP	PA	4/9/2009
EPA 8260		4-Chlorobenzotrifluoride	NELAP	PA	4/9/2009
EPA 8260		4-Chlorotoluene	NELAP	PA	4/7/2005
EPA 8260		4-Methyl-2-pentanone (MIBK)	NELAP	PA	8/26/2006
EPA 8260		Acetone	NELAP	PA	4/7/2005
EPA 8260		Acetonitrile	NELAP	PA	4/7/2005
EPA 8260		Acrolein (Propenal)	NELAP	PA	4/7/2005
EPA 8260		Acrylonitrile	NELAP	PA	4/7/2005
EPA 8260		Allyl chloride (3-Chloropropene)	NELAP	PA	8/26/2006
EPA 8260		Benzene	NELAP	PA	4/7/2005
EPA 8260		Benzyl chloride	NELAP	PA	8/26/2006
EPA 8260		Bromobenzene	NELAP	PA	4/7/2005
EPA 8260		Bromochloromethane	NELAP	PA	8/24/2005
EPA 8260		Bromodichloromethane	NELAP	PA	4/7/2005
EPA 8260		Bromoform	NELAP	PA	4/7/2005
EPA 8260		Carbon disulfide	NELAP	PA	8/24/2005
EPA 8260		Carbon tetrachloride	NELAP	PA	4/7/2005
EPA 8260		Chlorobenzene	NELAP	PA	4/7/2005
EPA 8260		Chloroethane	NELAP	PA	4/7/2005
EPA 8260		Chloroform	NELAP	PA	4/7/2005
EPA 8260		Chloroprene (2-Chloro-1,3-butadiene)	NELAP	PA	8/26/2006
EPA 8260		Cyclohexane	NELAP	PA	4/18/2006
EPA 8260		Dibromochloromethane	NELAP	PA	4/7/2005
EPA 8260		Dibromofluoromethane	NELAP	PA	8/26/2006
EPA 8260		Dibromomethane	NELAP	PA	8/24/2005
EPA 8260		Dichlorodifluoromethane (Freon 12)	NELAP	PA	4/7/2005
EPA 8260		Diethyl ether (Ethyl ether)	NELAP	PA	8/26/2006
EPA 8260		Ethyl methacrylate	NELAP	PA	8/24/2005
EPA 8260		Ethylbenzene	NELAP	PA	4/7/2005
EPA 8260		Heptane	NELAP	PA	4/18/2006
EPA 8260		Hexachlorobutadiene (1,3-Hexachlorobutadiene)	NELAP	PA	8/24/2005
EPA 8260		Iodomethane (Methyl iodide)	NELAP	PA	8/26/2006
EPA 8260		Isobutyl alcohol (2-Methyl-1-propanol)	NELAP	PA	8/26/2006

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Matrix: Solid and Chemical Materials

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8260		Isopropyl alcohol (2-Propanol)	NELAP	PA	8/26/2006
EPA 8260		Isopropylbenzene (Cumene)	NELAP	PA	4/7/2005
EPA 8260		Methacrylonitrile	NELAP	PA	8/26/2006
EPA 8260		Methyl acetate	NELAP	PA	4/18/2006
EPA 8260		Methyl bromide (Bromomethane)	NELAP	PA	4/7/2005
EPA 8260		Methyl chloride (Chloromethane)	NELAP	PA	4/7/2005
EPA 8260		Methyl tert-butyl ether (MTBE)	NELAP	PA	4/7/2005
EPA 8260		Methylacrylate	NELAP	PA	8/26/2006
EPA 8260		Methylcyclohexane	NELAP	PA	4/18/2006
EPA 8260		Methylene chloride (Dichloromethane)	NELAP	PA	4/7/2005
EPA 8260		Methylmethacrylate	NELAP	PA	8/24/2005
EPA 8260		Naphthalene	NELAP	PA	4/7/2005
EPA 8260		Propionitrile (Ethyl cyanide)	NELAP	PA	8/24/2005
EPA 8260		Styrene	NELAP	PA	4/7/2005
EPA 8260		Tetrachloroethene (PCE, Perchloroethylene)	NELAP	PA	4/7/2005
EPA 8260		Tetrahydrofuran (THF)	NELAP	PA	4/22/2010
EPA 8260		Toluene	NELAP	PA	4/7/2005
EPA 8260		Trichloroethene (TCE, Trichloroethylene)	NELAP	PA	4/7/2005
EPA 8260		Trichlorofluoromethane (Freon 11)	NELAP	PA	4/7/2005
EPA 8260	B	VOCs by GC/MS	NELAP	PA	4/8/2009
EPA 8260	C	VOCs by GC/MS	NELAP	PA	12/5/2013
EPA 8260		Vinyl acetate	NELAP	PA	4/7/2005
EPA 8260		Vinyl chloride (Chloroethene)	NELAP	PA	4/7/2005
EPA 8260		Xylenes, total	NELAP	PA	4/7/2005
EPA 8260		cis-1,2-Dichloroethene	NELAP	PA	4/7/2005
EPA 8260		cis-1,3-Dichloropropene	NELAP	PA	4/7/2005
EPA 8260		m+p-Xylene	NELAP	PA	8/26/2006
EPA 8260		m-Xylene	NELAP	PA	4/9/2009
EPA 8260		n-Butylbenzene	NELAP	PA	4/7/2005
EPA 8260		n-Hexane	NELAP	PA	12/5/2007
EPA 8260		n-Propylbenzene	NELAP	PA	4/7/2005
EPA 8260		o-Xylene	NELAP	PA	8/26/2006
EPA 8260		p-Isopropyltoluene (4-Isopropyltoluene)	NELAP	PA	8/26/2006
EPA 8260		p-Xylene	NELAP	PA	4/9/2009
EPA 8260		sec-Butylbenzene	NELAP	PA	4/7/2005
EPA 8260		tert-Butyl alcohol (2-Methyl-2-propanol)	NELAP	PA	4/8/2008
EPA 8260		tert-Butylbenzene	NELAP	PA	4/7/2005
EPA 8260		trans-1,2-Dichloroethene	NELAP	PA	4/7/2005
EPA 8260		trans-1,3-Dichloropropene	NELAP	PA	4/7/2005
EPA 8260		trans-1,4-Dichloro-2-butene	NELAP	PA	4/7/2005
EPA 8270		1,1'-Biphenyl (Biphenyl, Lemonene)	NELAP	PA	4/18/2006
EPA 8270		1,2,3,4-Tetrachlorobenzene	NELAP	PA	8/26/2006
EPA 8270		1,2,3,5-Tetrachlorobenzene	NELAP	PA	8/26/2006
EPA 8270		1,2,4,5-Tetrachlorobenzene	NELAP	PA	4/7/2005
EPA 8270		1,2,4-Trichlorobenzene	NELAP	PA	4/7/2005

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Laboratory Scope of Accreditation

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DEP Laboratory ID: 02-00416 **EPA Lab Code: PA00164** **TNI Code: TNI02151** **(412) 963-7058**
PADWIS ID: 02416

Matrix: Solid and Chemical Materials

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270		1,2-Dichlorobenzene (o-Dichlorobenzene)	NELAP	PA	4/7/2005
EPA 8270		1,2-Dinitrobenzene (1,2-DNB)	NELAP	PA	8/26/2006
EPA 8270		1,2-Diphenylhydrazine	NELAP	PA	4/18/2006
EPA 8270		1,3,5-Trichlorobenzene	NELAP	PA	8/26/2006
EPA 8270		1,3,5-Trinitrobenzene (1,3,5-TNB)	NELAP	PA	8/26/2006
EPA 8270		1,3-Dichlorobenzene (m-Dichlorobenzene)	NELAP	PA	4/7/2005
EPA 8270		1,3-Dinitrobenzene (1,3-DNB)	NELAP	PA	8/26/2006
EPA 8270		1,4-Dichlorobenzene (p-Dichlorobenzene)	NELAP	PA	4/7/2005
EPA 8270		1,4-Dioxane (1,4-Diethyleneoxide)	NELAP	PA	8/24/2005
EPA 8270		1,4-Naphthoquinone	NELAP	PA	8/26/2006
EPA 8270		1,4-Phenylenediamine	NELAP	PA	12/5/2007
EPA 8270		1-Chloronaphthalene	NELAP	PA	8/26/2006
EPA 8270		1-Methylnaphthalene	NELAP	PA	4/9/2009
EPA 8270		1-Naphthylamine (alpha-Naphthylamine)	NELAP	PA	8/26/2006
EPA 8270		2,2'-Oxybis(1-chloropropane) (bis(2-Chloro-1-methylethyl) ether)	NELAP	PA	4/18/2006
EPA 8270		2,2'-oxybis(1-Chloropropane)	NELAP	PA	4/7/2005
EPA 8270		2,3,4,6-Tetrachlorophenol	NELAP	PA	8/24/2005
EPA 8270		2,3,5,6-Tetrachlorophenol	NELAP	PA	8/26/2006
EPA 8270		2,3,7,8-TCDD (Dioxin) (screen)	NELAP	PA	8/26/2006
EPA 8270		2,3-Dichlorophenol (Dichlorophenol)	NELAP	PA	12/5/2007
EPA 8270		2,4,5-Trichlorophenol	NELAP	PA	4/7/2005
EPA 8270		2,4,6-Tribromophenol	NELAP	PA	4/9/2009
EPA 8270		2,4,6-Trichlorophenol	NELAP	PA	4/7/2005
EPA 8270		2,4-Dichlorophenol	NELAP	PA	4/7/2005
EPA 8270		2,4-Dimethylphenol	NELAP	PA	4/7/2005
EPA 8270		2,4-Dinitrophenol	NELAP	PA	4/7/2005
EPA 8270		2,4-Dinitrotoluene (2,4-DNT)	NELAP	PA	4/7/2005
EPA 8270		2,5-Dichlorophenol	NELAP	PA	12/5/2007
EPA 8270		2,6-Dichlorophenol	NELAP	PA	8/24/2005
EPA 8270		2,6-Dinitrotoluene (2,6-DNT)	NELAP	PA	4/7/2005
EPA 8270		2-Acetylaminofluorene	NELAP	PA	8/26/2006
EPA 8270		2-Chloronaphthalene	NELAP	PA	10/13/2010
EPA 8270		2-Chlorophenol	NELAP	PA	4/7/2005
EPA 8270		2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	NELAP	PA	4/7/2005
EPA 8270		2-Methylnaphthalene	NELAP	PA	4/7/2005
EPA 8270		2-Methylphenol (o-Cresol)	NELAP	PA	4/7/2005
EPA 8270		2-Naphthylamine (beta-Naphthylamine)	NELAP	PA	8/26/2006
EPA 8270		2-Nitroaniline	NELAP	PA	4/7/2005
EPA 8270		2-Nitrophenol	NELAP	PA	4/7/2005
EPA 8270		2-Phenylphenol	NELAP	PA	4/9/2009
EPA 8270		2-Picoline (2-Methylpyridine)	NELAP	PA	4/18/2006
EPA 8270		3+4-Methylphenol (m+p-Cresol)	NELAP	PA	4/7/2005
EPA 8270		3,3'-Dichlorobenzidine	NELAP	PA	4/7/2005
EPA 8270		3,3'-Dimethylbenzidine	NELAP	PA	8/24/2005

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Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 014-002 expiration date April 30, 2018. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 02-00416 EPA Lab Code: PA00164 TNI Code: TNI02151 (412) 963-7058

PADWIS ID: 02416

Matrix: Solid and Chemical Materials

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270		3-Methylcholanthrene	NELAP	PA	8/26/2006
EPA 8270		3-Nitroaniline	NELAP	PA	4/7/2005
EPA 8270		4,4'-Methylenebis(2-chloroaniline)	NELAP	PA	8/24/2005
EPA 8270		4,4'-Methylenebis(N N-dimethylaniline)	NELAP	PA	8/26/2006
EPA 8270		4-Aminobiphenyl	NELAP	PA	8/26/2006
EPA 8270		4-Bromophenyl phenyl ether	NELAP	PA	4/7/2005
EPA 8270		4-Chloro-3-methylphenol	NELAP	PA	4/7/2005
EPA 8270		4-Chloroaniline	NELAP	PA	4/7/2005
EPA 8270		4-Chlorophenol	NELAP	PA	8/26/2006
EPA 8270		4-Chlorophenyl phenyl ether	NELAP	PA	4/7/2005
EPA 8270		4-Dimethylaminoazobenzene (Dimethylaminoazobenzene)	NELAP	PA	8/26/2006
EPA 8270		4-Nitroaniline	NELAP	PA	4/7/2005
EPA 8270		4-Nitrobiphenyl	NELAP	PA	8/26/2006
EPA 8270		4-Nitrophenol	NELAP	PA	4/7/2005
EPA 8270		4-Nitroquinoline-1-oxide	NELAP	PA	8/26/2006
EPA 8270		4-Nitrotoluene	NELAP	PA	8/26/2006
EPA 8270		5-Nitro-o-toluidine	NELAP	PA	8/26/2006
EPA 8270		6-Methylchrysene	NELAP	PA	12/5/2007
EPA 8270		7,12-Dimethylbenz(a)anthracene	NELAP	PA	8/26/2006
EPA 8270		Acenaphthene	NELAP	PA	4/7/2005
EPA 8270		Acenaphthylene	NELAP	PA	4/7/2005
EPA 8270		Acetophenone	NELAP	PA	8/26/2006
EPA 8270		Aminoazobenzene	NELAP	PA	8/26/2006
EPA 8270		Aniline	NELAP	PA	4/7/2005
EPA 8270		Anthracene	NELAP	PA	4/7/2005
EPA 8270		Aramite	NELAP	PA	8/24/2005
EPA 8270		Atrazine	NELAP	PA	4/18/2006
EPA 8270		Azinphos-methyl (Guthion)	NELAP	PA	3/1/2007
EPA 8270		Benzaldehyde	NELAP	PA	8/26/2006
EPA 8270		Benzidine	NELAP	PA	4/7/2005
EPA 8270		Benzo[a]anthracene	NELAP	PA	4/7/2005
EPA 8270		Benzo[a]pyrene	NELAP	PA	4/7/2005
EPA 8270		Benzo[b]fluoranthene	NELAP	PA	4/7/2005
EPA 8270		Benzo[ghi]perylene	NELAP	PA	4/7/2005
EPA 8270		Benzo[k]fluoranthene	NELAP	PA	4/7/2005
EPA 8270		Benzoic acid	NELAP	PA	4/7/2005
EPA 8270		Benzyl alcohol	NELAP	PA	8/24/2005
EPA 8270		Butyl benzyl phthalate (Benzyl butyl phthalate)	NELAP	PA	4/7/2005
EPA 8270		Caprolactam	NELAP	PA	4/18/2006
EPA 8270		Carbaryl (Sevin)	NELAP	PA	12/5/2007
EPA 8270		Carbazole	NELAP	PA	4/7/2005
EPA 8270		Chlorobenzilate	NELAP	PA	8/24/2005
EPA 8270		Chrysene (Benzo[a]phenanthrene)	NELAP	PA	4/7/2005
EPA 8270		Cresols (total)	NELAP	PA	4/18/2006

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DEP Laboratory ID: 02-00416 **EPA Lab Code: PA00164** **TNI Code: TNI02151** **(412) 963-7058**
PADWIS ID: 02416

Matrix: Solid and Chemical Materials

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270		Di-n-butyl phthalate	NELAP	PA	4/7/2005
EPA 8270		Di-n-octyl phthalate	NELAP	PA	4/7/2005
EPA 8270		Diallate (cis or trans)	NELAP	PA	4/18/2006
EPA 8270		Dibenz[a,h]acridine	NELAP	PA	12/5/2007
EPA 8270		Dibenzo[a,h]anthracene	NELAP	PA	4/7/2005
EPA 8270		Dibenzofuran	NELAP	PA	4/7/2005
EPA 8270		Diethyl phthalate	NELAP	PA	4/7/2005
EPA 8270		Dimethoate	NELAP	PA	8/26/2006
EPA 8270		Dimethyl phthalate	NELAP	PA	4/7/2005
EPA 8270		Dinoseb (2-sec-Butyl-4,6-dinitrophenol, DNBP)	NELAP	PA	8/26/2006
EPA 8270		Disulfoton	NELAP	PA	8/26/2006
EPA 8270		Ethyl methanesulfonate	NELAP	PA	8/26/2006
EPA 8270		Famphur	NELAP	PA	8/26/2006
EPA 8270		Fluoranthene	NELAP	PA	4/7/2005
EPA 8270		Fluorene	NELAP	PA	4/7/2005
EPA 8270		Hexachlorobenzene	NELAP	PA	4/7/2005
EPA 8270		Hexachlorobutadiene (1,3-Hexachlorobutadiene)	NELAP	PA	4/7/2005
EPA 8270		Hexachlorocyclopentadiene	NELAP	PA	4/7/2005
EPA 8270		Hexachloroethane	NELAP	PA	4/7/2005
EPA 8270		Hexachloropropene	NELAP	PA	8/24/2005
EPA 8270		Indene	NELAP	PA	4/9/2009
EPA 8270		Indeno(1,2,3-cd)pyrene	NELAP	PA	4/7/2005
EPA 8270		Isodrin	NELAP	PA	8/26/2006
EPA 8270		Isophorone	NELAP	PA	4/7/2005
EPA 8270		Isosafrole	NELAP	PA	8/26/2006
EPA 8270		Kepone	NELAP	PA	4/18/2006
EPA 8270		Methapyrilene	NELAP	PA	12/5/2007
EPA 8270		Methyl methanesulfonate	NELAP	PA	8/26/2006
EPA 8270		Methyl parathion (Parathion, methyl)	NELAP	PA	8/24/2005
EPA 8270		N-Nitrosodi-n-butylamine	NELAP	PA	8/24/2005
EPA 8270		N-Nitrosodi-n-propylamine	NELAP	PA	4/7/2005
EPA 8270		N-Nitrosodiethylamine	NELAP	PA	4/7/2005
EPA 8270		N-Nitrosodimethylamine	NELAP	PA	4/7/2005
EPA 8270		N-Nitrosodiphenylamine	NELAP	PA	4/7/2005
EPA 8270		N-Nitrosomethylethylamine	NELAP	PA	8/24/2005
EPA 8270		N-Nitrosomorpholine	NELAP	PA	8/26/2006
EPA 8270		N-Nitrosopiperidine	NELAP	PA	8/26/2006
EPA 8270		N-Nitrosopyrrolidine	NELAP	PA	4/7/2005
EPA 8270		Naphthalene	NELAP	PA	4/7/2005
EPA 8270		Nitrobenzene	NELAP	PA	4/7/2005
EPA 8270		O,O,O-Triethyl phosphorothioate	NELAP	PA	8/26/2006
EPA 8270		Octachlorocyclopentene (Perchlorocyclopentene)	NELAP	PA	12/5/2007
EPA 8270		Octachlorostyrene	NELAP	PA	12/5/2007

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DEP Laboratory ID: 02-00416 EPA Lab Code: PA00164 TNI Code: TNI02151 (412) 963-7058

PADWIS ID: 02416

Matrix: Solid and Chemical Materials

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270		Parathion, ethyl (Ethyl parathion, Parathion)	NELAP	PA	8/24/2005
EPA 8270		Pentachlorobenzene	NELAP	PA	8/24/2005
EPA 8270		Pentachloroethane	NELAP	PA	8/26/2006
EPA 8270		Pentachloronitrobenzene (PCNB)	NELAP	PA	8/24/2005
EPA 8270		Pentachlorophenol (PCP)	NELAP	PA	4/7/2005
EPA 8270		Phenacetin	NELAP	PA	8/26/2006
EPA 8270		Phenanthrene	NELAP	PA	4/7/2005
EPA 8270		Phenol	NELAP	PA	4/7/2005
EPA 8270		Phorate (Thimet)	NELAP	PA	8/26/2006
EPA 8270		Pronamide (Kerb)	NELAP	PA	8/24/2005
EPA 8270		Pyrene	NELAP	PA	4/7/2005
EPA 8270		Pyridine	NELAP	PA	4/18/2006
EPA 8270	C	SOCs by GC/MS	NELAP	PA	4/8/2009
EPA 8270	D	SOCs by GC/MS	NELAP	PA	4/9/2009
EPA 8270		Safrole	NELAP	PA	8/26/2006
EPA 8270		Sulfotepp (Tetraethyl dithiopyrophosphate)	NELAP	PA	8/26/2006
EPA 8270		Thionazine (Thionazin, Zinophos)	NELAP	PA	8/26/2006
EPA 8270		a,a-Dimethylphenethylamine (Phentermine)	NELAP	PA	8/24/2005
EPA 8270		bis(2-Chloroethoxy)methane	NELAP	PA	4/7/2005
EPA 8270		bis(2-Chloroethyl) ether	NELAP	PA	4/7/2005
EPA 8270		bis(2-Ethylhexyl) phthalate (DEHP)	NELAP	PA	4/7/2005
EPA 8270		n-Octadecane	NELAP	PA	4/9/2009
EPA 8270		o-Toluidine (2-Toluidine, 2-Methylaniline)	NELAP	PA	8/24/2005
EPA 8270		p-(Dimethylamino)azobenzene	NELAP	PA	4/9/2009
EPA 8270		p-Chlorobenzilate (Ethyl 4,4'-dichlorobenzilate)	NELAP	PA	12/5/2007
EPA 8270		p-Phenylenediamine	NELAP	PA	4/9/2009
EPA 9010	C	Total cyanide	NELAP	PA	3/4/2013
EPA 9013		Cyanide extraction for solids and oils	NELAP	PA	12/5/2007
EPA 9013	A	Cyanide extraction for solids and oils	NELAP	PA	4/22/2010
EPA 9014		Total cyanide	NELAP	PA	12/14/2012
EPA 9030	B	Sulfide	NELAP	PA	4/7/2005
EPA 9034		Sulfide	NELAP	PA	4/7/2005
EPA 9040	C	pH	NELAP	PA	4/9/2009
EPA 9040	B	pH	NELAP	PA	4/7/2005
EPA 9045	D	pH	NELAP	PA	4/9/2009
EPA 9045	C	pH	NELAP	PA	4/7/2005
EPA 9056	A	Anions by IC	NELAP	PA	4/9/2009
EPA 9056		Bromide	NELAP	PA	8/26/2006
EPA 9056		Chloride	NELAP	PA	4/7/2005
EPA 9056		Fluoride	NELAP	PA	4/7/2005
EPA 9056		Nitrate as N	NELAP	PA	4/7/2005
EPA 9056		Nitrite as N	NELAP	PA	4/7/2005
EPA 9056		Orthophosphate as P	NELAP	PA	1/26/2009
EPA 9056		Sulfate	NELAP	PA	4/7/2005
EPA 9056		Total nitrate-nitrite	NELAP	PA	8/26/2006

Aaron Alger

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 014-002 expiration date April 30, 2018. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 02-00416 **EPA Lab Code: PA00164** **TNI Code: TNI02151** **(412) 963-7058**
PADWIS ID: 02416

Matrix: Solid and Chemical Materials

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 9065		Total phenolics	NELAP	PA	12/5/2007
EPA 9071	B	Oil and grease	NELAP	PA	4/9/2009
EPA 9095	B	Paint filter liquids test	NELAP	PA	4/9/2009
EPA Lloyd Kahn Method		Total organic carbon (TOC)	NELAP	PA	9/27/2007
OIA 1677		Available cyanide	NELAP	PA	4/18/2006
SM 2520 B		Salinity	NELAP	PA	4/8/2008
SM 2540 B		Residue, total	NELAP	PA	4/8/2008
SM 2540 G		Percent moisture in soil	NELAP	PA	4/13/2009
SM 2540 G		Residue, total	NELAP	PA	12/5/2007
SOP (00416) OP-011		Percent lipids	NELAP	PA	4/13/2009
SOP (00416) WC-033		Water leach	NELAP	PA	9/5/2012
Walkley Black		Total organic carbon (TOC)	NELAP	PA	4/8/2008

Karen Alger

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.

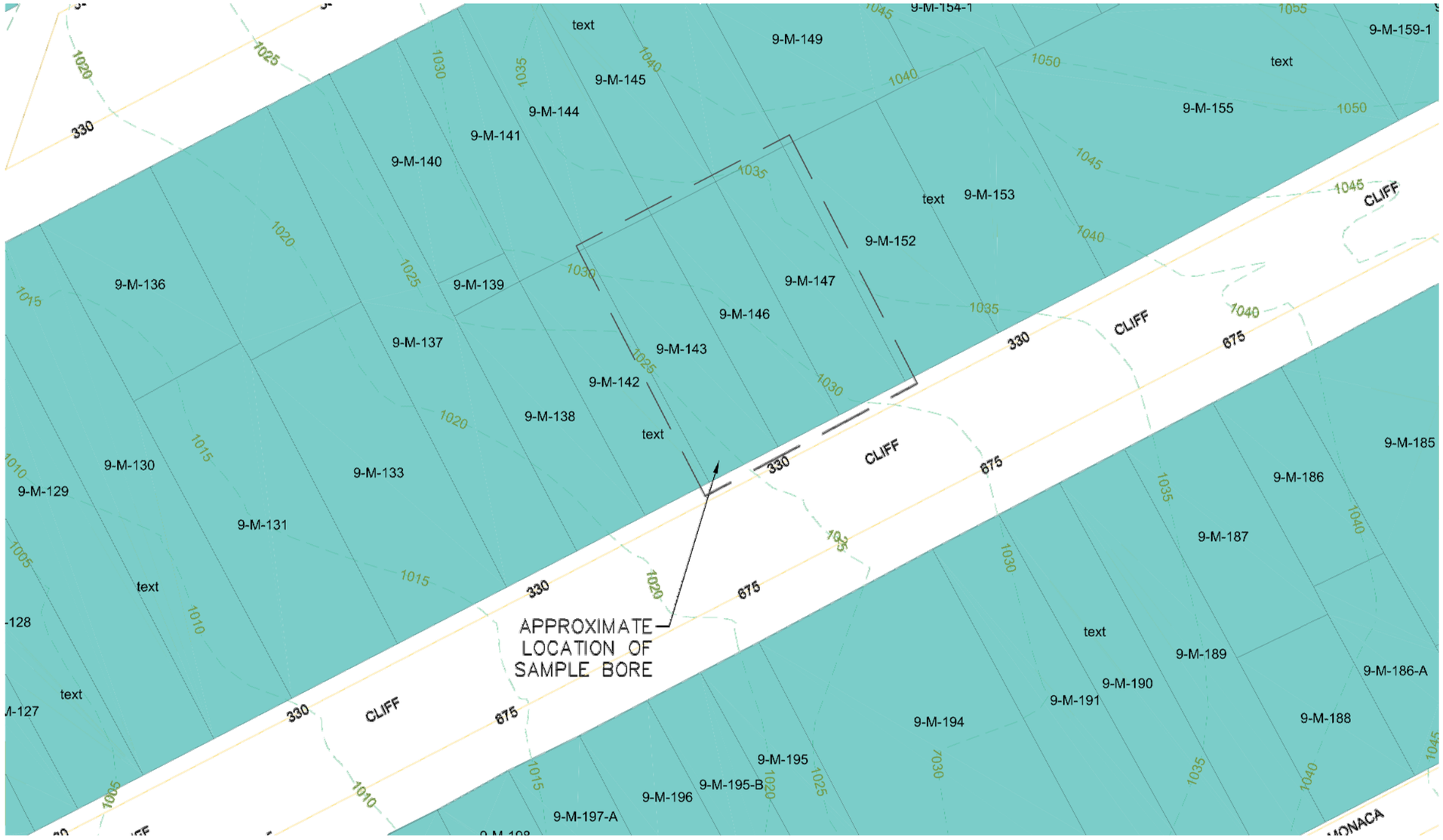
APPENDIX D: MAPS

Area of Investigation

flow Groundwater flow direction

700 RIVER AVE, SUITE 412
PITTSBURGH, PA 15212-5936
Ph (412) 321-3951 F (412) 321-3951
www.CosmosTechnologiesInc.com
Cosmos Technologies Inc.

LOCATION MAP
(SITES – D, E & F)



1835 CLIFF STREET

700 RIVER AVE, SUITE 412
PITTSBURGH, PA 15212-5936
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www.CosmosTechnologiesInc.com
Cosmos Technologies Inc.

MAP 1
1835 CLIFF STREET
(SITE – D)

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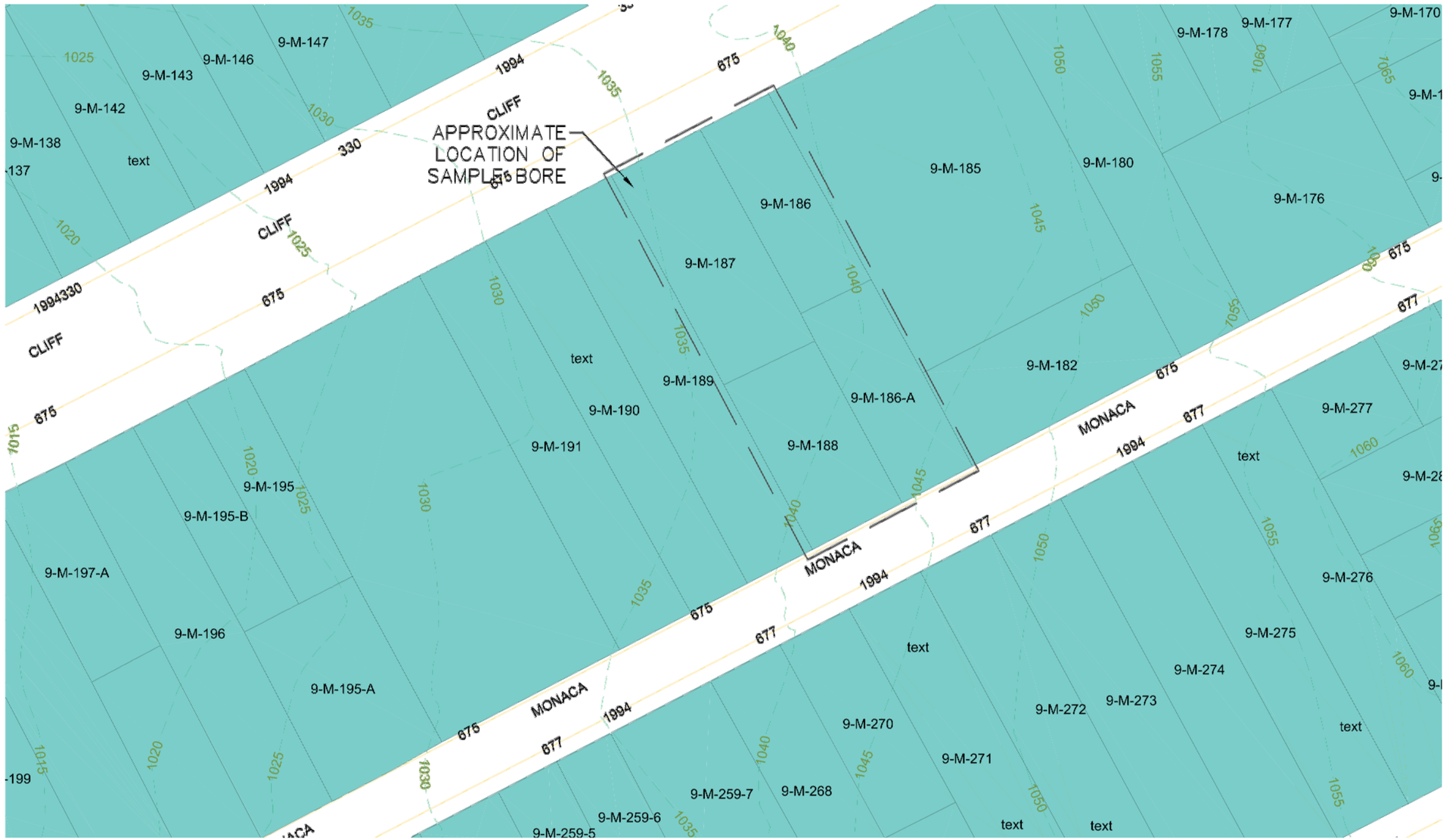

1850 CLIFF STREET

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MAP 2
1850 CLIFF STREET
(SITE – E)

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33 CLIFF STREET

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MAP 3
33 CLIFF STREET
(SITE – F)

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