A1. TITLE AND APPROVAL PAGE

QUALITY ASSURANCE PROJECT PLAN
for
Trees Atlanta Environmental Cleanup at 825 Warner Street
FY2018 City of Atlanta Brownfields Community-Wide Assessment Program

Conducted Under
EPA Brownfields Cooperative Agreement Recipient (CAR) No. BF 00D59517-0

Prepared for:

68 Mitchell Street, Suite 5100
Atlanta, Georgia 30303

Prepared by:

6611 Bay Circle, Suite 220
Norcross, Georgia 30071
678.443.1197

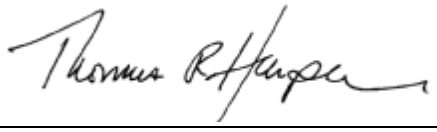
and

Environmental Technology Resources, Inc.
4780 Ashford Dunwoody Road
Suite A-456
Atlanta, Georgia 30338

Submittal Date:
September 8, 2020

Signature Approval:

ETRI Cleanup Project Manager:



Signature

Thomas R. Harper 09/24/2020

Printed Name / Date

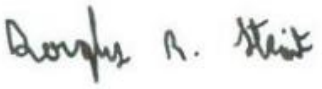
Cardno Project Manager:

Signature

Keith Ziobron, P.E. 09/24/2020

Printed Name / Date

Cardno QA/QC Officer:



Signature

Douglas Strait, P.E. 09/24/2020

Printed Name / Date

RLF EPA Project Officer/ EPA Designated Approving Official (DAO):

Signature

Camilla Warren

Printed Name / Date

Assessment EPA Project Officer/ EPA Designated Approving Official (DAO):

Signature

Derek Street

Printed Name / Date

City of Atlanta Brownfields Program Director:

Signature

Jessica Lavandier

Printed Name / Date

A2. TABLE OF CONTENTS

Section

Page

List of Appendices:

A3. DISTRIBUTION LIST

The following individuals will receive copies of the approved Quality Assurance Project Plan (QAPP) and any subsequent revisions:

- Derek Street, City of Atlanta Brownfields Community-Wide Assessment Project Officer & EPA Designated Approving Official (DAO), EPA Region 4, Sam Nunn Federal Center, 61 Forsyth Street Southwest, Brownfields Section, 10th Floor, Atlanta, Georgia 30303-8960, Phone: 440.562.8519, Email: street.derek@epa.gov

- Camilla Warren, City of Atlanta Brownfields Revolving Loan Fund (RLF) Project Officer & EPA DAO, EPA Region 4, Sam Nunn Federal Center, 61 Forsyth Street Southwest, Brownfields Section, 10th Floor, Atlanta, Georgia 30303-8960, Phone: 404.562.8574, Email: warren.camilla@epa.gov

- Jessica Lavandier, Authorized Representative and Brownfields Program Manager, City of Atlanta and Invest Atlanta, 68 Mitchell Street SW, Atlanta, GA 30303, Phone: 404.330.6000, Email: jlavandier@atlantaga.gov

- Connie Veates, Trees Atlanta, Property Owner, 225 Chester Avenue, SE, Atlanta, Georgia 30316, Phone: 404.681.4905, Email: Connie@treesatlanta.org

- Tom Harper, ETRI Cleanup Project Manager, Environmental Technology Resources, Inc. (ETRI), 4780 Ashford Dunwoody Road, Suite A-456, Atlanta, GA 30338, Phone: 770.888.8181; Email: etri@mindspring.com

- Keith Ziobron, P.E., Cardno Project Manager, Cardno, Inc. (Cardno), 6611 Bay Circle, Suite 220, Norcross, Georgia 30071, Phone: 678.443.1197, Email: keith.ziobron@cardno.com

- Douglas Strait, P.E., Quality Assurance/Quality Control Officer, Cardno, 6611 Bay Circle, Suite 220, Norcross, Georgia 30071, Phone: 770.316.2466, Email: douglas.strait@cardno.com

- Jon King, Project Manager, AquaTerra Recycling & Treatment (AquaTerra), 710 Moore Street, Oxford, GA 30054, Phone: 678.625.4025, Email:

- Ioana Pacurar, Laboratory Project Manager, Analytical Environmental Services, Inc. (AES), 3080 Presidential Drive, Atlanta, GA 30340, Phone: 770.457.8177, Email: ipacurar@aesatlanta.com

A4. PROJECT/TASK ORGANIZATION

This Quality Assurance Project Plan (QAPP) was prepared by Environmental Technology Resources, Inc. (ETRI) on behalf of the property owner, Trees Atlanta, and the City of Atlanta (City) for the lead impacted soil removal at 825 Warner Street.

Cardno was selected by the City of Atlanta (City) as their Qualified Environmental Professional (QEP) and assisted ETRI with the development of this QAPP. Cardno is also assisting the City in programmatic support services and grant management activities under their Environmental Protection Agency (EPA) Brownfield Community-wide Assessment Grant Cooperative Agreement Recipient Number BF 00D59517-0.

A checklist of the required content references and location within this document is provided in **Appendix A.**

A project organization chart is included in **Appendix B**. The following are the individuals participating in the project and their specific roles and responsibilities:

Derek Street, EPA Region 4 City of Atlanta Brownfields Community-Wide Assessment Grant Project Officer/DAO - Mr. Street is responsible for overseeing and monitoring the City's Community-Wide Assessment grant. As part of that responsibility, he ensures the processes described in the work plan are followed and the terms and conditions of the grant are met. The Brownfields Region 4 Quality Assurance Manager's DAO provides technical assistance to the Region 4 Project Officer working on Brownfields sites. The DAO's role is to provide technical reviews of QAPPs and QAPP Addenda that are generated. This includes the approval of this QAPP.

Camilla Warren, EPA Region 4 City of Atlanta Brownfields RLF Grant Project Officer/DAO - Ms. Warren is responsible for overseeing and monitoring the City's RLF grant. As part of that responsibility, she ensures the processes described in the work plan are followed and the terms and conditions of the grant are met. The DAO's role is to provide technical reviews of the QAPPs and QAPP Addenda that are generated.

Jessica Lavandier, City of Atlanta Brownfields Program Manager – Ms. Lavandier is responsible for the overall strategic direction of the project and ensures project activities are executed in accordance with the approved Work Plan and the Terms and Conditions of the Cooperative Agreement. She will also coordinate with Invest Atlanta which manages the financial aspects of the City of Atlanta Brownfield RLF program. This includes the approval of this QAPP and any revisions.

Keith Ziobron, Cardno Project Manager – Mr. Ziobron is the primary decision maker for the project and the primary user of the data to determine whether or not further action is required at the site. His specific responsibilities include:

1. Approving the QAPP and subsequent revisions in terms of Brownfields specific requirements for the QEP;
2. Overall responsibility of the cleanup project;
3. Overseeing project activities in accordance with the QAPP;
4. Validating field data;
5. Making final project decisions with the authority to commit the necessary resources to conduct the project;
6. Instituting corrective actions for problems encountered in the field sampling activities; and
7. Communicating corrective actions to Trees Atlanta and their respective contractor Project Managers to remedy problems encountered in the field and coordinating to correct any corresponding problems encountered.
8. Compiling documentation detailing any correct actions and providing them to the City of Atlanta Project Manager.
9. Audit contractors relative to Davis-Bacon Act compliance.

Douglas Strait, Cardno QA/QC Officer – Mr. Strait will assist the Cardno Project Manager in overseeing project activities in accordance with the QAPP and Design. As the QA/QC Officer, he provides documentation audits and technical review to assist in promoting, implementing, and documenting QA compliance.

Connie Veates, Trees Atlanta, Property Owner and Subgrant Recipient – Ms. Veates represents the owner of the 825 Warner Street property and manages the overall redevelopment of the property. She will be the main point of contact between the City of Atlanta, Cardno, and the contractors performing the cleanup work. As the recipient of the RLF subgrant, she is responsible to ensure the processes described in the Corrective Action Plan and QAPP are followed and the terms and conditions of the subgrant are met.

Tom Harper, ETRI, Trees Atlanta Representative and Cleanup Project Manager – The Cleanup Project Manager will coordinate project activities. He will reduce raw field data to determine if further corrective action is required at the site. Specific responsibilities include:

1. Overall responsibility of the environmental investigation and remediation oversight;
2. Coordinating field and laboratory activities;
3. Conducting project activities in accordance with the QAPP and the CAP;
4. Upon receipt from the Cardno Project Manager, make available the approved QAPP documents and subsequent revisions to the members of the sampling team.
5. Select the field sampling team and discuss project details with the Cardno Project Manager.
6. Conduct the field activities per the approved QAPP documents and supervise the field sampling team.
7. Report any field sampling problems to the Cardno Project Manager.
8. Implement corrective actions in the field as directed by the Cardno Project Manager. Corrective actions will be documented in the field logs and provided to the Cardno Project Manager.

Jon King, AquaTerra Project Manager – Mr. King will oversee the soil remediation activities conducted by AquaTerra, Trees Atlanta selected remediation contractor. Specifically, he will perform the following duties:

1. Provide continual oversight of soil remediation activities to ensure compliance with the Cleanup Work Plan and QAPP.
2. Upon receipt from the Cardno Project Manager, make available the approved QAPP documents and subsequent revisions to the members of the remediation team.
3. Report any remediation activity problems to the Cardno Project Manager.
4. Implement corrective actions in the field as directed by the Cardno Project Manager. Corrective actions will be documented in the field logs and provided to the Cardno Project Manager.

Ioana Pacurar, AES Laboratory Project Manager –Ms. Pacurar is responsible for the following:

1. Coordinating the analysis of the samples and the laboratory validation of the data;
2. Coordinating the receipt of the samples at the laboratory, selecting the analytical team, ensuring internal laboratory audits are conducted per the Laboratory's Quality Assurance Manual (QAM), and distributing the applicable sections of the QAPP and subsequent revisions to members of the analytical team;
3. Instituting corrective actions for problems encountered in the chemical analyses and reporting laboratory problems affecting the project data to the Cardno Project Manager and Cardno QA/QC Reviewer. Corrective actions for chemical analyses will be detailed in a QA report that will be provided via electronic and conventional mail.

A5. PROBLEM DEFINITION/BACKGROUND

The City of Atlanta (City) received an EPA Brownfields Community-wide Assessment Grant in 2017 (BF 00D59517). This funding is being used in part to prepare the appropriate documents for the cleanup of the Trees Atlanta property located at 825 Warner Street, which is to be funded with the City's EPA Brownfields RLF Grant.

Documents developed under the City's EPA Assessment Grant include the following:

- Analysis of Brownfield Cleanup Alternatives (ABCA)
- Quality Assurance Project Plan (QAPP, this document)

Documents developed by ETRI include the Corrective Action Plan (CAP), which outlines the corrective actions needed.

A.5.1 – Background Information

The subject property is currently developed with a one-story, approximate 23,000 square feet warehouse building. The building was constructed in 1952. The building is a steel-framed structure constructed on a concrete slab. The walls of the building are constructed of concrete block and galvanized metal panels. The building has a slightly pitched roof. A covered truck height loading dock area is located along the southern side of the building. A rail height dock is located adjacent to the northeast side of the building and extends to the east and southeast adjacent to an abandoned rail spur. An abandoned grain silo is located adjacent to the eastern side of the building. The building is currently leased to various artists which use the building as individual art studios. The Site Location Map is included as **Appendix C1.**

The history of the subject property was determined based on information obtained during the completion of a Phase I Environmental Site Assessment (ESA) completed by Oneida Total Integrated Enterprises (OTIE) in April 2019. Historical records show the subject property being developed with four small structures in 1932. Four smaller structures were on the western side of the property. One of the smaller structures was identified as an office and another smaller building was used for storage. A larger structure on the eastern side of the property was identified as being used for steel working and the occupant was identified as The F.E. Golian Company. A railroad spur was identified near the northern boundary of the property. By 1950, the subject property was developed with two structures. A smaller building was located on the southwest corner of the property and a larger building on the north central portion of the Site. The larger building was used as "Cold Storage" and "Wholesale Produce". A 1962 Sanborn map indicates that the property was developed with a large building on the eastern property boundary. The building was labeled as "The F.P. Golian Company Structural & Ornamental Steel". A 1978 Sanborn map labeled the use of the building as "Wholesale Meat".

Tax assessor records indicate that the existing warehouse building was constructed in 1952. A review of City directories dating back to 1952 indicate that the property was occupied by C.L. Fain Company which operated a wholesale produce company in the 1950's. In the early 1960's to sometime in the 1970's, Armour & Company operated a wholesale meat company on the property. Moms Bakery operated a commercial

bakery on the property from 1994 until 2010-2014. The Artist's studio has been in operation for the past eleven years.

According to the Fulton County Tax Assessor records, the subject property was acquired by the current owner Trees Atlanta, Inc. from Jabobar Properties, LLC on July 16, 2019.

Surrounding properties were developed residential or undeveloped land in 1927. The adjacent property to the north has been used for records storage and archiving. Properties to the east have historically been developed residential. The old State Farmer's Market on the adjacent property to the west from 1940-1957. Adjacent southern properties have been developed with commercial buildings used to stage roll-off containers and Conex boxes.

A.5.2 – Previous Environmental Investigations

Phase II ESA and Asbestos Survey, EPS, June 2006

A Phase II Environmental Site Assessment and limited asbestos survey were conducted on behalf of Jabobar Properties, LLC in June 2006. The Phase II ESA and asbestos survey were completed by Environmental Planning Specialists, Inc. (EPS). Seven soil boring were installed to depths ranging from 28 to 30 feet below land surface (bls). Groundwater samples were collected and analyzed for the presence of volatile organic compounds (VOC's). No VOCs were detected above laboratory detection limits in any of the groundwater samples.

The asbestos survey included the collection and analyses of 26 bulk samples which included wallboard, joint compound, ceiling tile, sealants and roof coverings. Asbestos was identified in black asphalt shingles around the perimeter of an upper crawl space, black/white flashing around a roof vent and black/white patching cement on asphalt.

Phase I ESA, OTIE, April 2019

In April 2019, a Phase I Environmental Site Assessment (ESA) was completed on the subject property by Oneida Total Integrated Enterprises. The Phase I ESA was completed for the U.S. Environmental Protection Agency – Region 4 and Trees Atlanta as part of a Targeted Brownfields Assessment. Oneida Total Integrated Enterprises prepared a report entitled: *Phase I Environmental Site Assessment Report 825 Warner Street, SW Atlanta, Fulton County, Georgia EPA TDD No. 0006/OT-06-017* dated April 2019.

The Phase I ESA identified the following recognized environmental conditions on the subject property.

- The regulatory database report identifies the property at 717 Warner Street on the US Brownfields database. This property was identified on the southeast corner of the subject property. The property description is "former drum storage facility". The Phase I report noted that a Phase II investigation conducted in 2006 did not identify any volatile organic compounds in groundwater.
- The subject property was identified on the SPILLS database due to an incident that occurred on August 27, 2010. The report indicates that an unknown amount of oil was discharged into a storm drain from any unknown source.

The following off-site RECs were identified in the Phase I ESA Report.

- A 1978 Sanborn map indicates that the adjacent property had transformers which may have contained PCBs
- A US Brownfields site located at 1121 Allene Avenue is located adjacent to the southeast side of the subject property. The adjacent property was identified as formerly having a drum storage facility.
- Champion International, which is located 500 feet south of the subject property, was identified as a LUST site
- ESB, Inc., which is located 0.294 miles from the subject property was identified as a State Hazardous Waste Site due to the release of lead
- Bernstein Scrap Metal is located approximately 500 feet to the northwest. This property was identified as having a release of Lead and is listed as a non-hazardous waste site.
- Four historical auto sites are located within 586 feet of the subject property.

Based on the findings from the Phase I, OTIE recommended that a Phase II ESA be completed. Excerpt of the OTIE Phase I ESA is included as **Appendix D1.**

Phase II ESA, ERTI, May 2019

On May 7, 2019, ETRI and its subcontractor, GeoLab Drilling mobilized to the site to install the soil borings. Three soil borings were installed on the property. Soil boring B1 was located on the southwest side of the property. Soil boring B2 was installed east of the southeast corner of the building and soil boring B3 was installed on the northeast side of the property and adjacent to an outside rail loading dock area. The soil borings were installed using Geoprobe® direct push technology (DPT) drill rig. Each soil boring was advanced to a depths of 35 feet. Soil boring locations are identified in Figure 2.

Soil samples collected from boring B1 at a depth of 3-4 feet, B2 at 7-10 feet and B3 at 2-3 feet were analyzed for Resource Conservation and Recovery Act (RCRA) Metals. The soil samples collected from B1 at 5-10 feet, B2 at 7-10 feet and B3 at 2-3 feet were analyzed for volatile organic compounds (VOCs) and polyaromatic hydrocarbons (PAHs). Samples VOC's were analyzed using EPA Method SW8260B, PAHs using EPA Method SW 8270D and RCRA Metals were analyzed using Method SW 6010D and 7471B. The results of the analyses of the soil samples are summarized in Table 1.

Table 1
Summary of Soil Sample Analyses – May 7, 2019
825 Warner Street, Atlanta, Georgia

Parameter	B1-3-4'	B1-5-10'	B2-7-10'	B3-2-3'	GA EPD NCs
Metals					
Arsenic	BRL	NA	27.9	15.4	41
Barium	63.9	NA	276	218	500
Cadmium	3.7	NA	28.9	7.3	39
Chromium	47.5	NA	31.9	42.6	1,200
Lead	39.2	NA	5,880	109	400
Mercury	BRL	NA	BRL	BRL	17

Parameter	B1-3-4'	B1-5-10'	B2-7-10'	B3-2-3'	GA EPD NCs
Selenium	BRL	NA	BRL	BRL	36
Silver	BRL	NA	BRL	BRL	10
Volatile Organic Compounds	NA	BRL	NA	NA	Chemical Specific
Naphthalene	NA	BRL	0.0086	NA	100
PAHs	NA	BRL	NA	NA	Chemical Specific
Fluoranthene	NA	BRL	6.57	NA	500
Phenanthrene	NA	BRL	6.05	NA	110
Pyrene	NA	BRL	5.58	NA	500

Notes:
Highlight Yellow – Above NC
BRL – Below Laboratory Reporting Limit
NA – Not Analyzed
Results in mg/Kg, ppm

After completing the soil borings, a groundwater sampling tool consisting of a telescopic four-foot length of wire mesh screen was inserted into a drive point rod. The depth to groundwater was determined to be approximately 24.22 feet in boring B1, 28.6 feet in B2 and 27 feet in B3.

A groundwater sample was collected by lowering a disposable length of polyethylene tubing into the hollow rods and connecting the tubing to a peristaltic pump at the surface. Groundwater was then extracted using the peristaltic pump. The samples were placed in 40-mL vials containing hydrochloric acid as a preservative and one-liter amber jars provided by the laboratory. The samples were then placed on ice for additional preservation.

The groundwater samples from borings B1, B2 and B3 were analyzed for volatile organic compounds using EPA Method SW 8260B. Groundwater samples collected from B2 and B3 were also analyzed for polyaromatic hydrocarbons using Method SW 8270D. Table 2 is a summary of the analyses of the groundwater samples.

Table 2
Summary of Groundwater Sample Analyses – May 7, 2019
825 Warner Street, Atlanta, Georgia

Parameter	B1	B2	B3	GA EPD NCs
Volatile Organic Compounds	BRL	BRL	BRL	
Naphthalene	BRL	BRL	0.0029	400
PAHs	NA	BRL	BRL	Chemical Specific

Notes:
BRL – Below Laboratory Reporting Limit
NA – Not Analyzed
Results in mg/L, ppm

Excerpts of the Phase II ESA are included as **Appendix D2.**

PPCAP, ERTI, June 2019

ETRI on behalf of the property owner, Trees Atlanta, submitted a Prospective Purchaser Corrective Action Plan (PPCAP) in June 2019 to the Georgia EPD Brownfield Group. This PPCAP outlined the previous investigations and the proposed cleanup plan to address the lead impacted soil to the Type 3 RRS. Part of the PPCAP was to further delineate the impacts identified in the May 2019 Phase II ESA. Excerpts of the PPCAP are included as **Appendix D3.**

Additional soil investigations were conducted on June 21, 2019. The purpose of these investigations was to define the extent of contamination discovered during the May 2019 investigations and install a temporary monitoring well in the area of highest lead in soils to determine if groundwater has been impacted.

Ten additional soil borings were installed on the property. Each soil boring was installed to a depth of 25 feet. Soil samples were collected from the upper one foot and below one foot in each boring. The surface samples were analyzed for RCRA Metals. Deeper samples were analyzed for total Lead. The results are summarized in Table 3, and compared to the EPD Type 3 non-residential Risk Reduction Standards (RRS).

Table 3
Summary of Soil Sample Analyses – June 21, 2019
825 Warner Street, Atlanta, Georgia

Parameter	Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver
Type 3 RRS (<1'/>1')	*30/41*	*1,650/1,650*	*39/39*	*1,200/ 1,200*	*400/400*	*17/6.28*	*36/36*	*96.6/96.6*
Type 4 RRS (<1'/>1')					*1,050/ 1,278*			
Sample ID								
B2-6-12"	7.99	291	BRL	24.2	1,390	0.315	BRL	BRL
B2-23-25'	NA	NA	NA	NA	17.7	NA	NA	NA
B4-6-12"	10.5	110	BRL	40.2	435	BRL	BRL	BRL
B4-6.5-7'	NA	NA	NA	NA	1,410	NA	NA	NA
B4-10'	NA	NA	NA	NA	23.5	NA	NA	NA
B5-6-12"	6.28	370	BRL	21.1	988	0.236	BRL	2.83
B5-7-8'	NA	NA	NA	NA	1,510	NA	NA	NA
B5-11-12'	NA	NA	NA	NA	16.6	NA	NA	NA
B6-6-12"	2.75	134	BRL	43.2	110	BRL	BRL	BRL
B6-7-8'	NA	NA	NA	NA	28	NA	NA	NA
B6-10-11'	NA	NA	NA	NA	13	NA	NA	NA
B7-6-12"	18.4	101	BRL	44.4	242	0.266	BRL	BRL
B7-5-6'	NA	NA	NA	NA	76.9	NA	NA	NA
B7-10-11'	NA	NA	NA	NA	19.9	NA	NA	NA
B8-6-12"	10.6	76.5	BRL	39.8	127	0.126	BRL	BRL
B8-6-7'	NA	NA	NA	NA	1,250	NA	NA	NA
B8-9-10'	NA	NA	NA	NA	10.7	NA	NA	NA
B9-6-12"	22.1	51.4	BRL	36.2	24.5	0.192	BRL	BRL
B9-7-8'	NA	NA	NA	NA	848	NA	NA	NA

Parameter	Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver
Type 3 RRS (<1'/>1')	*30/41*	*1,650/1,650*	*39/39*	*1,200/ 1,200*	*400/400*	*17/6.28*	*36/36*	*96.6/96.6*
Type 4 RRS (<1'/>1')					*1,050/ 1,278*			
B11-6-12"	3.23	49.9	BRL	59.1	28.8	0.129	BRL	BRL
B11-8-9'	NA	NA	NA	NA	92.3	NA	NA	NA
B11-10-11'	NA	NA	NA	NA	17.1	NA	NA	NA
B12-6-12"	8.29	199	BRL	7.85	6.2	0.336	BRL	BRL
B12-8-9'	NA	NA	NA	NA	35.2	NA	NA	NA
B12-10-11'	NA	NA	NA	NA	10	NA	NA	NA
B13-6-12"	11.7	371	BRL	16.8	196	BRL	BRL	BRL
B13-8-9'	NA	NA	NA	NA	20.1	NA	NA	NA
B13-10-11'	NA	NA	NA	NA	11.6	NA	NA	NA
B14-6-12"	6.97	120	BRL	32.1	111	BRL	BRL	BRL
B14-6-7'	NA	NA	NA	NA	18.7	NA	NA	NA
B14-10-11'	NA	NA	NA	NA	14.3	NA	NA	NA

Notes:
Yellow Highlight – Above Type 3 Risk Reduction Standards (RRS)
Red Highlight – Above Type 4 RRS
BRL – Below Reporting Level
NA – Not Analyzed
Results in mg/Kg, ppm
Type 3 and 4 RRS – less than 1 ft./greater than 1 ft.

A temporary one-inch groundwater monitoring wells was installed in boring B2. A groundwater sample was collected from TMW-1 on June 5, 2019. Prior to sampling groundwater, the temporary well was purged a minimum of three well volumes using peristaltic pump. The groundwater sample was submitted to Analytical Environmental Services, Inc. of Atlanta, Georgia for analyses. The groundwater samples were analyzed for the presence of total and dissolved lead using Method SW 6010. No detectable concentrations of lead were detected in the groundwater sample.

A6. PROJECT/TASK DESCRIPTION AND SCHEDULE

Based on the previous investigations and the Corrective Action Plan, the following section describes the cleanup actions to be conducted as part of the soil excavation.

The cleanup activities will be completed in conjunction with the negotiated requirements of the Georgia State Historic Preservation Office (SHPO) and Georgia Historic Preservation Division (HPD).

As Subject Site was accepted into the Georgia EPD Brownfield Program in June 2019, the project will be performed under the supervision of the following: Georgia EPD Brownfield Redevelopment Unit in accordance with O.C.G.A. Section 12-8-200 ("Brownfield Act" or "Act"). In addition, all work will utilize Region 4 Science and Ecosystem Support Division (SESD) "Field Branches Quality System and Technical Procedures" as a guide (https://www.epa.gov/quality/quality-system-and-technical-procedures-lsasd-field-branches)

Task 1: Health and Safety Plan Requirements

Prior to beginning cleanup activities, separate Site-Specific Health and Safety Plans (HASP) for Cardno

personnel and contractors retained by the owner will be prepared to meet the requirements of the Occupational Safety and Health Administration (OSHA) Standard 1910.120. These documents will outline potential hazards, the level of personal protection to be used, and the procedures to be followed for monitoring and emergency situations at the Subject Site.

It is assumed that the fieldwork will be performed in Level D personal protection including at a minimum: safety-toed boots, hard-hats, high-visibility clothing/vests, and safety glasses. The Georgia 811 Safe-Dig Utility Protection Center must be contacted to locate underground utilities at least 48 hours prior to initiating subsurface disturbance.

Task 2: Design Phase Investigation

To further delineate the lead impacts, design phase investigation will be completed prior to the implementation of cleanup activities. This design phase investigation will consist of the following:

- Property boundary survey to accurately identify property boundaries and define the limits of investigation.
- Install a minimum of five additional soil borings to delineate the limits of soil impacts. Borings will be advanced via a direct-push technology (DPT) and extended between 0-10 feet bgs. Soil samples will be analyzed for constituents of concern (COCs), as outlined in Section B1 of this document.
    - Borings will be located around the previously identified impacts (B4 and B-5)
    - One boring will be located on the northwest portion of the property to further assess the property for impacts.
    - One boring adjacent boring B5 and to be additionally analyzed for toxicity characteristic leachate procedure (TCLP) 8 RCRA metals for waste characterization purposes
    - If the building has been removed, additional soil borings will be installed within the former building footprint.
- Three of the soil borings will be advanced via DPT to five feet below the groundwater table (approximately 25 feet bgs), and to be converted to temporary monitoring wells.
    - Once installed, temporary wells will be developed until they produce sediment free water, and prior to sampling purged a minimum of three well volumes. Samples will be analyzed for COCs as outlined in Section B1 of this document.
    - Determine top of casing elevation of the temporary wells to determine groundwater flow direction
- Pending the results of the TCLP sample, a waste profile will be developed and submit the profile for possible disposal in a Subtitle D Landfill.

The purposes of each of the proposed soil boring and temporary monitoring wells is discussed in Section B1 of this document.

Task 3: Lead Impacted Soil Removal

Currently, soil impacted by lead is documented between 0 and 1 feet bgs in one location (B2) at the Subject Site. Soil impacted by lead is documented between 1-12 feet bgs in three locations (B2, B4, and B5).

Currently, the amount of lead impacted soil is estimated to be approximately 563 cubic yards (CY) or 810 tons. Maps depicting the current estimated area of soil removal is included as **Appendix C Figures 2 and 3.**

As discussed previously, a Design Phase Investigation will be conducted prior to the start of excavation activities to further delineate the soil lead impacts and to determine a baseline for groundwater impacts.

Upon delineation, impacted soil will be excavated horizontally and vertically with the Subject Site's boundaries to where no impacts are detected above the approved Georgia EPD Type 4 RRS. Specifically, soil will be remediated in accordance with Chapter 391-3-19 of the Georgia EPD Hazardous Site Response Act (HSRA) criteria for corrective action, which is outlined in the Corrective Action Plan. If additional impacts are encountered, then additional soil excavation may be required to achieve unconditional closure status.

All impacted soil will be removed, containerized, labeled, transported, and disposed of at a landfill licensed to accept the waste as profiled. The impacted materials will likely be characterized as non-hazardous and be disposed of at a Subtitle D Municipal Solid Waste Landfill. In order to expedite the disposal process, approval from a disposal facility of regulated wastes will be obtained in writing prior to transport of excavated soil (as outlined in Task 2).

The following additional measures may be considered during soil removal activities:

- Based on the estimated amount of soil removed, a land disturbance permit may be required with the City of Atlanta and if necessary will be obtain prior to implementation of remedial activities;
- Stockpiled soil will be stored on site, and the excavation pit will protected with a temporary six foot (minimum) chain-link fence;
- Cover staged/stockpiled soil with a three-millimeter (mil, minimum) thick plastic sheeting; and
- Implement best management erosion control practices in areas of exterior, exposed, soil, such as hay bales or silt fencing.
- Implement dust suppression techniques to limit potential exposure to nearby residents

Schedule

The City's Brownfields RLF grant will have a general schedule that will guide the process for this cleanup. The soil removal field activities are anticipated to commence within 30 days of the final QAPP approval. According to estimates from the selected remediation contractor, AquaTerra, soil removal activities should take approximately 5 working days.

The following programmatic schedule is provided below, which outlines the approximate schedule for the EPA Grant programmatic requirements.

Table 4
Proposed Project Timeline (dates depend on the EPA project award)
Trees Atlanta Project, Atlanta, Georgia

Activities	Activity Start Date	Activity End Date
QAPP	May 6, 2020	September 8, 2020
ABCA	August 20, 2020	October 28, 2020

Activities	Activity Start Date	Activity End Date
Public Engagement Meeting	September 29, 2020	October 29, 2020
Subgrant Approval	September 17, 2020	October 16, 2020
Design Phase Investigation	October 19, 2020	October 30, 2020
Soil Removal	November 2, 2020	November 6, 2020
Site Restoration	November 9, 2020	November 11, 2020
Compliance Status Report	November 11, 2020	November 26, 2020
RLF Closeout Report	November 27, 2020	December 12, 2020

This schedule will allow EPA a comment and review period for this QAPP and any subsequent revisions. Public notice is anticipated to be provided to Neighborhood Unit S in October 15, , 2020. This will allow for adequate time for public comment and review prior to start of work.

The Design Phase Investigation is anticipated to take approximately 14 days. Laboratory analytical results from the Design Phase Investigation will be requested for a 5-day or sooner rush turnaround times. If the Design Phase Investigation identified additional concerns or significant changes to the overall cleanup strategy that alters this schedule, the updated schedule will be provided in a QAPP Addendum.

Soil remediation activities is anticipated to take approximately five working days. Laboratory analytical results from excavation confirmation samples will be requested for a two-day or sooner rush turnaround times.

As the cleanup is designed to provide closure with the Georgia EPD through the Brownfield Program, and as such a Compliance Status Report will be completed within two months of completion of all cleanup activities. Upon completion of the Compliance Status Report, a RLF closeout report will be completed.

A7. QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT

A.7.1 – Data Quality Objectives

The following seven steps are used to determine the criteria for project specific data quality objectives (DQO) when performing cleanup projects funded under the City's Brownfields RLF grant.

1) State the Problem:

   Lead impacted soils are present throughout the Subject Site. Impacted soil has the potential to harm human health and the environment.

2) Identify the Decision

   Design phase investigation to further characterize and delineate the impacts, and then excavate, dispose of contaminated soil off-site, and backfill with clean soil.

3) Identify Inputs to the Decision
   - Previous soil and groundwater investigations conducted at the Subject Site
   - Historical records and documents with industry-specific experience
   - ETRI's PPCAP and CAP

4) Define the Study Area Boundaries

Soil impact locations are provided in ETRI's PPCAP included as **Appendix D,** and are further illustrated on **Appendix C Figures 2 and 3.**

5) Develop a Decision Rule

Proceed with Design Phase Investigation and then soil excavation.

6) Specify Limits on Data Gaps/Errors

Limits on data gaps and errors associated with analytical sampling are specified throughout this document. There are data gaps identified with respect to the previous reports which will be addressed with the Design Phase Investigation. If further data gaps are identified, they will require management decisions during the implementation of cleanup activities.

7) Optimize Design

The optimized design and sampling requirements are included in the Corrective Action Plan (included as **Appendix E**) and throughout this document.

A.7.2 Criteria for Measurement

The Georgia EPD Brownfields Program will oversee the cleanup, and base the cleanup standards in accordance with the acceptable corrective action for RRS under HSRA (Chapter 391-3-19.07(4)(a through e). The essential features for corrective action compliance require the following conditions be met:

- Free product must be removed to a practicable extent.
- Soil remaining in place under Type 1, 2, 3 and 4 risk reduction standards shall not exhibit hazardous waste characteristics of ignitability, corrosivity, or reactivity as defined in 40 CFR 261 Subpart C and the sum of regulated substance concentrations in air filled pore space shall not exceed 1000 parts per million (by weight or volume).
- The corrective action shall not allow exposure to contaminants that will affect the food chain, damage soils or biota, adversely impact vegetation or wildlife, or accumulate vapors in buildings which pose a threat to human health or the environment.
- The corrective action shall protect Georgia surface waters by adhering to the criterion listed in the Georgia Rules and Regulations for Water Quality Control at Rule 391-3-6-.03(5), or if concentration values are not provided in said Rules, concentrations at levels that exhibit acute toxicity to aquatic life as demonstrated pursuant to protocols established by the Director (Chapter 391-3-19-.07(4)(c)).
- If the detection limit and/or background concentration for a regulated substance is greater than the concentration specified in any risk reduction standard, the greater of the detection limit or background shall be used for determining compliance with the applicable risk reduction standard. Detection limit in this case implies the non-fraudulent use of any approved analytical test method that is appropriate for the particular application. Background shall be determined for samples taken from media that are unaffected by a release.

The guidelines have promulgated five types of risk reduction standards that can be used to display compliance regarding corrective action measures. The standards are described below:

- Type 1 - risk reduction standards are based on standardized exposure assumptions to ensure that the regulated substance poses no significant risk to residential properties.
- Type 2 - risk reduction standards are based on site-specific exposure assumptions to ensure that the regulated substance poses no significant risk to residential properties.
- Type 3 - risk reduction standards are based on standardized exposure assumptions to ensure that the regulated substance poses no significant risk to non-residential properties.
- Type 4 - risk reduction standards are based on site-specific exposure assumptions to ensure that the regulated substance poses no significant risk to non-residential properties.
- Type 5 - risk reduction standards that involve the use of controls such as caps, slurry walls, fences, etc. to minimize risk when it is not appropriate to apply Type 1-4 standards.

The Trees Atlanta property is a non-residential property, thus Type 3 and 4 criteria would be applicable to the site. The Type 4 RRS for lead in soil are calculated using EPA's Adult Lead Model (ALM).

The Type 4 soil direct-contact for lead using central tendency values for a commercial industrial worker (surface soils) is 1,050 mg/Kg and for an excavation worker (subsurface soils) is 1,278 mg/Kg. These values are calculated in accordance with Rule 391-3-19-.07(9)(d)2.(i) and 3(i).

A8. SPECIAL TRAINING REQUIREMENTS/CERTIFICATIONS

This section outlines the minimum training requirements for personnel conducing project activities. Current training records and certificates are kept in personnel files located at the respective headquarters of the project personnel. Specifically, these training documents will be kept on-site by the following key personnel:

- AquatTerra will ensure training certifications are kept for AquaTerra personnel on-site in a field trailer (or an on-site location), with copies made available to the Cardno Project Manager and ETRI Cleanup Project Manager. These records will also be kept at AquaTerra's Oxford office located at 710 Moore Street, Oxford, GA 30054.
- Trees Atlanta and their representatives will keep records of all their employees and contractors training certifications at their office located at 225 Chester Avenue, SE, Atlanta, Georgia 30316.
- Cardno will keep records of all their employees' training certifications on their person and at their Atlanta office located at 6611 Bay Circle, Suite 220, Norcross, GA 30071.

All training records will be made available upon request. Deficiencies and the need for new training are identified during annual personnel evaluations. Personnel deficient in any of the following requirements will not be allowed to conduct project activities.

Hazardous Waste Operations and Emergency Response (HAZWOPER)

The respective project managers will ensure that all on-site personnel have current certificates of training for the 40-hour Occupational Safety and Health Administration (OSHA) HAZWOPER Training Class with annual 8-hour refresher courses. All personnel mobilizing to the site shall carry a Certificate of Training identification card.

Certifications

- Qualified drilling contractor experienced with construction monitoring wells under the supervision of an ETRI Professional Engineer/Geologist will be contracted to facilitate project objectives.
- Excavation activities will be performed by AquatTerra with certified training requirements as outlined by OSHA regulations to conduct the functions that they are assigned.
- Analytical Environmental Services, Inc. (AES), will perform the analysis of the environmental samples in compliance with any and all applicable regulations and standards.

Any other personnel (City, EPA, contractors, etc.) visiting the Subject Site during cleanup activities, must ensure their personnel have at a minimum an OSHA 40-Hr HAZWOPER training certification. If they are to enter any regulated contained areas, then additional training certifications may be required. All training certifications will need to be verified as a pre-requisite for site visit(s).

A9. DOCUMENTATION AND RECORDS

All project documents will be filed per Cardno's standardized project filing system; with all original documents held by Cardno's Norcross, Georgia office (6611 Bay Circle, Suite 220, Norcross, GA 30071). All field-generated documents will be filed at Trees Atlanta office (225 Chester Avenue, SE, Atlanta, GA 30316) and their representatives ETRI's office (4780 Ashford Dunwoody Road, Suite A-456, Atlanta, GA 30338). All final project deliverables will be available for review at the Atlanta City Hall Planning Department office (68 Mitchell Street SW, Atlanta, GA 30303) or at Cardno's Norcross, GA office. All documents will be maintained electronically and/or by hard copy for at least five years.

All technical documents and records will be maintained in accordance with the requirements set forth in the US EPA Region 4, Science and Ecosystem Support Division (SESD), "*Field Branches Quality System and Technical Procedures*"(*http://www.epa.gov/region04/sesd/fbqstp*).

General Project Documentation and Records

General project documentation includes the following:

- Facility study plan (scope of work)
- Health and Safety Plans
- Agency notifications, permits, and compliance documentation
- Original chain of custody records and field log/books/notes
- Records obtained during the cleanup
- Field notes with field crew signatures or initials on all records/notes
- Record of use of field sampling and decontamination supplies, and equipment tracking
- Progress/status reports (to be submitted every week to the City of Atlanta and Cardno)
- Correspondence directly-related to the project

- Data validation/quality assessment reports
- Project audit and QA/QC reports

Field notes must be recorded during all site visits and typically include:

- Names of personnel, subcontractors, and others on-site
- Date and chronological summary of field activities
- Ambient conditions
- Sample location descriptions, sample ID (when applicable)
- Sampling equipment
- Field decontamination procedures
- Field calibration records
- Types of quality control samples collected
- Sampler signature
- Results of QC checks
- Documentation of all problems encountered in the field with corrective action resolution

Project records will include all correspondence, field logs and data sheets, laboratory analytical reports, audit findings, waste manifests, progress reports, and a closeout report. Progress reports will be submitted weekly to the City and Cardno, and will include at a minimum the following:

- Activities performed
- Personnel and equipment on-site
- Waste removed
- Lessons learned
- Deviations from the Design
- Updated schedule

Laboratory Documentation

When samples are collected for purposes of identifying additional materials or waste characterization, chain-of-custody records must accompany all samples from origin through disposal. All sample containers are labeled with sample location identification (ID), preservative, sampler name, analyses required, and date/time of collection. The sample location ID is linked to the labels, chain-of-custody, and field notes. The chain-of-custody record typically includes the following information:

- Project name and address
- Date and times of sample collection
- Name of sampler
- Sample location ID

- Number of samples
- Analyses required with preservation method
- Timeframe (days) sample results are needed

The laboratory analytical results are typically provided via electronic copies generally within 14 calendar days of sample receipt. Paper copies will be supplied by the laboratory only upon request or will be printed from the electronic copy by the Cleanup Project Manager. Upon receipt, Laboratory Data are reviewed by the Cleanup Project Manager and made available for review to the Cardno Project Manager. The electronic copy will be placed in a server, which is routinely "backed-up" to ensure data integrity.

The laboratory analytical report will include the following required information at a minimum:

- The dates of sample receipt, preparation, and analysis
- The condition of the samples upon receipt
- Sample preparation and analysis
- Any problems encountered during sampling, handling, storage, preparation, or analysis, and their solution
- Any variance from the standard operating procedures
- And a discussion of the quality of the reported analytical data

The laboratory will manage the original raw data and data validation report in both hard copy and electronic format. This information will be made available to the Cleanup Project Manager and Cardno Project Manager for their review. The Laboratory Director will maintain information on where the records are stored, and will identify who will be responsible for records management and how long specific types of records or documents will be maintained.

Progress and Closure Reports

A copy of the Georgia EPD Compliance Status Report (CSR) which summarizes the project closure in accordance with Georgia EPD regulations will be submitted to the City and Cardno by the Cleanup Project Manager. This report will be submitted to the City and Cardno within 60 days of project completion in order to receive and match waste manifests with landfill receipt tickets in compliance with the schedule provided in Section A6. Cardno will review this report, and include additional documentation to be submitted to the City and EPA which will include documentation of field activities (via weekly logs), a summary of all collected field data, analytical data reports, summary of design phase investigation and soil removal activities, analytical data, a written report of the audit of field activities (see Section C1 below), and copies of the waste manifests and landfill tickets that have been matched together proving proper disposal. The closure report typically includes the following components:

- Executive Summary

- Introduction/Background
- Site Description
- Abatement Activities
- Clearance Results
- Waste Profiles, Manifests, and Final Landfill Tickets (tabulated)
- Summary and Conclusions

B1. SAMPLING DESIGN PROCESS

This QAPP establishes minimum requirements for the design phase investigation, confirmatory soil sampling, and waste disposal characterization.

Design Phase Investigation

Collection and analysis of soil and groundwater samples are intended to initially identify the presence or absence of regulated substances such that informed decisions can be made regarding exposure potential impacts associated with these environmental media, and to provide a preliminary assessment of vapor encroachment risk. *It should be noted that execution of the planned assessment activities will not commence until this Site-Specific QAPP is approved by the EPA, and that specific sampling locations are subject to change depending on field conditions.*

During the advancement of soil borings via DTP, soil cores will be logged for lithology. Given the COCs, no photoionization detector (PID) screening is anticipated, but soil will be visual and olfactory characterized for evidence of impacts. All soil borings are to be advanced a minimum of 10 feet bgs. A minimum of one soil sample will be collected from each boring between 0-1 foot bgs, with additional samples collected between 1 – 5 feet bgs depending on the previously identified depth of impact.

The collected soil and groundwater samples will be submitted to AES in Norcross, Georgia for the following analysis based on the previous investigations:

- B15-20 and TMW2-4 – Investigation for metal impacts and delineation of known lead impacts
    - Analysis soil for 8 RCRA metals via EPA method 6010/7471
- B5 – Additionally analyzed at 1.5 feet bgs for TCLP 8 RCRA metals via EPA method 6010/7471

Of the five soil borings, three borings are to be advanced to groundwater via DPT to an anticipated depth of 25 feet bgs and converted to 1-inch diameter PVC temporary monitoring wells (TMW2-4). The three temporary wells will be developed, purged, and sampled after installation. Upon the completion of the sampling activities, the soil sample locations and temporary monitoring wells will be surveyed using a Global Positioning System (GPS) device and tied into a survey outlining the Subject Site's property boundary.

The following table summarizes the sample requirements during the Design Phase Investigation:

Table 4
Design Phase Investigation Sample Matrix
Trees Atlanta Project, Atlanta, Georgia

Sample Matrix	*Environmental Parameters*	*Sample Collection Method*	*Analytical Method*	*Number of Samples*
Soil	8 RCRA Metals	4 oz jar	EPA 6010/7471	>8
Soil	TCLP 8 RCRA Metals	1 liter jar	EPA 6010/7471	1
Groundwater	8 RCRA Metals	500mL HDPE container	EPA 6010/7471	>3

Field parameters collected in the field are not considered critical beyond demonstration of data quality, or guidance for subsequent sampling. Laboratory analyses are critical in determining if environmental impacts are present at the site, which may require additional delineation or other action.

Excavation Confirmation Sampling

Collection and analysis of soil samples are intended to confirm excavation has been completed to the extent necessary to achieve the required residential RRS goal. The investigations leading to the soil removal action were designed to fully delineate the vertical and horizontal limits of contamination, and therefore minimal confirmatory soil sampling is suggested at this time. However, in some areas soil confirmation will be required to verify the prior sampling results, or to fill in any potential data gaps.

As discussed above, a design phase investigation to further delineate and characterize the site is to occur prior to excavation; however, for the purposes of this report, the COCs and confirmation sampling requirements are anticipate to remain the same. If the results of the design phase investigation indicate otherwise, it will be addressed in a QAPP Addendum.

Confirmation samples will be analyzed for the COCs at the specific excavation areas. Confirmation soil samples will be collected in accordance with Georgia EPD confirmation sampling criteria as outlined in the Cleanup Work Plan (excerpt included as **Appendix E**). Specifically, confirmation samples will be collected from each direction (north, south, east, west) at intervals of one per 25 linear feet along the sidewalls of the excavation at the depth previously noted with the highest concentration and from the floor of the excavation on an approximate interval of one per 625 square feet.

The following table summarizes the sample requirements during the confirmation sampling:

Table 5
Confirmation Sample Matrix
Trees Atlanta Project, Atlanta, Georgia

Sample Matrix	*Environmental Parameters*	*Sample Collection Method*	*Analytical Method*	*Number of Samples*
Soil	Lead	4 oz jar	EPA 6010	>9

At a minimum, 9 soil samples are anticipated to be collected at each of the areas requiring confirmation samples (including three excavation floor and six sidewalls), with additional samples being required for each

additional 25 linear feet of sidewall and for each 625 square feet of excavation floor. Please note that sidewalls will only be collected within the confines of the Subject Site, and therefore will not be collected along perimeter sidewalls. Pending analytical results, additional soil samples may be required to further delineate impacted areas.

Any waste generated during this assessment (such as PPE) that may be characterized as hazardous, will be containerized and properly labeled until appropriate analytical tests are conducted to determine its waste characterization. Generated waste will be disposed of in the same way the material handled is disposed of. All management of generated waste will be conducted in accordance with EPA Region 4 SESDPROC-202-R3 SOP.

B2. SAMPLING & ANALYTICAL METHOD REQUIREMENTS

The SOPs associated with soil and groundwater sampling reference below will be adhered to. Links to the SOPs are provided hereafter.

- EPA Region 4 SOP SESDPROC-301-R4 – Groundwater Sampling
  - https://www.epa.gov/sites/production/files/2017-07/documents/groundwater_sampling301_af.r4.pdf
- EPA Region 4 SOP SESDPROC-205-R3 - Field Equipment Cleaning and Decontamination
  - https://www.epa.gov/sites/production/files/2016-01/documents/field_equipment_cleaning_and_decontamination205_af.r3.pdf
- EPA Region 4 SOP SESDPROC-202-R3 – Management of Investigative Derive Waste
  - https://www.epa.gov/sites/production/files/2015-06/documents/Management-of-IDW.pdf
- EPA Region 4 SOP SESDPROC-209-R4 – Packing, Marking, Labeling and Shipping of Environmental and Waste Samples
  - https://www.epa.gov/sites/production/files/2020-06/documents/Shipping-Environmental-and-Waste-Samples.pdf
- EPA Region 4 SOP SESDPROC-300-R3 – Soil Sampling criteria
  - https://www.epa.gov/sites/production/files/2015-06/documents/Soil-Sampling.pdf

The laboratory will provide containers for the samples; pre-preserved when applicable. The Cleanup Project Manager is responsible for ensuring the laboratory provides the appropriate sampling containers. Additionally, the Cleanup Project Manager and their Field Team is responsible for overseeing sample collection activities. Anticipated sample container and preservation requirements are listed in the following table:

Table 6
Sample Container and Preservation Requirements
Trees Atlanta Project, Atlanta, Georgia

Matrix	Parameter	Method	Container	Preservative	Hold Time	Min. Volume
Soil	Metals	6010/7471	Glass	Ice	180 days	4 oz
Soil	Metals (TCLP)	6010/7471	Glass	Ice	180 days	1 L
Groundwater	Metals	6010/7471	Plastic	Ice/HNO_3	7 days	500 mL

Precautions will be taken to prevent cross-contamination. If the field team encounters any problems or unexpected situations while in the field (e.g., access problems, safety issues, inadequate supplies, equipment failure, etc.), the Cardno Project Manager will be notified and corrective action implemented. Corrective action required during field activities will follow the Corrective Action Flow Chart included as **Appendix G.**

Any materials generated as a result of cleanup activities may require characterization for waste profiling. Materials, such as disposable personal protection equipment, will be containerized and properly labeled until appropriate analytical tests are conducted to determine its waste characterization. Materials generated on site that are characterized as non-hazardous will be disposed of as non-hazardous waste. Any identified containerized hazardous waste that is stored on site will be manifested and shipped to a permitted treatment and/or disposal facility. All management of waste materials will be conducted in accordance with EPA Region 4 SESDPROC-202-R3 SOP.

B3. SAMPLE HANDLING & CUSTODY REQUIREMENTS

Field and laboratory personnel will be aware, at all times, of the need to properly maintain all samples, whether in the field or in the laboratory, under strict chain of custody protocols and in a manner to retain physical sample properties and chemical composition. The handling and transportation of the samples will be accomplished in a manner that not only protects the integrity of the sample, but also documents sample custody. In general, packing, marking, labeling, and shipping of samples will be conducted in accordance with the SOP: *EPA, Region 4, Field Sampling Procedures: Packing, Marking, Labeling, and Shipping of Environmental and Waste Samples, SESDPROC-209-R4, February 23, 2020*). Samples will be packed and shipped in accordance with applicable and current US Department of Transportation (DOT) regulations and/or International Air Transport Association (IATA) standards. The following sections detail sample handling and custody requirements from sample collection to final delivery to the certified laboratory.

Upon collection, samples will be transferred immediately from the sampling device into appropriate laboratory-supplied containers. All samples collected will have discrete sample identification numbers. The unique sample identifications are necessary to identify and track each of the many samples collected for analysis during the duration of the project. Whenever possible, sample labeling procedures from previous investigations will be followed or continued. Sample collection containers used during field activities will be labeled with unique sample numbers.

Samples will be packaged in a manner to prevent breakage or cross contamination during shipping. A chain of custody form will be completed for each set of collected samples. The purpose of the COC procedure is to prevent misidentification of samples, prevent tampering of the samples during shipment and storage, allow easy identification of tampering, and allow for easy tracking of possession. If the chain of custody is broken at any time from sample collection through analysis, the respective project manager will be notified.

When collection samples leave the sampler's immediate control (e.g. shipment to laboratory), the sampler will sign and date the chain of custody form(s) to relinquish the samples. The chain of custody form will be

placed into a sealable bag. A custody seal will be placed on shipping containers when applicable. The custody seal will bear the collector's name and the date signed. The custody seal is used to ensure that the samples in the shipping container have not been tampered with, therefore ensuring sample integrity. If samples are delivered by the sampler directly to the laboratory, the custody seal may not be used.

B4. ANALYTICAL METHODS AND REQUIREMENTS

The laboratory will conduct analytical analysis for the media provided. Specifically, samples collected under the scope of this project will be submitted for laboratory analysis of constituents as specified in Section B2. Once the samples are received and logged in at the laboratory, the samples will be analyzed as requested on the chain of custody.

Available laboratory information and extraction and digestion criteria are included in Laboratory QAM documents, included in **Appendix F.** The Laboratory Director is responsible for overseeing the success of the analysis and for implementing corrective actions if deemed necessary as set forth in Section C1 of this document.

Non-standard or unpublished methodologies for analysis are not anticipated. Laboratory analysis will be performed in a standard turn-around time of 10 business days for electronic data and 14 business days for hardcopy.

Constituents of concern, analytical/extraction methods, sample container, preservation, holding time requirements, are provided in the referenced EPA guidance documents.

The detection limit requirements for each analyte are typically below regulatory limits for the parameters of interest. The Cardno Project Manager has reviewed the laboratory QC samples and control limits identified in the laboratory documentation. The quality of the data generated using the laboratory QAM will provide analytical data of a known quality and precision for projects under this Atlanta EPA Brownfield RLF Program.

B5. FIELD QUALITY CONTROL REQUIREMENTS

Quality control in the field will be conducted in accordance with the following SOP: *EPA, Region 4, Quality System Procedures: Field Sampling Quality Control, SESDPROC-011-R4, April 16, 2017.*

A sufficient volume of each sample will be collected in the field to allow for re-analysis if the laboratory data quality objectives are not reached or if additional analyses are required. All consumable equipment used to conduct sampling activities will be single use and dedicated by sample. All reusable equipment will be properly decontaminated prior to collection of additional samples.

Due to the nature of the remediation work, quality control requirements include the following:

Field Duplicate Samples: A field duplicate is a second sample collected at the same location as the original sample and will be used to assess sampling and laboratory precision. Duplicate air samples will be collected simultaneously or in immediate succession, following identical collection procedures, and treated in the same

manner during sample shipment, storage, and analysis. The sample containers will be assigned an identification number in the field such that they cannot be identified (blind duplicate) as duplicate samples by laboratory personnel. Field duplicate samples will be collected at a one-to-twenty ratio.

Field Blank Samples: A field blank is a sample that is prepared in the field to evaluate the potential for contamination of a sample by site contaminants from a source not associated with the sample collected. Deionized water is poured into the appropriate sample containers in dusty environments and/or from areas where contamination is suspected as being present in the atmosphere and originating from a source other than the source being sampled. During the life of the project, field blank samples will be collected once during the Design Phase Investigation and once during removal activities.

Trip Blank: Trip blanks are supplied by the designated laboratory and consist of deionized water in a 40-ml vial. The trip blank will remain in each sample cooler along with the investigation samples and will be analyzed for target volatile compounds only. No VOCs are anticipated to be analyzed during this cleanup, so no trip blanks are required.

Equipment Rinsate Samples: The equipment rinsate blank is a sample of deionized water that is prepared in the laboratory, shipped to the site with other sample containers, and poured over the cleaned, decontaminated sample collection equipment in between sample collection. The equipment rinsate blank will be used to evaluate potential cross-contamination that may occur by reusing sample collection equipment if not thoroughly decontaminated between sample collection events. Equipment rinsate blank samples will be collected weekly after equipment is cleaned, and is anticipated to be collected once during the Design Phase Investigation and once during removal activities.

Matrix Spike/Matrix Spike Duplicate (MS/MSD): A MS/MSD is a second sample collected at the same location as the original sample and is spiked with a known concentration of analytes of interest. Duplicate soil samples will be collected simultaneously or in immediate succession, following identical collection procedures, and treated in the same manner during sample shipment, storage, and analysis. The sample containers will be assigned an identification number in the field such that they cannot be identified (blind duplicate) as duplicate samples by laboratory personnel. MS/MSD samples will be collected at least once during the life of the project.

In summary, the following Field Sampling QC Table will be followed during this cleanup:

Table 7
Field Sampling QA/QC Sampling Requirements
Trees Atlanta Project, Atlanta, Georgia

QA/QC Sample	Matrix	Parameter	Method	Frequency
Field Duplicate	Soil	8 RCRA Metals	EPA 6010/7471	1 per 20 samples
Temp Blank	Water	Temperature	EPA 170.1	1 per cooler
Field Blank	Water	8 RCRA Metals	EPA 6010/7471	1 per week
Trip Blank	Water	VOCs	EPA 8260	None

QA/QC Sample	Matrix	Parameter	Method	Frequency
Equipment Rinsate Blank	Water	8 RCRA Metals	EPA 6010/7471	1 per week
MS/MSD	Soil	8 RCRA Metals	EPA 6010/7471	1 during life of project

All quality control samples will be submitted for laboratory analysis of the project constituent suite. Chain-of-Custody procedures will be completed as outlined in accordance with SOP: *EPA, Region 4, Quality System Procedures: Field Sampling Quality Control, SESDPROC-011-R4, April 16, 2017.*

B6. LABORATORY QUALITY CONTROL REQUIREMENTS

The following actions will be taken when control limits are exceeded or interferences or dilution problems are encountered or equipment sensitivity problem exists:

- Review data outliers with the laboratory
- Determine if reanalysis or resampling is required
- Flag data in the report and explain
- Indicate whether data can be used (as indicator), relied upon, or must be rejected

Laboratory quality control checks include:

- Laboratory Control Standard
- Laboratory Control Standard Duplicates
- Matrix Spikes
- Matrix Spike Duplicates
- Method Reagent Blanks

Each laboratory has a QC program in place to ensure the reliability and validity of the analysis performed. All analytical methods are documented in laboratory SOPs. Each SOP includes a QC section, which addresses the minimum requirements for the procedure. These SOPs will be presented upon request. The following paragraphs describe the QC samples potentially required for soil samples.

Method Blank: A method blank is a sample of ASTM Type II or organic-free (deionized) water that is carried through each step of the preparation and analytical method. A method blank sample will be prepared and analyzed with each batch of twenty or fewer samples. Method blank samples will be used to assess potential contamination attributed to laboratory operations during sample preparation and analysis.

Instrument Blank: An instrument blank is a sample of ASTM Type II or organic-free (deionized) water that is analyzed with associated calibrations of laboratory instruments. Instrument blank results will be used to assess potential contamination attributed to specific instrument calibration procedures.

Surrogate Spikes: Surrogate spikes are compounds that will be added to every blank, standard, sample, and matrix spike sample as specified in the organic analytical methodology. Surrogate compounds are generally brominated, fluorinated, or isotopically labeled compounds not expected to be in environmental samples. The

results of the surrogate spike will be used to evaluate the accuracy of the analytical measurement on a sample-specific basis.

Laboratory Control Samples: Laboratory control samples (LCS) are well-characterized laboratory generated samples used to monitor the laboratory's day-to-day performance of analytical methods. The LCS is a method blank spiked with known concentrations of target analytes. The LCS is carried through each step of the preparation and analytical method. LCS will be reported in %R and used to assess the precision and accuracy of the analytical process independent of matrix effects. Controlling lab operations with LCS (rather than surrogates or matrix spike) offers the advantage of being able to differentiate low recoveries due to procedural errors with those due to matrix effects.

Evaluation criteria for laboratory control samples are dependent upon sample matrix, analytical instrumentation, and analytical method requirements. If required by the method and if sufficient sample volume is available, the laboratory will reanalyze any samples not conforming to QC criteria. It is expected that sufficient sample volumes/weights will be collected to allow for reanalysis when necessary.

Specifically, for this project, the laboratory quality control requirements include the following:

Table 8
Laboratory Quality Control Requirements
Trees Atlanta Project, Atlanta, Georgia

Matrix	Parameter	Method	Laboratory Control Spike (LCS) Range	Relative Percent Different	Matrix Spike (MS) Range	Relative Percent Difference
Soil	Metals	6010/7471	80-120%	20%	75-125%	20%
Ground water	Metals	6010/7471	80-120%	20%	75-125%	20%

Additional laboratory quality documentation is provided in the laboratory QAM included in **Appendix F.**

B7. FIELD EQUIPMENT AND CORRECTIVE ACTION

An inspection checklist and initial calibration check will be completed by a field team member upon arrival at the site, prior to the commencement of any site sampling activities. A maintenance kit, which will include extra batteries, calibration standards, and commonly needed spare parts, will be made available at the site. Any preventive or corrective maintenance completed will be documented in the field notes. If any equipment fails the initial testing and inspection, a second attempt to calibrate the meter will be performed. If any equipment fails the second calibration attempt, spare equipment can be obtained from inventory or rented from an environmental sampling supply vendor.

All of the field equipment will be inspected and calibrated before and after each site visit, and after every 8 hours of use. Field equipment calibration log books are maintained for each piece of equipment and project field logs are maintained for each sampling event and given to the Cleanup Project Manager or Field Team

Leader upon completion of the sampling event to maintain in the project file for reference. The Cardno Project Manager or QA/QC Officer may request spot checks of equipment calibration at any time. Calibration records can be traced to equipment logs by referencing project specific field notes. Equipment calibrations are completed in accordance with manufacturer specifications.

Corrective action required during field activities will follow the Corrective Action Flow Chart included as **Appendix G.**

B8. LAB EQUIPMENT AND CORRECTIVE ACTION

The Laboratory QAM addresses the testing, inspection, and maintenance for the analytical instruments and is provided as **Appendix F**. Procedures include reviewing the instrument log for any notations regarding problems experienced during previous use and verifying that scheduled preventative maintenance has been conducted in accordance with the manufacturer's recommendations. The lab will document any preventative or corrective maintenance conducted on laboratory equipment/instrumentation. The Laboratory Director is responsible for overseeing the testing, inspection, and analytical instruments in accordance with their provided QAM.

B9. ANALYTICAL SENSITIVITY AND PROJECT CRITERIA

Analytical method sensitivity and project criteria for the analytical methods within the scope of this project will be determined by the remedial action goals and with the consideration of the selected laboratory. Minimum detection limits for soil samples will comply with the Georgia Comparison of Existing Contamination to Risk Reduction Standards (Rule 391-3-19.07), and the site-specific residential and non-residential RRS approved by the Georgia EPD in December 2019 as outlined in the Cleanup Work Plan (an excerpt included as **Appendix E**). The following table provides the required method detection limit and reporting limits:

Table 9
Laboratory Reporting Limits
Trees Atlanta Project, Atlanta, Georgia

Matrix	Parameter	Analytical Reporting Limit Range	Analytical Detection Limit Range	Project Criteria
Soil	Metals	1 – 100 ug/Kg	0.0498 – 1.25 ug/Kg	Georgia EPD Type 4 RRS
Ground Water	Metals	0.01 – 1 ug/L	0.00124 – 0.115 ug/L	Georgia EPD Type 4 RRS

B10. DATA MANAGEMENT AND DOCUMENTS

Data for this project will be produced in the following locations:

1. At the jobsite, specifically with ETRI and AquaTerra personnel.
2. With the City of Atlanta Brownfield Program Manager's office located at Atlanta City Hall, 68 Mitchell

Street SW, Atlanta, GA 30303.

3. With Cardno's Atlanta office, located at 220 Bay Circle, Suite 220, Norcross, GA 30071.
4. At the AES laboratory, located at 3080 Presidential Drive, Atlanta, GA 30340.

Data collected onsite will be recorded on field data worksheets and into field logbooks, which will become a part of the project file. Prior to submission into the project file, the respective project manager officer will review for accuracy and usability, and submit to the City and the Cardno Project Manager within 14 days of receipt for their review and submittal to the project file.

These documents and records are also maintained in accordance with the requirements set forth in the US EPA Region 4, Science and Ecosystem Support Division (SESD), "*Field Branches Quality System and Technical Procedures*". A sample of some of the required documentation includes the following:

- Field personnel signatures or initials on all records/notes with a waterproof pen.
- Use of field sampling and decontamination supplies and equipment are tracked with an in-house system.
- Sampling containers are prepared by the laboratory and shipped with a packing list documenting contents.
- Preservatives used by the laboratory are traceable by preparation date, vendor, and lot number.
- Sampling containers are pre-cleaned at the laboratory.
- Water level indicator and field parameter meters are cleaned according to specifications and documentation is contained in the field notes.
- All equipment is maintained and calibrated in accordance with manufacturers' specifications.

Field logs will include weather observations at the Subject Site when field activities were conducted. All relevant observations or digressions from the procedures in this QAPP, deemed notable by any field team member, will also be recorded in the field logbook. The Cleanup Project Manager will submit copies of the field data worksheets and logbooks with the field activity report as a periodic deliverable, or as part of the final report.

The laboratory provides electronic copies of the analytical results generally within 14 days of sample receipt. Paper copies will be supplied by the laboratory upon request or will be printed from the electronic copy by the respective project manager. The Cardno Project Manager will ultimately be responsible for reviewing the data to verify its usability, ensuring the analytical report meets requirements, and for forwarding it to the City of Atlanta and/or EPA Project Officer, when applicable.

After the laboratory report is reviewed, data is then formatted into tables and compared to regulatory limits to determine if contamination is present at the subject property. Upon completion of formatting of the Analytical Data Table, the data will be reviewed for accuracy by the respective project manager. Site figures and maps including analytical results and sample locations may be prepared for submittal with the closeout report.

These figures and maps are also reviewed for accuracy by the respective project manager, which will ultimately be reviewed by the Cardno Project Manager. The schedule for the respective project managers to review the data for accuracy and usability will be approximately 14 days after receipt of data. A summary of their findings will be included in the progress reports submitted to Cardno and the City of Atlanta on a weekly basis.

AES will manage the original raw data and data validation report for projects in both hard copy and electronic format. This information will be made available to the respective project manager and Cardno Project Manager upon request. The Laboratory Director/QA/QC Manager will maintain information on where the records are stored and will identify who will be responsible for records management and how long specific types of records or documents will be maintained.

Project records will include all correspondence, field logs and data sheets, laboratory analytical reports, audit findings, waste manifests, progress reports, and a closeout report. Progress reports will be submitted weekly to the City and Cardno, and will include at a minimum the following:

- Activities performed
- Personnel and equipment on-site
- Sampling activities
- Waste removed
- Lessons learned
- Deviations from the Design
- Updated schedule

The following entities will be responsible for various weekly progress reports:

- ETRI will submit to Cardno and the City weekly correspondence summarizing design phase investigation and removal activities, summarization of sampling activities, and waste manifests.
- Cardno will submit to the City weekly correspondence summarizing ETRI and AquaTerra weekly reports, all deliverables, and Davis-Bacon Act compliance documentation.

A closeout report will be submitted to the City and Cardno by the Cleanup Project Manager. This report will include the EPD Compliance Status Report (CSR) from ETRI summarizing cleanup activities and requesting closure with the Georgia EPD. The closeout report will also include copies of field notes and logs, analytical laboratory results, a summary of activities completed with any deviations from the approved QAPP, conclusions, and recommendations and will be submitted to the Cardno Project Manager, the City, and EPA Region 4 Brownfields Project Officer.

All records and reports and checklist from the USEPA Region 4 Designated Approving Official will be stored in the physical project file located at Trees Atlanta main office at 225 Chester Avenue, SE, Atlanta, GA 30316. Additional copies will be stored with the City of Atlanta and Cardno's Atlanta office. All records will be made

available upon request during the life of the project and for a minimum of three years after the project. The project file will be eventually archived for a minimum period of five (5) years.

Corrective action for detecting and correcting errors in records will follow the Corrective Action Flow Chart included as **Appendix G**.

C1. ASSESSMENT AND RESPONSE ACTIONS

Any assessment will include soil assessments to determine the general subsurface conditions of the Subject Site, delineation of horizontal and/or vertical extent of contamination, and corrective action.

The verification and validation of all reported data will be conducted by the QA/QC Officer, and QA review of all reports will be conducted by the Cardno Project Manager or similar senior technical staff (as appropriate). The QA/QC Officer may conduct an on-site field audit at the time(s) when samples are being collected for both field and laboratory analysis. The QA/QC Officer will have the authority to halt the on-site work if he/she believes the findings from the audit justify such action. In the event discrepancies are identified during an audit, the QA/QC Officer will discuss findings with the Cardno Project Manager and Cleanup Project Manager. The Cleanup Project Manager will be responsible for corrective actions related to field activities. Audit findings will be included in the final reports. In the event the Cleanup Project Manager hires a subcontractor to perform a specialized task, they will provide oversight of the work by an experienced Field Team Technician, Field Team Leader, or Project Manager.

The laboratory will provide a narrative report with the analytical results referencing the project, associated chain-of-custody, quality control issues, and the validity and integrity of the results. Section D2 of this QAPP discusses the verification and validation process in detail.

Communicating and resolving problems that arise in the field, via corrective actions implementation, will be addressed and overseen by the Project Manager. Corrective action for detecting and correcting errors in records will follow the Corrective Action Flow Chart included as **Appendix G**.

C2. PROJECT REPORTS

Execution of proposed field activities will not commence until this QAPP is approved by the EPA.

All reports will be reviewed for technical accuracy and data quality by the Cardno Project Manager, QA/QC Officer, or similar senior technical staff (as appropriate). The final report will include a description of project activities, a summary of data, results drawn from the data quality assessment, the field activity reports, details of any problems encountered during the project and the corrective actions taken, and conclusions from the results and the rationale for those conclusions. The final report will be distributed to the project team and reviewed for conformance with internal document standards. Final reports will be forwarded to the EPA Project Officer, the Atlanta Brownfields Project Manager, and the Georgia EPD Brownfields Coordinator, as applicable.

D1. FIELD DATA EVALUATION

At a minimum, field data will be evaluated in accordance with the following SOP: *EPA, Region 4, Quality System Procedures: Field Sampling Quality Control, SESDPROC-011-R4, April 16, 2017.* The ETRI and Cleanup Project Managers will validate the field data and discuss any problems identified during the project with the Cardno Project Manager. Data will be reviewed for integrity by checking all field entries for errors and consistency. Data validation will be accomplished through a series of checks and reviews intended to assure that the reported results are of a verifiable, reproducible, and acceptable quality.

A data usability review that includes an assessment of field procedures (including field notes, boring logs, field screening results, and field analytical data) completeness, comparability, representativeness, precision, and bias (accuracy) of the data will be performed by the Cleanup Project Manager. The findings of this review will be documented and presented in the final report.

If verification or validation indicates that samples have been collected and/or analyzed out of compliance with the QAPP (for instance deviations from the acceptance criteria for quality control defined in this QAPP and its addendums), resampling may be required. The Cleanup Project Manager must contact the Cardno Project Manager and EPA Project Officer in the event that there are any deviations from the QAPP and the Brownfields EPA Project Officer will determine if the data is acceptable or if resampling is required. If data is accepted that deviates from the QAPP, the data will be used for screening purposes only and annotated as such.

D2. LABORATORY DATA EVALUATION

The Laboratory Director/QA/QC Manager will review and verify the laboratory data generated under their corrective action system for accuracy according to the laboratory's QAM/LQM, as detailed in Section B8 of this document. Quality control checks are performed on field data by reviewing the chain of custody forms and results from the lab for each sampling event. All sample results will be reviewed and correlated to field measurements and observations. The validation process will include:

- Narrative review
- Quality control blanks meet criteria
- Appropriate preservatives were used and hold times were met
- Quality control data (spikes, duplicates) are acceptable
- Surrogate spike recoveries are acceptable
- Unacceptable data are identified and corrective actions are initiated
- Data qualifiers are assigned (by lab) if necessary:

In addition to evaluating data qualifiers associated with laboratory analyses, a comparison of the sample duplicate(s) and the corresponding sample result(s) will be made to evaluate the reproducibility of the sample results based on the laboratory analysis and sample collection and transportation procedures. For this

comparison, if the duplicate or sample result is less than five (5) times the reporting limit then the comparison is made by the absolute difference between the results (S-D). If these differences are within two times (2X) the "acceptable" limits, they are considered "slightly high"; anything beyond that would be considered "high". If both sample and duplicate results are greater than five times (5X) the reporting limit (the higher of the two RLs, if they're not the same), then precision is assessed by the %RPD (difference in results divided by the average of the two results X 100); <35% RPD = "good/acceptable", >35% but < 50% = variability is "slightly high", >50% = "high".

Based on the data qualifiers provided by the laboratory, and on the sample/sample duplicate comparison described above; data will be categorized as fully quantified, qualified, or unusable. Unusable data will not be utilized in the project decision process. Raw data will be included in all submitted project reports.

The Cardno Project Manager or QA/QC Officer will perform verification and validation of laboratory data for conformance with the data objectives stated in this QAPP. Data verification will include completeness, correctness, and conformance evaluations. Data validation will be performed to assess the quality and usability of the data generated. Data verification and validation will be performed in accordance with EPA's "*Guidance on Environmental Data Verification and Validation"* (EPA QA/G8), dated November 2002. Results of the data verification and validation, including potential influence on the data quality will be summarized in the final report.

Typical validation activities include the following:

Table 10
Validation Activities
Trees Atlanta Project, Atlanta, Georgia

Item	Activity
Data Deliverables and QAPP	Ensure that all required information on sampling and analysis was provided (including planning documents).
Analytes	Ensure that required lists of analytes were reported as specified.
Chain-of-Custody	Examine the traceability of the data from time of sample collection until reporting of data. Examine chain-of-custody records against contract, method, or procedural requirement.
Holding Time	Identify holding time criteria, and either confirm that they were met or document any deviations. Ensure that samples were analyzed within holding times specified in method, procedure, or contract requirements. If holding times were not met, confirm that deviations were documented, that appropriate notifications were made (consistent with procedural requirements), and that approval to proceed was received prior to analysis.
Sample Handling	Ensure that required sample handling, receipt, and storage procedures were followed, and that any deviations were documented.

Item	Activity
Sampling Methods and Procedures	Establish that required sampling methods were used and that any deviations were noted. Ensure that the sampling procedures and field measurements met performance criteria and that any deviations were documented.
Analytical Methods and Procedures	Establish that required analytical methods were used and that any deviations were noted. Ensure that the QC samples met performance criteria and that any deviations were documented.
Data Qualifiers	Determine that the laboratory data qualifiers were defined and applied as specified in methods, procedures, or contracts.
Deviations	Determine the impacts of any deviations from sampling or analytical methods and SOPs. Consider the effectiveness and appropriateness of any corrective action.
Sampling Plan	Determine whether the sampling plan was executed as specified (i.e., the number, location, and type of field samples were collected and analyzed as specified in the QAPP).
Sampling Procedures	Evaluate whether sampling procedures were followed with respect to equipment and proper sampling support (e.g., techniques, equipment, decontamination, volume, temperature, preservatives, etc.).
Co-located Field Duplicates	Compare results of collocated field duplicates with criteria Established in the QAPP.
Project Quantitation Limits	Determine that quantitation limits were achieved, as outlined in the QAPP and that the laboratory successfully analyzed a standard at the QL.
Confirmatory Analyses	Evaluate agreement of laboratory results.
Performance Criteria	Evaluate QC data against project-specific performance criteria in the QAPP (i.e., evaluate quality parameters beyond those outlined in the methods.).
Data Qualifiers	Determine that the data qualifiers applied were those specified in the QAPP and that any deviations from specifications were justified.
Validation Report	Summarize deviations from methods, procedures, or contracts. Include qualified data and explanation of all data qualifiers.

D3. **DATA USABILITY AND PROJECT VERIFICTION**

Analytical data generated in accordance with approved methodologies will be considered definitive and quantitative based on the results and findings of the validation process.

The Cardno Project Manager or QA/QC Officer will validate the field data and discuss any problems identified during the project with the Cleanup Project Manager. Any problems and associated corrective actions will be documented in the field logs and the closeout report. The Cleanup Project Manager will discuss any problems along with proposed corrective actions with the Cardno Project Manager. A copy of the process

flow chart is included in **Appendix I.**

Because data generated with significant deviations from the requirements of the QAPP will be rejected and because of the nature of the work (biased sampling), all data will have the same expected uncertainties and there will be no limitations on data use. The following is a list of considerations for data usability assessment:

Table 11
Data Usability
Trees Atlanta Project, Atlanta, Georgia

Item	Assessment Activity
Data Deliverables and QAPP	Ensure that all necessary information was provided, including but not limited to validation results
Deviations	Determine the impact of deviations on the usability of data.
Sampling Locations, Deviations	Determine if alterations to sample locations continue to satisfy the project objectives.
Chain-of-Custody, Deviation	Establish that any problems with documentation of custody procedures do not prevent the data from being used for the intended purpose.
Holding Times, Deviation	Determine the acceptability of data where holding times were exceeded.
Damaged Samples, Deviation	Determine whether the data from damaged samples are useable. If the data cannot be used, determine whether resampling is necessary.
PT Sample Results, Deviation	Determine if the implications of any unacceptable analytes (as identified by the PT sample results) on the usability of the analytical results. Describe any limitations on the data.
SOPs and Methods, Deviation	Evaluate the impact of deviations from SOPs and specified methods on data quality.
QC Samples	Evaluate the implications of unacceptable QC sample results on the data usability for the associated samples. For example, consider the effects of blank contamination.
Matrix	Evaluate matrix effects (interference or bias).
Meteorological Data and Site Conditions	Evaluate the possible effects of meteorological (e.g., wind, rain, temperature) and site conditions on sample results. Review field reports to identify whether any unusual conditions were presented and how the sampling plan was executed.
Comparability	Ensure that results from different data collection activities achieve an acceptable level of agreement.
Completeness	Evaluate the impact of missing information. Ensure that enough information was obtained for the data to be useable.
Background	Determine if background levels have been adequately established (if appropriate).
Critical Samples	Establish that critical samples and critical target analytes/COCs were collected and analyzed. Determine if the results meet criteria specified in this QAPP.
Data Restrictions	Describe the exact process for handling data that do not meet PQOs (i.e.,

Item	Assessment Activity
	when measurement performance criteria are not met). Depending on how those data will be used, specify the restrictions on the use of those data for environmental decision-making.
Usability Decision	Determine if the data can be used to make a specific decision considering the implications of all deviations and corrective action.
Usability Report	Discuss and compare overall precision, accuracy, representativeness, comparability, completeness, and sensitivity for each matrix, analytical group, and concentration level. Describe limitations on the use of the project if criteria for data quality indicators are not met.

Field modifications regarding sampling analysis may be necessary for circumstances such as auger refusal, limited access areas, or when enough sample volume could not be collected for various reasons. Re-sampling may be necessary if results are deemed unacceptable for various reasons such as exceeding laboratory holding times or to confirm previous sampling and/or excavation activities, etc. These variables will be further defined throughout this QAPP based on the specific contaminants of concern. Upon receipt of the laboratory data, the data will be reviewed to verify its usability. Upon determination, data is then formatted into tables and compared to regulatory limits to determine if concentrations of COCs exceed CTLs at the subject property. Upon completion of formatting the Analytical Data Table; data will be reviewed for accuracy by the Cardno QA/QC Officer.

The Cleanup Project Manager, with oversight from the Cardno Project Manager, will evaluate the usability of individual sample results at the parameter level. Analytical results will be evaluated based on sensitivity criteria described through this QAPP. Data limitations will be documented along with how the data should be used. Conclusions and recommendations drawn from all assessment information will be documented in the final report. Site figures and maps including analytical results and sample locations are frequently prepared for submittal with final reports. These figures and maps are also reviewed for accuracy by the Cardno QA/QC Officer.

Usable data will be tabulated and compared to applicable GEPD and EPA target concentrations. Concentrations which exceed these targets will be highlighted for easy identification. The Field QA/QC Officer will compare and review the laboratory data to the table for completeness, correctness, and accuracy. Usable data will be provided on site figures and other graphical representation and will also be reviewed for completeness, correctness, and accuracy.

The Cardno Project Manager will conduct an overall project evaluation using the field and laboratory evaluations, tabular and graphical data presentations, and analytical sensitivity criteria to determine its value in developing the site conceptual model and assist with the decision making process.

LIST OF ABBREVIATIONS

ABCA	Analysis of Brownfields Cleanup Alternatives
AOC	Area of Concern
ASTM	American Society for Testing and Materials
bgs	Below Ground Surface
BS	Blank Spike
BSD	Blank Spike Duplicate
BSA	Brownfields Site Assessment
BSRA	Brownfields Site Rehabilitation Agreement
BTEX	Benzene, Toluene, Ethylbenzene, and Total Xylenes
C	Celsius
CD	Compact Disc
COC	Contaminants of Concern
CTL	Cleanup Target Levels
DAO	(EPA) Designated Approving Official
DEFT	Decision Error Feasibility Trials
DO	Dissolved Oxygen
DPT	Direct Push Technology
DQO	Data Quality Objective
DRO	Diesel Range Organics
e.g.	exempli gratia - for example
ESA	Environmental Site Assessment
ECD	Electron Capture Device
FID	Flame Ionization Detector
GC	Gas Chromatography
GC-MS	Gas Chromatography – Mass Spectrometry
GIS	Geographic Information Systems
GPS	Global Positioning Satellite
GRO	Gasoline Range Organics
HAZWOPER	Hazardous Waste Operations and Emergency Response
HPLC	High Performance Liquid Chromatography
ICP	Inductively Coupled Plasma
ID	Identification
i.e.	*id est* - that is
ISHB	Inactive Hazardous Sites Branch
IUPAC	International Union of Pure and Applied Chemistry
kg	kilogram
L	Liter
LCS	Laboratory Control Sample
LIMS	Laboratory Information Management System
MCL	Maximum Contaminant Level
MDLs	Method Detection Limits
MIP	Membrane Interface Probe

LIST OF ABBREVIATIONS

mL	Milliliter
MNA	Monitored Natural Attenuation
MTBE	Methyl tert-butyl ether
MW	Monitor Well
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NA	Not Applicable
NC	North Carolina
NCBP	North Carolina Brownfields Program
NELAC	National Environmental Laboratory Accreditation Conference
NCDEQ	North Carolina Department of Environmental Quality
ORP	Oxidation Reduction Potential
OSHA	Occupational Safety and Health Administration
OVA	Organic Vapor Analyzer
PAHs	Polynuclear Aromatic Hydrocarbons
PCB	Polychlorinated biphenyl
PE	Performance Evaluation
P.E.	Professional Engineer
P.G.	Professional Geologist
PID	Photo-ionization Detector
PQLs	Practical Quantification Limits
QA	Quality Assurance
QAM	Quality Assurance Manual
QAP	Quality Assurance Plan
QAPP	Quality Assurance Project Plan
QC	Quality Control
RAP	Remedial Action Plan
RCRA	Resource Conservation and Recovery Act
REC	Recognized Environmental Condition
RL	Reporting Limit
RPD	Relative Percent Difference
RQAO	Regional Quality Assurance Designated Approving Official
RSC	Regional Screening Levels
SESD	Science and Ecosystem Support Division
SPLP	Synthetic Precipitate Leaching Procedures
SRG	Soil Remediation Goals
SS	Soil Sample
SW	Solid Waste
SVOC	Semi-Volatile Organic Compounds
SOP	Standard Operating Procedure
TAL	Target Analyte List
TCL	Target Compound List

LIST OF ABBREVIATIONS

TCLP	Toxicity Characteristic Leaching Procedure
TPH	Total Petroleum Hydrocarbons
TQM	Total Quality Management
USC	United Soil Classification
U.S. EPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UST	Underground Storage Tank
µg	microgram
ug	microgram
VOC	Volatile Organic Compounds

Appendix A

USEPA Region 4 Brownfields QAPP Review Checklist

USEPA REGION 4 BROWNFIELDS QAPP REVIEW CHECKLIST

QAPP Title: Quality Assurance Project Plan for Brownfields Projects for 825 Warner Street soil remediation
Cooperative Agreement Recipient: City of Atlanta, Assessment Grant
Grant Number: BF 00D59517-0
QAPP Preparer: Doug Strait
QAPP Date: 9/8/2020
Transmittal Date: 9/8/2020
DAO Reviewer: Derek Street

*This is **not** an exhaustive list of requirements and is not intended as guidance for developing a QAPP. Refer to the Preparation of Quality Assurance Project Plans for EPA Brownfields Projects in the Southeast for comprehensive requirements.

**For DAOs, mark each element in the right-hand column with one of the following abbreviations:
P = Present & Acceptable; **NP** = Not Present; **I** = Incomplete; **NA** = Not Applicable

ELEMENT	Page Number & Paragraph	EPA Use
A1. Title and Approval Sheet	Pg. 1	
Title (Including CAR's name and revision #)	Pg. 1	
Grant Number	Pg. 1	
Name of organization that prepared the QAPP	Pg. 1	
Dated signature of approving officials: printed names, titles, organizations, date, and signatures	Pg. 2	
Other signatures, as needed	Pg. 2	
A2. Table of Contents	Pg. 3	
A3. Distribution List	Pg. 4	
A4. Project/Task Organization	Pg. 4 - 6	
Key individuals, technical disciplines, and responsibilities	Pg. 4 - 6	
Organizational chart/table depicting lines of authority and reporting responsibilities	Appendix B	
A5. Problem Definition/Background	Pg. 6-12	
Clearly state the problem or decision to be resolved	Pg. 6-12	
Provide historical and background information	Pg. 6-12	
A6. Project/Task Description	Pg. 12-15	
List measurements to be made	Pg. 14	
Cite applicable technical, regulatory, or program-specific quality standards, criteria, and/or objectives	Pg. 14	
Note special personnel or equipment requirements	Pg. 8	
Provide work schedule	Pg. 10; Tbl 1	
Note required project and QA records/reports	Pg. 10	
A7. Quality Objectives and Criteria for Measurement Data	Pg. 11	
State project objectives and limits, both qualitatively and quantitatively	Pg. 11	
State and characterize measurement quality objectives to applicable action levels or criteria	Pg. 11	

ELEMENT	Page Number & Paragraph	EPA Use
A8. Special Training /Certification	Pg. 11-12	
State trainings, date of trainings, expirations, and where applicable records are maintained	Pg. 11-12	
A9. Documentation and Records	Pg. 12-15	
List information and records to be included for this project	Pg. 12-15	
State requested lab turnaround time	Pg. 14	
Give retention time and location for records and reports	Pg. 15	
B1. Sampling Process Design and Site Figures	Pg. 15-17	
Type and number of samples required	Pg. 15-17; Pg. 16 Table; Pg. 17 table	
Sampling design and rationale	Pg. 15-17	
Sampling locations and frequency	Pg. 15-17	
Sample matrices	Pg. 15-17; Pg. 16 Table; Pg. 17 Table	
Classification of each measurement parameter as either critical or needed for information only	Pg. 15-17	
Describe/list SOPs used to characterize and dispose of IDW	Pg. 17	
B2. Sampling and Analytical Procedures	Pg. 17-18	
Describe the sampling methods and procedures or cite the specific SOPs to be used to guide the sample collection	Pg. 17	
Describe how problems (lost samples, broken equipment, etc.) will be resolved and documented	Pg. 18	
If SOPs are referenced, include a table listing all field sampling SOPs that will be used. Include the title of SOP, date, revision number and organization that wrote the SOP. Describe any modifications to the SOPs that are necessary for your project.	Pg. 18; Pg. 18 Table	
B3. Sample Handling and Custody	Pg. 18-19	
Sample handling requirements	Pg. 18-19	
Chain-of-custody procedures	Pg. 19	
B4. Analytical Methods and Requirements	Pg. 19	
Identify the extraction, digestion, analytical methodologies to be followed	Pg. 19	
Specify the turnaround time for hardcopy/electronic laboratory data deliverables	Pg. 19	
Provide the laboratory SOPs as appropriate	Pg. 19	
Identify the individual(s) responsible for overseeing the analysis and implementing corrective actions	Pg. 19	
B5. Field Quality Control Requirements	Pg. 19-21	
Design the field QC program that will be routinely performed, and provide a corresponding field sampling QC table in the QAPP	Pg. 19-21; Pg. 21 Table	

ELEMENT	Page Number & Paragraph	EPA Use
Include field duplicate samples for each matrix and parameter, trip blanks for VOC samples, temperature blanks, and QA/QC samples as necessary	Pg. 19-21; Pg. 21 Table	
B6. Laboratory Quality Control Requirements	Pg. 21-22	
Determine the laboratory QC data to be routinely included with the laboratory's data package, and provide a corresponding laboratory analytical QC table.	Pg. 21-22; Pg. 22 Table	
B7. Field Equipment Calibration and Corrective Action	Pg. 22-23	
If contained in SOPs, reference that appendix in this section of the QAPP. Otherwise, provide a field equipment calibration table for the types of field equipment routinely used	Pg. 22-23	
Discuss the corrective actions taken in the field when the control limits are not met	Pg. 22-23	
B8. Laboratory Equipment Calibration and Corrective Action	Pg. 23	
If contained in laboratory SOPs, reference that appendix in this section. Otherwise, provide a laboratory equipment calibration table for each analytical method	Pg. 23	
Note responsible individuals	Pg. 23	
B9. Analytical Sensitivity and Project Criteria	Pg. 23	
Provide an analytical method sensitivity and project criteria table for the analytical methods that will be routinely performed	Pg. 23	
If the laboratory provides only one analytical method limit, note in the table whether it is the MDL or the QL/RL that is being reported	Pg. 23; Pg. 23 Table	
B10. Data Management and Documentation	Pg. 24-26	
Describe standard record-keeping, data storage, and retrieval requirements for digital and hard copies of field data, laboratory data, and manipulated data; Include any checklists used for data management	Pg. 24-26	
Describe the control mechanism for detecting and correcting errors, and ensuring accuracy	Pg. 25	
Include the name, title, and organization of the person(s) responsible for these activities	Pg. 25	
C1. Assessments and Corrective Actions	Pg. 26	
Assessments/oversight that will be performed and frequency	Pg. 26	
The person(s) responsible for performing the assessments/oversight, and where the results will be documented	Pg. 26	
Identify who will receive the assessment/oversight report; who will be responsible for dealing with corrective actions; and follow up on assessments/oversight	Pg. 26	

ELEMENT	Page Number & Paragraph	EPA Use
C2. Project Reports	Pg. 26-27	
Identify the types of reports that will be routinely generated	Pg. 26-27	
Provide a detailed description of the contents of project final reports to establish expectations between report preparer and client	Pg. 26-27	
D1. Field Data Evaluation	Pg. 27	
Describe the final data evaluation process that will be routinely performed on the field data	Pg. 27	
Indicate how the results of the evaluation will be documented, and what will be presented the final report(s). Indicate the position(s) of the person(s) who will be performing the field data evaluation	Pg. 27	
D2. Laboratory Data Evaluation	Pg. 27-29	
Describe the final data evaluation process that will be routinely performed on the laboratory data	Pg. 27-28; Pg. 28-29 Table	
Perform a completeness check of the laboratory data package to ensure it is compliant with the requirements in the QAPP	Pg. 27-28; Pg. 28-29 Table	
Document the presence or absence of any problems with the data, and note any relevant sample data that may be impacted.	Pg. 27-28; Pg. 28-29 Table	
Evaluate the field QC sample results including data qualifiers for sample results	Pg. 27-28; Pg. 28-29 Table	
D3. Evaluating Data in Terms of User Needs	Pg. 29-31	
Describe the overall project evaluation process that will be routinely performed to determine the usability of the data, update the conceptual site model, and determine if the objectives of the project have been met	Pg. 29-30	
Tabulate the field sample data together with the state/federal standards for presentation in the final report	Pg. 30 Table	
Using the summary tables and graphical presentations, evaluate the usability of the individual field sample results at the parameter level. Document any limitations	Pg. 31	
Document observations, trends, anomalies, or data gaps that may exist. Evaluate how the results have impacted the conceptual site model, and if the objectives of the project have been met. Draw conclusions and recommendations from all the information	Pg. 30-31; Pg. 30 Table	

Final QAPP disposition:
___ *Approved, no comments*
___ *Approved with comments, resubmittal **not** required*
___ *Conditionally approved, comments must be addressed, resubmittal required*
___ *Not approved, comments must be addressed, resubmittal required*

References

EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5, March 2001, EPA/240/B-01/003,

Guidance for Quality Assurance Project Plans, EPA QA/G-5, December 2002, EPA/240/R-02/009
(Available from EPA's Website: http://www.epa.gov/quality)

Appendix B

Project Organizational Chart

Quality Assurance Project Organizational Chart

City of Atlanta
Brownfields Program Manager
» *Jessica Lavandier*
Phone: 404.330.6000

USEPA
Brownfields Project Manager/DAO
» *Camilla Warren*
404.562.8274

Cardno
QA/QC Officer
» *Douglas Strait, P.E.*
Phone: 770.316.2466

Cardno
Project Manager
» *Keith Ziobron, P.E.*
Phone: 678.443.1197

Tree Atlanta
Owner
» *Connie Veates*
Phone: 404.681.4905

ETRI
Cleanup Project Manager
» *Tom Harper*
Phone: 770.888.8181

Subcontracted Services

Laboratory
AES
» *Ioana Pacurar*
Phone: 770.457.8177

Soil Removal Contractor
AquaTerra
» *Jon King*
Phone: 678-625-4025

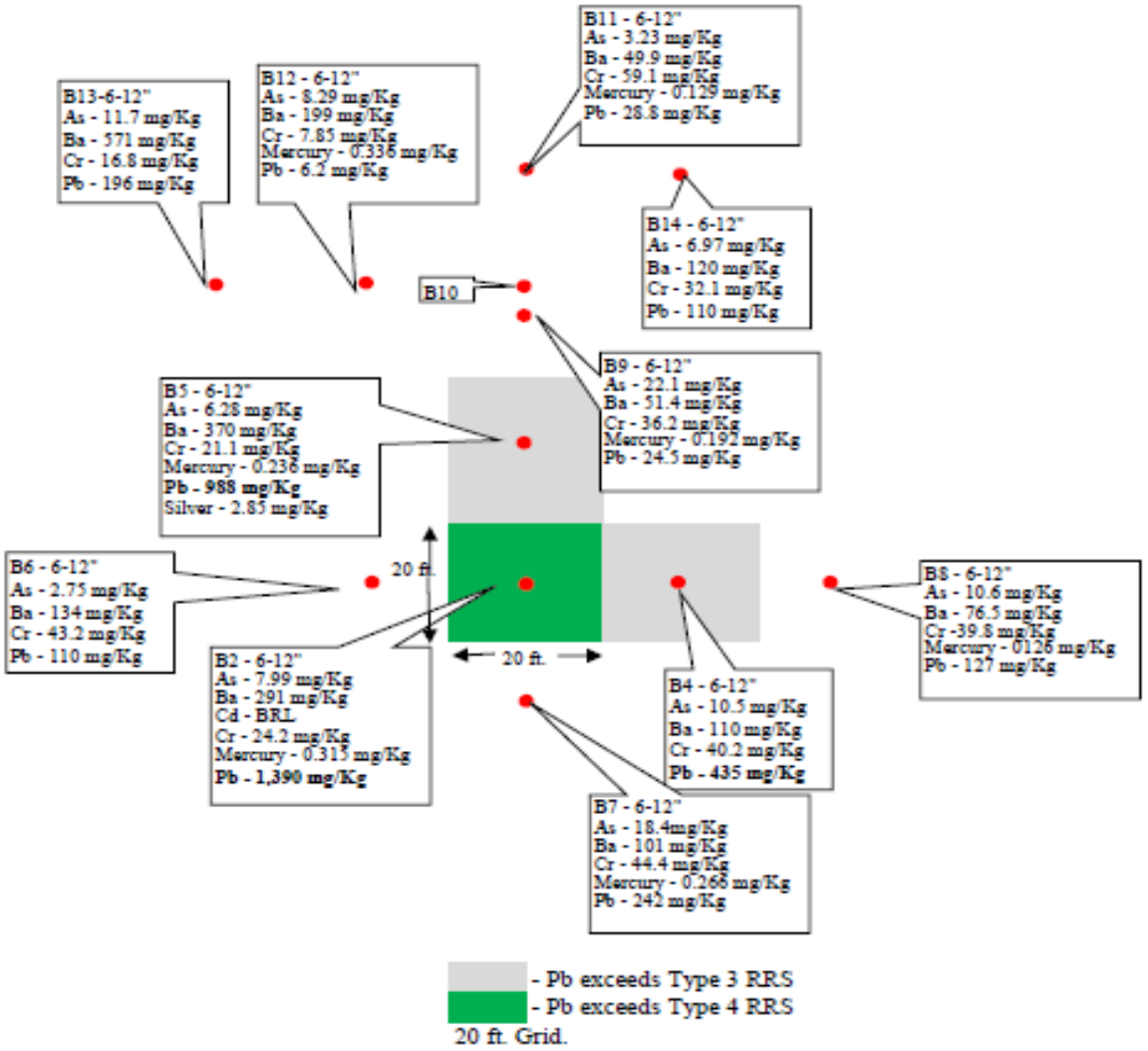
Appendix C
Figures

ETRI
Environmental Technology Resources, Inc.
4780 Ashford Dunwoody Rd.
Suite A-456
Atlanta, Georgia 30338

● Soil Boring Location

Project No.	Scale	Date
19-064	Not to Scale	2018

FIGURE 1
SOIL BORING LOCATIONS
825 Warner Street
Atlanta, Georgia



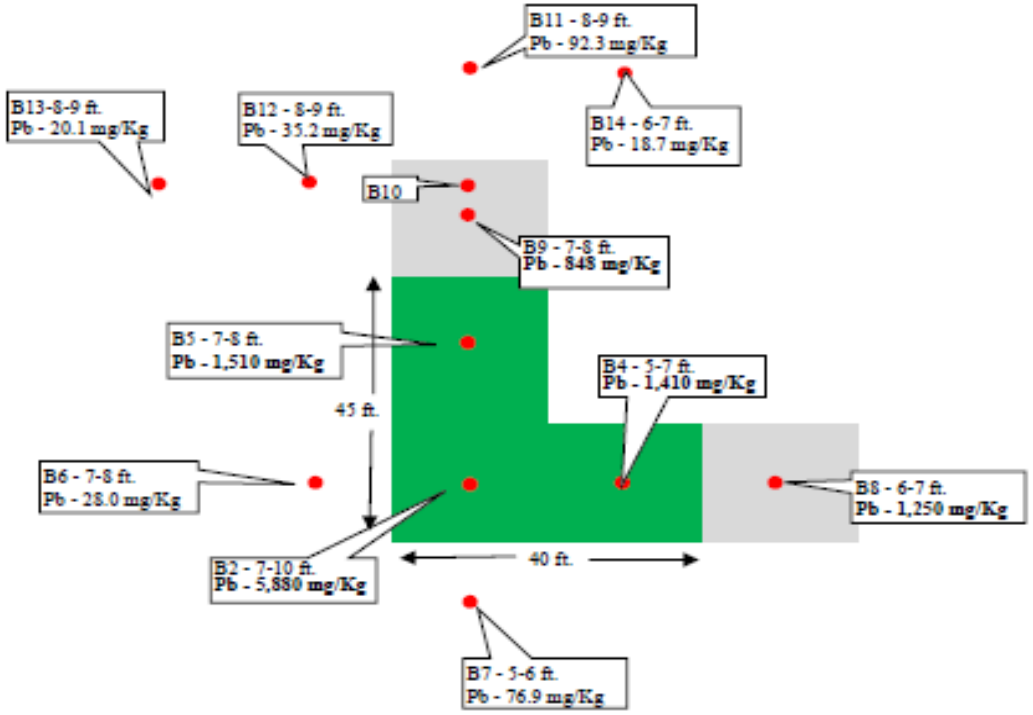
Lead Cleanup Level - 1,050 mg/Kg

Soil Quantity - 0-12 inches
20 ft. x 20 ft. x 1 ft. = 400 ft3 = 15 cubic yards

ETRI
Environmental Technology Resources, Inc.
4780 Ashford Dunwoody Rd.
Suite A-456
Atlanta, Georgia 30338

Project No.	Scale	Date
19-064	Not to Scale	5-18-2020

FIGURE 2
ANALYTICAL RESULTS AND AREAS REQUIRING REMOVAL - Depth 0-12 inches
825 Warner Street
Atlanta, Georgia



Lead Cleanup Level - 1,278 mg/Kg

Soil Quantity - 1-12 feet
45 ft. x 20 ft. x 12 ft. = 10,800 ft3 = 400 cubic yards
minus 15 cubic yards = 385 cubic yards
20 ft. x 20 ft. x 12 ft. = 4,800 ft3 = 178 cubic yards

ETRI
Environmental Technology Resources, Inc.
4780 Ashford Dunwoody Rd.
Suite A-456
Atlanta, Georgia 30338

Project No.	Scale	Date
19-064	Not to Scale	5-18-2020

FIGURE 3
ANALYTICAL RESULTS AND AREAS REQUIRING REMOVAL - Depth 1-12 feet
825 Warner Street
Atlanta, Georgia

Appendix D

Excerpts of Previous Reports

PHASE I ENVIRONMENTAL SITE ASSESSMENT REPORT
825 WARNER STREET SW
ATLANTA, FULTON COUNTY, GEORGIA

EPA TDD No. 0006/OT-06-017

Prepared for:

US Environmental Protection Agency - Region 4
61 Forsyth Street SW
High Shoals, Georgia 30303

Trees Atlanta
225 Chester Avenue SE
Atlanta, Georgia 30316

Prepared by:

Oneida Total Integrated Enterprises
1220 Kennestone Circle, Suite 106
Marietta, Georgia 30066
678-355-5550

EPA Contract No.: EP-S4-15-01
OTIE Project No.: 2015106-1017

April 2019

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ATTACHMENTS

LIST OF ACRONYMS

ACM	asbestos containing materials
AST	Aboveground storage tank
ASTM	American Society of Testing and Materials
CESQG	Conditionally exempt small quantity generator
CERCLIS	Comprehensive Environmental Response, Compensation and Liability Information System
bgs	below ground surface
ESA	Environmental Site Assessment
EDR	EDR Technology Corporation
FEMA	Federal Emergency Management Agency
GWCI	Groundwater Contamination Inventory
HSWA	Hazardous and Solid Waste Amendments
LF	Landfill Site
LUST	Leaking Underground Storage Tank
NRCS	Natural Resources Conservation Services
NWI	National Wetlands Inventory
NWIS	National Water Inventory System
OTIE	Oneida Total Integrated Enterprises
PCB	Polychlorinated biphenyls
RCRA	Resource Conservation and Recovery Act
REC	Recognized environmental concerns
SHWS	State Hazardous Waste Site
SWF	Solid Waste Facility
TDD	Technical Direction Document
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UST	Underground storage tank

1.0 SUMMARY

The United States Environmental Protection Agency Region 4 (USEPA) is assisting Trees Atlanta with redevelopment of a Brownfields site located in Atlanta, Fulton County, Georgia (GA). The USEPA contracted Oneida Total Integrated Enterprises (OTIE) to conduct a Phase I Environmental Assessment of the property located at 825 Warner Street SW in Atlanta, GA (the "Subject Site" or "Subject Property").

As part of this assessment, OTIE performed a Phase I Environmental Site Assessment (ESA) to assess whether recognized environmental conditions (RECs) are present at the Subject Site. In this report, the term REC refers to the presence or likely presence of any hazardous substances or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances or petroleum products into structures on the property or into the ground, groundwater, or surface water of the property. The term REC is not intended to include *de minimis* conditions that generally do not present a material risk of harm to public health or the environment and that generally would not be the subject of an enforcement action if brought to the attention of appropriate governmental agencies [American Society of Testing and Materials (ASTM), 2014]. This work was performed in accordance with the ASTM Standard Practice E1527-13 (ASTM, 2014).

In this report, OTIE provides information from the Phase I ESA completed for the Subject Site, as shown in Figure 2. During performance of this Phase I ESA, OTIE emphasized evaluating the likelihood that RECs are located at or in close proximity to the Subject Site. The scope of services for this Phase I ESA included:

1) a review of historical information/records regarding land use and environmental conditions at the Subject Site,
2) performance of a visual reconnaissance to document existing conditions at the Subject Site and the immediately adjacent land area,
3) interviews of key persons familiar with the Subject Site, and
4) preparation of this report.

Report findings and recommendations are presented below. A more complete discussion of the information obtained during the Phase I ESA is presented in the following sections of this report. Supporting data, figures, photographs, and other information are attached in Appendices A through H.

1.1 Findings

Evidence exists of RECs related to historic on-site operations and residual contamination from actual releases.

Subject Property RECs

The Subject Property is currently occupied and operational as "The Bakery", a multi-faceted space for artists which has reportedly operated as such for the last 10 years. Based on available records dating from 1888 until 2017, the Subject Site, referred to as 825 Warner Street located at 825 Warner Street SW, Atlanta, Fulton County, Georgia, and comprised of one parcel, was developed as early as 1927 as a structural and ornamental steel company. Around 1950 the

Subject Property was redeveloped as a produce company which transitioned into a meat company (Armour Meats) around 1961. Armour Meats operated until 1978 according to city directory listings. Operations at the Subject Property are unknown from 1978 until 1994. From 1994 to 2014 Mom's Bakery occupied the Subject Property. Several other commercial businesses also operated at the Subject Property during from 2010 to 2014 according to city directory listings.

Based on the known history of the Subject Property and a review of the available information, the following RECs were identified on the Subject Property:

- The EDR report has the property located at 717 Warner St SW listed in the US Brownfields database. The EDR Detail Map illustrates this property at the southeast corner of the Subject Property. The site was listed as receiving an assessment grant. The property description is "former drum storage facility (ongoing remediation), federal notifier for hazardous substance release." There was no date provided with this listing as to when this occurred and if there was a release or not. A Phase II investigation was conducted in 2006 and a soil boring was advanced near the southeast corner of the Subject Property and the groundwater results indicated no detections of VOCs.
- The EDR report has a SPILLS database listing for the Subject Property with an incident occurring on August 27, 2010. The incident involved an unknown amount of oil being discharged into a storm drain from an unknown source. The responsible party was unknown. The Atlanta Police Department (APD), Atlanta Fire Department, and the USEPA were involved with the initial investigation which lead to the discovery of an abandoned truck with an estimated 1,000 gallon tank that had leaked upwards of 1,000 gallons of what was believed to be waste oil onto the ground surface and into a storm drain. The property owner was identified as Mr. Berry Goren who hired a contractor to handle the cleanup. An investigator (J.R. Campbell) with the APD followed up on the incident on September 4, 2010. At that time Mr. Goren stated that the frac tanks were still on site awaiting disposal. After repeated attempts to contact Mr. Goren, the same APD investigator issued a "Hand Off memo" electronically to Renee Hudson-Goodley on December 1, 2010. At that time, Mr. Goren's voluntary compliance in removing the frac tanks and properly disposing or recycling of the unknown substances in the tanks had been unsuccessful. No other information followed.

Adjacent properties RECs

The immediate adjacent properties consist of a property to the north that is reportedly utilized for records and archiving; to the east is Allene Avenue SW beyond which is the Atlanta Beltline and residential properties; to the south is Warner Street SW beyond which appears to be commercial properties that stage open top roll off dumpsters and Conex boxe,s and a thrift store; and to the west by a large vacant commercial property that operated as the old State Farmers Market from about 1940 to 1957. Based on available records dating back to 1888, the vicinity of the Subject Site was first developed residentially as early as 1927. Evidence exists of RECs related to residual contamination from suspected or actual releases at the following nearby properties located at a higher elevation from the Subject Site:

- The 1978 Sanborn map indicates that a property adjacent to the south of the Subject Property had transformers. Transformers in 1978 were known to have polychlorinated biphenyls (PCBs) containing oil and as a result this is a REC to the Subject Property.
- A US Brownfields site (1121 Allene Avenue) is listed adjacent to the southeast of the Subject Property beyond Allene Avenue. The property is described as "A building which formerly housed a drum storage facility". The property received a hazardous and petroleum assessment grant. No information was provided regarding a cleanup and as a result this is a REC to the Subject Site.
- A LUST site (Champion International Corp) is located approximately 500 feet south southwest of the Subject Property and has had a total of 15 USTs utilized on the property dating back to 1959. The lack of information regarding cleanup measures and status makes this property a REC to the Subject Site.
- A State Hazardous Waste Site (ESB, Inc.) is located 0.294-mile from the Subject Property. The site has a known release of lead in soils at levels exceeding the reportable quantity. Investigations are being conducted to determine the level of cleanup necessary for groundwater. Given the known release this property is a REC to the Subject Site.
- A Georgia Non Hazardous Site Inventory Site (Bernstein Scrap Metal) is located approximately 500 feet northwest of the Subject Property. The site is listed as having contamination in the form of lead. Given the close proximity of this site to the Subject Property and that there is known lead contamination this property is a REC to the Subject Site.
- There are four EDR Historical Auto sites located within 586 feet of the Subject Property to the southeast and southwest. These properties operated as either gas and/or oil service stations or automobile repair shops. Given these properties likely utilized USTs or above ground storage tanks (ASTs) as a part of their operations these properties are RECs to the Subject Site.

Other

Given the age of the former facility buildings, asbestos containing materials (ACM) and lead-based paint (LBP) may be present in the construction debris remaining on site.

1.2 Recommendations

To further evaluate environmental issues associated with the identified RECs at the Subject Site and nearby surrounding area, OTIE recommends that a Phase II ESA be completed. The goal of this Phase II ESA would be to assess soil and groundwater quality on the Subject Property to determine whether on-site or off-site releases have impacted the property.

Additionally, OTIE recommends that a ational Emission Standards for Hazardous Air Pollutants (NESHAP) ACM and LBP surveys be performed prior to any demolition or renovation activities take place on the Subject Property building.

2.0 INTRODUCTION

2.1 Purpose

This Phase I ESA was conducted to evaluate whether RECs are indicated at, or in the immediate vicinity of the property located at 825 Warner Street SW in Atlanta, Fulton County, Georgia. This included an evaluation of the potential for RECs to require additional investigation and/or remedial activities at the Subject Site.

Further discussion regarding the scope of services performed by OTIE during this Phase I ESA is presented below.

2.2 Detailed Scope-of-Services

This work was completed in accordance with the ASTM Practice 1527-13. This included collecting and reviewing the following types of information (where available):

- Physical setting characteristics of the property through a review of referenced sources such as topographic maps and geologic, soils and hydrologic reports.
- Usage of the Subject Property, adjoining properties and surrounding area through a review of referenced historical sources such as land title records, fire insurance maps, city directories, aerial photographs, prior reports and interviews.
- Observations and interviews regarding current Subject Property usage and condition including: the use, treatment, storage, disposal or generation of hazardous substances, petroleum products, hazardous wastes, nonhazardous solid wastes and wastewater.
- Usage of adjoining and surrounding area properties and the likely impact of known or suspected releases of hazardous substances or petroleum products from those properties in, on, or at the Subject Property.
- Information in referenced environmental agency databases and local environmental records, within the specified approximate minimum search distance from the property.
- Potential for subsurface vapor migration in, on or at the Subject Property as described in Section 8.0

2.3 Significant Assumptions

Certain information contained in this report has been obtained from regulatory database search firms, regulatory and public agencies, personal interviews, and Fulton County. It is assumed that the information obtained from these and other information sources is true and accurate. OTIE makes no representations or warranties that such information is accurate or that any independent investigation, beyond the agreed upon scope of services, has been or will be made to verify the accuracy of such information.

2.4 Limitations and Exceptions

The opinions rendered in this report are based on information collected during the conduct of this assessment and represent OTIE's professional judgment regarding the status of the Subject Site and, as such, are not a guarantee. Rather, OTIE's professional judgment is based on generally accepted environmental practices and procedures designed to assess environmental liability with respect to current and customary standards of due care recognized by the consulting profession at the time this investigation was performed.

2.5 Special Terms and Conditions

The work was performed under the USEPA Superfund Technical Assessment and Response Team (START) Contract EP-S4-15-01 held by OTIE dated April 2015.

2.6 User Reliance

OTIE has no obligation to any party other than USEPA and Trees Atlanta, who intends to or will rely on this report and specifically disclaims any responsibility to any third party. OTIE assumes no obligation for reporting any facts contained in this report to anyone other than the above parties unless otherwise directed by them.

3.0 SITE DESCRIPTION

3.1 Location and Legal Description

The physical address for the Subject Site is 825 Warner Street SW, Atlanta, Georgia. Geographic coordinates for the approximate center of the property are 33.724954° North Latitude and 84.414558° West Longitude.

According to user provided information, as well as the Fulton County Tax Office, the Subject Property is located on one parcel, identified with PIN number 14 010600090070. The Subject Property encompasses 2.9 acres and is currently owned by Jabobar Properties, LLC. A copy of the Tax Record Card and the signed Access Authorization form and TBA application for the property is provided in Appendix D.

An aerial figure showing the parcel boundaries is provided as Figure 2.

3.2 Subject Site and Vicinity General Characteristics

The location and general physical characteristics of the Subject Site and surrounding area are illustrated on the United States Geological Survey (USGS) topographic map in Figure 1, and an annotated 2018 aerial photograph showing the Subject Property and general site vicinity characteristics provided as Figure 2.

The Subject Property is located in a mixed commercial and industrial area within the City of Atlanta southwest of downtown. It is bound by Warner Street SW to the south, Allene Avenue SW to the east, a large vacant industrial property to the west, and large records and archives building to the north (Figure 2).

The topography elevation at the Subject Site is on average 1,032 feet above mean sea level (amsl). Surface topography across the Subject Property and surrounding area generally slopes towards the north northeast. The direction of groundwater flow at the site is unknown, but it is expected to mimic the surface topography and flow towards the north northeast.

3.3 Current Use of Property

The Subject Property is currently occupied and operational as “The Atlanta Bakery” a multi-faceted arts complex.

3.4 Descriptions of Structures, Roads, Other Improvements on the Site

The Subject Property consists of 2.9 acres (Figure 2). A 6-foot tall chain link fence with a locked gate secures the perimeter of the Subject Site. The fence is generally in fair to good condition. The surface is covered with asphalt to the south and east of the site building. The site building is a one story, square shaped , approximately 23,000 square feet warehouse space. Near the northeast corner of the site building is a 30 feet tall out of use grain silo. There is a loading dock area along the south wall of the site building. Located in the loading dock area near the southeastern corner of the site building is a circular locked hatch that covers an access to the sewage system. Photographs of these features are provided in Appendix B.

The following table provides other improvements to the Subject Property.

Property Improvements	
Adjoining and/or Access/Egress Roads	Vehicular access to the Subject Property is restricted from Warner Street. A locked maintained gate blocks vehicular access from Warner Street.
Unimproved Areas	The eastern and western portions of the Subject Property have never been developed and remain undisturbed.
Landscaped Areas	Garden area along Warner Street on the western half of the site.
Surface Water	None
Potable Water Source	City of Atlanta
Sanitary Sewer Utility	City of Atlanta
Storm Sewer Utility	City of Atlanta
Electrical Utility	Georgia Power
Natural Gas Utility	None
Total Square Feet of Space (approximate)	23,000
Construction Completion Date (year)	Construction of the current warehouse building was in the 1970's.
Interior Finishes Description	Drywall and joint compound, painted concrete block, ceiling tile
Exterior Finishes Description	Painted concrete block wall and steel rock decking
Cooling System Type	Central air units
Heating System Type	Forced air units
Emergency Power	None

3.5 Current Use of Adjoining and Potentially Significant Nearby Properties

The Subject Property is bordered to the north by a large records and archives building; to the east by Allene Avenue SW followed by the Atlanta Beltline (ABL) and a public farm associated with the ABL; Warner Street SW beyond which are properties where roll off dumpsters and Conex boxes are staged, and a thrift store to the south; and to the west by a large vacant commercial property.

4.0 USER-PROVIDED INFORMATION

Under the ASTM Practice 1527-13, the Phase I ESA report "User" (the person or entity for which the report is prepared) is obligated to provide certain information, if available. A summary of the available User-provided information is listed below.

4.1 Title Records

OTIE reviewed chain-of-title records available on the Fulton County Board of Assessors website (http://www.qpublic.schneidercorp.com) as part of this assessment (Appendix C). The deeds indicate the following ownership history for the Subject Site:

Date	Grantor	Grantee	Deed Book/Page	Deed Type
4/3/2017	Zipperman Anita B	Jabobar Properties LLC	57421/0595	Unknown
6/2/2006	Ezell Multi Use Developments	Jabobar Properties LLN	42978/00109	QC
2/22/2005	Capital Mortgage Corp	Ezell Multi Use Developments	39512/00205	LW
12/23/2004	Tower Financial Services Inc	Capital Mortgage Corp	39113/00026	WD
1/6/2004	Slaughter Jason	Tower Financial Services Inc	37383/00386	DP
2/25/2002	Moms Bakery Inc & Harold Kay	Slaughter Jason	31945/00573	WD
8/26/1997	Gray Chester L & Neal	Harold Kay Moms Bakery Inc	23103/00005	LW
11/2/1981	Unknown	Unknown	07991/00199	Unknown

No indications of possible RECs were noted in the reviewed documents.

4.2 Environmental Liens or Activity and Use Limitations

User has no knowledge of any environmental liens against the property that are filed or recorded under federal, tribal, state or local law. Per the scope of work, no AUL/Lien Search was performed in association with the Subject Property for this assessment.

According to information obtained from the of the Fulton County Tax office's website (https://www.gis.fultoncountyga.gov), the property taxes have been paid through 2018.

4.3 Specialized Knowledge

The User did not provide OTIE with any specialized knowledge that is material to RECs in connection with the Subject Property.

4.4 Commonly Known or Reasonably Ascertainable Information

The User representative, Mr. Greg Levine of Trees Atlanta has been associated with the Subject property for approximately 6 weeks. The information provided is summarized in section 7.0.

4.5 Valuation Reduction for Environmental Issues

The User provided no information regarding a significant valuation reduction for environmental issues associated with the Subject Property.

According to the Fulton County tax information for the Subject Site, the market value is $410,000 (Appendix I).

4.6 Owner, Property Manager, and Occupant Information

The Subject Site is owned by Jabobar Properties LLC (see Section 3.1). It is currently occupied by "The Bakery" and used as artist studio space for approximately the last 10 years. Reportedly originally the property was developed as a bakery associated with the adjacent State Farmers Market.

4.7 Reason for Performing Phase I ESA

The non-profit organization Trees Atlanta would like to redevelop the Subject Site into an urban ecology center/educational center. Prior to redevelopment activities, Trees Atlanta would like to assess the site for any potential environmental contamination. The principle focus of this Phase I ESA is to document if RECs are present at the Subject Site.

4.8 Other

USEPA provided OTIE with a copy of the EPA Region 4 - Targeted Brownfields Assessment Application Form for the Subject Site, EPA Region 4 - Targeted Brownfields Site Eligibility Determination Outline for the Subject Site, and Access Authorization form for the Subject Site (Appendix D).

5.0 RECORDS REVIEW

5.1 Standard Environmental Record Sources

The regulatory database review was performed to determine whether the Subject Site and/or nearby properties have been formerly identified as having caused or having the potential to cause a REC. EDR of Shelton, Connecticut, an environmental database search agency, provided the Federal and State database search report. The EDR Summary Report maps, summary tables, and detailed information pages for selected sites are presented in Appendix A. The distribution of identified sites relative to the Subject Site is shown on maps included with the EDR report.

Unless otherwise noted, the information provided by the regulatory agency database report and other sources referenced in this report, were considered sufficient for REC, controlled recognized environmental condition (CREC), historical recognized environmental condition (HREC) or de minimis condition determinations without conducting supplemental agency file reviews.

A complete list of the databases researched by EDR is presented in Appendix A. Further discussion of the records that contained the Subject Site and nearby sites within the relevant search radii is provided below.

Regulatory Database	Target Property	Search Distance (Miles)	Within ⅛ mile	Within ¼ mile	Within ½ mile	Within 1 mile	Totals
Federal CERCLIS SEMS		0.50	1	2	1	0	4
Leaking Underground Storage Tank Database (LUST)		0.50	1	2	12	NR	15
RCRA-CESQG (conditionally exempt small quantity generator		0.25	0	1	NR	NR	1
ERNS (Federal ERNS list)	X	TP	NR	NR	NR	NR	1
Underground Storage Tank (USTs)		0.25	1	3	NR	NR	4
Aboveground Storage Tank (ASTs)		0.25	0	1	NR	NR	1
The State Hazardous Waste Sites (SHWS)		1.0	0	0	1	0	1
GA Non-HSI		1.0	1	3	4	14	22
State Brownfields		0.50	0	1	2	NR	3
US Brownfields		0.50	5	9	17	NR	31
SWRCY (local landfill/solid waste disposal sites)		0.50	0	0	1	NR	1
DEL SWHS		1.0	0	0	0	1	1
SPILLS (Records of Emergency Release Reports)	X	TP	NR	NR	NR	NR	1
RCRA NonGen/NLR		0.25	4	2	NR	NR	6
EDR Hist Auto		0.125	4	NR	NR	NR	4

Notes
NR: Not reported
TP: Target Property

5.1.1 Federal Government

Records from the Federal Government were reviewed to determine the potential of the subject areas to be contaminated and/or have on-site generation of hazardous wastes.

The following Federal records contained nearby sites within the relevant search radii.

SEMS (Superfund Enterprise Management System): This database tracks hazardous waste sites, potentially hazardous waste sites, and remedial activities performed in support of USEPA's Superfund Program across the United States. The list was formerly known as CERCLIS, renamed to SEMS by the EPA in 2015. The list contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). This dataset also contains sites which are either proposed to or on the National Priorities List (NPL) and the sites which are in the screening and assessment phase for possible inclusion on the NPL.

The SEMS database listed four sites within a 0.5-mile radius of the Subject Site:

J & W Pallet & Drum Co. (EPA ID: GAD984310797) **Adjacent to the southeast and at a higher elevation**
According to the EDR report, this site is located 321 feet southeast and at a higher elevation than the Subject Site. The site is listed as No Further Remedial Action Planned (NFRAP)-Site does not qualify for the NPL based on existing information. On 2004-06-24 an Action Name: RMVL indicates a removal was done.
Given that this property received a NFRAP status, this listing is not considered a REC to the Subject Site.

The remaining three SEM database listings are greater than 0.220 mile from the Subject Property and have a NFRAP or Removal Only Site (No Site Assessment Work Needed) Non NPL Status. These database listings are not considered a REC with potential to impact the Subject Property.

Resource Conservation and Recovery Action (RCRA)-Conditionally Small Quantity Generator (CESQG): The RCRA database is EPA's comprehensive information system, providing access to data supporting the RCRA of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the RCRA. CESQGs generate less than 100 kilograms (kg) of hazardous waste or less than 1 kg of acutely hazardous waste per month.

The RCRA database listed one site within a 0.25-mile radius of the Subject Site:

ESB Inc (EPA ID: GAD078105749) **⅛ – ¼ mile SSE lower elevation**
According to the EDR report, this site is located 1,217 feet south southeast and at a lower elevation than the Subject Site. The site is listed as operator with a start date of 01/01/1948. The site is listed as having lead waste. The site received a notice of violation on 02/04/1999 and received a Date Achieved compliance on 03/23/2000.
Given the distance and lower elevation in relation to the Subject Site and compliance being achieved this listing is not considered a REC to the Subject Site.

US BROWNFIELDS: The EPA's listing of Brownfields properties from the Cleanups in My Community program, which provides information on Brownfields properties for which information is reported back to EPA, as well as areas served by Brownfields grant programs.

A review of the US BROWNFIELDS list, as provided by EDR, and dated 12/17/2018 has revealed that there are 31 US BROWNFIELDS sites within approximately 0.5 miles of the target property.

717 Warner ST SW (US Brownfields ID: 1023618953) **Target Property**
According to the EDR report, this site is located 244 feet east southeast and at a higher elevation than the Subject Site. The EDR Detail Map illustrates this listing at the southeast corner of the Subject Property. This property is listed as receiving an assessment grant. The property description is "former drum storage facility (ongoing remediation), federal notifier for hazardous substance release."
Given this listing is actually the Subject Property; this **is considered a REC** to the Subject Site.

Multiple Addresses-1121 Allene Avenue (US Brownfields ID: 1023620254) **<1/8 mile SE and higher elevation**
According to the EDR report, this site is located 442 feet southeast and at a higher elevation than the Subject Site. This appears to be an adjacent property beyond Allene Avenue. This property is listed as receiving a hazardous and petroleum assessment grant. The property description is "A building which formerly housed a drum storage facility and a recapped tire business is on-site. Similar businesses have operated on-site since at least 1978."
Given this listing is adjacent to and at a higher elevation than the Subject Property; and that the property was described as "a drum storage facility" this **is considered a REC** to the Subject Site.

OTIE briefly reviewed the remaining 29 US Brownfields database listings. Due to potential groundwater contamination not being a threat to the Subject Property as municipal water is utilized for potable purposes the listings are not considered a REC to the Subject Property at this time.

RCRA-NonGen / NLR list: The database includes Non-Generators that do not presently generate hazardous waste.

The RCRA-NonGen / NLR database listed six sites within a 0.25-mile radius of the Subject Site.

J & W Pallet & Drum Co. **Adjacent to the SE and at a higher elevation**
According to the EDR report, this property is 321 feet southeast and at a higher elevation than the Subject Property. Information states this facility was granted a Non-Generator classification as of 05/31/2005. Additional information states this facility was a CESQG as of 11/04/1993 and no violations found.
Given that no violations have been reported, this listing is not considered a REC.

JW Oil (RCRA NonGen/NLR ID: 1010316263) **Adjacent to the SW and at a higher elevation**
According to the EDR report, this property is 406 feet southwest and at a higher elevation than the Subject Property. Information states this facility was granted a Non-Generator classification as of 01/27/2010. Additional information states this facility was classified "Not a generator, verified" on 07/06/2009. On 06/03/2008 multiple violations were cited for "Transporters – General" and "Used Oil – Processors and Re-refiners". Those violations received a Date Achieved Compliance of 07/10/2009 by the state and subsequently received an "Action Satisfied (Case Closed)" status on 07/10/2009.
Given that the property was granted a "Case Closed" status , this listing is not considered a REC.

OTIE briefly reviewed the remaining four database listings. Due to potential groundwater contamination not being a threat to the Subject Property as municipal water is utilized for potable purposes the listings are not considered a REC to the Subject Property at this time.

5.1.2 State Government

Records from the state government were reviewed to determine the potential of the Subject Site and nearby sites to be contaminated and/or have on-site generation of hazardous wastes.

The following State Government records contained the Subject Site and nearby sites within the relevant search radii.

LUST Database: The GA Environmental Protection Division (GAEPD) manages a database listing of all LUSTs. LUST records contain an inventory of reported leaking underground storage tank incidents. This list is updated on a quarterly basis.

The LUST database listed 15 sites within a 0.5-mile radius of the Subject Site:

Champion International Corp (LUST ID: GAD981282312 and Facility ID: 09000160) **< ⅛- mile SSW and higher elevation**
This site is located 503 feet and at a higher elevation from the Subject Site. According to the EDR report, the facility is inactive and industrial. Reportedly there has been a total of 15 underground storage tanks (USTs) on this property. One UST was removed in 1959 and contained diesel. Seven USTs (tanks 1, 2, 3, 4, 5, 6, and 10) were removed in 1960 and contained hazardous substances. Three USTs (tanks 7, 8, and 9) were removed in 1972 and contained hazardous substances. Two USTs (tanks 1A/FO and 1B/FO) were removed in 1974 and contained diesel. Two tanks (tanks 2/FO and 3/FO) were removed in 1976 and contained diesel. The size of the USTs is unknown. Information states the cleanup status was "transferred" and the date received was 09/09/1988.
Given the distance and upgradient elevation of this site from the Subject Site, and the lack of information available regarding the leak, cleanup measures, or closure status, this database listing **is considered a REC** with potential to impact the Subject Property.

Harmon Brothers Charter Service (LUST ID: 1006787752 and Facility ID: 09060535) **1/8 - 1/4 mile SSE and higher elevation**
This site is located 994 feet and at a higher elevation from the Subject Site. According to the EDR report, this facility has had two LUST incidents (1999 and 2011) and was granted a No

Further Action status and closed in 2006 and 2011, respectively.
Given the site was granted No Further Action status by the state, this database listing is not considered a REC with potential to impact the Subject Property.

Othello Event Center (LUST ID: S118627684 and Facility ID: 10002509) **1/8 - 1/4 mile WSW and higher elevation**
This site is located 0.225-mile and at a higher elevation from the Subject Site. According to the EDR report, this facility had one UST installed in 2015 and then closed in ground. The facility is inactive and commercial. No other information was provided.
Given the distance this property is from the Subject Property and that there was no reported release, this database listing is not considered a REC with potential to impact the Subject Property.

Alterman Cold Storage (LUST ID: S104887784 and Facility ID: 09060811) **1/4 - 1/2 mile NNW and higher elevation**
This site is located 0.288-mile and at a higher elevation from the Subject Site. According to the EDR report, this facility was granted a No Further Action status on 11/15/2001. No other information was provided.
Given the distance and that the site was granted a No Further Action status, this database listing is not considered a REC with potential to impact the Subject Property.

J&L Associates Inc (LUST ID: 1006779128 and Facility ID: 09060560) **1/4 - 1/2 mile NW and higher elevation**
This site is located 0.316-mile and at a higher elevation from the Subject Site. According to the EDR report, this facility was granted a No Further Action status on 12/05/2001. This site had two USTs installed in 1998 and has a Tank Status of “Removed from Ground”.
Given the distance and that the site was granted a No Further Action status, this database listing is not considered a REC with potential to impact the Subject Property.

VBK 2 Ent Inc (LUST ID: U003002442 and Facility ID: 00601121) **1/4 - 1/2 mile NNW and higher elevation**
This site is located 0.347-mile and at a higher elevation from the Subject Site. According to the EDR report, this facility was granted a NFA - Remediation status on 1/26/2004. This site currently has 5 USTs in use and all were installed in 1985. Three of the USTs contain gas; one contains diesel; and one contains kerosene.
Given the distance and that the site was granted a No Further Action status, this database listing is not considered a REC with potential to impact the Subject Property.

GA Bldg Auth Warehouse/Dept AD S (LUST ID: U001920478 and Facility ID: 09060359) **1/4 - 1/2 mile WSW and higher elevation**
This site is located 0.401-mile and at a higher elevation from the Subject Site. According to the

EDR report, this facility was granted a No Further Action status on 08/25/1994. The site had one UST containing gas installed in 1994 and has a Tank Status of "Removed from Ground".
Given that the site was granted a No Further Action status, this database listing is not considered a REC with potential to impact the Subject Property.

Doc's Auto Repair (LUST ID: U001491552 and Facility ID: 09060281) **1/4 - 1/2 mile West and higher elevation**
This site is located 0.402-mile and at a higher elevation from the Subject Site. According to the EDR report, this facility was granted a NFA – Monitoring Only (MNA) status on 07/11/2006. The site is an inactive gas station. This site has had a total of 8 USTs all of which were installed in 2004 and have a Tank Status of "Removed from Ground". Six of the USTs contained gas; two contained used oil; and one contained kerosene.
Given the distance and that the site was granted a No Further Action status, this database listing is not considered a REC with potential to impact the Subject Property.

878 Murphy Avenue (LUST ID: U004022523 and Facility ID: 10000846) **1/4 - 1/2 mile North and higher elevation**
This site is located 0.421-mile and at a higher elevation from the Subject Site. According to the EDR report, this facility had a confirmed release on 03/10/2005. The facility is currently an inactive gas station that had a total of 5 USTs all of which were installed on 02/10/2005 and have a Tank Status of "Removed from Ground". One UST was reported to contain used oil, the other four the contents were unreported. The facility received a No Further Action status on 03/18/2005.
Given the distance and that the site was given a No Further Action status, this database listing is not considered a REC with potential to impact the Subject Property.

981 Ashby Street (LUST ID: U004022722 and Facility ID: 10000434) **1/4 - 1/2 mile NNW and higher elevation**
This site is located 0.435-mile and at a higher elevation from the Subject Site. According to the EDR report, this facility had a confirmed release on 09/08/2003 and then received a No Further Action status on 09/25/2003. The facility is currently inactive and had one UST installed on 01/01/1998 and has a Tank Status of "Removed from Ground". The contents of the UST were unreported.
Given that the site was given a No Further Action status, this database listing is not considered a REC with potential to impact the Subject Property.

IRCC Georgia (LUST ID: N/A and Facility ID: 09060829) **1/4 - 1/2 mile NNW and higher elevation**
This site is located 0.451-mile and at a higher elevation from the Subject Site. According to the EDR report, this facility received a No Further Action status on 11/16/2000.

Given the distance and that the site was given a No Further Action status, this database listing is not considered a REC with potential to impact the Subject Property.

Former Lee Street Station (LUST ID: 1006796103 and Facility ID: 10000114)
1/4 - 1/2 mile North and higher elevation

This site is located 0.465-mile and at a higher elevation from the Subject Site. According to the EDR report, this facility had a confirmed release on 08/21/2002 and has a Cleanup Status of NFA – Monitoring Only (MNA). The site received a No Further Action status on 06/16/2005. The facility is an inactive gas station that had 2 USTs that were installed on 01/01/1980 and contained gas and were "Closed in Ground".

Given the cleanup status of NFA – Monitoring Only (MNA) and the distance this property is from the Subject Site, this database listing is not considered a REC with potential to impact the Subject Property.

Atlanta Hydraulic Repair Svc Inc (LUST ID: U001478413 and Facility ID: 00600667)
1/4 - 1/2 mile SW and higher elevation

This site is located 0.325-mile and at a higher elevation from the Subject Site. According to the EDR report, this facility has a Cleanup Status of NFA – Clean Closure as of 02/17/1998. The facility is an inactive commercial property that had one UST that was installed on 03/05/1951, contained gas and was "Removed from Ground".

Given the cleanup status of NFA – Clean Closure and the distance this property is from the Subject Site, this database listing is not considered a REC with potential to impact the Subject Property.

Jupiter Development Inc (LUST ID: U001478740 and Facility ID: 00601089)
1/4 - 1/2 mile ESE and lower elevation

This site is located 0.387-mile and at a lower elevation from the Subject Site. According to the EDR report, this facility has a Cleanup Status of NFA – Suspected Release. The facility received a No Further Action cleanup status on 05/04/2004. The facility currently has 3 USTs (2-gas and 1-diesel) in use that were installed in 1984.

Given the cleanup status of NFA, the distance and lower elevation this property is from the Subject Site, this database listing is not considered a REC with potential to impact the Subject Property.

Former C&R Motors (LUST ID: N/A and Facility ID: 10001392)
1/4 - 1/2 mile SSW and lower elevation

This site is located 0.443-mile and at a lower elevation from the Subject Site. According to the EDR report, this facility had a Confirmed Release on 07/25/2007 and then received a Cleanup Status of No Further Action on 10/26/2007.

Given the cleanup status of NFA, the distance and lower elevation this property is from the Subject Site, this database listing is not considered a REC with potential to impact the Subject Property.

UST Database: GAEPD manages the registry of regulated USTs under Subtitle I of the Resource Conservation and Recovery Act (RCRA). Available information varies by state program. This list is updated on an annual basis.

The UST database listed the four following sites within a 0.25-mile radius of the Subject Site:

Champion International Corp (UST Facility ID: N/A) **<1/8 mile SSW and higher elevation**
This site is located 503 feet and at a higher elevation from the Subject Site. According to the EDR report, the facility is inactive and industrial. Reportedly there has been a total of 15 underground storage tanks (USTs) on this property. One UST was removed in 1959 and contained diesel. Seven USTs (tanks 1, 2, 3, 4, 5, 6, and 10) were removed in 1960 and contained hazardous substances. Three USTs (tanks 7, 8, and 9) were removed in 1972 and contained hazardous substances. Two USTs (tanks 1A/FO and 1B/FO) were removed in 1974 and contained diesel. Two tanks (tanks 2/FO and 3/FO) were removed in 1976 and contained diesel. The size of the USTs is unknown. Information states the cleanup status was "transferred" and the date received was 09/09/1988.
Given the distance and upgradient elevation of this site from the Subject Site, and the lack of information available regarding the leak, cleanup measures, or closure status, this database listing **is considered a REC** with potential to impact the Subject Property.

Harmon Brothers Charter Service (UST Facility ID: U003006119) **1/8 – 1/4 mile SSE and higher elevation**
This site is located 0.188-mile and at a higher elevation from the Subject Site. According to the EDR report, the facility is inactive and commercial. Four USTs have been installed on the property between 1974 and 2008. Two USTs contained gas, one contained diesel, and one contained kerosene. All four USTs have a Tank Status of "Removed from Ground".
Given the Tank Status of "Removed from Ground" this database listing is not considered a REC with potential to impact the Subject Property.

Othello Event Center (UST Facility ID: U004250119) **1/8 – 1/4 mile WSW and higher elevation**
This site is located 0.225-mile and at a higher elevation from the Subject Site. According to the EDR report, the facility is inactive and commercial. One UST was installed in 2015. The UST has a Tank Status of "Closed in Ground".
Given the Tank Status of "Closed in Ground" this database listing is not considered a REC with potential to impact the Subject Property.

Sprint Atlanta Wireline Switch (UST Facility ID: 1006784974) **1/8 – 1/4 mile SE and lower elevation**
This site is located 0.201-mile and at a lower elevation from the Subject Site. According to the EDR report, the facility is active and commercial. The facility has four USTs currently in use and installed between 1986 and 2014. All four tanks contain diesel.
Given that this property is at a lower elevation than the Subject Site and there is no mention of a release this database listing is not considered a REC with potential to impact the Subject Property.

Aboveground Storage Tank (AST) Database: The AST database contains registered ASTs. The data comes from ADEMs AST data with owner/site/tank information database. This list is updated periodically.

The AST database listed one site within a 0.25-mile radius of the Subject Site:

Chemweld, Inc. - Closed (AST ID: A100330904) **1/8 – 1/4 mile South and higher elevation**
This site is located 1,010 feet south and at a higher elevation from the Subject Site. The EDR report indicates that there are 0 tanks on the property.
Given the database information and distance, this database listing is not considered a REC.

SWHS: (Inactive Hazardous Sites Inventory) State Hazardous Waste Sites records are the states' equivalent to CERCLIS. These sites may or may not already be listed on the federal CERCLIS list. Priority sites planned for cleanup using state funds (state equivalent of Superfund) are identified along with sites where cleanup will be paid for by potentially responsible parties. Available information varies by state. This list is updated quarterly.

The SWHS database has listed one site within a 1-mile radius:

ESB, Inc. – (SWHS Facility ID: 10778) ¼ - ½ mile SSE and higher elevation
This site is located 0.294-mile and at a higher elevation from the Subject Site. According to the EDR report, this site has a known release of lead in soils at levels exceeding the reportable quantity. Cleanup activities are being conducted for source materials and soil. Investigations are being conducted to determine how much cleanup is necessary for groundwater. Many regulated substances are listed for the facility.
Given the known release and higher elevation of this site this database listing **is considered a REC** for the Subject Site.

GA NON-HSI: Georgia Non Hazardous Site Inventory Sites.

A review of the GA NON-HSI list, as provided by EDR, and dated 12/31/2018 has revealed that there are 22 GA NON-HSI sites within approximately 1 mile of the Subject Site.

Champion International Corp (GA NON-HSI ID: 1000688198) **<⅛ mile SSW higher elevation**
According to the EDR report, this site is located 503 feet south southwest and at a higher

elevation than the Subject Site. This site has a Report Date of 09/01/1998. The only other relevant information listed is scoring for Ground Water Pathway Scores of 0.8 and 6.5; and On-Site Pathway Score 7.2 and 18.5.
Given that this site did not score above the HRS threshold, this is not considered a REC to the Subject Site.

Bernstein Scrap Metal (GA NON-HSI ID: S105174686) Incorrectly mapped by EDR
This site was incorrectly mapped by EDR. The site is located approximately 500 feet northwest and at a higher elevation than the Subject Site. This site has a Report Date of 10/01/2001. The site is listed as having contamination in the form of lead. The only other relevant information listed is scoring for Ground Water Pathway Score of 8.3; and On-Site Pathway Score of 0.0.
Given the distance that this site is from the Subject Property and that lead contamination may still exist on the property **this is considered a REC** to the Subject Site.

The remaining 20 GA NON-HSI database listings are greater than 0.220 miles from the Subject Property. Due to the distance the listings are from the Subject Property coupled with potential groundwater contamination not being a threat to the Subject Property as municipal water is utilized for potable purposes the listings are not considered a REC to the Subject Property at this time.

State Brownfields: The Brownfields Public Record lists properties where response actions under the Georgia Hazardous Site Reuse and Redevelopment Act are planned, ongoing or completed.

A review of the BROWNFIELDS list, as provided by EDR, and dated 11/06/2018 has revealed that there are three BROWNFIELDS sites within approximately 0.5 miles of the target property.

1066 Murphy Avenue (Brownfields ID: S118891977 and Facility ID: 13351) 1/8 – 1/4 mile WNW and higher elevation
According to the EDR report, this site is located 1,230 feet west northwest and at a higher elevation than the Subject Site. This facility has a Date Cleanup Plan of 09/19/2016 and a Date Cleanup Completed of Not Reported. This facility has a Risk of TBD.
Given the distance this property is from the Subject Property this is not considered a REC to the Subject Site.

1116 Murphy Avenue (Brownfields ID: S118891979 and Facility ID: 13383) 1/4 – 1/2 mile West and higher elevation
According to the EDR report, this site is located 1,711 feet west and at a higher elevation than the Subject Site. This facility has a Date Cleanup Plan of 09/15/2016 and a Date Cleanup Completed of Not Reported. This facility has a Risk of TBD.
Given the distance this property is from the Subject Property this is not considered a REC to the Subject Site.

Unpaint Corporation Property (Brownfields ID: S107031932 and Facility ID: 1017) 1/4 – 1/2 mile North and higher elevation
According to the EDR report, this site is located 1,805 feet north and at a higher elevation than the Subject Site. This facility has a Date Cleanup Plan of 06/09/2005 and a Date Cleanup Completed of Not Reported.
Given the distance this property is from the Subject Property this is not considered a REC to the Subject Site.

5.1.3 Tribal Government

Although the Subject Site is not located on Tribal land, standard Tribal databases were reviewed by EDR to assess if any sites near the Subject Site are in these databases. The reviewed databases included INDIAN LUST Leaking Underground Storage Tanks on Indian Land (up to 0.5 mile), and INDIAN UST Underground Storage Tanks on Indian Land (up to 0.25 mile).

No sites on the reviewed tribal databases were identified within the above specified distances of the Subject Site.

5.2 Additional Environmental Record Sources

The Subject Site was found in the searched additional environmental record sources.

The following additional records contained the Subject Site and nearby sites within the relevant search radii.

5.2.1 Other Reviewed Databases and Records

EDR Hist Auto: EDR has searched selected national collections of business directories and has collected listings of potential gas station/filling station/service station sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include gas station/filling station/service station establishments. The categories reviewed included, but were not limited to gas, gas station, gasoline station, filling station, auto, automobile repair, auto service station, service station, etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

A review of the EDR Hist Auto list, as provided by EDR, has revealed that there are 4 EDR Hist Auto sites within approximately 0.125 miles of the target property.

Sartain S Garage (EDR Hist Auto ID: 1009353809) <1/8 mile SE and higher elevation
According to the EDR report, this site is located 411 feet southeast and at a higher elevation than the Subject Site. Information states this property was "Automobile Repairing".
Given that there is no information regarding a release on this property this is not considered a REC to the Subject Site.

State Market Truck Service (EDR Hist Auto ID: 1009384174) **<1/8 mile WSW and higher elevation**
According to the EDR report, this site is located 456 feet west southwest and at a higher elevation than the Subject Site. Information states this property was "Gasoline Stations".
Given that this property is only 456 feet from and at a higher elevation than the Subject Property; and that is was historically a gasoline station that likely had USTs this **is considered a REC** to the Subject Site.

Scotts S Service Station (EDR Hist Auto ID: 1009354013) **<1/8 mile SE and higher elevation**
According to the EDR report, this site is located 542 feet southeast and at a higher elevation than the Subject Site. Information states this property was a "Gasoline and Oil Service Stations and General Automotive Repair Shops" from 1947-1986.
Given that this property is only 542 feet from and at a higher elevation than the Subject Property; and that is was historically a gasoline and oil service station that likely had USTs this **is considered a REC** to the Subject Site.

Johnnie Garage (EDR Hist Auto ID: 1009354031) **<1/8 mile SSE and higher elevation**
According to the EDR report, this site is located 586 feet south southeast and at a higher elevation than the Subject Site. Information states this property was "Automobile Repairing" from 1952-1998.
Given that this property is only 586 feet from and at a higher elevation than the Subject Property; and that is was historically operated as an automobile repair shop this **is considered a REC** to the Subject Site.

EDR SPILLS Database

Berry Gohen (SPILLS ID: S1208113009) **Target Property**
According to the EDR report, a report was received on 08/27/2010 that "an unknown amount of oil was discharged into a storm drain from an unknown source. Responsible party unknown". An initial investigation occurred on 08/27/2010. Atlanta Police, Fire Department, and the EPA were all involved with the initial investigation. On 12/01/2010, "Repeated attempts at gaining Mr. Goren's voluntary compliance in removing the frac tanks and properly disposing or recycling of the unknown substances in the tanks have been unsuccessful."
Given that this spill occurred on the Subject Property this **is considered a REC** to the Subject Site.

5.3 Local Environmental Record Sources

5.3.1 Local Environmental/Health Department

OTIE did not submit an Open Records Request to the Fulton County Health Department for copies of records relating to environmental permits or regulations which may be on-file for the property.

The lack of this information is considered a data gap. However, based on information obtained from other sources during the course of this assessment, the presence of this data gap does not appear to represent a significant data gap. Information deemed to be not pertinent will be archived in OTIE's files.

5.3.2 Fire Department

OTIE did not submit an Open Records Request to the City of Atlanta Fire Department for copies of records relating to fires at the Subject Property since enough of a history is available from other sources regarding the fires.

The lack of this information is considered a data gap. However, based on information obtained from other sources during the course of this assessment, the presence of this data gap does not appear to represent a significant data gap. Information deemed to be not pertinent will be archived in OTIE's files.

5.3.3 Building Department

OTIE did not submit an Open Records Request to the City of Atlanta for copies of records relating to available building permits and Certificates of Occupancy for the property which may be on file.

The lack of this information is considered a data gap; however, based on information obtained from other sources during the course of this assessment, the presence of this data gap does not appear to represent a significant data gap.

5.3.4 Planning & Zoning Department

According to Fulton County Geographic Information System (GIS) website (https://gis.fultoncountyga.gov/Apps/PropertyMapViewer), the Property is zoned as I4 – Industrial Small Tracts. A copy of the information obtained is provided in Appendix I.

5.3.5 Electrical Utility Company

According to interviews, Georgia Power currently provides electrical service to the property and surrounding areas.

5.3.6 Water and Sewer Utility

The City of Atlanta provides potable water utilities and sanitary sewer service to the Subject Property.

5.3.7 Other Local Environmental Records Sources

No additional local environmental records sources were reviewed.

5.4 Physical Setting

5.4.1 Topography and Surface Hydrology

The topography of the project area was determined by review of the 2014 Southwest Atlanta 7.5-Minute Series Quadrangle USGS maps. Topography at the Subject Site averages 1027 feet above mean sea level. The general topographic gradient is towards the northeast.

5.4.2 Geologic and Hydrogeologic Setting

The surface soils at the Subject Site and surrounding developed areas are classified by the United States Department of Agriculture - Natural Resources Conservation Service, formerly the Soil Conservation Service, as sandy clay. The soils at the Subject Site are considered Urban Land, where the native soils have been greatly altered (see EDR Summary Report in Appendix A). The soil does not meet the requirements for a hydric soil.

The Subject Site is located within the Piedmont-Blue Ridge Province. The region is underlain by metamorphic bedrock.

5.4.3 Other Physical Setting Sources

Flood Plain Map
The Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRMs), depicting the area where the property is located was reviewed as part of this assessment. According to FIRM Community Panel Number 13121C0356F, the Subject) is not located in a flood plain as determined by FEMA (Appendix I).

Wetlands Map
According to the United States Fish and Wildlife Service, on-line National Wetland Inventory (NWI) Mapper no federal wetlands are identified at the property (Appendix I).

5.5 Historical Use Information on the Subject Site and Vicinity

Property information from a variety of private and public sources was obtained to aid in developing a property history, including ownership and usage. The earliest record that includes the Subject Site that could be located is a 1888 topographical map.

Based on the information obtained during the Phase I ESA, as described in this report, the following Subject Site and vicinity history was developed.

Date or Time Frame	Subject Property Historical Uses	Surrounding Area Historical Uses
1888 - 1927	Subject Property is undeveloped.	Area is undeveloped.
1927 - 1950	Subject Property was developed as a structural and ornamental steel company as early as 1927 according to a Sanborn map.	The areas to the south and east were first developed residentially as early at 1927 according to historical topo maps. The areas to the north and west were developed what appears to be commercially. The area to the west was developed as early as 1949 as a market according to an aerial photograph and a Sanborn map. There is a railroad present first in 1927 east of the Subject Property beyond Allene Avenue.
1950 - 1957	The Subject Property was redeveloped as a produce company.	The areas to the south and east remain residential. The property to the north appears to have been

Date or Time Frame	Subject Property Historical Uses	Surrounding Area Historical Uses
1957 - 1961	The Subject Property was occupied by the same building that first appeared in the 1949 aerial photograph. It is unknown exactly what operations took place during this time period. This is considered a data gap.	developed commercially as early as 1949 as well. According to a website the property to the west operated as the State Farmers Market from 1940-1957.
1961 - 1978	The Subject Property operated as a meat company according to city directory listings and a Sanborn map.	The properties to the east beyond Allene Avenue and the railroad remain residential. The properties to the south beyond Warner Street appear to be no longer residential sometime between 1962 and 1968, after that the area appears to be commercial properties. The property to the west appears to continue to operate as a market. The property to the north appeared to operate as a commercial property.
1978 - 1994	The Subject Property was occupied by the same building that first appeared in the 1949 aerial photograph. It is unknown exactly what operations took place during this time period. This is considered a data gap.	
1994 - 2014	The Subject Property operated as Moms Bakery according to city directory listings. From 2010-2014 there were a few other commercial businesses that operated out of the Subject Property as well.	The majority of the surrounding area remains the same with the exception of the railroad being redeveloped as the Atlanta Beltline sometime between 1993 and 2007 according to aerial photographs.
2014 - Present	Reportedly the Subject Property has been utilized as artist studio space from 2009-present.	

In summary, the reviewed records and information indicate the existence of RECs in the surrounding area. Specifically, a property adjacent to the south of the Subject Site had transformers on it in 1978 according to a Sanborn map. Transformers in 1978 had PCB containing oil contained in the equipment and this is seen as a REC.

5.5.1 Sanborn Maps

Copies of historic Sanborn maps that include the Subject Site were obtained from EDR. Maps were obtained for the years 1932, 1950, 1962, and 1978 (Appendix E). The following information was obtained from each map. The table bellows shows the information that was obtained for the Subject Site.

Map Year	Subject Property	Surrounding Area
1932	The Subject Site is developed with five structures. Four smaller structures are located on the western half of the property. One of the smaller structures is labeled "Off." which is likely abbreviated from office. One other small structure is labeled "STGE" which is likely abbreviated from storage. One larger structure labeled "Steel Working Wood Flr" is located on the eastern portion of the property fronting on Allene Ave. SW. The property is labeled with "The F.E. Golian Co.". Just west of the larger building it is labeled "Steel Traveling Crane Fr." There is a railroad spur that runs parallel to the northern boundary of the property.	The vicinity of the Subject Site is developed the south and southwest residentially. The property to the north and west of the Subject Site is undeveloped. To the east beyond Allene Avenue SW is a railroad beyond which are residential properties.

Map Year	Subject Property	Surrounding Area
1950	The Subject Site is developed with two structures, one small structure at the southwest corner of the property and one larger structure in the north center portion of the property. The large building is labeled "Whol. Produce" and "Cold Stge." The railroad spur is still present.	The area remains unchanged from the 1914 map. The property adjacent to the north is now developed with a large squared shaped building labeled "Whol Produce". To the west the property is now developed with large rectangular buildings of which one is labeled "Market". The remaining areas remain unchanged from the 1932 map.
1962	The Subject Property is developed with a large building situated at the eastern boundary along Allene Avenue SW labeled "The F.E. Golian Co. Structural & Ornamental Steel" with a traveling crane of the southwestern corner of the building. West of the traveling crane the map appears to be missing due to a bad copy.	Due to the copying error of this map only residential properties to the south and east beyond the L & N Belt Line railroad are visible.
1978	The Subject Property is developed very similarly to the 1950 map. The large building is labeled "Whol. Meat".	To the north an additional L-shaped building is visible; to the northeast along the railroad and three rectangular shaped building labeled "City Board of Education"; and to the south across Warner St. the properties are no longer residential. One parcel to the south is labeled as "Transformers". To the west there are three large buildings with the label "Gov't Surplus Matl. & Food Stge".

The reviewed historical Sanborn maps did identify past uses indicating RECs on the Subject Site or surrounding area. A property adjacent to the south of the Subject Site had transformers on it in 1978. Transformers in 1978 had PCB containing oil contained in the equipment and this is seen as a REC.

5.5.2 Historic Topographic Maps

Copies of historic topographic maps that include the Subject Site were obtained from EDR. Maps were obtained for the years 1888, 1895, 1927/28, 1954, 1968, 1973, 1983, 1995, 1999 and 2014 (see Appendix F). The following information was obtained from each map. The table below shows the information that was obtained for the Subject Site.

Map Year And Type	Subject Property	Surrounding Area
1888 Series: 30 Scale: 1:125000 Atlanta	The Subject Site is undeveloped.	The vicinity of the Subject Site is undeveloped.
1895 Series: 30 Scale: 1:125000 Atlanta	The Subject Site remains unchanged from 1888.	The area remains unchanged from the 1888 map.
1927/28 Series: 3 Scale: 1:12000 Atlanta	The Subject Property is developed with the one large building situated on the eastern boundary of property and two small buildings at the southwestern corner of the property. There is a rail line visible on the northern border of the property.	The vicinity of the Subject Site appears developed for residential use to the south and east beyond the rail line. Adjacent to the north and west remains undeveloped land.

Map Year And Type	Subject Property	Surrounding Area
1954 Series: 7.5 Scale: 1:24000 East Point	The Subject Site now has one square shaped building located centrally on the northern border of the property. The three buildings mentioned previously no longer remain.	There is now a large irregularly shaped structure southeast of the Subject Site. The rest of the area remains undeveloped.
1968 Series: 7.5 Scale: 1:24000 Southwest Atlanta	The Subject Site remains unchanged from 1954.	The area remains unchanged from the 1954 map.
1973 Series: 7.5 Scale: 1:24000 Southwest Atlanta	The Subject Site remains unchanged from 1954.	The area remains unchanged from the 1954 map.
1983 Series: 7.5 Scale: 1:24000 Southwest Atlanta	The Subject Site remains unchanged from 1954.	The area remains unchanged from the 1954 map.
1995 Series: 7.5 Scale: 1:24000 Southwest Atlanta	The Subject site appears undeveloped.	The area appears undeveloped.
1999 Series: 7.5 Scale: 1:24000 Southwest Atlanta	The Subject site appears undeveloped.	The area appears undeveloped.
2014 Series: 7.5 Scale: 1:24000 Southwest Atlanta	The Subject site appears undeveloped.	The area appears undeveloped.

The reviewed historical topographic maps did not identify past uses indicating RECs on the Subject Site or surrounding area other than those already discussed in prior sections of this report.

5.5.3 Aerial Photographs

Copies of aerial photographs at varying scales were obtained from EDR (1938, 1940, 1949, 1955, 1960, 1968, 1972, 1978, 1981, 1988, 1993, 2007, 2010, 2013, and 2017). Copies of these aerial photographs are provided in Appendix G. The table below summarizes the information obtained from reviewing these photos.

Photo Year and Quality	Subject Property	Surrounding Area
1938 Scale: 1"=500' Photograph is excellent quality	The Subject Property appears to have a small structure located at the northwest corner of the property. Other than that one structure the property appears undeveloped.	The area south of Warner Street appears to be developed residentially. To the north and west the land is undeveloped. To the east Allene Avenue is visible with a rail line and what appears to be residential properties beyond.

Photo Year and Quality	Subject Property	Surrounding Area
1940 Scale: 1"=500' Photograph is fair quality	In addition to the one structure in the 1938 photo three more small structures are visible on the western half of the property.	The vicinity of the Subject Property remains unchanged.
1949 Scale: 1"=500' Photograph is fair quality	In addition to the structures mentioned in 1940, there is now a large square shaped building centrally located on the property and one small structure south of the large building.	The area to the south and east remains very similar. The property to the west now is developed with two large rectangular shaped buildings. To the north there is now a large square shaped building.
1955 Scale: 1"=500' Photograph is excellent quality.	The Subject Property remains unchanged from 1949.	The vicinity of the Subject Property remains unchanged from 1949.
1960 Scale: 1"=500' Photograph is good quality	It appears two of the small structures have been demolished. Other than that the Subject Property is very similar.	One of the large rectangular structures to the west was demolished and replaced with a very large rectangular shaped building. No other discernable changes are evident since 1949.
1968, 1972, 1978, 1981, 1988 Scale: 1"=500' Photographs are good to excellent quality	There are no discernable changes from the 1960 photo.	There are no discernable changes from the 1960 photo.
1993 Scale: 1"=500' Photographs are good to excellent quality	There are no discernable changes from the 1960 photo.	The only discernable change from the 1960 photo is there is now another large building directly north of the Subject Property.
2007, 2010, 2017 Scale: 1"=500' Photograph is excellent quality	There is now only the one large structure centrally located on the Subject Property. All of the other small buildings have since been demolished.	There are no discernable changes from the 1993 photo.

The reviewed historical aerial maps did not identify past uses indicating RECs on the Subject Site or surrounding area.

5.5.4 City Directory

Copies of City Street Directories that include the Subject Site were obtained from EDR. Directories were obtained for the years 1905, 1911, 1916, 1922, 1927, 1932, 1937, 1942, 1947, 1952, 1957, 1960, 1961, 1965, 1966, 1970, 1971, 1975, 1976, 1981, 1982, 1986, 1991, 1994,

1999, 2005, 2010, and 2014 (see Appendix H). The following information was obtained from each directory. The table below shows the information that was obtained for the Subject Site.

Year and Reference	Subject Site	Surrounding Area
2014 EDR Digital Archive	825 Warner St. SW – Alchemy LLC, BMW Performance Plus, Colaboratory LLC, Moms Bakery Inc	1135 Allene Ave SW – Pacer Rutlege Antonio Favors No other addresses listings
2010 EDR Digital Archive	825 Warner St. SW – Colaboratory LLC, Lovelace Linares, Moms Bakery Inc	**1141 Allene Ave SW – IQ Auto Repair** No other significant listings
2005 Haines Company, Inc.	No listing	No significant listings
1999 Haines Company	825 Warner SW – Moms Bakery Inc	No significant listings
1994 Haines and Company Inc.	825 Warner St SW – Moms Bakery Inc	No significant listings
1986 R.L. Polk Co. Publishers	825 Warner St SW – No Return	**1141 Allene Ave SW – Reliable Hydraulics repr shop** No significant listings
1981 Atlanta City Directory Co.	825 Warner St SW – Vacant	No significant listings
1971 Atlanta City Directory Co.	825 Warner St SW – Armour & Co br whol	**1089 Allene Ave SW – Coile Reliable Truck Trailer Service Co Inc** No other significant listings
1965 Atlanta City Directory Co.	825 Warner St SW – Armour & Co br whol meats PL	**1089 Allene Ave SW – Reliable Truck Trailer Serv** No other significant listings
1961 Atlanta City Directory Co.	825 Warner Ave SW – Armour & Co br whol meats	**1089 Allene Ave SW – Reliable Truck Trailer Serv Co Inc reprs** **1150 Allene Ave SW – Macs Truck Terminal gas sta** No other significant listings
1957 Atlanta City Directory Co.	825 Warner Ave SW – Fain C L Co whol prod	**1135 Allene Ave SW – Sartains Garage auto reprs** No other significant listings
1952 Atlanta City Directory Co.	825 Warner Ave SW – Fain C L Co whol prod	**1150 Allene Ave SW – Scott Serv Sta** No other significant listings
City directory listings older than 1952 were not reviewed.		

The reviewed historical city directories did identify past uses indicating RECs in the surrounding area. The listings that indicated RECs are **bolded.**

5.5.5 Building Department Records

OTIE contracted EDR to provide reasonably ascertainable historical building department records. According to the EDR Building Permit Report, no building permits were available for the Subject Property.

5.5.6 Zoning/Land Use Records

Zoning/Land Use Records were previously summarized in Section 5.3.4.

5.5.7 Prior Reports

OTIE obtained a copy of the following report for the Subject Property:

- Environmental Planning Specialists, Inc. Phase II Environmental Site Assessment & Limited Asbestos Survey. June 2006 (Attachment 1).

A Phase II Environmental Site Assessment was conducted on behalf of Jabobar Properties, LLC to assess the possibility of subsurface contamination from on-site activities and adjacent properties. Seven soil borings ranging from 28 to 30 feet below land surface were advanced site wide on the Subject Property. Groundwater samples were collected and analyzed for Volatile Organic Compounds (VOCs). No VOCs were detected above laboratory detection limits in any of the groundwater samples.

An asbestos inspection was also conducted as a part of the Phase II. Twenty-six (26) bulk samples including wallboard, joint compound, ceiling tile, sealants and roof coverings were collected for asbestos analysis. The results of the survey indicate that asbestos is present in the building materials listed below.

- Black Asphalt shingle around the perimeter of the upper crawl space
- Black/ White flashing around roof vent
- Black/ White patching cement on asphalt

The information reviewed does not indicate RECs were identified on the Subject Property.

5.5.8 Other Historical Sources

OTIE located historical information regarding the west adjacent property that operated as the State Farmers Market for approximately 17 years from the 1940s to 1957. This information was obtained from a website (http://www.atlantapreservationcenter.com/place_detail?id=271&pt=1&year=all).

OTIE did not review any additional historical sources related to the Subject Property.

6.0 SITE RECONNAISSANCE

6.1 Methodology and Limiting Conditions

This Phase I ESA consists of reviewing readily available ownership, land use, and regulatory database information, and the results from a visual site reconnaissance to assess whether known or potential RECs are associated with the Subject Site. On March 27, 2019, Mr. Ryan Stubbs of OTIE visited the Subject Site to observe and document environmental conditions at and in the vicinity of the Subject Site. Mr. Stubbs was accompanied by Ms. Willow Goldstein the leasee of the Subject Site.

The site reconnaissance included inspection of the Subject Property, and a "windshield" survey of the adjacent properties. The visual inspection included documentation of the presence or absence of RECs such as ASTs, USTs, fill areas, depressions, distressed vegetation, the presence of monitoring wells or past soil boring activity, and other potential indicators at the Subject Site and adjacent properties. Weather conditions were clear. Phase I ESA reconnaissance photos taken during the site visits are contained in Appendix B.

6.2 General Site Setting

A description of the Subject Property and vicinity is provided in Section 3.4 and 3.5. The Subject Site was occupied by "The Bakery" a multi-faceted event space that utilizes the entire site building. Good housekeeping practices were observed at the time of the site recon.

6.3 Hazardous Substance Use, Storage, and Disposal

OTIE did not observe evidence of the use, storage or disposal of hazardous substances, including hazardous wastes, on the Subject Property.

6.4 Underground Storage Tanks

OTIE did not observe evidence of USTs on the Subject Property.

6.5 Aboveground Storage Tanks

OTIE did not observe evidence of ASTs on the Subject Property.

6.6 Other Petroleum Products

OTIE did not observe evidence of other petroleum products.

6.7 Unidentified Substance Containers

OTIE did not observe evidence of other petroleum products.

6.8 Nonhazardous Solid Waste

OTIE did observe evidence of nonhazardous solid waste on the Subject Property. Raintree Waste is utilized for trash service.

6.9 Wastewater

OTIE did not observe evidence of generated, treated or discharged wastewater on the Subject Property or to adjoining properties.

6.10 Waste Pits, Ponds and Lagoons

OTIE did not observe evidence of waste pits, ponds or lagoons in, on or at the Subject Property.

6.11 Drains and Sumps

OTIE did observe a locked cover over what is reportedly an access to the sanitary sewer system at the Subject Site.

6.12 Septic Systems

OTIE did not observe evidence of a septic system on the property.

6.13 Stormwater Management System

OTIE did not observe any evidence of surface water, surface impoundments, retention ponds, and/or dry wells at the Subject Property. One storm drain basin was observed in the asphalt covered area to the south of the site building.

6.14 Wells

OTIE did not observe evidence of wells at the Subject Property.

6.15 Windshield Survey Observations

The properties adjacent to the Subject Site were visually inspected from the edges of the Subject Site or street side. Figure 2 illustrates the adjacent properties. OTIE also performed a windshield survey of the facilities identified in the EDR report as potential RECs related to residual contamination from the releases to impact the Subject Site.

The immediate surrounding properties were mostly industrial and commercial to the north, south, and west. To the east is the Atlanta Beltline beyond which are residential properties. OTIE did not observe REC on adjacent properties with potential to impact the Subject Site.

7.0 INTERVIEWS

Mr. Barry Zipperman, Co-Manager of Jabobar Properties, LLC (owner of Subject Property) was interviewed on March 29, 2019 by Mr. Ryan Stubbs of OTIE. Mr. Zipperman indicated that his knowledge of the Subject Site was limited to what is contained in the Phase II report from June 2006. OTIE had Mr. Zipperman complete an X3 User Questionnaire (Appendix I). Mr. Zipperman has no knowledge of any environmental cleanup liens filed against the Subject Property. He indicated that the purchaser Trees Atlanta, Inc. requested this Phase I.

Ms. Willow Goldstein the leasee was interviewed on March 27, 2019 during the site recon by Mr. Stubbs. Ms. Goldstein utilizes the building as "The Bakery" a space for artists. Ms. Goldstein said that the vertical tank on the Subject Property use to be a grain silo. She also said the locked hatch near the front loading dock is for servicing the sanitary sewage drain and she doesn't know the origin of the soil mounds located on the east and west sides of the property.

Mr. Greg Levine (User Representative) completed the Targeted Brownfields Assessment (TBA) Application Form. Mr. Levine's knowledge of the Subject Property is limited to the answers he provided on the application form (Appendix D). Paraphrasing from the TBA form, "To the best of our knowledge the property was originally developed as a bakery associated with the adjacent State Farmers Market. The current warehouse was constructed in the 1970's and has most recently been used as artist studio space (approx. 10 years). A Limited Phase 2 conducted in June 2006 uncovered limited ACM in the asphalt roofing, flashing, and cement patching. Soil and groundwater samples were tested for VOCs only and came back with nothing above laboratory detection limits. For the past three years, Trees Atlanta has used a portion of the adjacent State Farmers Market to stage its tree planting and landscaping activities along the Westside Trail. The level of community involvement and interest stemming from that, as well as the adjacent Urban Farm, is considerable."

8.0 SUBSURFACE VAPOR MIGRATION

OTIE conducted a limited screening for potential vapor encroachment conditions (VECs) that may affect the property. The VEC screening focused on the current and historical usage of the Subject Property and also utilized the aforementioned regulatory agency database report provided by EDR and an EDR Vapor Encroachment Screen (VES) Report to evaluate identified Chemicals of Concern (COCs), including petroleum hydrocarbons. To identify the area of concern (AOC) for contaminated sites with non-petroleum hydrocarbon COCs, OTIE utilized the approximate minimum search distance defined by ASTM E 2600-10 of 1,760 feet (1/3 mile) from the property boundary for COC-contaminated sites. For sites contaminated with petroleum hydrocarbon COCs, OTIE utilized the AOC approximate minimum search distance of 528 feet (1/10 mile). The AOC was adjusted accordingly based on review of physical setting characteristics, known release information, property and land features, groundwater flow direction, and soil type, et al.

OTIE considered the nature and extent of on-site and nearby sources of potential subsurface vapor migration by evaluating the current and historical usage of the property, the construction type and history, the physical setting, and the potential sources of subsurface vapor migration through the review of regulatory agency database information that was summarized in Section 5.1. Based on the evaluation of the known or suspected releases of hazardous substances, historical site operations or petroleum product storage/usage, distance from the property, potential pathways, shallow groundwater and soil type, et al, potential subsurface vapor migration sources were determined to represent a REC condition in connection with the property as follows:

An oil spill was reported on the Subject Property on 08/27/2010. The oil was discharged into a storm drain from an unknown source and the responsible party was unknown. Surrounding properties with current and removed USTs present a possible vapor intrusion risk due to known past releases of gas into the soil and/or groundwater.

9.0 OTHER ENVIRONMENTAL CONDITIONS

9.1 Asbestos-Containing Material (ACM)

Based on the scope of work for this ESA, sampling and analyses for ACM was not conducted. All suspect ACM should be properly assessed prior to disturbance. The Subject Property's building was reportedly constructed in the 1970s which makes it likely to have ACMs present. Observed building materials were noted to be in good condition at the time of the site visit.

A limited ACM survey was conducted in 2006 as a part of a Phase II ESA (Attachment 1). According to lab results three (3) materials were positive for asbestos content:

- Black Asphalt shingle around the perimeter of the upper crawl space
- Black/white flashing around roof vent
- Black/white patching cement on asphalt

The TBA Application form indicates demolition of the Subject Property building. If demolition will be done to the building a National Emission Standards for Hazardous Pollutants (NESHAP) type of asbestos survey must be conducted prior to any demo activities.

9.2 Radon

Radon is a naturally occurring colorless, odorless gas that is a by-product of the decay of radioactive materials potentially present in bedrock and soil. The EPA guidance action level for annual residential exposure to radon is 4.0 picoCuries per liter of air (pCi/L). The guidance action level is not a regulatory requirement for private owners of commercial real estate, but is commonly used for comparison purposes to suggest whether further action at a building may be prudent.

OTIE's review of published propensity data revealed that the Subject Property is located in Radon Zone 1, which indicates that the average indoor level of radon is predicted to be >4 pCi/L. Specific published data from the state database compiled by EDR for Fulton County showed that of 100 percent of 1 indoor test results were below 4.0 pCi/L. Specific published data from the federal database compiled by EDR for zip code 30310 showed that 100 percent of the one indoor test results were was below the referenced USEPA Standard of 4.0 pCi/L. The activity measured was 0.300 pCi/L for 1st Floor Living Areas and 2.100 pCi/L for Basements. Based on the vacancy of the property, no additional investigation for radon is recommended at this time.

9.3 Lead in Drinking Water

OTIE confirmed that the municipally-supplied water meets all drinking water standards for lead.

9.4 Lead-Based Paint (LBP)

Consideration of LBP on painted surfaces was not included in the scope of work for this ESA. However, due to the age of the building it is likely that LBP is present.

9.5 Mold Screening

Consideration of mold was not included in the scope of work for this ESA.

9.6 Additional User Requested Services

No additional User requested services were included in the scope of work for this ESA.

10.0 REPORT FINDINGS

The following represents findings from completion of the Phase I ESA. In summary, the above Phase I ESA findings indicate the presence of historic RECs on the Subject Property and in nearby adjacent property with potential to impact the Subject Site.

10.1 On-Site

The Subject Property is currently occupied and operational as "The Bakery" a multi-faceted space for artists which has reportedly operated as such for the last 10 years. Based on available records dating from 1888 until 2017, the Subject Site, referred to as 825 Warner Street located at 825 Warner Street SW, Atlanta, Fulton County, Georgia, and comprised of one parcel, was developed as early as 1927 as a structural and ornamental steel company. Around 1950 the Subject Property was redeveloped as a produce company which transitioned into a meat company (Armour Meats) around 1961 which operated until 1978 according to city directory listings. From 1978-1994 it is unknown as to what the operations were at the Subject Property. From 1994-2014 Mom's Bakery occupied the Subject Property during that time from 2010-2014; a few other commercial businesses operated out of the Subject Property as well according to city directory listings.

Based on the known history of the Subject Property and a review of the available information, the following RECs were identified on the Subject Property:

- The EDR report has the property at 717 Warner St SW listed in the US Brownfields database. The EDR Detail Map illustrates this property at the southeast corner of the Subject Property. The site was listed as receiving an assessment grant. The property description is "former drum storage facility (ongoing remediation), federal notifier for hazardous substance release." There was no date provided with this listing as to when this occurred and if there was a release or not. A Phase II investigation was conducted in 2006 and a soil boring was advanced near the southeast corner of the Subject Property and the groundwater results indicated no detections of VOCs.
- The EDR report has a SPILLS database listing for the Subject Property with an incident occurring on 08/27/2010. The incident involved an unknown amount of oil being discharged into a storm drain from an unknown source and the responsible party was unknown. The Atlanta Police Department (APD), Atlanta Fire Department, and the EPA were involved with the initial investigation which lead to the discovery of an abandoned truck with an estimated 1,000 gallon tank that had leaked in the upwards of 1,000 gallons of what was believed to be waste oil on the ground surface and into a storm drain. The property owner was identified as Mr. Berry Goren who hired a contractor to handle the cleanup. An investigator (J.R. Campbell) with the APD followed up on the incident on 09/14/2010. At that time Mr. Goren stated that the frac tanks were still on site awaiting disposal. After repeated attempts to contact Mr. Goren, the same APD investigator issued a "Hand Off memo" electronically to Renee Hudson-Goodley on 12/01/2010. At that time, Mr. Goren's voluntary compliance in removing the frac tanks and properly disposing or recycling of the unknown substances in the tanks had been unsuccessful. No other information followed.

10.2 Off-Site

The immediate adjacent properties consist of a property to the north that is reportedly utilized for records and archiving; to the east is Allene Avenue SW beyond which is the Atlanta Beltline and residential properties; to the south is Warner Street SW beyond which appears to be commercial properties that stage open top roll off dumpsters and conex boxes and a thrift store; and to the west by a large vacant commercial property that operated as the old State Farmers Market from round 1940-1957. Based on available records dating back to 1888, the vicinity of the Subject Site was first developed residentially as early as 1927. Evidence exists of RECs related to residual contamination from suspected or actual releases at the following nearby properties located at a higher elevation from the Subject Site:

- The 1978 Sanborn map indicates that a property adjacent to the south of the Subject Property had transformers. Transformers in 1978 were known to contain PCBs and as a results this is a REC to the Subject Property.
- A US Brownfields site (1121 Allene Avenue) is listed adjacent to the southeast of the Subject Property beyond Allene Avenue. The property is described as "A building which formerly housed a drum storage facility". The property received a hazardous and petroleum assessment grant. No information was provided regarding a cleanup and as a result this is seen as a REC to the Subject Site.
- A LUST site (Champion International Corp) is located approximately 500 feet south southwest of the Subject Property and has had a total of 15 USTs utilized on the property dating back to 1959. The lack of information regarding cleanup measures and status makes this property a REC to the Subject Site.
- A State Hazardous Waste Site (ESB, Inc.) is located 0.294-mile from the Subject Property. The site has a known release of lead in soils at levels exceeding the reportable quantity. Investigations are being conducted to determine how much cleanup is necessary for groundwater. Given the known release this property is a REC to the Subject Site.
- A Georgia Non Hazardous Site Inventory Site (Bernstein Scrap Metal) is located approximately 500 feet northwest of the Subject Property. The site is listed as having contamination in the form of lead. Given the close proximity of this site to the Subject Property and that there is known lead contamination this property is a REC to the Subject Site.
- There are four EDR Historical Auto sites located within 586 feet of the Subject Property to the southeast and southwest. These properties operated as either gas and/or oil service stations or automobile repair shops. Given these properties likely utilized USTs or ASTs as a part of their operations these properties are RECs to the Subject Site.

10.3 Other

Given the age of the site building, asbestos containing materials (ACM) and lead-based paint (LBP) may be present in building materials contained in the Subject Property's building.

11.0 OPINION

In OTIE's professional opinion, known or suspected RECs are located on the Subject Site. Further evaluation of their potential significance is provided below.

Soil and/or groundwater contamination could exist at the Subject Site as a result of a release from one or more of the following potential sources:

- The Subject Property was listed as a US Brownfields site in the EDR report and described as being a "former drum storage facility (ongoing remediation), federal notifier for hazardous substance release." There was no date provided with this listing as to when this occurred and if there was a release or not.
- The waste oil spill that occurred on the Subject Site on 08/27/2010 as reported in the EDR report.

Although not considered RECs under the AAI rule, the following should be considered prior to demolition or renovation activities at the Subject Site:

- ACM may be present.
- LBP may be present.

To further evaluate environmental issues associated with the identified RECs at the Subject Site and nearby surrounding area, OTIE recommends that a Phase II ESA be completed. The goal of this Phase II ESA would be to assess soil and groundwater quality on the Subject Property to determine whether on-site or off-site releases have impacted the property.

Additionally, OTIE recommends that a NESHAP ACM and LBP surveys be performed prior to any demolition or renovation activities take place on the Subject Property building.

12.0 SIGNATURES OF ENVIRONMENTAL PROFESSIONALS

During March 27, 2019 through April 12, 2017, OTIE completed a Phase I ESA for the USEPA on behalf of Trees Atlanta. This work was performed by the undersigned environmental professional. Qualifications are provided in the following section of this report.

> I declare that, to the best of my professional knowledge and belief, I meet the definition of Environmental Professional as defined in §312.10 of this part.
>
> We have the specific qualifications based on education, training, and experience to assess a property of the nature, history, and setting of the subject property. We have developed and performed the all appropriate inquiries in conformance with the standards and practices set forth in 40 CFR Part 312.

R. C. Stubbs

April 10, 2019

Ryan Stubbs — Date

Senior Environmental Scientist
Author

Limari D. Krebs

April 12, 2019

Limari Krebs — Date

Senior Environmental Chemist
Reviewer

13.0 QUALIFICATIONS OF ENVIRONMENTAL PROFESSIONAL

Ryan Stubbs

Senior Environmental Scientist

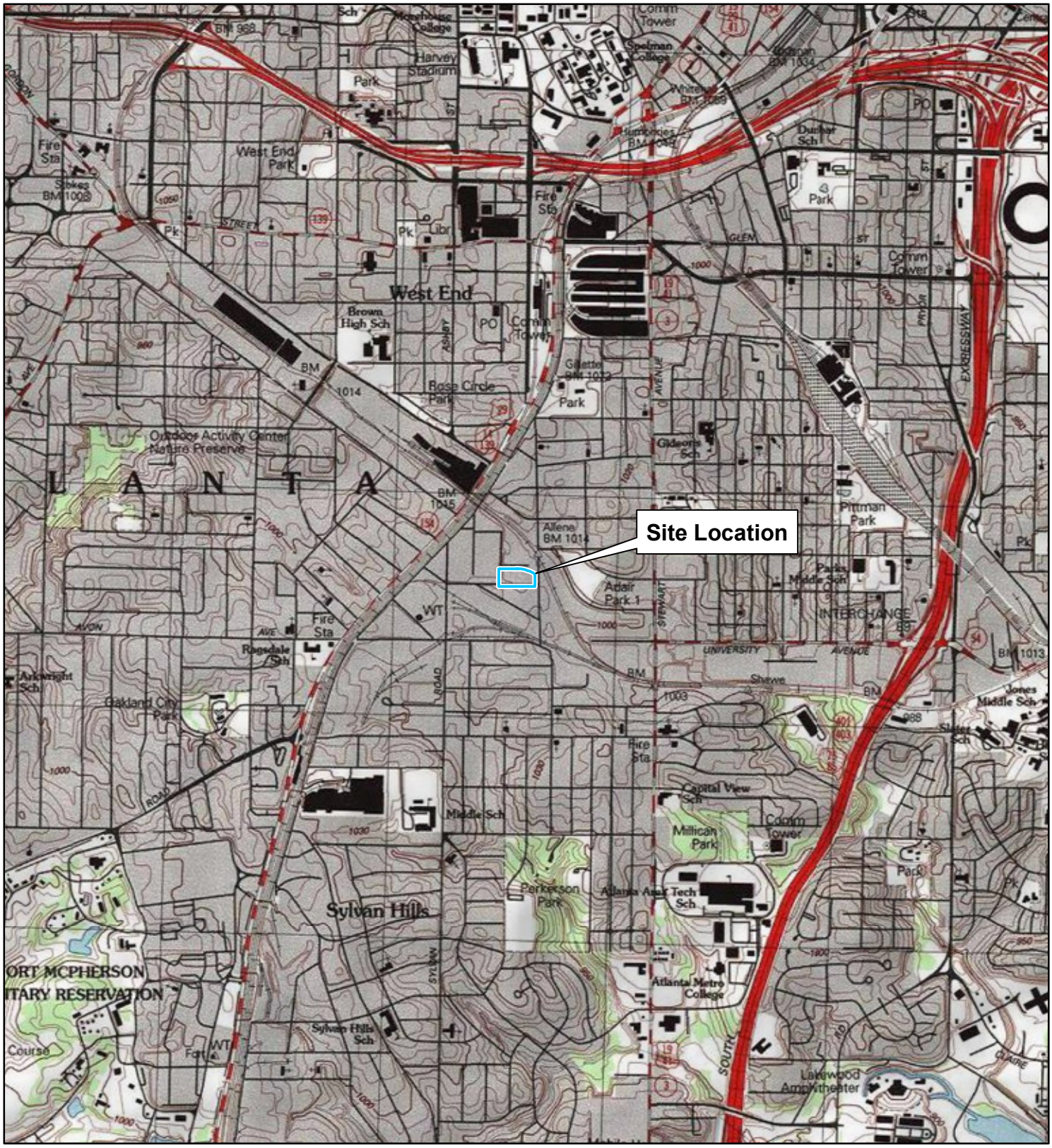
Mr. Ryan Stubbs has a Bachelor's Degree in Biology with over 20 years' experience as a project manager, senior environmental scientist, and business unit health and safety leader in the environmental industry. His experiences include regulatory compliance support; due diligence investigations; asbestos related activities; lead-based paint activities; emergency response support; site assessment investigations; risk assessment support; removal action oversight; and procurement. Mr. Stubbs also has extensive experience with suspect asbestos containing materials and Phase I and II assessments for targeted brownfields sites.

Limari Krebs

Senior Environmental Chemist

Ms. Krebs has a Bachelor's Degree in Chemist with over 20 years' experience as a project manager, senior chemist, and quality assurance/quality control manager in the environmental industry. Her experiences include regulatory compliance support; due diligence investigations; insurance underwriting support; asbestos related activities; emergency response support; site assessment investigations; litigation support; data quality development, management and interpretation support; risk assessment support; and procurement. Ms. Krebs also has extensive experience with suspect asbestos containing materials and Phase I and II assessments for targeted brownfields sites.

FIGURES



Source: ArcGIS Online Services, US Topo Maps

Disclaimer: This map is intended for visual orientation use only. In no way is this map to be used for precise locational use.

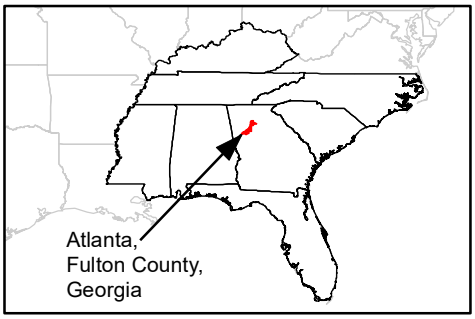
G:\GIS_Workspace\2015 Projects\2015106 - 825 Warner Street\Figure 1 - Topographical Map.mxd

Legend

Site Location

0 1,000 2,000 Feet

N

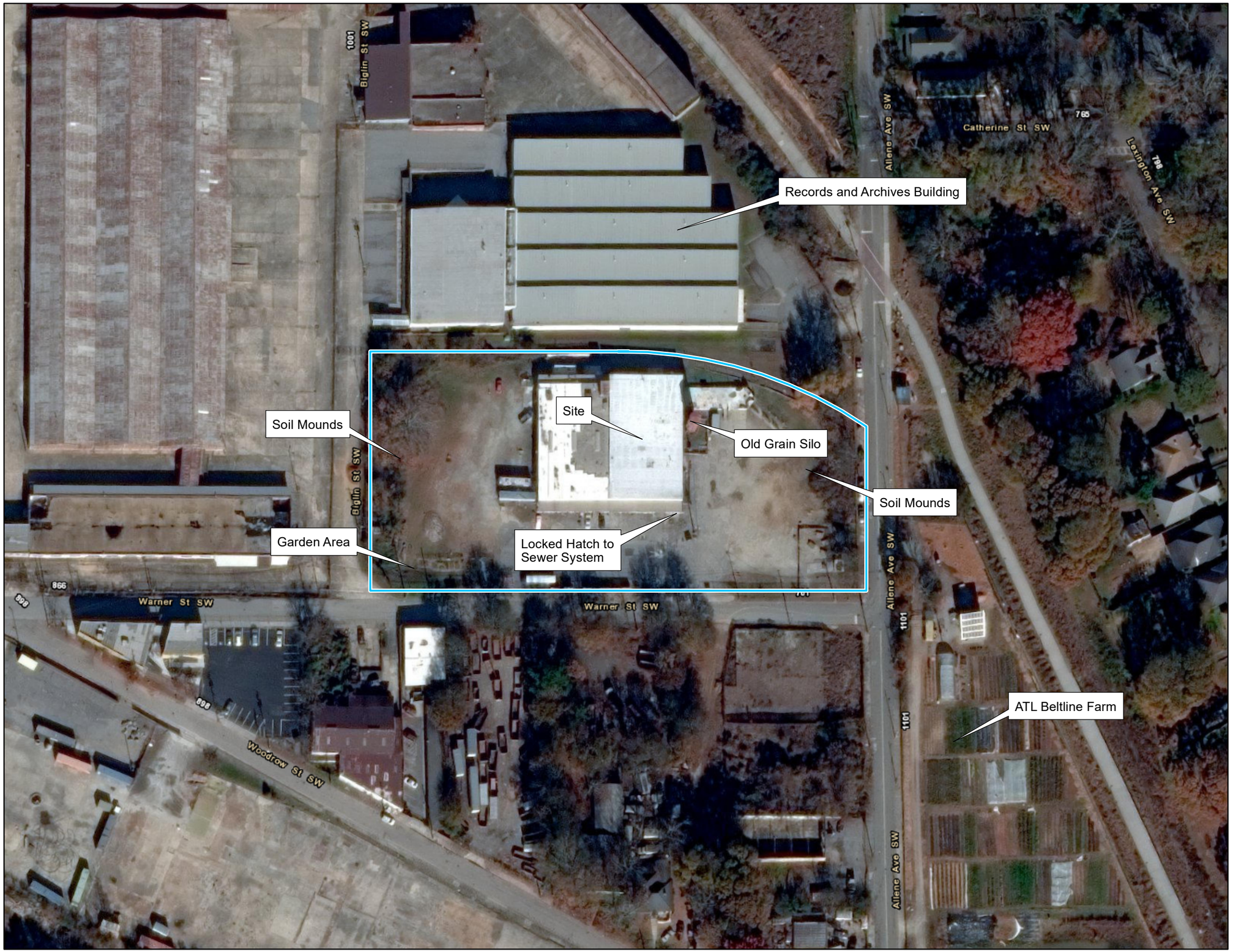


United States Environmental Protection Agency

825 WARNER STREET
ATLANTA, FULTON COUNTY,
GEORGIA
TDD NO: 0006/OT-06-017

FIGURE 1
TOPOGRAPHICAL MAP

OTIE
An Oneida Nation Company



Aerial Basemap Source: ESRI World Imagery (Clarity)

Legend

Site Property

N

0 50 100 200

Feet

United States Environmental Protection Agency

825 WARNER STREET
ATLANTA, FULTON COUNTY, GEORGIA
TDD NO: 0006/OT-06-017

FIGURE 2
SITE LOCATION MAP

OTIE
An Oneida Nation Company

G:\GIS_Workspace\2015 Projects\2015106 - 825 Warner Street\Figure 2 - Site Location Map.mxd

ETRI

Environmental Technology Resources, Inc.

May 29, 2019

Ms. Connie Veates
Co-Executive Director and Chief Operating Officer
Trees Atlanta
225 Chester Avenue, SE
Atlanta, Georgia 30316

Re: Phase II Environmental Site Assessment Report
825 Warner Street
Atlanta, Fulton County, Georgia

Dear Ms. Veates:

As you know, Oneida Total Integrated Enterprises was retained by the U.S. EPA Region IV and Trees Atlanta in April 2019 to complete a Phase I Environmental Site Assessment of the property located at 825 Warner Street in Atlanta, Fulton County, Georgia ("subject property"). The location of the property is shown in **Figure 1**.

The results of the Phase I ESA identified recognized environmental conditions associated with the prior use of the subject property along with a documented release on off-site properties. The Phase I ESA identified the following recognized environmental conditions on the subject property.

- The regulatory database report identifies the property at 717 Warner Street on the US Brownfields database. This property was identified on the southeast corner of the subject property. The property description is "former drum storage facility". The Phase I report noted that a Phase II investigation conducted in 2006 did not identify any volatile organic compounds in groundwater.
- The subject property was identified on the SPILLS database due to an incident that occurred on August 27, 2010. The report indicates that an unknown amount of oil was discharged into a storm drain from any unknown source.

The following off-site RECs were identified in the Phase I ESA Report.

- A 1978 Sanborn map indicates that the adjacent property had transformers which may have contained PCBs.
- A US Brownfields site located at 1121 Allene Avenue is located adjacent to the southeast side of the subject property. The adjacent property was identified as formerly having a drum storage facility.
- Champion International, which is located 500 feet south of the subject property, was identified as a LUST site.
- ESB, Inc., which is located 0.294 miles from the subject property was identified as a State Hazardous Waste Site due to a release of Lead.
- Bernstein Scrap Metal is located approximately 500 feet to the northwest. This property was identified as having a release of Lead and is listed as a non-hazardous waste site.
- Four historic auto sites are located within 586 feet of the subject property.

Based on the findings from the Phase I, Oneida Total Integrated Enterprises recommended that a Phase II ESA be

4780 Ashford Dunwoody Road
Suite A-456
Atlanta, Georgia 30338
Telephone 770-888-8181
Fax 770-888-8188

completed.

METHODS AND RESULTS OF SOIL AND GROUNDWATER INVESTIGATIONS

ETRI initially notify the Utility Protection Center (UPC) to identify underground utilities in the areas that would be investigated. UPC completed the utility locate (Ticket No. 05029-500-041) prior to beginning on-site work.

On May 7, 2019, ETRI and its subcontractor, GeoLab Drilling mobilized to the site to install the soil borings. Three soil borings were installed on the property. Soil boring B1 was located on the southwest side of the property. Soil boring B2 was installed east of the southeast corner of the building and soil boring B3 was installed on the northeast side of the proeprty and adjacent to an outside rail loading dock area. The locations of the soil borings are shown in **Figure 2**.

The soil borings were installed using Geoprobe® direct push technology (DPT) drill rig. The soil borings were advanced to a depth of 35 feet. The soil samples were screened for total volatile organic compounds using a field calibrated MiniRae 3000 - Photoionization Detector (PID). Soil samples were selected for analyses based on discoloration, odors and PID readings. Soil boring logs are included in **Attachment A**.

The samples were submitted to Pace Analytical Services, LLC of Peachtree Corners, Georgia for analyses. The soil samples collected from boring B1 at a depth of 3-4 feet, B2 at 7-10 feet and B3 at 2-3 feet were analyzed for RCRA Metals. The soil samples collected from B1 at 5-10 feet, B2 at 7-10 feet and B3 at 2-3 feet were analyzed for volatile organic compounds (VOC's) and polyaromatic hydrocarbons (PAHs). Samples VOC's were analyzed using EPA Method SW8260B, PAHs using EPA Method SW 8270D and RCRA Metals were analyzed using Method SW 6010D and 7471B. The results of the analyses of the soil samples are summarized in **Table 1** and are shown in **Figure 2**. The analytical report is included in **Attachment B**.

Table 1
Summary of Soil Sample Analyses – May 7, 2019
825 Warner Street, Atlanta, Georgia

Parameter	**B1-3-4'**	**B1-5-10'**	**B2-7-10'**	**B3-2-3'**	**GA EPD NC's**
Metals		NA			
Arsenic	ND		27.9	15.4	41
Barium	63.9		276	218	500
Cadmium	3.7		28.9	7.3	39
Chromium	47.5		31.9	42.6	1,200
Lead	39.2		**5,880**	109	400
Mercury	ND		ND	ND	17
Selenium	ND		ND	ND	36
Silver	ND		ND	ND	10
Volatile Organic Compounds	NA	ND		NA	Chemical Specific
Naphthalene		ND	0.0086		100
PAHs	NA	ND			Chemical

Parameter	**B1-3-4'**	**B1-5-10'**	**B2-7-10'**	**B3-2-3'**	**GA EPD NC's**
					Specific
Anthracene		ND	ND		500
Benzo(a)anthracene		ND	ND		5.0
Benzo(a)pyrene		ND	ND		1.64
Benzo(b)fluoranthene		ND	ND		5.0
Benzo(k)fluoranthene		ND	ND		5.0
Benzo(g,h,i) perylene		ND	ND		500
Chrysene		ND	ND		5.0
Dibenzo(a,h)anthracene		ND	ND		5.0
Fluoranthene		ND	6.57		500
Fluorene		ND	ND		360
Indeno(1,2,3-cd)pyrene		ND	ND		5.0
1-Methylnaphthalene		ND	ND		NR
2-Methylnaphthalene		ND	ND		NR
Naphthalene		ND	ND		100
Phenanthrene		ND	6.05		110
Pyrene		ND	5.58		500

Notes:
ND – Not Detected
NA – Not Analyzed
Results in mg/Kg, ppm

After completing the soil borings, a groundwater sampling tool consisting of a telescopic four-foot length of wire mesh screen was inserted into a drive point rod. Given that a dual tube system of soil sample collection was being used, the wire mesh screen was advanced to the bottom of the outer MacroCore and the MacroCore was retracted by five feet exposing the screen to groundwater. The depth to groundwater was determined to be approximately 24.22 feet in boring B1, 28.6 feet in B2 and 27 feet in B3.

A groundwater sample was collected by lowering a disposable length of polyethylene tubing into the hollow rods and connecting the tubing to a peristaltic pump at the surface. Groundwater was then extracted using the peristaltic pump. The samples were placed in 40-mL vials containing hydrochloric acid as a preservative and one-liter amber jars provided by the laboratory. The samples were then placed on ice for additional preservation.

The groundwater samples were delivered to Pace Analytical Services, LLC of Peachtree Corners, Georgia for analyses. The groundwater samples from borings B1, B2 and B3 were analyzed for volatile organic compounds using EPA Method SW 8260B. Groundwater samples collected from B2 and B3 were also analyzed for polyaromatic hydrocarbons using Method SW 8270D. Table 2 is a summary of the analyses of the groundwater samples.

Table 2
Summary of Groundwater Sample Analyses – May 7, 2019
825 Warner Street, Atlanta, Georgia

Parameter	**B1**	**B2**	**B3**	**GA EPD NC's**
Volatile Organic Compounds	ND	ND		
Naphthalene	ND	ND	0.0029	400
PAHs	NA	ND	ND	Chemical Specific

Notes:
ND – Not Detected
NA – Not Analyzed
Results in mg/L, ppm

After reviewing the results of the sample analyses and specifically the high concentration of Lead in soil boring B2 at a depth of 7 – 10 feet, additional testing was performed to determine the leachability of this soil. The leachability of the soil was determined using the Synthetic Precipitation Leaching Procedure (EPA). The SPLP is applicable for materials where the leaching potential due to normal rainfall is to be determined. Instead of the landfill leachate simulating acetic acid mixture, nitric and sulfuric acid are utilized in an effort to simulate the acid rains resulting from nitic and sulfuric oxides.

The B2-7-10 ft. sample was analyzed by Analytical Environmental Services, Inc. of Atlanta, Georgia. The SPLP analyses was performed using EPA SW-846, Method 1312. The results of the SPLP Lead analyses determined that the leachability of sample B2-7-10 ft. is 0.168 mg/L. The drinking water standard for Lead is 0.015 mg/L.

DISCUSSION OF RESULTS

Three soil borings were installed as part of a Phase II ESA on the property located at 825 Warner Street in Atlanta, Georgia. The following conclusions can be made regarding the results of the Phase II ESA.

- A high concentration of total Lead (5,880 mg/Kg) was detected in a sample collected from soil boring B2 at a depth of 7-10 feet. Fluoranthene, Phenanthrene and Pyrene were also detected in this sample. The Lead leachability of this sample, as determined by the SPLP procedure, was determined to be 0.168 mg/L
- Naphthalene was detected in a groundwater sample collected from boring B3 at a concentration of 0.0029 mg/L.
- The results of the Phase II ESA determined that off-site properties have had little, if any impact to the environmental conditions of the property.
- The August 2010 spill event does not appear to have had an impact on groundwater on the subject property.

Under the Georgia Hazardous Site Response Act, notification to the Georgia EPD Hazardous Site Response and Remediation Program is required when concentrations of contaminants in soils exceed notification concentrations. Petroleum releases are exempt from notification under HSRA. The concentration of Lead detected in the soil sample collected from boring B2 is greater than the Georgia EPD HSRA Notification concentrations.

Notification is also required when groundwater contamination exceeds drinking water standards. The concentration of Naphthalene in groundwater in B3 is below the EPA Maximum Contaminant Level (MCL) and notification would not be required.

Once notified, the Georgia EPD will evaluate the information provided in the release notification using the Reportable Quantity Screening Method (RQSM). Some of the factors that are used in evaluating a release to soil include the toxicity of the chemical released, accessibility to the property and the distance to the nearest residence or day care center. Some of the factors that are used in evaluating a release to groundwater include the toxicity of the chemical released and the distance to the nearest private or public drinking water well.

If you have any questions related to the report, please give me a call at (770) 888-8181.

Sincerely,
ENVIRONMENTAL TECHNOLOGY RESOURCES, INC.

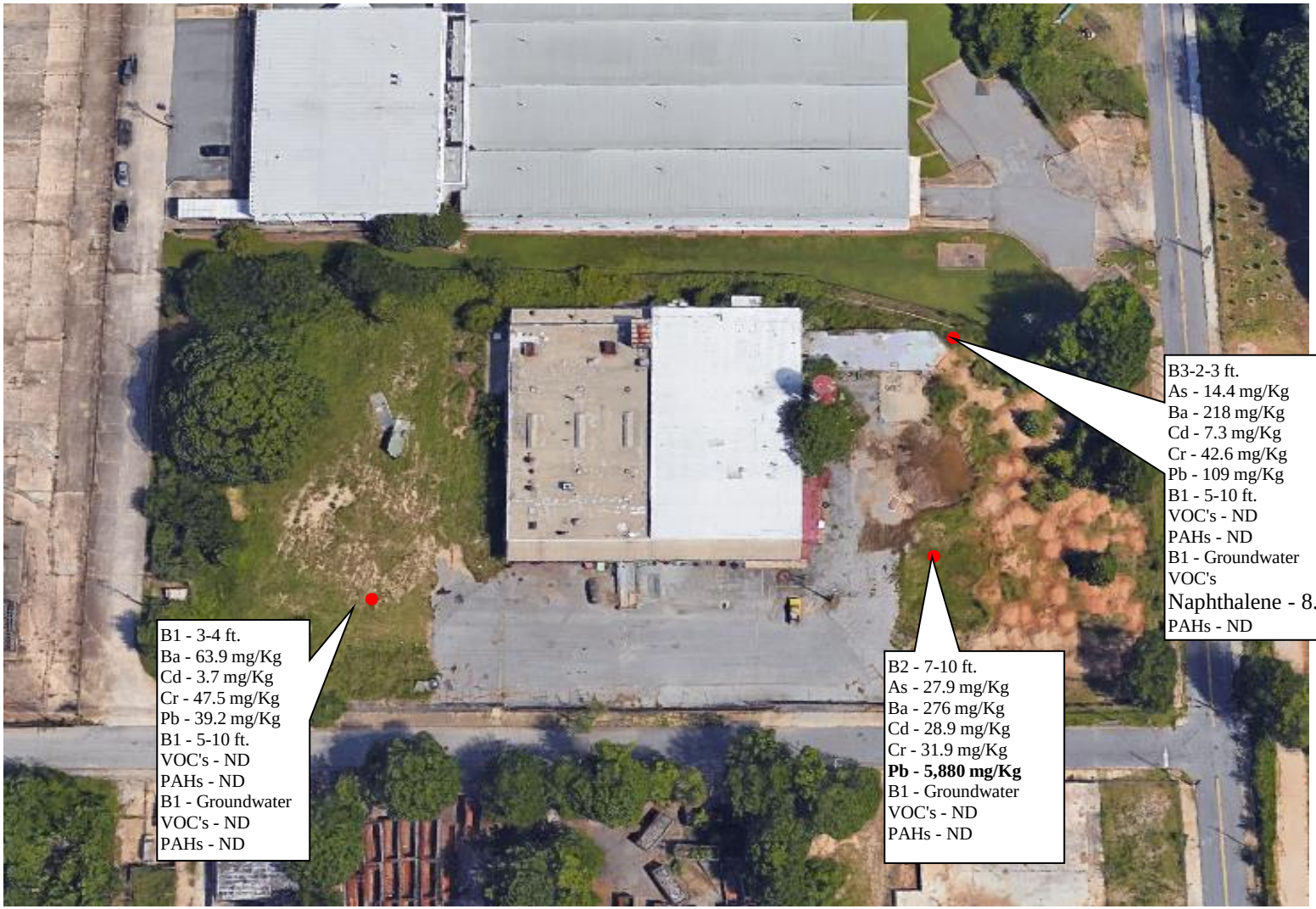
Thomas R. Harper
Technical Director

Attachments

19-064 – Phase 2 ESA Report

Figures

Source: U.S. Geologic Survey	**ETRI** Environmental Technology Resources, Inc. 4780 Ashford Dunwoody Rd. Suite A-456 Atlanta, Georgia 30338 Scale: Not to Scale	**FIGURE 1** **SITE LOCATION MAP** 825 Warner Street Atlanta, Georgia Project Number 19-064



ETRI

Environmental Technology Resources, Inc.
4780 Ashford Dunwoody Rd.
Suite A-456
Atlanta, Georgia 30338

Source: Bing.com/maps
● Soil Boring Location

Project No.	Scale	Date
19-064	Not to Scale	2018

FIGURE 2
SOIL BORING LOCATIONS AND ANALYTICAL RESULTS
825 Warner Street
Atlanta, Georgia

ETRI

Environmental Technology Resources, Inc.

June 18, 2019

Ms. Shannon Ridley
Georgia Environmental Protection Division
Brownfield Group
2 Martin Luther King Jr. Drive
Suite 1054 East Tower
Atlanta, Georgia 30334

Re: PPCAP
825 Warner Street, SW
Atlanta, Fulton County, Georgia

Dear Ms. Ridley:

Enclosed, please find one paper copy and two CD copies of the Prospective Purchaser Corrective Action Plan for the property located at 825 Warner Street, SW in Atlanta, Fulton County, Georgia. Included is a Brownfield Eligibility Form along with a check for $3,000.00.

Please feel free to contact me at (770) 888-8181 with any questions concerning the PPCSR.

Sincerely,
ENVIRONMENTAL TECHNOLOGY RESOURCES, INC.

Thomas R. Harper
Technical Director

Attachment

Cc. Ms. Connie Veates, Trees Atlanta

19-064.201

4780 Ashford Dunwoody Road
Suite A-456
Atlanta, Georgia 30338

Telephone 770-888-8181
Fax 770-888-8188

PROSPECTIVE PURCHASER CORRECTIVE ACTION PLAN

825 Warner Street, SW

Atlanta, Fulton County, Georgia

Submitted To:

Georgia Department of Natural Resources

Environmental Protection Division
Brownfield Program
2 Martin Luther King Jr. Drive
Floyd Towers East, Suite 1054
Atlanta, Georgia 30334

Prepared By:

Environmental Technology Resources, Inc.

4780 Ashford Dunwoody Road, Suite A-456
Atlanta, Georgia 30338
Telephone # (770) 888-8181

June 17, 2019

PROSPECTIVE PURCHASER CORRECTIVE ACTION PLAN
825 Warner Street, SW
Atlanta, Fulton County, Georgia

TABLE OF CONTENTS

Section **Page**

List of Figures

List of Appendices

PROSPECTIVE PURCHASER CORRECTIVE ACTION PLAN
825 Warner Street, SW
Atlanta, Fulton County, Georgia

1.0 INTRODUCTION

1.1 GENERAL

This Prospective Purchaser Corrective Action Plan (PPCAP) has been prepared for the Trees Atlanta for the property located at 825 Warner Street, SW in Atlanta, Fulton County, Georgia ("subject property" or "Site"). The subject property is located in Land Lot 106 of the 14th Land District of Fulton County, Georgia. The property is bound by Warner Street, SW to the south, Biglin Street, SW to the west and Allene Avenue to the east. A Site Location Map depicting the location of the subject property and its surrounding topography is included as **Figure 1**.

The approximate latitude and longitude coordinates of the property are 33° 43' 29.34" north and -84° 24' 52.23" west, respectively. The site is located within the Southwest Atlanta, Georgia Topographic Quadrangle, (United States Geologic Survey, 7.5-minute series topographic quadrangle map dated 1993).

The subject property consists of an irregular shaped parcel totaling approximately 2.9-acres. The property is identified by Fulton County Tax Assessor's as Parcel No. 14 010600090070.

According to the legal description, the subject property has approximately 533 feet of frontage along Warner Street, SW. The western side of the property has approximately 258.6 feet of frontage along Biglin Street, SW and the north-northeastern side of the property is approximately 552.4 feet. The eastern side of the property has approximately 177.3 feet of frontage along Allene Avenue. The approximate boundaries of the property are shown in the Tax Map, **Figure 2**. A copy of the legal description of the property is included in **Appendix A**.

The subject property is developed with a one-story, approximate 23,000 square feet warehouse building. The building was constructed in 1952. The building is a steel-framed structure constructed on a concrete slab. The walls of the building are constructed of concrete block and galvanized metal panels. The

building has a slightly pitched roof. A covered truck height loading dock area is located along the southern side of the building. A rail height dock is located adjacent to the northeast side of the building and extends to the east and southeast adjacent to an abandoned rail spur. An abandoned grain silo is located adjacent to the eastern side of the building. A Site Plan is included as **Figure 3** which shows features of the subject and surrounding properties.

The building is currently leased to various artists which use the building as individual art studios.

The current owner of the property is:

Jabobar Properties, LLC
918 Ponce de Leon Avenue, NE
Atlanta, Georgia 30306

1.2 PROSPECTIVE PURCHASER INFORMATION

The Prospective Purchaser of the subject property is:

Trees Atlanta
225 Chester Avenue
Atlanta, Georgia 30316

The contact person for Trees Atlanta is:
Ms. Connie Veates
Co-Executive Director and COO
(404) 681-4905

Trees Atlanta plans to use the property for non-residential use.

1.3 SITE HISTORY

The history of the subject property was determined by reviewing aerial photographs, topographic maps, tax assessor records, Sanborn maps and City directories. Sanborn maps show the subject property being developed with four small structures in 1932. Four smaller structures were on the western side of the property. One of the smaller structures was identified as an office and another smaller building was used for storage. A larger structure on the eastern side of the property was identified as being used for steel working and the occupant was identified as The F.E. Golian Company. A railroad spur was identified near

the northern boundary of the property. By 1950, the subject property was developed with two structures. A smaller building was located on the southwest corner of the property and a larger building on the north central portion of the Site. The larger building was used as "Cold Storage" and "Wholesale Produce". A 1962 Sanborn map indicates that the property was developed with a large building on the eastern property boundary. The building was labeled as "The F.P. Golian Company Structural & Ornamental Steel". A 1978 Sanborn map labeled the use of the building as "Wholesale Meat".

Tax assessor records indicate that the existing warehouse building was constructed in 1952. A review of City directories dating back to 1952 indicate that the property was occupied by C.L. Fain Company which operated a wholesale produce company in the 1950's. In the early 1960's to sometime in the 1970's, Armour & Company operated a wholesale meat company on the property. Moms Bakery operated a commercial bakery on the property from 1994 until 2010-2014. The Artist's studio has been in operation for the past ten years.

Surrounding properties were developed residential or undeveloped land in 1927. The adjacent property to the north has been used for records storage and archiving. Properties to the east have historically been developed residential. The old State Farmer's Market on the adjacent property to the west from 1940-1957. Adjacent southern properties have been developed with commercial buildings used to stage roll-off containers and Conex boxes.

1.4 PREVIOUS ENVIRONMENTAL INVESTIGATIONS

A Phase II Environmental Site Assessment and limited asbestos survey were conducted on behalf of Jabobar Properties, LLC in June 2006. The Phase II ESA and asbestos survey were completed by Environmental Planning Specialists, Inc. Seven soil boring were installed to depths ranging from 28 to 30 feet below land surface. Groundwater samples were collected and analyzed for the presence of volatile organic compounds (VOC's). No VOC's were detected above laboratory detection limits in any of the groundwater samples.

The asbestos survey included the collection and analyses of 26 bulk samples which included wallboard, joint compound, ceiling tile, sealants and roof coverings. Asbestos was identified in black asphalt shingles around the perimeter of an upper crawl space, black/white flashing around a roof vent and black/white

patching cement on asphalt.

2.0 INVESTIGATIONS COMPLETED FOR THE PROSPECTIVE PURCHASER

In April 2019, a Phase I Environmental Site Assessment (ESA) was completed on the subject property by Oneida Total Integrated Enterprises. The Phase I ESA was completed for the U.S. Environmental Protection Agency – Region 4 and Trees Atlanta as part of a Targeted Brownfields Assessment. Oneida Total Integrated Enterprises prepared a report entitled: *Phase I Environmental Site Assessment Report 825 Warner Street, SW Atlanta, Fulton County, Georgia EPA TDD No. 0006/OT-06-017* dated April 2019.

The Phase I ESA identified the following recognized environmental conditions on the subject property.

- The regulatory database report identifies the property at 717 Warner Street on the US Brownfields database. This property was identified on the southeast corner of the subject property. The property description is "former drum storage facility". The Phase I report noted that a Phase II investigation conducted in 2006 did not identify any volatile organic compounds in groundwater.
- The subject property was identified on the SPILLS database due to an incident that occurred on August 27, 2010. The report indicates that an unknown amount of oil was discharged into a storm drain from any unknown source.

The following off-site RECs were identified in the Phase I ESA Report.

- A 1978 Sanborn map indicates that the adjacent property had transformers which may have contained PCBs
- A US Brownfields site located at 1121 Allene Avenue is located adjacent to the southeast side of the subject property. The adjacent property was identified as formerly having a drum storage facility.
- Champion International, which is located 500 feet south of the subject property, was identified as a LUST site
- ESB, Inc., which is located 0.294 miles from the subject property was identified as a State Hazardous Waste Site due to a release of Lead.
- Bernstein Scrap Metal is located approximately 500 feet to the northwest. This property was identified as having a release of Lead and is listed as a non-hazardous waste site.
- Four historical auto sites are located within 586 feet of the subject property.

Based on the findings from the Phase I, Oneida Total Integrated Enterprises recommended that a Phase II ESA be completed.

On May 7, 2019, ETRI and its subcontractor, GeoLab Drilling mobilized to the site to install the soil borings. Three soil borings were installed on the property. Soil boring B1 was located on the southwest side of the property. Soil boring B2 was installed east of the southeast corner of the building and soil

boring B3 was installed on the northeast side of the property and adjacent to an outside rail loading dock area. The locations of the soil borings are shown in **Figure 4**.

The soil borings were installed using Geoprobe® direct push technology (DPT) drill rig. The soil borings were advanced to a depths of 35 feet. The soil samples were screened for total volatile organic compounds using a field calibrated MiniRae 3000 - Photoionization Detector (PID). Soil samples were selected for analyses based on discoloration, odors and PID readings.

The soil samples collected from boring B1 at a depth of 3-4 feet, B2 at 7-10 feet and B3 at 2-3 feet were analyzed for RCRA Metals. The soil samples collected from B1 at 5-10 feet, B2 at 7-10 feet and B3 at 2-3 feet were analyzed for volatile organic compounds (VOC's) and polyaromatic hydrocarbons (PAHs). Samples VOC's were analyzed using EPA Method SW8260B, PAHs using EPA Method SW 8270D and RCRA Metals were analyzed using Method SW 6010D and 7471B. The results of the analyses of the soil samples are summarized in **Table 1** and are shown in **Figure 4**. The analytical report is included in **Attachment B**.

Table 1
Summary of Soil Sample Analyses – May 7, 2019
825 Warner Street, Atlanta, Georgia

Parameter	**B1-3-4'**	**B1-5-10'**	**B2-7-10'**	**B3-2-3'**	**GA EPD NC's**
Metals		NA			
Arsenic	ND		27.9	15.4	41
Barium	63.9		276	218	500
Cadmium	3.7		28.9	7.3	39
Chromium	47.5		31.9	42.6	1,200
Lead	39.2		**5,880**	109	400
Mercury	ND		ND	ND	17
Selenium	ND		ND	ND	36
Silver	ND		ND	ND	10
Volatile Organic Compounds	NA	ND		NA	Chemical Specific
Naphthalene		ND	0.0086		100
PAHs	NA	ND			Chemical Specific
Anthracene		ND	ND		500
Benzo(a)anthracene		ND	ND		5.0
Benzo(a)pyrene		ND	ND		1.64

Parameter	B1-3-4'	B1-5-10'	B2-7-10'	B3-2-3'	GA EPD NC's
Benzo(b)fluoranthene		ND	ND		5.0
Benzo(k)fluoranthene		ND	ND		5.0
Benzo(g,h,i) perylene		ND	ND		500
Chrysene		ND	ND		5.0
Dibenzo(a,h)anthracene		ND	ND		5.0
Fluoranthene		ND	6.57		500
Fluorene		ND	ND		360
Indeno(1,2,3-cd)pyrene		ND	ND		5.0
1-Methylnaphthalene		ND	ND		NR
2-Methylnaphthalene		ND	ND		NR
Naphthalene		ND	ND		100
Phenanthrene		ND	6.05		110
Pyrene		ND	5.58		500

Notes:
ND – Not Detected
NA – Not Analyzed
Results in mg/Kg, ppm

After completing the soil borings, a groundwater sampling tool consisting of a telescopic four-foot length of wire mesh screen was inserted into a drive point rod. Given that a dual tube system of soil sample collection was being used, the wire mesh screen was advanced to the bottom of the outer MacroCore and the MacroCore was retracted by five feet exposing the screen to groundwater. The depth to groundwater was determined to be approximately 24.22 feet in boring B1, 28.6 feet in B2 and 27 feet in B3.

A groundwater sample was collected by lowering a disposable length of polyethylene tubing into the hollow rods and connecting the tubing to a peristaltic pump at the surface. Groundwater was then extracted using the peristaltic pump. The samples were placed in 40-mL vials containing hydrochloric acid as a preservative and one-liter amber jars provided by the laboratory. The samples were then placed on ice for additional preservation.

The groundwater samples were delivered to Pace Analytical Services, LLC of Peachtree Corners, Georgia for analyses. The groundwater samples from borings B1, B2 and B3 were analyzed for volatile organic compounds using EPA Method SW 8260B. Groundwater samples collected from B2 and B3 were also analyzed for polyaromatic hydrocarbons using Method SW 8270D. **Table 2** is a summary of the analyses of the groundwater samples.

Table 2
Summary of Groundwater Sample Analyses – May 7, 2019
825 Warner Street, Atlanta, Georgia

Parameter	**B1**	**B2**	**B3**	**GA EPD NC's**
Volatile Organic Compounds	ND	ND		
Naphthalene	ND	ND	0.0029	400
PAHs	NA	ND	ND	Chemical Specific

Notes:
ND – Not Detected
NA – Not Analyzed
Results in mg/L, ppm

3.0 QUALIFICATION OF SITE AND PROSPECTIVE PURCHASER

The Hazardous Site Reuse and Redevelopment Act has set forth certain criteria in order to qualify for the Brownfield's Limitation of Liability. Based on our understanding of the site, we conclude that both the property and Trees Atlanta meet the Act's requirements as summarized below.

Subject Property

1. Has had a pre-existing release;
2. Does not have liens filed under subsection (e) of Code Section 12-8-96 against it;
3. Is not listed on the Federal National Priority List
4. Is not undergoing response activity by an order of the Environmental Protection Agency;
5. Is not a hazardous waste facility as defined in Code Section 12-8-62.

Trees Atlanta

1. Is not a current or former subsidiary, division, parent company or partner of any prior owners of the property;
2. Is not the former employer or current employer, nor otherwise affiliated with the current owners of the subject property or any person who has contributed or is contributing to a release on the property;
3. Has not found evidence of liens filed under subsection (e) of Code Section 12-8-96 against the property;
4. Is not in violation of any order, judgment, statute, rule or regulation subject to the enforcement authority of the director.

4.0 CORRECTIVE ACTION PLAN

4.1 SUMMARY OF SOIL AND GROUNDWATER CONDITIONS

The suspected source of Lead and PAHs in soil on the subject property is believed to be from fill that was placed on the property and an unknown time. Additional soil investigations will be completed to define the depth and extent of Lead contamination that exists on the property.

4.2 CORRECTIVE ACTION COMPLETED OR IN PROGRESS

No corrective actions have been completed on the 825 Warner Street property.

4.3 CORRECTIVE ACTION APPROACH AND SELECTED TECHNOLOGIES

Based on the investigations that have been completed, soils contaminated with the Lead and PAHs have been identified east of the building and on the eastern side of the property. These soils do not meet Type 3 or Type 4 Risk Reduction Standards for Lead.

Additional investigations will be conducted to further define the vertical and horizontal extent of elevated concentrations of Lead above the non-residential risk reduction standards. A soil boring will be installed in the area of B2 for the purpose of installing a temporary one-inch groundwater monitoring well. The temporary well will be installed to a depth of 30 feet with ten feet of screen. Soil samples will be collected from the upper one ft. of soil and also just above the saturated zone.

Install additional soil borings in a grid pattern in the area of B2 to further define the extent of soil contamination. The additional soil borings will be installed to a depth of 25 feet. The initial additional four borings will be installed approximately 20 feet to the north, south, east and west of boring B2. Based on visual observations made during the additional boring installations, additional borings will be installed at less or greater distances to define the extent of soil contamination. We estimate that a total of 8 to 10 borings can be installed to a depth of 25 feet. Soil samples will be collected at depths of 0-1 ft., at the depth suspected of being the highest level of Lead in soil (7-10 feet in B2) and one additional sample at a

greater depth per boring. The proposed soil boring locations are shown **Figure 5**.

A groundwater sample will be collected from the temporary well after purging the well. The well will be purged using a peristaltic pump. Turbidity will be monitored, and a sample collected once the turbidity is below 10 NTU (if possible). The groundwater sample will be analyzed for total and dissolved Lead. Surface soil samples will be analyzed for RCRA Metals. Subsurface soil samples will be analyzed for total Lead. Additional soil samples will also be collected from other areas of the property and from below the building footprint once the existing building is demolished. The additional soil samples will also be analyzed for RCRA Metals and/or total Lead.

If soil contaminated with Lead is found on the subject property that is above Type 3 or Type 4 Risk Reduction Standards, these soils will be remediated using excavation and off-site disposal.

The excavation, handling, transportation and disposal of the volatile organic compounds material will be performed in a manner to prevent contamination of the surrounding, un-impacted areas and in accordance with applicable federal, State and local laws. Any soils containing contaminants of concern (COC's) which require off-site disposal will be placed on a liner or barrier before placement on the ground or pavement. The excavated contaminated soil will be transported in compliance with all applicable regulations for transporting such waste and disposal at a pre-approved disposal facility permitted to accept the designated waste.

If the results of the investigations identify soil above the appropriate risk reduction standards inside the building or adjacent to the building, an alternative method of remediation may be necessary. In-situ chemical oxidation may be utilized to reduce the concentrations of contaminants to below the appropriate risk reduction standards. If an alternative method is selected for remediation, a CAP Amendment will be submitted with details of the proposed implementation and confirmation methodology.

All work will be performed in accordance with applicable regulations, and in accordance with a site specific Health and Safety Plan and OSHA Standards.

4.3.1 Effectiveness

If any soil removal or treatment is required, confirmation soil sampling will be conducted to determine the effectiveness of the removal or treatment activities. In the area of soil boring B2, delineation samples will be used to verify the effectiveness of the soil removal. In other areas, confirmation samples will be collected every 25 feet along side walls of the excavation with a minimum of four per excavation. One confirmation soil sample will be collected for every 625 square feet of the excavation floor. The confirmation soil samples will be analyzed for contaminants of concern.

The results of the soil sample analyses will be compared to the applicable Risk Reduction Standards. Confirmation soil samples will be used to confirm the effectiveness of the removal process.

4.3.2 Other Regulatory or Permitting Requirements

If required, transporters and facilities licensed to handle the waste will be utilized during the removal project. Consideration will be given to the possible risks associated with vapor intrusion. Appropriate mitigation measures would be implemented to reduce the risk associated with vapor intrusion.

The prospective purchaser will work with the Georgia EPD, prior to collecting any additional samples, to determine the specific locations and number of samples to be collected for additional assessment.

4.4 SCHEDULE

Additional site investigations will be implemented within six (6) months of acquisition of the property. The prospective purchaser compliance status report will be submitted to the Georgia EPD on or prior to December 31, 2020.

5.0 PREPARATION OF CSR

An environmental consultant will prepare a Prospective Purchaser Compliance Status Report (PPCSR) on behalf of Trees Atlanta. The written report will consist of information in the format required for submission to the Georgia EPD. The PPCSR will include the following:

- A legal description of the property which comprises the Brownfield site,
- A description of each known source of release,
- A summary of all pertinent field and laboratory data,
- Definition of the horizontal and vertical extent of on-site soil contamination above HSRA notification concentrations,
- A baseline of groundwater conditions will be established,
- A description of geologic and hydrogeologic conditions at the site,
- Analytical results with chain of custody,
- A legal description and, if available, a survey plat,
- A description of the corrective actions used to bring the property into compliance with the RRS,
- A description of existing or potential human or environmental receptors and risk reduction standards,
- A summary of previous actions taken to eliminate, control, or minimize the potential risk at the site,
- An evaluation of the vapor intrusion pathway will be evaluated and addressed as necessary,
- Documentation of the proper characterization, transportation, and disposal of contaminated soils and/or hazardous wastes, if any, and,
- A concise statement of findings or the report including Trees Atlanta compliance with the appropriate soil risk reduction standards.
- Signature and seal of a Georgia Registered Professional Geologist and/or Professional Engineer.

6.0 CERTIFICATION STATEMENT

I certify that this report and all attachments were prepared under my direction in accordance with a system designed to assure that qualified personnel properly evaluated the information submitted. Based on my inquiry of the person or persons who prepared the information, the information submitted is, to the best of my knowledge, belief, true, accurate, and complete.

Connie Veates — 6-13-19

Ms. Connie Veates, COO
Trees Atlanta

Date

Thomas R. Harper — June 17, 2019

Thomas R. Harper, Technical Director
Environmental Technology Resources, Inc.

Date

Figures

Source: U.S. Geologic Survey	**ETRI** Environmental Technology Resources, Inc. 4780 Ashford Dunwoody Rd. Suite A-456 Atlanta, Georgia 30338 Scale: Not to Scale	**FIGURE 1** **SITE LOCATION MAP** 825 Warner Street Atlanta, Georgia Project Number 19-064

Source: Fulton County Tax Assessor

ETRI
Environmental Technology Resources, Inc.
4780 Ashford Dunwoody Rd.
Suite A-456
Atlanta, Georgia 30338
Scale: Noted

FIGURE 2
TAX MAP
825 Warner Street
Atlanta, Georgia

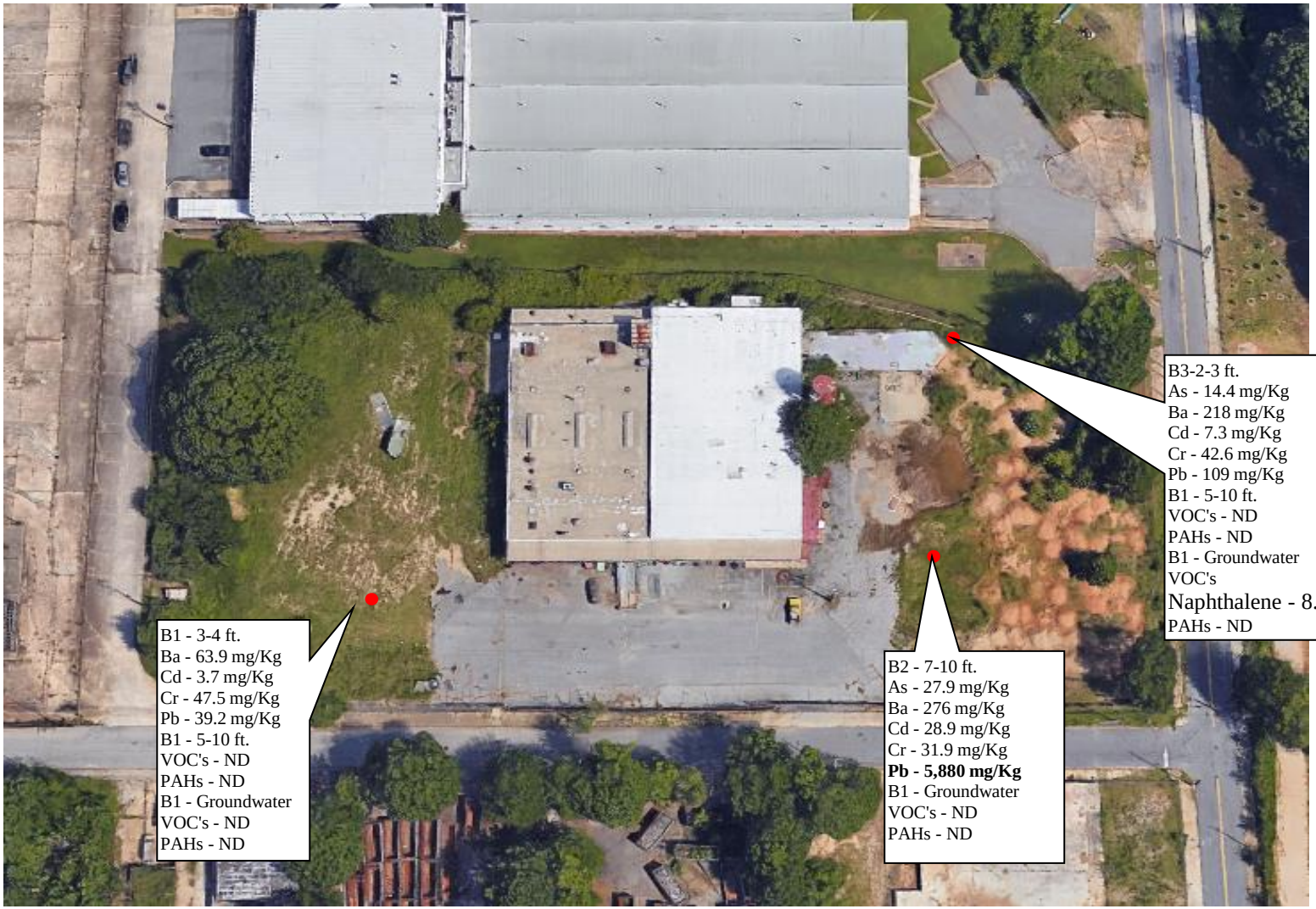
Project Number 19-064

ETRI
Environmental Technology Resources, Inc.
4780 Ashford Dunwoody Rd.
Suite A-456
Atlanta, Georgia 30338

Source: Bing.com/maps

Project No.	Scale	Date
19-064	Not to Scale	2018

FIGURE 3
SITE PLAN
825 Warner Street
Atlanta, Georgia



ETRI

Environmental Technology Resources, Inc.
4780 Ashford Dunwoody Rd.
Suite A-456
Atlanta, Georgia 30338

Source: Bing.com/maps
● Soil Boring Location

Project No.	Scale	Date
19-064	Not to Scale	2018

FIGURE 4
SOIL BORING LOCATIONS AND ANALYTICAL RESULTS
825 Warner Street
Atlanta, Georgia

ETRI
Environmental Technology Resources, Inc.
4780 Ashford Dunwoody Rd.
Suite A-456
Atlanta, Georgia 30338

Proposed Soil Boring Location
Soil Boring Location

Project No.	Scale	Date
19-064	Not to Scale	2018

FIGURE 5
PROPOSED SOIL BORING LOCATIONS
825 Warner Street
Atlanta, Georgia

Appendix E

Corrective Action Plan

CORRECTIVE ACTION PLAN

825 Warner Street, SW
Atlanta, Fulton County, Georgia

Prepared for:

Trees Atlanta
225 Chester Avenue, SE
Atlanta, Georgia 30316

And

The City of Atlanta

Prepared by:

Environmental Technology Resources, Inc.
4780 Ashford Dunwoody Road
Suite A-456
Atlanta, Georgia 30338

May 2020

CORRECTIVE ACTION PLAN
825 Warner Street, SW
Atlanta, Fulton County, Georgia

Prepared by:
Environmental Technology Resources, Inc.
4780 Ashford Dunwoody Road
Suite A-456
Atlanta, Georgia 30338

May 2020

_____ Date: _____
Connie Veates
Co-Executive Director, Trees Atlanta

_____ Date: May 28, 2020
Thomas R. Harper
Project Manager/Quality Assurance Manager

CORRECTIVE ACTION PLAN
Trees Atlanta Project
825 Warner Street
Atlanta, Fulton County, Georgia

TABLE OF CONTENTS

Section **Page**

List of Tables

List of Figures

1.0 INTRODUCTION

1.1 Background Information

The "Site" or "subject property" is located at 825 Warner Street, SW in Atlanta, Fulton County, Georgia. The property is bound by Warner Street, SW to the south, Biglin Street, SW to the west and Allene Avenue to the east. A Site Location Map is included as **Figure 1**.

The property is identified by Fulton County Tax Assessor's as Parcel No. 14 010600090070. The approximate boundaries of the property are shown in the Tax Map, **Figure 2**.

The subject property includes approximately 2.9 acres of land and is developed with a one-story, approximate 23,000 square feet warehouse building. The building was constructed in 1952. The building is a steel-framed structure constructed on a concrete slab. The walls of the building are constructed of concrete block and galvanized metal panels. The building has a slightly pitched roof. A covered truck height loading dock area is located along the southern side of the building. A rail height dock is located adjacent to the northeast side of the building and extends to the east and southeast adjacent to an abandoned rail spur. An abandoned grain silo is located adjacent to the eastern side of the building. The building is currently leased to various artists which use the building as individual art studios.

The history of the subject property was determined by reviewing aerial photographs, topographic maps, tax assessor records, Sanborn maps and City directories. Sanborn maps show the subject property being developed with four small structures in 1932. Four smaller structures were on the western side of the property. One of the smaller structures was identified as an office and another smaller building was used for storage. A larger structure on the eastern side of the property was identified as being used for steel working and the occupant was identified as The F.E. Golian Company. By 1950, the subject property was developed with two structures. A smaller building was located on the southwest corner of the property and a larger building on the north central portion of the Site. The larger building was used as "Cold Storage" and "Wholesale Produce". A 1962 Sanborn map indicates that the property was developed with a large building on the eastern property boundary. The building was labeled as "The F.P. Golian Company Structural & Ornamental Steel". A 1978 Sanborn map labeled the use of the building as "Wholesale Meat".

A review of City directories dating back to 1952 indicate that the property was occupied by C.L. Fain Company which operated a wholesale produce company in the 1950's. In the early 1960's to sometime in the 1970's, Armour & Company operated a wholesale meat company on the property. Moms Bakery operated a commercial bakery on the property from 1994 until 2010-2014. The Artist's studio has been in operation for the past eleven years.

A Phase II Environmental Site Assessment and limited asbestos survey were conducted on behalf of Jabobar Properties, LLC in June 2006. The Phase II ESA and asbestos survey were completed by Environmental Planning Specialists, Inc. Seven soil boring were installed to depths ranging from 28 to 30 feet below land surface. Groundwater samples were collected and analyzed for the presence of volatile organic compounds (VOC's). No VOC's were detected above laboratory detection limits in any of the groundwater samples.

Source: U.S. Geologic Survey	**ETRI** Environmental Technology Resources, Inc. 4780 Ashford Dunwoody Rd. Suite A-456 Atlanta, Georgia 30338 Scale: Not to Scale	**FIGURE 1** **SITE LOCATION MAP** 825 Warner Street Atlanta, Georgia Project Number 19-064

Source: Fulton County Tax Assessor

ETRI
Environmental Technology Resources, Inc.
4780 Ashford Dunwoody Rd.
Suite A-456
Atlanta, Georgia 30338
Scale: Noted

FIGURE 2
TAX MAP
825 Warner Street
Atlanta, Georgia

Project Number 19-064

The asbestos survey included the collection and analyses of 26 bulk samples which included wallboard, joint compound, ceiling tile, sealants and roof coverings. Asbestos was identified in black asphalt shingles around the perimeter of an upper crawl space, black/white flashing around a roof vent and black/white patching cement on asphalt.

Trees Atlanta, Inc. (Trees Atlanta) acquired the subject property on July 16, 2019. Prior to acquiring the property, Trees Atlanta filed for a limit of liability protection under the Georgia Brownfield Act. A provisional limit of liability was issued to Trees Atlanta by the Georgia EPD prior to the acquisition of the property.

1.2 Constituents of Concern and Cleanup Levels

Based on investigations completed in 2019, the constituent of concern has been identified as Lead in soil. The Trees Atlanta property is a non-residential property, thus Type 3 and 4 criteria would be applicable to the site.

The Type 4 (non-residential) RRS for Lead in soil is calculated using EPA's Adult Lead Model (ALM). Groundwater testing in the area of highest Lead concentrations in soils determined that groundwater does not contain detectable concentrations of total or dissolved Lead in groundwater. Therefore, a risk reduction standard based on direct contact with soils will be appropriate for the Trees Atlanta site.

The Georgia EPD published Type 4 soil direct contact RRS for Lead using central tendency values for commercial/institutional workers (surface soils) at 1,050 mg/Kg. For an excavation worker, (subsurface soils), the Lead concentration is 1,278 mg/Kg. These values are calculated in accordance with Rule 391-3-19-.07(9)(d)2.(i) and 3.(i). A site specific leaching value will be calculated in accordance with Rule 391-3-19-.07(9)(d)1 to determine the final RRS value.

Table 1 is a summary of the soil cleanup standards that are will apply to the Trees Atlanta site.

Table 1
Soil Cleanup Levels
Trees Atlanta Site, Atlanta, Georgia

Parameter	**Type 4 Risk Reduction Standard Surface Soil (0-1 ft.)**	**Type 4 Risk Reduction Standard Subsurface Soil (> 1ft.)**
Lead	1,050 mg/Kg	1,278 mg/Kg

2.0 SOIL CONFIRMATION

2.1 Results of Soil Confirmation

In April 2019, a Phase I Environmental Site Assessment (ESA) was completed on the subject property by Oneida Total Integrated Enterprises. The Phase I ESA was completed for the U.S. Environmental Protection Agency – Region 4 and Trees Atlanta as part of a Targeted Brownfields Assessment. Oneida Total Integrated Enterprises prepared a report entitled: *Phase I Environmental Site Assessment Report 825 Warner Street, SW Atlanta, Fulton County, Georgia EPA TDD No. 0006/OT-06-017* dated April 2019.

The Phase I ESA identified recognized environmental conditions on the subject property and surrounding off-site properties. Based on the findings from the Phase I, Oneida Total Integrated Enterprises recommended that a Phase II ESA be completed.

ETRI was retained by Trees Atlanta to complete the Phase II ESA. On May 7, 2019, ETRI and its subcontractor, GeoLab Drilling mobilized to the site to install the soil borings. Three soil borings were installed on the property. Soil boring B1 was located on the southwest side of the property. Soil boring B2 was installed east of the southeast corner of the building and soil boring B3 was installed on the northeast side of the property and adjacent to an outside rail loading dock area. The soil borings were installed using Geoprobe® direct push technology (DPT) drill rig. Each soil boring was advanced to a depths of 35 feet. Soil boring locations are identified in **Figure 3**.

Soil samples collected from boring B1 at a depth of 3-4 feet, B2 at 7-10 feet and B3 at 2-3 feet were analyzed for RCRA Metals. The soil samples collected from B1 at 5-10 feet, B2 at 7-10 feet and B3 at 2-3 feet were analyzed for volatile organic compounds (VOC's) and polyaromatic hydrocarbons (PAHs). Samples VOC's were analyzed using EPA Method SW8260B, PAHs using EPA Method SW 8270D and RCRA Metals were analyzed using Method SW 6010D and 7471B. The results of the soil sample analyses are summarized in **Table 2**.

ETRI

Environmental Technology Resources, Inc.
4780 Ashford Dunwoody Rd.
Suite A-456
Atlanta, Georgia 30338

Proposed Soil Boring Location
Soil Boring Location

Project No.	Scale	Date
19-064	Not to Scale	2018

FIGURE 3
SOIL BORING LOCATIONS
825 Warner Street
Atlanta, Georgia

Table 2
Summary of Soil Sample Analyses – May 7, 2019
825 Warner Street, Atlanta, Georgia

Parameter	**B1-3-4'**	**B1-5-10'**	**B2-7-10'**	**B3-2-3'**	**GA EPD NC's**	**Type 3 RRS**
Metals		NA				
Arsenic	ND		27.9	15.4	41	30/41
Barium	63.9		276	218	500	1,650/1,650
Cadmium	3.7		28.9	7.3	39	39/39
Chromium	47.5		31.9	42.6	1,200	1,200/1,200
Lead	39.2		**5,880**	109	400	400/400
Mercury	ND		ND	ND	17	17/6.82
Selenium	ND		ND	ND	36	36/36
Silver	ND		ND	ND	10	96.6/96.6
Volatile Organic Compounds	NA	ND		NA	Chemical Specific	
Naphthalene		ND	0.0086		100	100/90.9
PAHs	NA	ND			Chemical Specific	
Fluoranthene		ND	6.57		500	1,040/1,040
Phenanthrene		ND	6.05		110	NR
Pyrene		ND	5.58		500	2,810/2,810

Notes:
ND – Not Detected
NA – Not Analyzed
NR – Not Regulated
Results in mg/Kg, ppm

After completing the soil borings, a groundwater sampling tool consisting of a telescopic four-foot length of wire mesh screen was inserted into a drive point rod. The depth to groundwater was determined to be approximately 24.22 feet in boring B1, 28.6 feet in B2 and 27 feet in B3.

The groundwater samples from borings B1, B2 and B3 were analyzed for volatile organic compounds using EPA Method SW 8260B. Groundwater samples collected from B2 and B3 were also analyzed for polyaromatic hydrocarbons using Method SW 8270D. **Table 3** is a summary of the analyses of the groundwater samples.

Table 3
Summary of Groundwater Sample Analyses – May 7, 2019
825 Warner Street, Atlanta, Georgia

Parameter	**B1**	**B2**	**B3**	**GA EPD NC's**
Volatile Organic Compounds	ND	ND		
Naphthalene	ND	ND	0.0029	400
PAHs	NA	ND	ND	Chemical Specific

Notes:
ND – Not Detected
NA – Not Analyzed
Results in mg/L, ppm

Additional soil investigations were conducted on June 21, 2019. The purpose of these investigations was to define the extent of contamination discovered during the May 2019 investigations and install a temporary monitoring well in the area of highest Lead in soils to determine if groundwater has been impacted.

Ten additional soil borings were installed on the property. Each soil boring was installed to a depth of 25 feet. Soil samples were collected from the upper one foot and below one foot in each boring. The surface samples were analyzed for RCRA Metals. Deeper samples were analyzed for total Lead. The results are summarized in **Table 4**.

Table 4
Summary of Soil Sample Analyses – June 21, 2019
825 Warner Street, Atlanta, Georgia

Parameter	**B2-6-12”**	**B2-23-25’**	**B4-6-12”**	**B4-6.5-7’**	**B4-10’**	**B5-6-12”**	**B5-7-8’**	**B5-11-12’**	**Type 3 RRS**
Metals									
Arsenic	7.99		10.5			6.28			30/41
Barium	291		110			370			1,650/1,650
Cadmium	BRL		BRL			BRL			39/39
Chromium	24.2		40.2			21.1			1,200/1,200
Lead	1,390	17.7	435	1,410	23.5	988	1,510	16.6	400/400
Mercury	0.315		BRL			0.236			17/6.82
Selenium	BRL		BRL			BRL			36/36
Silver	BRL		BRL			2.83			96.6/96.6

Parameter	**B6-6-12”**	**B6-7-8’**	**B6-10-11’**	**B7-6-12”**	**B7-5-6’**	**B7-10-11’**	**B8-6-12”**	**B8-6-7’**	**B8-9-10’**	**Type 3 RRS**
Metals										
Arsenic	2.75			18.4			10.6			30/41
Barium	134			101			76.5			1,650/1,650
Cadmium	BRL			BRL			BRL			39/39
Chromium	43.2			44.4			39.8			1,200/1,200
Lead	110	28.0	13.0	242	76.9	19.9	127	1,250	10.7	400/400
Mercury	BRL			0.266			0.126			17/6.82
Selenium	BRL			BRL			BRL			36/36
Silver	BRL			BRL			BRL			96.6/96.6

Parameter	**B9-6-12”**	**B9-7-8’**	**B11-6-12”**	**B11-8-9’**	**B11-10-11’**	**B12-6-12”**	**B12-8-9’**	**B12-10-11’**	**Type 3 RRS**
Metals									
Arsenic	22.1		3.23			8.29			30/41
Barium	51.4		49.9			199			1,650/1,650
Cadmium	BRL		BRL			BRL			39/39
Chromium	36.2		59.1			7.85			1,200/1,200
Lead	24.5	848	28.8	92.3	17.1	6.20	35.2	10.0	400/400
Mercury	0.192		0.129			0.336			17/6.82
Selenium	BRL		BRL			BRL			36/36
Silver	BRL		BRL			BRL			96.6/96.6

Table 4 (continued)
Summary of Soil Sample Analyses – June 21, 2019
825 Warner Street, Atlanta, Georgia

Parameter	**B13-6-12”**	**B13-8-9’**	**B13-10-11’**	**B14-6-12”**	**B14-6-7’**	**B14-10-11’**	**Type 3 RRS**
Metals							
Arsenic	11.7			6.97			30/41
Barium	371			120			1,650/1,650
Cadmium	BRL			BRL			39/39
Chromium	16.8			32.1			1,200/1,200
Lead	196	20.1	11.6	111	18.7	14.3	400/400
Mercury	BRL			BRL			17/6.82
Selenium	BRL			BRL			36/36
Silver	BRL			BRL			96.6/96.6

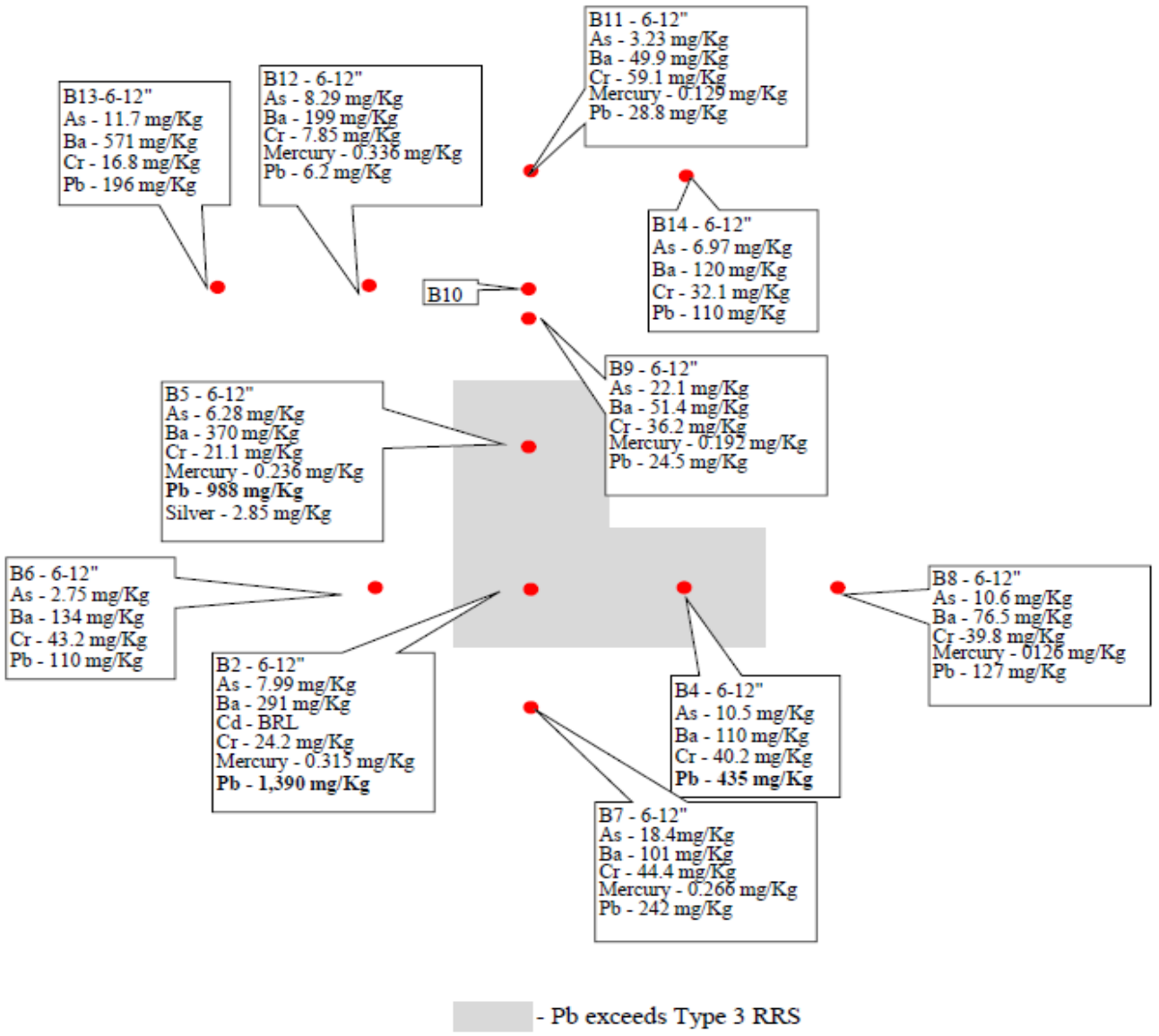
Notes:
BRL – Below Reporting Level
Results in mg/Kg, ppm
RRS – less than 1 ft./greater than 1 ft.

The soil boring locations and results of the sample analyses are shown in **Figures 4, 5 and 6**.

The results of the additional investigations determined the following:

- Surface soils and soils at depths of greater than 1 ft. were found to contain concentrations of Lead above Type 3 and 4 RRS. The concentrations of total Lead in soils appear to significantly decrease below depths of 8 feet.

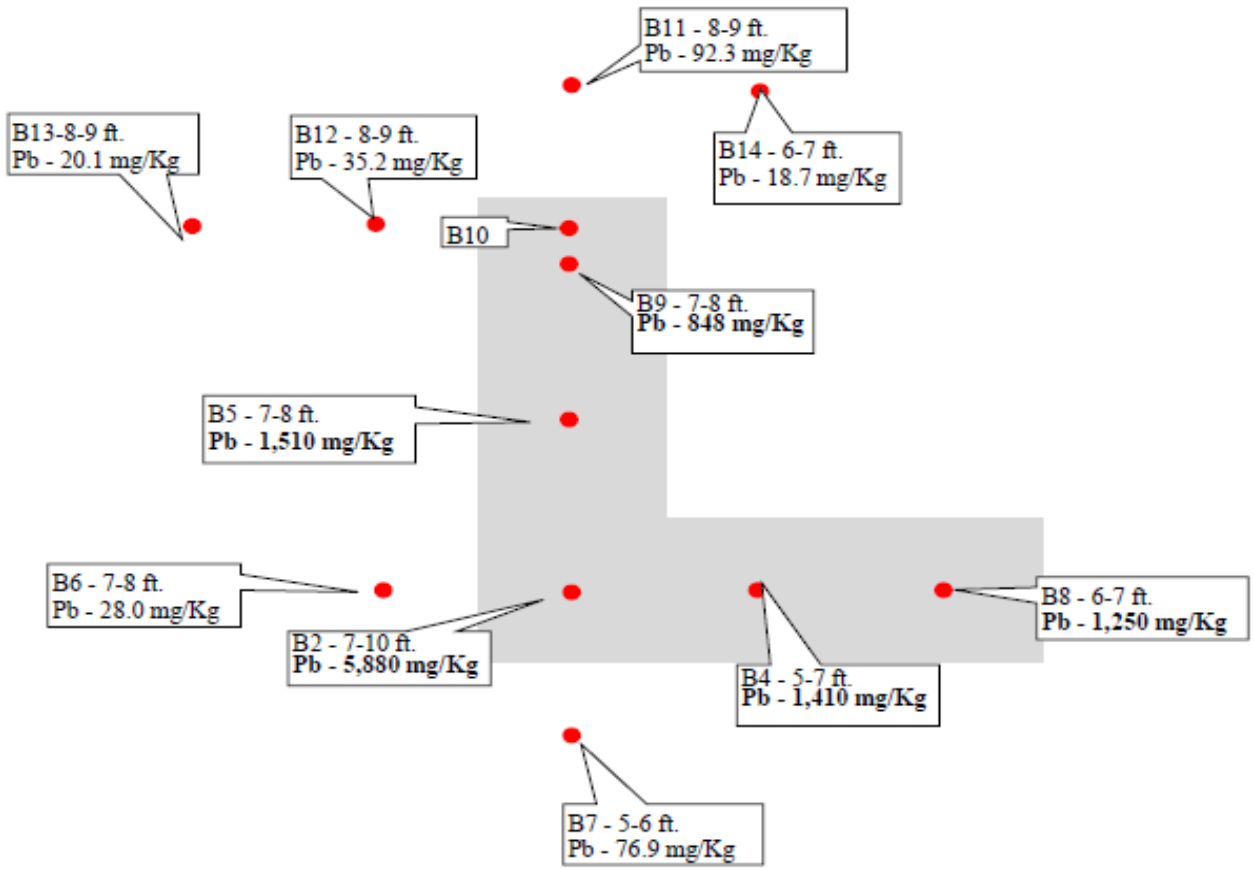
- Total and dissolved Lead in groundwater was below reporting levels in the area of highest concentrations of Lead.



ETRI
Environmental Technology Resources, Inc.
4780 Ashford Dunwoody Rd.
Suite A-456
Atlanta, Georgia 30338

Project No.	Scale	Date
19-064	Not to Scale	5-18-2020

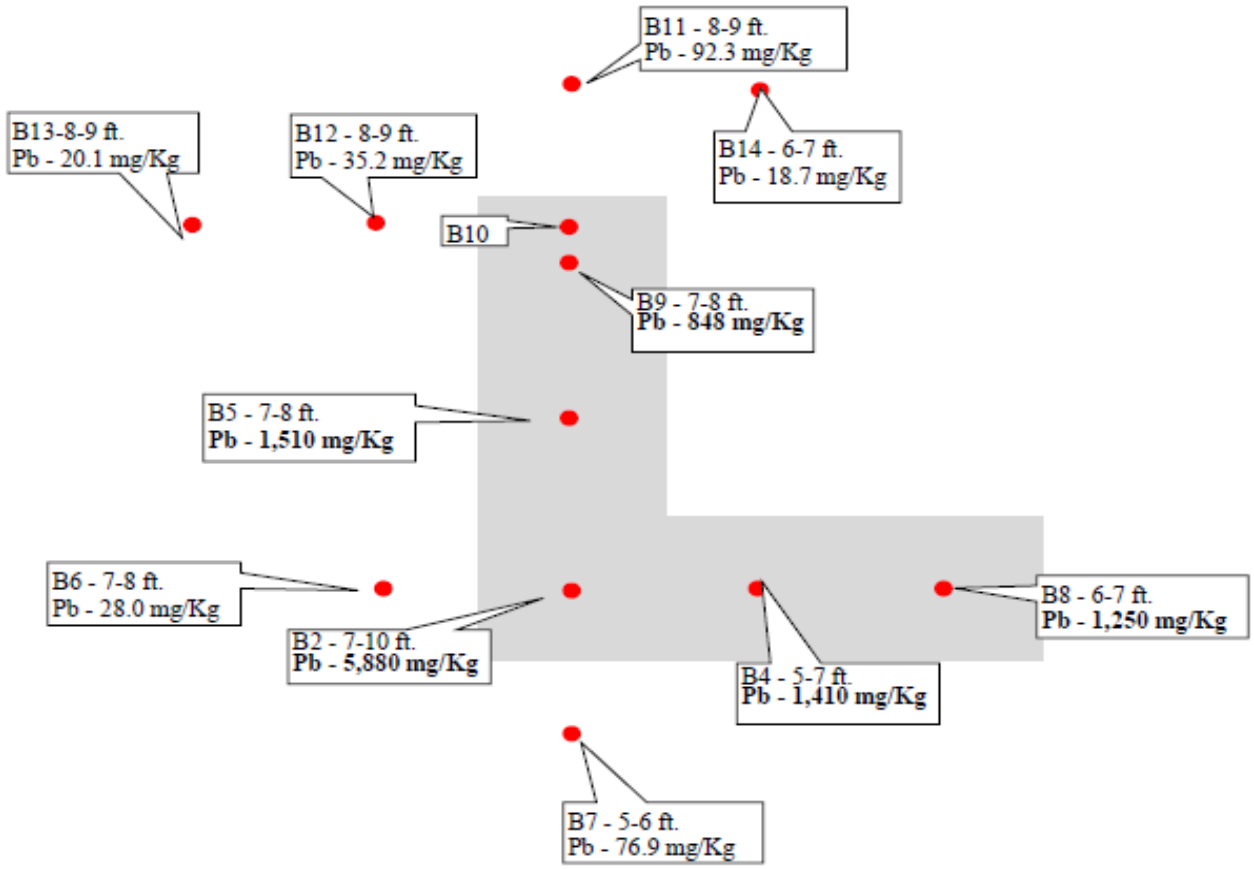
FIGURE 3
SOIL SAMPLE ANALYTICAL RESULTS - 0-12 inches
825 Warner Street
Atlanta, Georgia



ETRI
Environmental Technology Resources, Inc.
4780 Ashford Dunwoody Rd.
Suite A-456
Atlanta, Georgia 30338

Project No.	Scale	Date
19-064	Not to Scale	5-18-2020

FIGURE 5
SOIL SAMPLE ANALYTICAL RESULTS - 5-10 feet
825 Warner Street
Atlanta, Georgia



ETRI Environmental Technology Resources, Inc. 4780 Ashford Dunwoody Rd. Suite A-456 Atlanta, Georgia 30338			**FIGURE 6** **SOIL SAMPLE ANALYTICAL RESULTS -** **Greater than 10 feet** **825 Warner Street** Atlanta, Georgia
	Project No. 19-064	Scale Not to Scale	Date 5-18-2020

2.2 Volumetric Estimate of Contaminated Soils Requiring Corrective Actions

Utilizing the data developed during the June 2019 soil sampling, the approximate volume of soil that will require corrective actions was estimated. The following is a discussion of the volumetric estimate of contaminated soils that will require corrective actions at the Trees Atlanta site. Figures showing details on the areas to be excavated are included in Figures 7 and 8.

Surface Soils

Eleven surface soil samples were collected and were analyzed for total RCRA Metals. The total Lead concentration in samples collected from soil borings B2, B4 and B5 exceed the Type 3 RRS of 400 mg/Kg. The sample collected from boring B2 was found to have a total Lead concentration of 1,390 mg/Kg which exceeds the Type 4 RRS of 1,050 mg/Kg.

Excavation Plan – Surface Soils (see Figure 7)

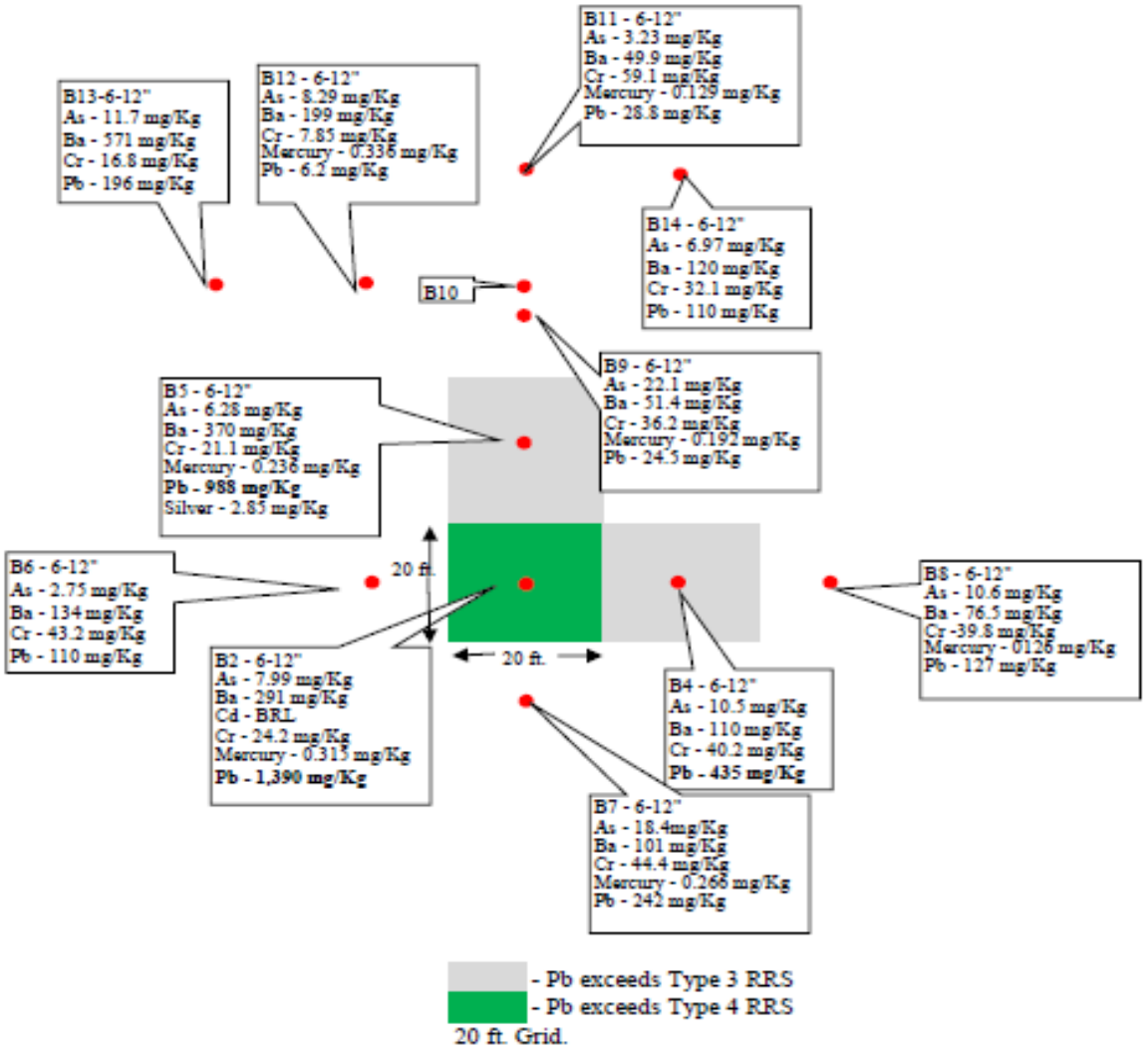
- Remove the upper 12 inches of soil in the area of boring B2. The dimensions of the excavation are estimated to be 20 feet by 20 feet.
- Estimated volume of soil – 15 yd^3

Subsurface Soils

Subsurface soil samples were collected from eleven soil borings. Soil samples collected from boring B2 at 7-10 feet, B4 at 5-7 feet, B5 at 7-8 feet, B8 at 6-7 feet and B9 at 7-8 feet were found to have total Lead concentrations greater than the Type 3 RRS. The concentrations of total Lead in boring B2 at 7-10 ft. (5,880 mg/Kg), B4 at 5-7 ft. (1,410 mg/Kg) and B5 at 7-8 ft. (1,510 mg/Kg) exceed the Type 4 RRS.

Excavation Plan – Area of borings B2, B4 and B5 (see Figure 8)

- Excavate soils in an area measuring 45 feet by 20 feet and an adjoining area measuring 20 feet by 20 feet to a depth of 12 feet below ground surface.
- Estimated volume of soil – 563 yd^3



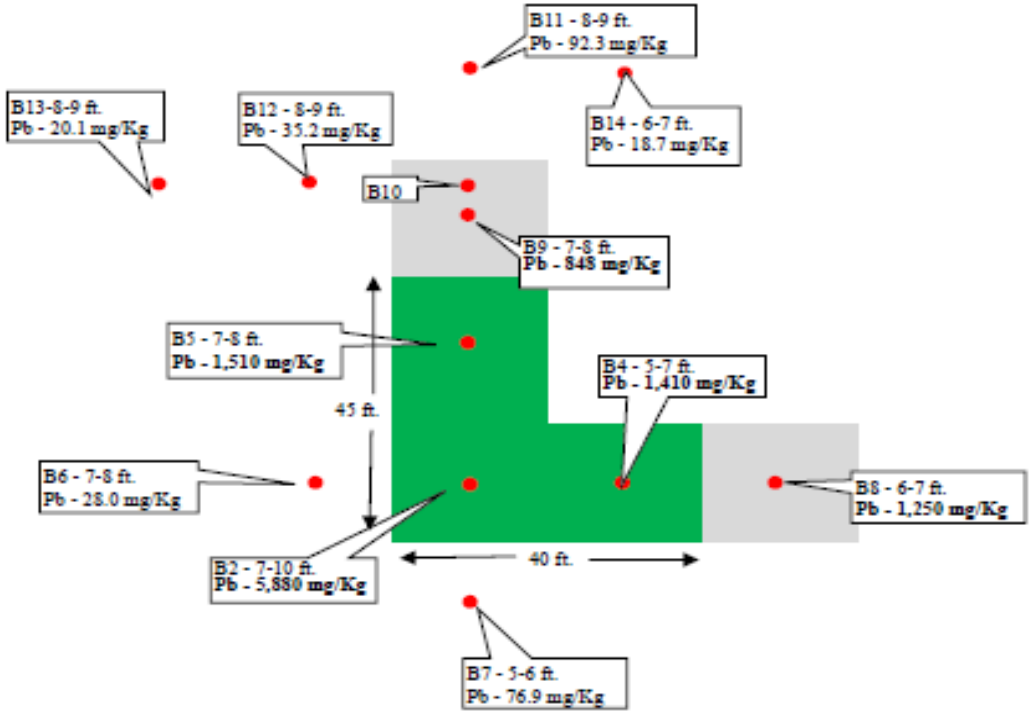
Lead Cleanup Level - 1,050 mg/Kg

Soil Quantity - 0-12 inches
20 ft. x 20 ft. x 1 ft. = 400 ft3 = 15 cubic yards

ETRI
Environmental Technology Resources, Inc.
4780 Ashford Dunwoody Rd.
Suite A-456
Atlanta, Georgia 30338

Project No.	Scale	Date
19-064	Not to Scale	5-18-2020

FIGURE 7
EXCAVATION PLAN - DEPTH - 0-12 inches
825 Warner Street
Atlanta, Georgia



Lead Cleanup Level - 1,278 mg/Kg

Soil Quantity - 1-12 feet
45 ft. x 20 ft. x 12 ft. = 10,800 ft3 = 400 cubic yards
minus 15 cubic yards = 385 cubic yards
20 ft. x 20 ft. x 12 ft. = 4,800 ft3 = 178 cubic yards

ETRI
Environmental Technology Resources, Inc.
4780 Ashford Dunwoody Rd.
Suite A-456
Atlanta, Georgia 30338

Project No.	Scale	Date
19-064	Not to Scale	5-18-2020

FIGURE 8
EXCAVATION PLAN - DEPTH - 1-12 feet
825 Warner Street
Atlanta, Georgia

3.0 SOIL REMEDIATION

3.1 Remedial Action Approach

The objective of the corrective action measures will be to achieve compliance with Type 4 risk reduction standards applicable to soils on the subject property.

3.1.1 Soil Corrective Actions

The planned corrective actions for the Trees Atlanta site will involve the excavation and off-site disposal of Lead contaminated soils. Soils that exceed risk reduction standards will be excavated using heavy equipment (track hoe or equivalent). The excavated soils will be placed into trucks and will be transported to a Subtitle D landfill.

An estimated 809 tons of Lead contaminated soils will be excavated and disposed in a Subtitle D Landfill.

The soil excavation plan will be conducted in accordance with the estimated volume of soil requiring corrective actions as presented in Section 2.2.

3.1.2 Erosion and Sediment Control Measures

Prior to implementing corrective actions on soils, an Erosion and Sediment Control Plan may need to be prepared for the project. Measures will be taken to minimize erosion and control the loss of sediment during the implementation of corrective actions. The goal will be to prevent the spread of soil from the work area by spillage, dust, vehicle traffic and storm water. This will include the use of siltation fencing, hay bales and removal of soil on tires and trucks prior to exiting the property. Excavation will only take place during dry conditions.

Spillage could occur during transport of the soil into dump trucks. This type of spillage will be monitored and controlled by not overfilling the bucket of the loader. All contact equipment including excavators, loaders and other heavy machinery will be decontaminated prior to leaving the work area. All heavy equipment will be manually brushed and scraped followed by a pressure wash as necessary prior to leaving the site.

3.2 Management, Profiling and Disposal

Prior to implementing corrective actions, the selected contractor will submit a waste profile to the land disposal facility. The purpose of the waste profile is to document the contaminants and contaminant concentrations and ensure acceptability by the landfill.

The soils that exceed risk reduction standards will be placed directly into dump trucks and will be hauled to the designated facility for disposal. Waste manifests will accompany each load that is hauled and disposed. No treatment of the soil is planned prior to its disposal.

3.3 Confirmation Sampling and Analyses

After completing the soil excavation, soil samples will be collected from the side walls and pit bottom of the excavation to confirm that remaining soils have concentrations of contaminants are below applicable risk reduction standards. The confirmation samples will be collected in accordance with the approved Quality Assurance Project Plan. Based on the results of the investigations conducted in 2019, the confirmation sample analyses will be limited to total Lead.

The analytical results for total Lead will be compared to the remediation level goals that have been established. Sidewall and pit bottom samples will be collected using a stainless steel hand auger. All samples will be grab samples and no composite samples will be collected for analyses. Sidewall samples will be collected from each designated excavation area. Samples will be collected at a frequency of approximately every 25 linear feet. Pit bottom samples will be collected at a rate of one sample per 625 square feet.

3.4 Permitting

As noted, an Erosion and Sediment Control Plan may need to be prepared for this project. If required, the Erosion and Sediment Control Plan will be submitted to local authorities for approval.

3.5 Health and Safety

All corrective action work will be performed in compliance with all applicable OSHA regulations and in accordance with a Site Specific Health and Safety Plan (SSHASP).

The SSHASP provides measures for measuring, monitoring, and controlling exposure of workers for hazardous compounds during site cleanup and provides for monitoring and controlling work conditions to ensure a safe working environment. The selected contractor will be required to provide their own SSHASP in accordance with OSHA requirements and in accordance with the specific requirements of the contractor.

3.5 Schedule

A schedule for corrective actions has been developed which includes beginning and ending dates for corrective actions as well as specific activities within the project. **Table 5** identifies the activities and the activity start and end date.

Table 5
Corrective Action - Project Schedule
Trees Atlanta, Atlanta, Georgia

Activities	**Activity Start Date**	**Activity End Date**
Receive Proposals from Contractors	June 22, 2020	June 22, 2020
Select Contractor	July 1, 2020	
Begin Soil Excavation	August 3, 2020	August 10, 2020
Collect Confirmation Soil Samples	August 5, 2020	August 10, 2020
Obtain Results of Confirmation Soil Samples	August 6, 2020	August 11, 2020
Transport and Dispose of Contaminated Soils	August 6, 2020	August 10, 2020
Site Restoration	August 11, 2020	August 12, 2020

Appendix F

AES Laboratory QAM

Standard Operating Procedure for the

Quality Assurance Manual

Analytical Environmental Services, Inc.
3080 Presidential Drive
Atlanta, Georgia 30340-0370
(770) 457-8177
FAX (770) 457-8188

Effective Date of Revision 24: February 20, 2019
Portal Server Location:
http:// Home/Documents/Quality Assurance/QA Manual/
AES_2019_QA_Manual_Rev_24

Andria Yildirim, President — Date 2/11/2018
808 Barn Owl Road
Marietta, Georgia 30068-2478
(770) 913-9431 phone

Mehmet Yildirim, VP of Operations / Laboratory Manager — Date 2/11/2019

Dana Till, Technical Director — Date 2/11/19

James Wallace, Technical Director Microbiology — Date 2/11/19

Douglas Mendrala, Quality Assurance Manager — Date 2/11/19

STANDARD OPERATING PROCEDURES FOR THE
QUALITY ASSURANCE PROGRAM

2.0 TABLE OF CONTENTS

2.0 TABLE OF CONTENTS (cont.)

2.0 TABLE OF CONTENTS (cont.)

2.0 TABLE OF CONTENTS (cont.)

2.0 TABLE OF CONTENTS (cont.)

3.0 STATEMENT OF POLICY

3.1 Quality Policy: The objective of Analytical Environmental Services, Inc is to generate high quality data in a cost effective manner, which is accurate, impartial, reliable, and adequate for its intended use. Management of AES is committed to following accepted laboratory practices to achieve high quality of testing services, and strives to ensure both the analytical validity and legal defensibility of all reported data.

AES management is committed to compliance with The NELAC Institute (TNI) Standards, AIHA-LAP, LLC International Standard (ISO/IEC 17025) as well as North Carolina and South Carolina rules to establish, implement, and maintain a quality system appropriate to the scope of all laboratory activities, including the type, range, and volume of testing. Management is committed to the accepted professional laboratory practices and shall document the policies, systems, programs, procedures, and instructions to the extent necessary to enable AES to assure the quality of the test results generated. Management is committed to good professional laboratory practice to meet customer requirements with quality service.

Quality system documentation is communicated to, understood by, and made available to personnel through AES management by means of training and educational instruction. All laboratory staff concerned with analytical testing activities must familiarize themselves with the quality documentation and implement the policies and principles in their work. It is the policy of AES to continually improve quality systems and provide support to improvement efforts.

3.2 Purpose: The Quality Assurance Program (QAP) sets forth the management policy, organizational structure, and procedures for chemical analyses performed by AES. Management encourages the development and use of the best testing practices as dictated by each measurement situation. However, the procedures set forth herein must be followed to the greatest extent possible. All deviations must be documented in each individual case and maintained with the sample data. The QA Manual and all Standard Operating Procedures will be reviewed no less than annually.

Appropriate use of data generated under the varying conditions encountered in environmental analyses requires reliance on the quality control practices incorporated into the procedures. Although the EPA, state environmental protection departments, The NELAC Institute (TNI), AIHA-LAP, LLC, other regulatory agencies, and clients require the use of approved methods for sampling and analysis, the mere approval of these procedures does not guarantee adequate results. Inaccuracies can result from many causes, including matrix effect, equipment malfunction, and operator error. Therefore, the quality control component of each method is indispensable and cannot be compromised.

This manual delineates the elements of the QA Program that must be implemented by all analytical sections of the laboratory. The requirements outlined in this procedure are the minimum requirements. Method-specific procedures and project-specific Quality Assurance Project Plans (QAPP) may require more stringent QA requirements.

3.3 Definitions

3.3.1 Quality Assurance (QA) is the total program for assuring reliability of the monitoring and measurement of data. It comprises all those planned and systematic actions necessary to provide adequate confidence that all aspects of laboratory service programs are performed in a manner satisfactory to AES management and to the needs of its customers.

3.3.2 Quality Control (QC) is the routine application of procedures for obtaining prescribed standards of performance in the monitoring and measurement process. It encompasses the operational procedures, techniques, and activities that provide the means to measure, evaluate and document

the quality of data obtained in the laboratory. The QC Program specifies the minimum practices, which shall be used to assure that data is produced of a known and defensible quality and within acceptable limits.

3.4 Fields of Testing

This manual covers methods for the analysis of aqueous, solid, waste, and air matrices currently on AES scopes of accredited testing for AIHA-LAP, LLC, Florida DOH, The NELAC Institute (TNI), North Carolina DENR and South Carolina DHEC. A detailed list of test methods and analytes may be found in Section 5.0, which defines the minimum level of quality assurance/quality control needed to meet required specifications. All methods carried out by AES shall meet these stipulations 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 stated. In these cases, the laboratory will abide by the more stringent criteria, following a review and acceptance of the requirements by the Laboratory Manager and the Quality Assurance Manager.

3.5 Management of the Quality Assurance Manual

This manual was prepared in accordance with the current The NELAC Institute (TNI) standards and AIHA-LAP, LLC requirements. It also follows guidelines set by the U.S. Environmental Protection Agency, Florida DOH and ISO/IEC 17025. Tests are always carried out in accordance with stated methods and customers' requirements.

3.5.1 The QA manual is reviewed annually by the Quality Assurance Manager and laboratory personnel to confirm that it reflects current in-house practices and meets all the requirements of both AES' clients and accrediting agencies. Modifications may be made in order to correct inconsistencies, implement improvements, encompass new concepts or procedures, adapt to new regulations, or update any changes in state or national policies or standards. The Quality Assurance Manager, Laboratory Manager, Technical Director, and relevant operational staff review the changes before they are integrated into the QA manual.

3.5.2 Policies or procedures in the manual which demand immediate attention are addressed through the use of temporary and permanent Interim Change Notices as described in Section 8.

3.6 Control of the Quality Assurance Manual

The Quality Assurance Manual is considered confidential within Analytical Environmental Services, Inc. It may not be altered in any manner by anyone other than the Quality Assurance Manager, the Laboratory Manager, or an employee duly appointed by either of the aforementioned. The manual shall be marked as an "Uncontrolled Copy" if provided to external users or regulators. It is intended for the exclusive purpose of the review of AES' quality systems and shall not be used in any other way without written permission of the President, Laboratory Manager, or Quality Assurance Manager.

3.7 Order of Precedence

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

1. Analytical Environmental Services, Inc., Interim Change Notice
2. Quality Assurance Manual
3. Standard Operating Procedures
4. Other (memos, charts, published methods, etc.)

4.0 ORGANIZATION AND RESPONSIBILITY

4.1 Organization

Analytical Environmental Services, Inc. is a locally owned, permanent laboratory facility that

performs chemical and biological testing on a variety of environmental samples. These include solid waste matrices, soils, sediments, fibrous wastes, polymeric emulsions, filter cakes, spent carbons, spent catalysts, air sampling media, ground, surface and waste waters, aqueous sludges, caustic liquors, acid liquors, waste solvents, oily wastes, and tars.

4.2 Organizational Structure

The relationship between management, technical operations, support services and quality system is as follows: Laboratory Operations, Quality Assurance Department, Technical Director, and Customer Service Department report to the Vice President of Operations, who in turn reports to the company President. The Vice President of Technical Operations (Support Services) also reports directly to the President. The organizational structure of AES provides for an independent Quality Assurance Department with the overall responsibility of developing and auditing for compliance to a comprehensive Quality Assurance Program. The QA Department has the authority and organizational freedom to ensure that QA activities are implemented and accomplished. The Quality Assurance Manager reports directly to the Vice-President of Operations of AES.

4.2.1 Because of the breadth of knowledge required to produce quality data, the cooperation of numerous individuals is required. All assigned personnel shall remain diligent to identify, report, and promptly rectify issues or events affecting data quality as they occur. To encourage the identification of these situations, management at all levels shall promote continuous quality improvement throughout the entire company. These events and their resolutions must be verified and substantiated as required by this document and any other applicable QA guidelines.

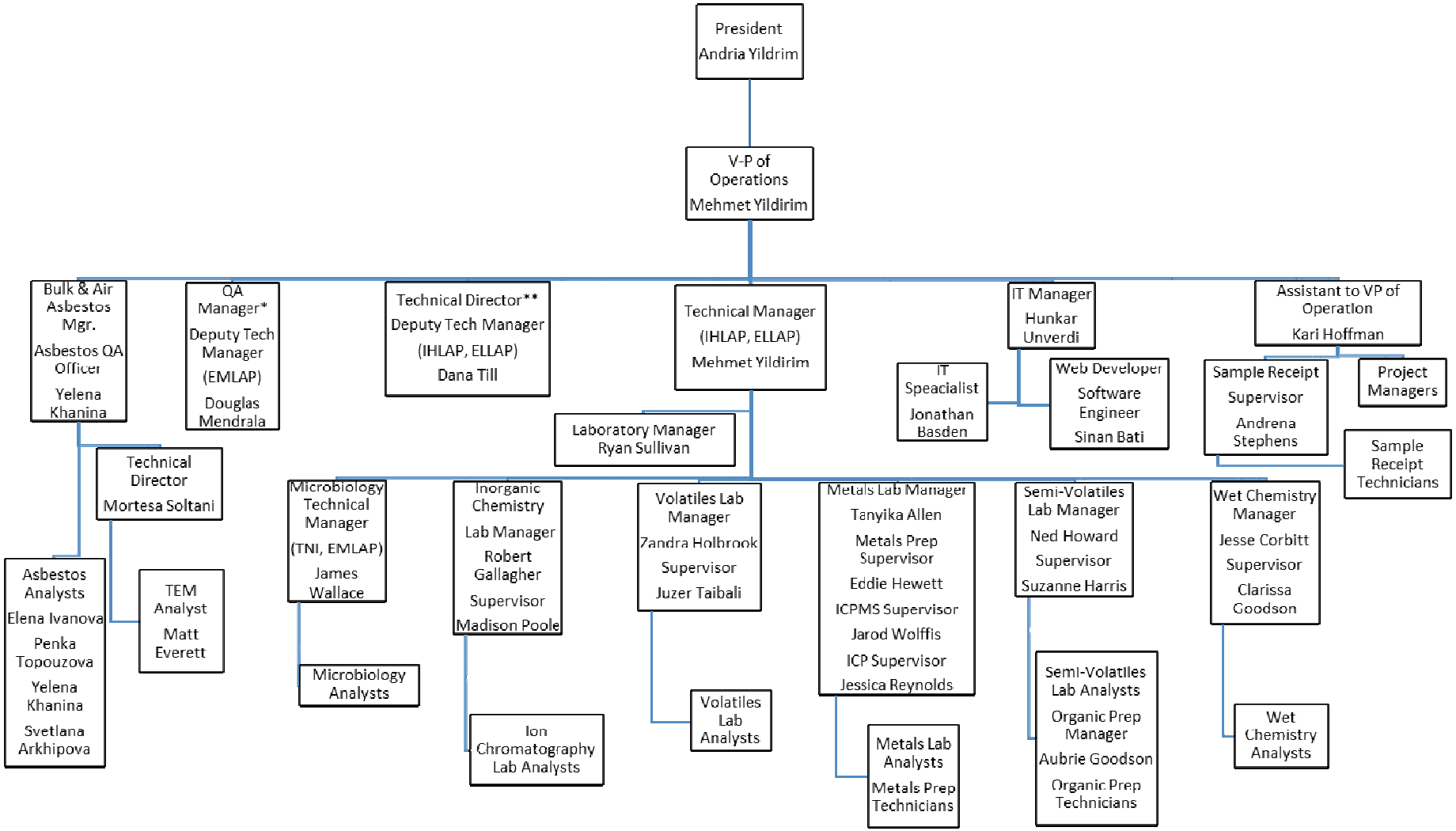
4.2.2 The establishment of a Quality Assurance Program requires the services of all the employees of AES in order to carry out the monitoring, record keeping, statistical techniques, and other functions required by the system. This total commitment of all personnel to the production and reporting of reliable data is dependent upon the conscientious effort of everyone involved. It is important, therefore, that each member of the organization have a clear understanding of his duties, responsibilities, and relationship to the total effort.

4.3 Organizational Chart

The organizational structure at AES is documented in the form of an organizational chart, Figure 4-1, which identifies the personnel involved in the production of quality data and depicts the lines of communication and responsibility throughout the entire organization.

Figure 4-1, ORGANIZATIONAL CHART

Analytical Environmental Services, Inc.



*TNI: The QA Manager will serve as deputy in the event of the Technical Director's absence.
**TNI: The Technical Director will serve as deputy in the event of the QA Manager's absence.

For AIHA-LAP LLC accreditation: The Laboratory Technical Director will serve as deputy for the IHLAP and ELLAP Technical Manager. The Laboratory Technical Director will also serve as deputy for the IHLAP and ELLAP Quality Assurance Manager. The Laboratory Quality Assurance Manager will serve as deputy for the EMLAP Microbiology Technical Manager and the Microbiology Quality Assurance Coordinator.

4.4 Responsibilities and Position Requirements

It is the responsibility of all AES employees to implement the Quality Assurance Program effectively. The roles and responsibilities of the technical management and the Quality Assurance Manager to ensure compliance with the regulatory standards (including AIHA-LAP, LLC and NELAC) are outlined in the position descriptions below. All chemists and technicians are responsible for understanding and following the measures of the QA program, and for reporting any quality failures to a Manager or Supervisor in a timely manner. Supervisors and Managers are responsible for ensuring that all laboratory personnel are familiar with the requirements of the Quality Assurance Program and that these requirements are implemented and maintained. It is the responsibility of the Supervisor to ensure that all laboratory personnel are trained to perform their assigned tasks. It is the responsibility of each Supervisor to ensure that any quality failures are reported to the Quality Assurance Department immediately.

The essential personnel involved in the implementation of and/or monitoring of the Quality Assurance Program are identified in the following sections.

4.4.1 President

The President is ultimately responsible for the quality of services provided by AES. The President is also responsible to establish and implement the procedures, policies, and findings of the QA program. The President is responsible for the commitment of delivering the appropriate tools and resources to the senior level staff and laboratory management to ensure that the overall QA program and clients needs can be met. The President authorizes the Quality Assurance Manager to perform internal audits on behalf of the company.

4.4.2 Vice-President of Operations

The Vice-President of Operations is responsible for the overall operation of the laboratory and reports directly to the President. The Vice-President of Operations ensures that all of the resources are available to implement and follow the procedures and policies as written in the AES QA Manual as well as management's commitment to compliance with The NELAC Institute (TNI) Standards. The Vice-President of Operations reviews and approves the Corporate Quality Assurance Manual. The Vice-President of Operations also authorizes the Quality Assurance Manager to perform internal audits on behalf of the company.

Either the President or Vice-President of Operations will conduct the annual management review of laboratory operations to assess the effectiveness of policies and procedures in order to implement changes where deemed necessary. The agenda of the annual meeting will include reports from all department supervisors and cover such topics as quality assurance, accreditations, documentation, changes in the laboratory, equipment and maintenance needs, results of audits etc. The topics to be discussed will be determined by the President or Vice-President of Operations. A current list of topics is presented in Attachment 6.

4.4.3 Vice-President of Technical Services

The Vice-President of Technical Services reports directly to the President and is responsible for the selection and trouble-shooting of all equipment and instrumentation. The Vice-President of Technical Services is also responsible for the installation, maintenance, and data management associated with all computers, automated equipment, network systems, software, and Internet services, as well as the Laboratory Information Management System (LIMS). The Vice-President of Technical Services ensures that all computers and automated equipment used for acquiring, processing, manipulating, recording, reporting, retrieving, or storing test data meet all of AES' Quality Assurance objectives, and that all computer software is documented and adequate for use.

This position provides for the protection of the integrity of all electronic data. All computers and automated equipment must be maintained to ensure proper functioning, which includes providing environmental and operating conditions necessary to maintain the integrity of the test data. The Vice-President of Technical Services establishes and implements appropriate procedures for ensuring electronic data security.

4.4.4 Laboratory Manager

The Laboratory Manager is responsible for the daily operations within the analytical sections of the laboratory. If the Laboratory Manager is absent for a period of time exceeding 15 consecutive calendar days, the Vice-President of Operations must designate another full-time staff member meeting the qualifications of the Laboratory Manager to temporarily perform this function. In case of a change of Laboratory Manager, all necessary, accrediting authorities must be notified in writing within thirty days. The following is the position description for Laboratory Manager:

Position Description and Requirements

Position Title: Laboratory Manager

Position Description: This position is responsible for the following:

- Oversees the daily operations of the laboratory.
- Ensures that client specific reporting & quality control requirements are met.
- Works with the Project Managers and Department Managers to ensure project objectives are met in a timely manner.
- Sets goals and objectives for both the business and the laboratory employees.
- Provides direction to departmental managers to steer all departmental efforts toward the overall corporate production goals.
- Discusses and resolves disagreements, as necessary, with laboratory personnel.
- Coordinates any unresolved concerns between the project managers and the departmental supervisors.
- Ensures that all analysts and supervisors have the appropriate education & training to properly carry out the duties assigned to them, and ensures that this training has been documented.
- Ensures that a sufficient number of qualified personnel are employed to supervise and perform the work of the laboratory.
- Ensures that HR policies are adhered to and maintained.
- Ensures management's commitment to compliance with The NELAC Institute (TNI) Standards
- Ensures compliance with International Standard ISO/IEC 17025
- Hires key personnel and recruits professional talent.
- Reviews and approves all SOPs prior to their implementation and ensures all approved SOPs are implemented and adhered to.
- Schedules analytical operations.
- Supervises the maintenance of instruments and the scheduling of repairs.
- Ensures that appropriate corrective actions are taken to address analyses as requiring such actions by internal & external performance or procedural audits.
- Ensures that personnel are free from any commercial, financial or other undue pressures that which adversely affect the quality of their work.
- Supervises the preparation & maintenance of laboratory records.
- Responsible for holding documented meetings as needed with the departmental supervisors.

Position Requirements: BA or BS in Chemistry, Microbiology, Biology, Environmental Science or any other related degree. Must have 2-5 years of experience carrying out the duties described above.

4.4.5 Quality Assurance Manager

The QA Manager is responsible for establishing a Quality Assurance Program that meets the quality assurance objectives of the company, and its clients. If the QA Manager is absent for a period of time exceeding 15 consecutive calendar days, the Vice-President of Operations must designate another full-time staff member meeting the qualifications of the QA Manager to temporarily perform this function. In case of a change of QA Manager, all necessary accrediting authorities must be notified in writing within thirty days. The following is the position description for Quality Assurance Manager:

Position Description and Requirements

Position Title: Quality Assurance Manager

Position Description: This position is responsible for the following:

- Directs all corporate quality assurance (QA).
- Responsible for developing and maintaining all QA systems and documentation.
- Responsible for all aspects of the State and Federal Certification processes.
- Maintains records of acceptable performance of MDLs.
- Directs management to compliance to the AIHA-LAP, LLC Accreditation Policies
- Directs management to compliance with The NELAC Institute (TNI) Standards
- Ensures compliance with International Standard ISO/IEC 17025
- Has authorization from company President and VP of Operations to conduct internal audits
- Maintains all quality control charts.
- Has direct access to the Technical Director and to the highest level of management where decisions are made on laboratory policy and resources.
- Serves as focal point for QA/QC; has responsibility for the oversight and review of quality control data.
- Functions independently from laboratory operations for which QA oversight is held.
- Evaluates data objectively and performs assessments without outside influence.
- Performs periodic reviews of test reports under AIHA-LAP, LLC according to the LQSR.
- Conducts internal audits on the entire laboratory technical operation annually.
- Notifies laboratory management of deficiencies in the quality system and monitors corrective action.
- Maintains currency of the QA manual.
- Responsible for preparing/submitting a quarterly report to the President and Vice-President of Operations.
- Serves as deputy in the event of the Technical Director's absence.

Position Requirements: Must have a BA or BS in Chemistry, Microbiology, Biology, Environmental Science or any other related degree. Must have 2-5 years of experience carrying out the duties described above.

4.4.6 Department Director

The Department Director reports to the Vice President of Operations / Laboratory Manager and is responsible for the administrative functions within the assigned department(s). This includes but is not limited to non-production activities such as monitoring Demonstrations of Capabilities, oversight of Standard Operating Procedure updates, Method Detection Limits Studies, as well as departmental instrument maintenance and quality assurance assignments. In addition, the Department Director is responsible for assuring adequate staffing and training.

Position Description and Requirements

Position Title: Department Director (If Applicable)
Position Description: This position is responsible for the following:

- Oversees the daily operations of the laboratory.
- Ensures that client specific reporting & quality control requirements are met.
- Works with the Project Managers and Group Team Leaders to ensure that project objectives are met in a timely manner.
- Sets goals and objectives for both the business and the laboratory employees.
- Provides direction to departmental managers to steer all departmental efforts toward the overall corporate production goals.
- Discusses and resolves disagreements, as necessary, with laboratory personnel.
- Coordinates any unresolved concerns between the project managers and the departmental supervisors.
- Ensures that all analysts and supervisors have the appropriate education & training to properly carry out the duties assigned to them, and ensures that this training has been documented.
- Ensures that a sufficient number of qualified personnel are employed to supervise and perform the work of the laboratory.
- Ensures that HR policies are adhered to and maintained.
- Ensures management's commitment to compliance with The NELAC Institute (TNI) Standards
- Hires key personnel and recruits professional talent.
- Reviews and approves all SOPs prior to their implementation and ensures all approved SOPs are implemented and adhered to.
- Schedules analytical operations.
- Supervises the maintenance of instruments and the scheduling of repairs.
- Ensures that appropriate corrective actions are taken to address analyses as requiring such actions by internal & external performance or procedural audits.
- Ensures that personnel are free from any commercial, financial or other undue pressures that which adversely affect the quality of their work.
- Supervises the preparation & maintenance of laboratory records.
- Responsible for holding documented meetings as needed with the departmental supervisors.

Position Requirements: A Degree or the necessary experience to achieve the requirements outlined in the position description. Must have 2-5 years of experience carrying out the duties described above.

4.4.7 Technical Director

The Technical Director exercises daily supervision of laboratory procedures and the reporting of results. If the Technical Director is absent for a period of time exceeding 15 consecutive calendar days, the Vice-President of Operations must designate another full-time staff member meeting the qualifications of the Technical Director to temporarily perform this function. In case of a change of Technical Director, all necessary accrediting authorities must be notified in writing within thirty days. The following is the position description for Technical Director:

Position Description and Requirements

Position Title: Technical Director

Position Description: This position is responsible for the following:

- Updates SOPs as required.

- Maintains Test Codes
- Ensures that all employees are properly trained
- Reviews and approves revisions to the Quality Assurance Manual.
- Maintains records of employee training including acceptable performance of IDOCs.
- Provides technical assistance in the development of new methods.
- Responsible for following direction given by the Vice-President of Operations.
- Ensures management's commitment to compliance with The NELAC Institute (TNI) Standards
- Ensures compliance with International Standard ISO/IEC 17025
- Provides technical guidance to analytical staff.
- Assists with internal and external audits.
- Ensures that appropriate corrective actions are taken to address analyses identified as requiring such actions by internal and external performance or procedural audits.
- Oversees equipment maintenance and repair.
- Assists the Laboratory Manager in the investigation of new technologies and proposed equipment acquisitions by the laboratory.
- Serves as deputy in the Quality Manager's absence.

Position Requirements: A Bachelors Degree in chemical, environmental, biological, or physical sciences or engineering, with at least 24 college semester credit hours in chemistry and at least two years of experience in the environmental analysis of representative inorganic and organic analytes for which the laboratory seeks or maintains accreditation. A Masters or Doctoral Degree may be substituted for one year of experience.

4.4.8 Technical Assistant

The Technical Assistant reports directly to the Technical Director and assists with the implementation and maintenance of all programs assigned to the Technical Director.

Position Description and Requirements

Position Title: Technical Assistant

Position Description: This position is responsible for the following:

- Schedules, tracks and provides preliminary document review for DOC studies.
- Performs SOP updates as instructed from Tech. Director.
- Maintains SOP document control system.
- Scans and publishes completed documents to Portal Server for archiving.
- Schedules and documents training sessions and staff meetings held by Tech. Director.
- Assists Tech. Director with development of training program content and media.
- Assists Tech. Director with day-to-day functions of the Tech. Direction Dept. as needed.

Position Requirements: A Bachelors Degree in a science or engineering based major.

4.4.9 Director of Project Management

The Director of Project Management serves as a liaison between the laboratory and its clients ensuring the delivery of reports and data packages. The following is the position description for the Director of Project Management:

Position Description and Requirements

Position Title: Director of Project Management

Position Description: The Director of Project Management serves as a liaison between the laboratory and its clients, and ensures delivery of data packages. Responsibilities include:

- Meets client specifications by communicating project and QA requirements to the laboratory.
- Assigns project managers.
- Notifies laboratory personnel of incoming projects and sample delivery schedules and requirements.
- Monitors the status of data package projects in-house to ensure timely and accurate delivery of reports.
- Informs clients of data package related problems and resolves service issues.
- Coordinates requests for sample containers and other services such as data packages.
- Reviews and approves, with input from the Vice-President of Operations, proposals for marketing.
- Reviews laboratory data reports and quotes.

Position Requirements: High School diploma or equivalent, at least 2 years management or supervisory experience, strong computer and personnel skills, knowledge of the environmental and chemical sciences, and previous project management experience.

4.4.10 Project Manager

The Project Manager is responsible for directly ensuring that the individual client's needs are met on a project-by-project basis with respect to the laboratory's QA program and any project-specific QA programs. The Project Manager is responsible for disseminating any project-specific information to the Laboratory Manager and/or Laboratory Director. Non-routine QA requirements must be approved by the Laboratory Director and Laboratory Manager. The following is the position description for Project Manager:

Position Description and Requirements

Position Title: Project Manager

Position Description: This position is responsible for the following:

- Ensures effective and accurate communication between the client and the laboratory.
- Handles all client requests and needs.
- Utilizes any corporate documents to consult with clients about client questions or concerns.
- Responsible for notifying the Director of Project Management of any client activities that entail services that are not currently performed by AES.
- Assesses client requests with consultation with the Director of Project Management.
- Develops and maintains client records and requirements.
- Ensures that the laboratory is aware of, and completes, all client requests and requirements.
- Responsible for meeting with the Marketing Manager, Director of Project Management, and President on a periodic basis for marketing purposes.
- Communicates proper sampling, shipping, and receiving procedures to clients.
- Documents all client interaction and maintains all client information in the Project Management System.
- Reviews and approves data reports prior to their release to the clients.
- Ensures client specific reporting and quality control requirements are met.

Position Requirements: A Degree or the necessary experience to achieve the position requirements outlined in the Position Description.

4.4.11 Department Manager

Oversees daily operation of department(s), supervises all employees, and handles all issues in the department(s).

Position Description and Requirements

Position Title: Department Manager

Position Description: This position is responsible for the following:

- Supervise all employees to ensure they are working to full potential and being productive at all times.
- Handle all personnel issues, i.e. conflict between workers, inappropriate behavior, schedule changes, time-off requests, etc…
- Write warnings if needed.
- Ensure employee's time sheets reflect actual work schedule.
- Make sure clock in-out times are accurate.
- Make sure employees are coming to work at the designated time.
- Monitor employee breaks.
- Assign tasks to personnel using the Task Management software.
- Grade task upon completion, this is to be included in the employee's Performance Evaluation.
- The use of this software will also be used in performing supervisor's Performance Evaluation.
- Perform Employee Performance Evaluations on all employees in department.

Production responsibilities:

- Maintain backlog to ensure all samples are completed within holding time, due date, and that all special requirements are met.
- Keep track of inventory and order supplies as needed.
- Sufficient amounts of reagents, solvents, standards, etc… must be kept at all times so production is not affected because of a shortage of supplies.
- Identify and solve problems within the department including, but not limited to equipment, tests performed, and any other issues resulting from the preparation/analysis of samples.
- A supervisor is required to stay until problems are solved or rush work is completed to within a reasonable amount of time or hour (this includes staying late and working weekends.)
- Delegate work to employees.
- Assign batches and/or tests.
- Assign new tests to employees so workload can be spread evenly among staff.
- Assign duties to employees, i.e. ordering of supplies, logging in new supplies, etc…

QA Responsibilities:

- Ensure all employees are properly trained and DOC's performed.
- Ensure all CDOC's are performed on a yearly basis for all employees and for all tests.
- Ensure MDL's are completed/prepped yearly, more often where applicable, or as needed due to instrument changes/maintenance.
- Complete PT samples in a timely manner and identify any issues with test as soon as possible.
- If necessary, coordinate preparing/running of Proficiency samples with associated departments to ensure their timely completion and enough samples remain for all tests.
- QA review any data generated within department.
- Review and revise SOP's when necessary.
- Ensure all batches, logbook pages, raw data, & paperwork are scanned & posted onto the Portal Server.

Position Requirements: A Bachelors Degree in chemical, environmental, biological, or physical sciences or engineering and at least two years of experience in the environmental analysis representative of that which will be overseen.

4.4.12 Supervisors

Supervisors are responsible for the operation of their respective section of the laboratory, and report to the managers.

Position Description and Requirements

Position Title: Supervisors

Position Description: Supervisors report to their respective Manager on all aspects of sample processing. If a section does not have a supervisor, the Manager of that section functions as the supervisor. The Supervisor's responsibilities include, when applicable:

- Training and qualification of personnel (under their supervision) on procedures.
- Monitors necessary protocols and standard operating procedures, including control charts.
- Maintains QC within their area of responsibility.
- Ensures that personnel (under their supervision) use approved procedures, and maintain all instrumental QC.
- Recommends and implements new or revised QC policies as approved by the QA Manager.
- Assists Technical Director in reviewing preventative maintenance as detailed in the QA manual or SOPs.
- Reviews all data and QC results, and reports non-conformances to the appropriate QA Manager,
- Technical Manager, and/or Vice-President of Operations.
- Provides guidance to analysts in resolving problems encountered daily during sample preparation and analysis, in conjunction with the Technical Director or Quality Assurance Manager.
- Ensures all logbooks are maintained and current.
- Maintains adequate and valid inventory of reagents, standards, spare parts, and other relevant resources required to perform daily analysis.
- Assists Technical Director with MDLs and IDOCs.

Position Requirements: A Degree or the necessary experience to achieve the requirements outlined in the position description.

4.4.13 Analysts

Analysts are responsible for performing the various testing, digestive, and extractive procedures required in the laboratory.

Position Description and Requirements

Position Title: Analysts

Position Description: Each type of analyst position and the specific training required is described in detail in the Employee Training Files maintained by the Technical Director. In general, analysts are responsible for the following duties:

- Performs analyses by adhering to analytical and quality control protocols prescribed by SOPs, the QA manual, turn around times, rush analyses and short hold analyses, and project specific requirements (e.g. data packages).

- Documents standard and sample preparation, instrument calibration and maintenance, data calculations, and any observed non-conformances on work lists, bench sheets, or laboratory notebooks.
- Reports all out-of-control situations, instrument problems, matrix problems, and QC failures, which might affect the reliability of the data, to their respective supervisors or the QA Manager.
- Reviews all data generated prior to entering and submitting the data to the next level of review.
- Suggests method improvements to their supervisor, Technical Director, or the QA Manager for potential incorporation into SOPs.

Position Requirements: At a minimum, analysts must possess a high school diploma or equivalent. If the analyst operates ICP or GC/MS equipment, the analyst must satisfactorily complete a short course offered by an equipment manufacturer, professional organization, university, or other qualified training facility (formal in-house training is acceptable). The minimum experience requirement for the independent operation of AA, ICP, HPLC and GC is six months; 1 year for GC/MS equipment.

4.4.14 Project Manager Assistant

Project Manager Assistants are responsible for providing assistance to project managers with the production and completion of data packages.

Position Description and Requirements

Position Title: Project Manager Assistant

Position Description: Project manager assistants report to the project managers. This position is primarily responsible for assisting project managers with on time completion of all data packages and to ensure effective and accurate communication between lab and project managers with respect to data package status. In general project manager assistants are responsible for the following duties:

- Assigns data packages and completion dead lines to appropriate lab departments.
- Responsible for initial data package review after data package was completed by lab departments
- Responsible of notifying project managers or Director of Project Management of any internal problems or discrepancies that may affect data package on time completion.
- Responsible for formatting data package (inserting dividers, making table of contents, copying reports, COC and checklist, putting all data in appropriate order, etc);
- Responsible for setting bookmarks and creating CD ROM's, completing and updating data package status document (located on the AES Server) on the daily basis, and ensures that data package was scanned or copied after approved by the project manager

Position Requirements: A Degree or the necessary experience to achieve the requirements outlined in the position description.

4.5 Improper, Unethical, or Illegal Actions; Data Integrity System; and Confidentiality of Client Information and Proprietary Rights

4.5.1 It is recognized that the quality assurance program is an inherent function involving all of the organizational components and personnel. The achievement of quality objectives is attained by each individual performing assigned work in strict compliance with approved and applicable requirements and procedures.

4.5.2 For a quality assurance program to succeed, it is imperative that all employees adhere to procedures which detect and prevent improper, unethical, or illegal actions which could in any way compromise the reliability and data integrity. Training in legal, ethical, data integrity, and confidentiality of client

information and proprietary rights responsibilities is mandatory. Records are maintained that document, through individual signatures, that every employee understands the consequences of improper, unethical, or illegal actions related to data integrity. Potential instances of improper, unethical, illegal actions or Data Integrity issues will be discussed and addressed in senior management meetings.

4.5.3 Improper actions are defined as deviations from method-specified or client-specified analytical or quality assurance practices. These events may be intentional or unintentional. Disciplinary measures may include verbal warnings, written warnings, and/or dismissal.

4.5.4 Unethical or illegal actions are defined as the deliberate falsification or alteration of analytical or quality assurance results where failed method, quality control, or client specifications are made to appear acceptable. These actions affect the integrity of the data. Also included as unethical or illegal actions is the falsification and reporting of data where analyses were never performed. Disciplinary measures may include verbal warnings, written warnings, and/or dismissal. Findings of fraud may be prosecuted to the fullest extent of the law.

4.5.5 Employee training of legal, ethical, and data integrity responsibilities establishes the program and procedures that prevent and detect improper, unethical, or illegal actions by employees. Deterrence begins with a position of zero tolerance established by management. Employee training supports and sustains the policy.

4.5.5.1 Training of laboratory employees with respect to their legal and ethical responsibilities is comprised of three basic components:

4.5.5.1.1 The definition of improper, unethical, or illegal actions.

4.5.5.1.2 The elements of the laboratory's prevention and detection program.

4.5.5.1.3 Some examples of inappropriate laboratory practices that affect data integrity.

4.5.5.2 Training courses in legal and ethical responsibilities also include the potential punishments and penalties for fraudulent conduct.

4.5.6 Laboratory management implements a variety of proactive measures to promote the prevention and detection of improper, unethical, or illegal activities. Minimum requirements are included in the quality program by means of the following:

4.5.6.1 An ethics and data integrity policy that is read and signed by all personnel.

4.5.6.2 Initial and annual ethics and data integrity training.

4.5.6.3 Internal audits.

4.5.6.4 Anti-fraud language in client contracts and project agreements, where applicable.

4.5.6.5 Analyst notation and signature on manual integration changes to data and/or calculations.

4.5.6.6 Mandatory use of electronic and computer software audit functions wherever possible.

4.5.6.7 A no-fault policy that encourages employees to come forward and report fraudulent activities.

4.5.7 Employees are provided routine communications in the form of training, lectures, and updates in policy that are intended to reduce illicit behavior.

4.5.8 Any of the following means may be used to monitor the quality and validity of test results:

4.5.8.1 Internal quality control samples.

4.5.8.2 Interlaboratory comparisons or proficiency test studies.

4.5.8.3 Certified reference materials or internal quality control using secondary reference materials.

4.5.8.4 Replicate tests using the same or different methods.

4.5.8.5 Re-testing of retained samples.

4.5.8.6 Correlation of results for different characteristics of a sample.

4.5.9 Examples of inappropriate practices include the following:

4.5.9.1 Failure to properly record and preserve data: Analysts must be able to clearly demonstrate how analytical values were obtained from the associated raw data. Such documentation shall be maintained by the laboratory and be available to data users or auditors at any time. This includes failure to document data in the original logbook or on the original company form. Transferring data from a scratch paper or note paper to the logbook or company form is never allowed. The data must be recorded in the appropriate document at the time the test or preparation is being performed by the person performing the test. Failure to comply with this will result in disciplinary measures up to and including dismissal.

4.5.9.2 Failure to properly document errors: All errors, mistakes, and justifications for manual integrations must be fully explained within the case narrative of the final report.

4.5.9.3 Failure to initiate corrective actions: Analysts having knowledge of any part of an analysis or procedure that requires corrective action must immediately notify management.

4.5.9.4 Failure to report a missed holding time: Samples analyzed outside of allowed holding times must not be reported without qualifying the data, and some results may be unusable due to lack of validity. Backdating an analysis to save a missed hold time is forbidden.

4.5.9.5 Failure to follow methods or SOPs as written: Methods and standard operating procedures must be followed without deviation. Analysts must immediately submit any changes to the Technical Director for revisions.

4.5.9.6 Signing another person's signature to documentation.

4.5.10 Improper, unethical, and illegal actions are considered fraudulent because they affect the integrity of the data. Gross deviations from specified procedures will be investigated for potential improper, unethical, illegal actions and data integrity issues. Findings of fraud may be prosecuted to the fullest extent of the law. The following are examples of improper, unethical, and illegal conduct that affect data integrity:

4.5.10.1 Improper use of manual integrations to meet calibration or method Quality Control criteria, such as peak shaving or peak enhancement, if performed solely to meet QC requirements.

4.5.10.2 Falsification of results to meet method requirements.

4.5.10.3 Reporting of results without analyses to support the data or reporting results from the analysis of one sample for those of another.

4.5.10.4 Selective exclusion of data to meet QC criteria, such as dropping calibration points without technical or statistical justification.

4.5.10.5 Misrepresentation of laboratory performance by falsifying calibration data or QC.

4.5.10.6 Reporting QC limits in data reports that are not part of the data set reported or to historical data.

4.5.10.7 Citing matrix interference as a basis for exceeding acceptance limits, especially without

initiating corrective actions, in interference-free matrices.

4.5.10.8 Unwarranted manipulation of computer software such as subtracting or not subtracting a blank or background, altering chromatographic baselines, or improper background subtraction (GC/MS) to comply with ion abundance criteria in to meet QC requirements.

4.5.10.9 Improper alteration of analytical conditions, such as modifying an EM voltage or changing a GC temperature program to induce a shorter analytical run time, which makes the standard analysis different from the sample analysis.

4.5.10.10 Misrepresentation of QC samples, such as adding surrogates after sample extraction, omitting sample preparation steps for QC samples, over-spiking, or under-spiking.

4.5.11 The Data Integrity System (a.k.a. Legal & Ethical Training SOP) is reviewed annually as part of the annual management review.

4.5.12 To ensure confidentiality of data integrity issues, a chain of command policy has been adopted. Employees are encouraged to bring data integrity issues to their immediate supervisor. If the supervisor is a part of the data integrity issue, then the employee brings the issue to the Laboratory Manager, who is part of upper management. In the absence of the Laboratory Manager, the issue is brought to either the Quality Assurance Manager or the Technical Director. Confidential consultation with the Human Resources Manager may take place to resolve the issue. Discussions will take place outside the laboratory and in upper management's office(s) to again help ensure confidentiality.

4.5.13 Employees are also trained the importance of Confidentiality of Client Information and Proprietary Rights. Employees are taught as part of their Legal & Ethical Training that they should not discuss client information, events, knowledge of investigations, or results outside the work place. This information is considered confidential. Further, they are informed that failure to comply is a violation of their Legal & Ethical training and is considered grounds for termination of employment.

4.6 Undue Internal and External Pressures

4.6.1 AES, Inc. strives for the highest caliber of laboratory performance in conjunction with accomplishing quality objectives. One component of realizing this goal is to protect laboratory personnel from undue internal and external pressures.

4.6.2 At AES, Inc. analysts and technicians are insulated from work-related undue pressures that would compromise the quality of their work. Management is aware and considerate of these internal pressures such as management burdens and project deadlines, and of external stresses such as customer complaints and priority requests for analysis.

4.6.3 Management policy is to remain supportive of laboratory personnel and aware of their workloads and the demands placed upon them. Precautions are taken to ensure that there are no conflicts of interest between staff and clients. For example, priority requests, complaints, or status of work inquiries are directed through supervisors, managers, or administrative personnel.

4.6.4 Internal complaints and concerns expressed by employees are handled by AES' policy of encouraging free communication with all levels of management. An "open door" approach promotes avenues of communication that could prevent improper conduct or data integrity issues resulting from undue external and internal pressures. Reducing workload for individual employees may include assigning additional personnel to assist in heavily backlogged areas, providing additional support, supplies, or equipment, or affording technical assistance and resources.

4.7 Responsibilities

4.7.1 It is the responsibility of all AES employees to implement the Quality Assurance Program effectively. All chemists and technicians are responsible for understanding and following the measures of the QA program, and for reporting any quality failures to a Manager or Supervisor in a timely manner.

4.7.2 Supervisors and Managers are responsible for ensuring that all laboratory personnel are familiar with the requirements of the Quality Assurance Program and that these requirements are implemented and maintained. It is the responsibility of each Supervisor to ensure that any quality failures are reported to the Project Manager and the Quality Assurance Department immediately.

4.7.3 It is the responsibility of the Technical Director to ensure that all laboratory personnel are trained to perform their assigned analyses.

4.7.4 The laboratory's approved signatories and designees of the Technical Manager are identified as follows:

Laboratory Manager
Director of Project Management
Project Managers

Individuals are authorized as project manager report signatories based on meeting the qualifications of project manager job description in the QA Manual as well as completion of the following training:

Quality Assurance Manual
Legal & Ethical Training
PCM Asbestos Reports Training

Individuals are authorized to act as project manager report signatories when these documents have been completed and signed by the individual(s) and referenced managers.

5.0 QUALITY ASSURANCE PROGRAM

5.1 The Quality Assurance Program (QAP) has been developed to provide a high-quality document that complies with the intent of testing regulations, standards, and established guidelines. The QAP takes into account requirements for special controls, processes, test equipment and skills to attain the required quality and the need for verification of quality by inspection and test. It also provides for the training of personnel to attain required proficiency levels and for regular assessments of the QAP to assure the adequacy of resources and the effectiveness of management controls established to achieve quality. The Quality Manual is maintained in a current condition.

5.2 Revisions to this QAP are made and controlled by the QA Manager, Technical Director, and Vice-President of Operations in accordance with AES' quality assurance practices. Such revisions and updates shall be performed as needed to improve the effectiveness of this program. Control of this QA manual is accomplished following the requirements of Section 8.2, "Document Control".

5.3 Definitions (Not Alphabetical)

5.3.1 Batch - A group of samples and QC samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents.

5.3.1.1 Preparation Batch - is composed of between 1 and 20 samples of the same matrix and meets the criteria for a batch as described in Section 5.3.1. Preparation batches consist of extractions, digestions, or concentrations. The maximum time between the start of processing of the first and last sample in a preparation batch is 24 hours. A preparation batch must have a spiked sample and a duplicate sample (or matrix spike duplicate).

5.3.1.2 Analytical Batch - is composed of prepared environmental samples (extracts, digestates, or concentrates) or non-prepared environmental samples which are analyzed together as a

group. When the batch contains non-prepared samples as a group, the rules for preparation batches must be followed.

5.3.1.2.1 Test categories where samples do not have to be prepared prior to analysis include GRO, VOC, Ion Chromatography, direct injection SVOC, orthophosphorus, turbidity, pH, and Conductivity.

5.3.1.2.2 When soil VOC or GRO samples arrive in ENCORES or in jars, they considered prepared when placed into water or methanol. Rules for preparation batches apply.

5.3.1.2.3 The maximum length of time that an analytical batch can be left open is 24 hours. An analytical batch may have no more than 20 samples of similar matrix.

5.3.1.2.4 Test procedures take precedence over analytical batch considerations. For example, if the test procedure identifies a batch as occurring over a 12 or 24 hour period, then batches may not be left open for the time period stated in Section 5.3.1.2.1.

5.3.1.2.5 Methanol or water VOC or GRO samples prepared in the laboratory from ENCORES or jars cannot be combined into a sequence with samples that have not been prepared by the laboratory so as to create a batch that contains more than 20 samples or runs for longer than 24-hours.

5.3.1.2.6 An analytical batch must include the analysis of a spiked sample and a duplicate sample (or matrix spiked duplicate) every 20 samples in the batch. In addition, internal quality control dictates that a LCS sample is also included in the batch.

5.3.1.2.7 Always analyze the quality control samples at the beginning of the analytical batch. Quality control samples include the MS, MSD, LCS, LCSD, MB, CCB, and CCV.

5.3.1.2.8 Always verify batch completion date in LIMS.

5.3.2 Accuracy - The nearness of a result or the mean (average) of a set of results as compared to the true value. Accuracy is assessed by means of reference samples, laboratory control spikes, matrix spikes, etc, and is measured in percent recovery.

5.3.3 Blank - There are several types of blanks. The various types are defined below.

5.3.3.1 Calibration Blank - specified in some analytical procedures, is an aliquot of analyte-free matrix used to establish a zero-concentration instrument response value.

5.3.3.2 Reagent Blank (as defined under AIHA-LAP, LLC Accreditation) - includes all the reagents using the same procedure as is used for samples.

5.3.3.3 Method Blank, often referred to as a media blank (as defined under AIHA-LAP, LLC Accreditation) - Blank sampling media and analytical reagents analyzed, when applicable, with each batch of samples, using the same procedure that is used for samples. Typical media includes wipes, filters, and air cartridges. Clients should supply specimens of blank sampling media from the same source lot as was used for collecting the field samples.

5.3.3.4 Method Blank (as defined for environmental samples under NELAC or other state accreditations) - an aliquot of analyte-free matrix, usually reagent water or clean sand, to which all reagents are added in the same volumes or proportions as used in sample processing. The method blank is carried through the complete sample preparation and analytical procedure. The method blank is used to document the absence of contamination resulting from the analytical process.

5.3.3.4.1 Except for certain conditions listed below, all analytes associated with the blank must have concentrations less than the reporting limit.

5.3.3.4.1.1 The reporting limit may be raised above the level of contamination in the method blank and associated samples with documentation of client approval. (Note: This is not acceptable under any AIHA-LAP, LLC Accreditation Programs.)

5.3.3.4.1.2 Sample results are 10 times the concentration of the method blank. The data may be reported with a flag indicating that low level contamination was detected in the method blank. Report data with a "B" qualifier.

5.3.3.4.2 Field Blank (Usually associated with environmental samples under NELAC or other state accreditations) - also called an equipment blank. A field blank is an aliquot of analyte–free water brought to the field in sealed containers, transferred to a sample container, and transported back to the laboratory with the samples to be analyzed. The field blank is used to evaluate any possible contamination introduced to the samples during the field collection process.

5.3.3.4.3 Trip Blank - an aliquot of analyte-free water which accompanies the empty containers to the field and the collected samples back to the laboratory. The trip blank is an indicator of possible sample contamination originating from site conditions and sample transportation.

5.3.4 Initial Calibration Verification (ICV) Standard - An ICV is a standard that has been prepared from a source that is not the same as the source used for the preparation of the calibration curve. A second source represents either, a different lot number of standard purchased from the same vendor, or the same standard purchased from a second vendor. ICV standards are not prepared using the same procedures as samples (e.g., digestions or extractions). The individual test methods describe the preparative procedures and suppliers for these standards. ICV standards are analyzed immediately after a successful calibration curve has been developed. Typically, the ICV standards are prepared so that their concentrations represent a midpoint of the calibration curve.

5.3.5 Continuing Calibration Verification (CCV) Standard - A CCV is a standard that has been prepared from the same source as the calibration standards. CCV standards are not prepared using the same procedures as samples are prepared (e.g. digestions or extractions). The individual test methods describe the preparative procedures and suppliers for these standards. CCV standards must be analyzed every 10 samples throughout the analytical batch, and at the beginning and end of the analytical batch.

5.3.6 Laboratory Control Sample (LCS) - Typically prepared by spiking an analyte free matrix such as an aliquot of reagent water or analyte–free soil (Work done under AIHA-LAP, LLC IHLAP accreditation, the LCS/LCSD is prepared by spiking the same media used for sampling. For AIHA-LAP, LLC ELLAP accreditation, the appropriate blank matrix/media is spiked.) with the analyte(s) of interest. The LCS is prepared and analyzed employing the same methodology as the associated samples. The LCS is used to monitor, assess, and control the laboratory's performance of the methods employed for sample preparation and analysis. The LCS must be performed once per analytical batch, extraction batch, or digestion batch. An extraction or digestion batch is defined as twenty or fewer samples of similar matrix analyzed in a 24-hour period using similar preparative and/or extraction techniques. In many cases, a duplicate LCS sample (LCSD) will be analyzed along with the LCS.

5.3.7 Deionized Water (DI Water, DIW) - Reagent free water that is prepared by passage through various filters and membranes.

5.3.8 Environmental Sample - An environmental sample or field sample is a representative portion of any matrix (aqueous, non-aqueous, mixed waste, etc.) collected from any source for which the determination of the composition of the contamination is requested or required. For the purpose of this procedure, environmental samples are classified as follows:

5.3.8.1 Aqueous - Aqueous samples include surface water, ground water, drinking water, or wastewater. Wastewater consists of municipal and industrial influents and effluents.

5.3.8.2 Soils - Soil samples consist of sediments, soils, and sludges.

5.3.8.3 Non-Aqueous Liquids - Non-aqueous liquids consist of solvents, oils, and fuels. These sample types are not miscible with aqueous samples.

5.3.8.4 Non-Soil Solids - Non-soil solids consist of solid waste, precipitate waste, industrial sludges, concrete, wood, paint chips, ash, and wipes.

5.3.8.5 Bioassay - Bioassay samples consist of bio-solids and municipal waste treatment sludges.

5.3.8.6 Air - Air samples consist of filters, absorbent traps, activated carbon, and passive monitors used in the collection of air samples. Additionally, air samples can be collected in SUMMA canisters or Tedlar bags. In these two cases, the sample is the air itself.

5.3.9 External Quality Control - Those practices that monitor the quality of data from sources outside the control of the laboratory (e.g. multi-laboratory performance evaluation samples and external audits).

5.3.10 Instrument Detection Limits (IDL) - The minimum concentration limits of an analyte above the instrument noise level that can be detected and quantified with a high degree of confidence (>95%).

5.3.11 Internal Quality Control - Those practices implemented internally to monitor the quality of data and which are under the control of the laboratory (i.e. intra-laboratory performance samples, internal audits, single blind samples, etc.)

5.3.12 Matrix Spike / Matrix Spike Duplicate (MS/MSD) - An environmental sample to which predetermined quantities of specific analytes are added prior to sample preparation and analysis. Percent recoveries are calculated for each of the spiked analytes to assess the effect of the matrix on analyte recovery. In addition, a calculation of precision is made between the results of the MS/MSD to determine reproducibility of results in a specific matrix. This is measured by either the Relative Percent Difference (RPD) or Percent Relative Standard Deviation (%RSD). MS and MSD samples are analyzed with each analytical, extraction, or digestion batch of up to 20 samples. MS and MSD precision and accuracy limits are developed from quality control data.

5.3.13 Method Detection Limits (MDL) - The term MDL is defined by the EPA as the minimum concentration of a substance that can be measured and reported, in a specific matrix, with 99% confidence that the measured concentration is distinguishable from method blank results (Note: previous definition was that the measured concentration was greater than zero). Initial MDLs are calculated two ways. First, they are calculated any analyte presence in method blanks as MDL_b (Blank MDL). If some but not all of the method blanks for an individual analyte give numerical results, the Blank MDL is set equal to the highest result. Second, the MDL is calculated from spiked samples, giving the MDL_S (Spike MDL). The MDL used will be the higher MDL between the Blank MDL and the Spiked MDL. MDLs are verified quarterly by analyzing two spiked samples. Annual reverification using data from the four quarterly MDL verifications or from using the last 50 or six months' worth of blanks, whichever is greater. The annual reverification is performed within 13 months of the initial MDL. The calculated MDL using the quarterly checks must be within a factor of 0.5 to 2.0 of the initial MDL. If it is, the reverification is complete and the MDL value remains the same until the next reverification. If the calculated MDL is not within a

factor of 0.5 to 2.0 of the (initial) MDL study, the initial study must be repeated.

5.3.14 Precision - The agreement of a set of replicate results. Typically, the laboratory analyzes LCS and LCSD or MS and MSD samples and reports the results as RPD or %RSD.

5.3.15 Practical Quantitation Limit (PQL) - The lowest analyte concentration that can be reliably achieved, within specified limits of precision & accuracy, during routine operating conditions. Practical Quantitation Limit is used synonymously with 'Reporting Limit', "Lower Limit of Quantitation" (LLOQ), and "Minimum Level". The quantitation limits are tied to the detection limits in that the PQLs are never less that MDLs. A low level standard is analyzed at the PQL where applicable.

5.3.16 Qualifiers - A phrase or word group that limits or modifies the meaning. (See section 12.5.4)

5.3.17 RCRA - Resource Conservation Recovery Act

5.3.18 Relative Percent Difference (RPD) - A measure of agreement between two replicate results, expressed as follows:

$$RPD = 100 * \frac{X_1 - X_2}{\overline{X}}$$

where: X_1 and X_2 = the two results

$\overline{X}$ = mean value of the results

5.3.19 Relative Standard Deviation (RSD) – The variance from the mean or true value divided by the mean or true value, expressed as a percentage.

$$\% \text{ RSD} = 100 * S/\overline{X}$$

where:

$\overline{X}$ = arithmetic mean of the measurements

S = variance

5.3.20 Representativeness - The degree to which data represent a characteristic of a population or set of samples. It is a measurement of both analytical and field sampling precision.

5.3.21 Standard Curve - A curve, which plots known standard concentrations or amounts of an analyte versus the instrument response for the analyte. This curve is used to determine the concentration of the analyte in the unknown samples.

5.3.22 Surrogate - Organic compound(s) which is/are similar to analytes of interest in chemical composition, extraction efficiency, and chromatographic retention, but are not normally found in environmental samples. These compounds are spiked into all blanks, standards, samples, and spiked samples prior to analysis. Percent recoveries are calculated for each surrogate to assess the effectiveness of the sample preparation and analysis and any potential matrix effects.

5.3.23 TNI - The NELAC Institute

5.3.24 AIHA-LAP, LLC - American Industrial Hygiene Association, Laboratory Accreditation Program, LLC

5.3.25 Method of Standard Additions - The standard addition technique involves adding known amounts of standard to one or more aliquots of the processed sample solution. This technique compensates for a sample constituent that enhances or depresses the analyte signal, thus producing a different slope from that of the calibration standards. It will not correct for additive interferences that cause a baseline shift.

5.3.26 Estimation of Uncertainty - is the parameter associated with the result of a measurement that

characterizes the dispersion of the values that could reasonably be attributed to the measurement. (See section 12.1 for more information.)

5.3.27 Measurand Quantity intended to be measured or analyte concentration. The measurands for methods under AIHA-LAP, LLC accreditation are available in the SOPs. (See section 12.1 for more information.)

5.3.28 Interim Limits - are used to establish the level of uncertainty when limits are not available until enough laboratory data has been compiled to establish historical limits. Interim limits may be derived from published methods, those limits within similar analysis, LCS recovery ranges, or based on reasonable expectations from laboratory experience.

5.3.29 Lower Limit Of Quantitation (LLOQ) - As defined in EPA's SW-846 Compendium, it is the lowest point of quantitation, or in most cases, the lowest point in the calibration curve, which is ideally less than or equal to the desired regulatory action levels based on the stated project requirements. (Synonymous with PQL, Reporting Limit, and Minimum Level.)

5.3.30 Minimum Level - is a term from 40CFR136 that refers to either the sample concentration equivalent to the lowest calibration point in a method or a multiple of the MDL, whichever is higher. Minimum Levels may be obtained in several ways: they may be published in a method; they may be based on the lowest acceptable calibration point used; or they may be calculated by multiplying the MDL (from the method or as determined by the laboratory) by a factor of 3.

5.3.31 BRL (Below Reporting Limit) - The acronym BRL is used to report the PQL in an easy to understand manner. On AES analytical reports, BRL is next to the Reporting Limit. Together, BRL and the Reporting Limit mean that if the analyte were present in the sample, it would be below the reporting limit. It would be below the range of specified limits of precision and accuracy. EPA considers the terms Reporting Limit, Practical Quantitation Limit, Lower Limit of Quantitation (LLOQ), and Minimum Level to be synonymous. In most cases, this corresponds to the lowest point on the calibration curve.

The relationship between the MDL and the PQL (Reporting Limit) is that the MDL is the point at which the analyte is detected but the PQL is the point at which the quantitation is considered to be of known precision and accuracy. Concentrations between the MDL and PQL are estimated values.

5.4 Data Quality Objectives for Environmental Testing

5.4.1 Precision. The laboratory objective for precision is to meet the performance criteria demonstrated for all analytical methods as published by the USEPA under SW-846 and 40 CFR Part 136. These criteria are met on similar samples and similar sample matrices. Precision is documented based on replicate analysis, usually duplicate or matrix spike duplicate samples.

5.4.2 Accuracy. The laboratory objective for accuracy is to meet the performance criteria demonstrated for these analytical methods as published by the USEPA under SW-846 and 40 CFR Part 136. These criteria are met on similar samples and similar sample matrices. Accuracy is documented based on recovery data; usually matrix spike samples.

5.4.3 Representativeness. The laboratory objective for representativeness is to provide data which is representative of the sampled medium. The representativeness of the analytical data is a function of the procedures used in processing 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 in quality to data generated by other laboratories for similar samples and to data compiled by AES over time. The comparability

objective may be documented by any of the following:

5.4.4.1 Inter-laboratory studies carried out by regulatory agencies.

5.4.4.2 Inter-laboratory studies initiated for specific projects or contracts.

5.4.4.3 Comparison of periodically generated statements of accuracy, precision, and reporting limits to those of other laboratories.

5.4.4.4 Through approval from the US EPA or other regulatory agencies for any procedure to which significant modifications have been made.

5.4.5 Completeness. The completeness objective for data is can be set for a particular project and is expressed as the ratio of the valid data to the total data over the course of the project.

5.5 Criteria for Quality Indicators

5.5.1 The precision and accuracy acceptability limits for analyses performed at Analytical Environmental Services, Inc are located in the LIMS and posted on the portal server. The limits in the tables are either laboratory-generated or derived from USEPA methods.

5.5.2 Table 5-3 defines the criteria for data acceptability. Data may be accepted when QC falls outside these limits if probable cause can be attributed to the matrix, and laboratory control samples (LCS) show that the method is in control. Deviations are documented in the final report to the client. In instances where an LCS limit is not available, a limit of 30-130% recovery may be used until in-house limits are available. (Note: Sometimes an alternative default limit may be found in a published method and substituted.) In some cases, lower default limits may be set with approval from the Quality Assurance Manager and Technical Director. The acceptable range of some compounds may be broader, based on prior knowledge of the analyte (e.g., phenols in EPA Method 8270C).

5.5.3 Statistically Derived Limits

5.5.3.1 Selected methods and programs require statistically derived accuracy and precision limits. Analytical Environmental Services, Inc. routinely uses statistically derived limits to evaluate method performance and to determine when corrective action is appropriate.

5.5.3.2 The laboratory periodically updates the limits as stated, but no less than annually. Analysts must use the current limits as found in LIMS.

5.5.3.3 The QA Manager maintains an archive of all limits used within the laboratory. If a method defines the QC limits, the method limits are used. If a method requires the generation of historical limits, they can be derived from data in the LIMS database or by viewing archives.

5.5.4 Development of new QC limits.

5.5.4.1 The QA Manager determines limits using the in-house LIMS system. This is accomplished by the statistical analysis of data for each test method where the method specifies that internal limits are developed.

5.5.4.2 Reviewed data types within the methods include LCS, LCSD, MS, MSD, and surrogates in samples, control samples, and spikes. It is recommended that surrogates are evaluated on a separate basis for samples, LCS, and MS since recovery limits will be wider for client samples than for laboratory control samples.

5.5.4.3 QC limits are updated in LIMS through the Quality Control Section. To change limits, activate the tab called “control charting”. Enter the desired test code, analyte, and sample type. Enter the number of desired data points, and then “get data”.

5.5.4.4 The minimum number of data points chosen should be 20. For tests which data is generated more frequently, e.g. volatile surrogate recoveries in samples, a minimum of 40 data points should be chosen.

5.5.4.4.1 For tests in which there are less than 20 data points, use the interim limits specified by the method. If interim limits are not specified by the method, the QA Manager and Technical Director must choose interim limits that represent an estimation of the current laboratory performance. The data in the tables should be footnoted accordingly.

5.5.4.4.2 For tests in which data is generated more frequently, e.g. volatile surrogate recoveries in samples, a minimum of 40 data points is chosen. The LIMS will pick data points in historical order beginning with the date the action is being performed. The LIMS will compile as many data points are available if the requested number exceeds the number of points in LIMS The LIMS will pick data points in historical order beginning with the date the action is being performed. If the requested number exceeds the number of points in LIMS, then LIMS will compile as many data points as are available.

5.5.4.5 Data should be observed for outliers, and these samples de-selected using the "radio buttons". Once the data is reviewed, limits can be recalculated by choosing the "Re Calc Stats" tab. Outlying data points are determined by the following two methods:

5.5.4.5.1 Grubbs Test - is a statistical test used to detect outliers in a univariate data set assumed to come from a normally distributed population.

5.5.4.5.2 Manual observation of data set to verify that the data points selected are within the calculated control limits. If they are not, then the data points must be "de-selected" and the limits recalculated until the data is within the calculated limits.

5.5.4.6 The lower limit determined from historical data shall not be set to a value less than 10. That is, if the calculated lower limit is < 10, a default value of 10 will be used for the lower limit unless specified by the published method.

5.5.4.7 When the data set is acceptable, choose the "Preview" tab to view data in a page format. Through the "Windows" application, print the data in "Adobe" format by selection of the proper network printer. The file should be saved in one of the following folders depending on which QC type:

TestMethod_Matrix_LCS_LCSD_REC
TestMethod_Matrix_LCS_LCSD_RPD
TestMethod_Matrix _MSD_REC
TestMethod_Matrix _MSD_RPD
TestMethod_Matrix_SURR_REC

5.5.5 Review of revised QC limits

5.5.5.1 After data has been revised for each test method and matrix, a copy of the QC Tables and charts is presented to the department managers, Technical Director, and Vice President of Operations for review. After a week comment period, the updated limits are entered into the laboratory LIMS system.

5.6 External Quality Assurance Objectives

5.6.1 External Quality Control is the process of employing outside sources to monitor the quality of the data produced by the laboratory. Included in the external quality control program are the analysis of performance evaluation samples and participation in performance evaluation audits.

5.6.1.1 AES, Inc. analyzes Proficiency Test (PT) samples for each PT field of testing as defined in The NELAC Institute (TNI) and AIHA-LAP, LLC Fields of Test tables according to matrix type,

analyte, and regulatory or environmental program. Samples are obtained from NELAP-designated PTOB / PTPA-approved PT providers (such as Environmental Resource Associates) for NELAP compliance or directly from AIHA-LAP, LLC to meet their program requirements. The results of the analyses are submitted to the PT Provider for scoring. Study reports are maintained for a minimum of five years on the portal server. The analyses of PT studies are conducted in accordance with all TNI or AIHA-LAP, LLC. Where required (as with gravimetric analyses for AIHA-LAP, LLC), an internal PT will be used.

5.6.1.1.1 AES participates in a minimum of two single-blind, single-concentration PT studies per year for each PT field of testing for which it is accredited. Studies are performed at least 15 calendar days apart. Successful completion of two of the last three proficiency rounds for a given PT field of testing must occur in order to maintain accreditation.

5.6.1.1.2 Blind water or soil PT samples contain amounts of specific constituents that are unknown to laboratory personnel. Upon arrival, PT samples are logged into the Laboratory Information Management System (LIMS) and tracked as routine environmental samples. PT samples provided by the vendor may be 'whole' samples or may have been provided in a concentrated form. PT vendor instructions are followed and dilutions performed on the concentrated vials to make them the 'whole' sample to be tested. Routine procedures for dilutions and analysis are followed per method specific SOPs. The laboratory results must be completed and reported within the required turn around time.

5.6.1.1.3 AES, Inc. maintains copies of all written, printed, and electronic records, including, but not limited to bench sheets, instrument strip charts and chromatograms or printouts, data calculations, and data reports resulting from the analysis of any PT sample. These records are maintained for five years or for as long as required by the applicable regulatory program, whichever is greater. These records include a copy of the PT study report forms used to report PT results. All laboratory records are available to assessors of the Primary Accrediting Authority during on-site audits.

5.6.1.1.4 Whenever a study is failed, AES determines the cause for the failure and takes the necessary corrective actions. The investigation and action taken are documented into QA records and provided, if required, to the Primary Accrediting Authority.

5.6.1.2 Performance evaluation samples are also obtained from the following list of suppliers.

5.6.1.2.1 ELPAT. This proficiency testing program is administered by the American Industrial Hygiene Association-Laboratory Accreditation Program (AIHA-LAP, LLC). Once a quarter, the laboratory receives a set of proficiency samples from Research Triangle Institute for the analysis of lead content. The matrices are soils, wipes, and/or paint chips.

5.6.1.2.2 PAT. This proficiency testing program is administered by the American Industrial Hygiene Association-Laboratory Accreditation Program (AIHA-LAP, LLC). Once a quarter, the laboratory receives a set of proficiency samples to be analyzed for metals, asbestos fibers, This program is required as part of the laboratory's certification to perform analyses on samples that measure indoor air quality.

5.6.1.2.3 EMPAT. This proficiency testing program is administered by the American Industrial Hygiene Association-Laboratory Accreditation Program (AIHA-LAP, LLC). EMPAT fungal proficiency samples are available for both the 'Direct Examination'. Once a quarter, the laboratory receives notification that the Fungal Direct Examination Proficiency Testing Program has opened on the AIHA-LAP, LLC website. The lab has access to the portal for 24 hours a day for 7 days at which time the study closes. This program requires the identification of selected slides within a set amount of time.

5.6.1.2.4 North Carolina Department of Environmental, Health and Natural Resources. Once a year the laboratory receives performance samples for certification by North Carolina for all analyses not already submitted under other programs. These samples are critical for the continuation of certification by the state of North Carolina. To renew certification each year, the lab must submit acceptable PT sample results to the NC WW/GW LC Program for each parameter, analyte, technology and matrix (where a method is matrix-specific) by October 31.
A laboratory that fails a PT sample for a parameter method technology must take steps to identify the root cause of the failure, take corrective action, report the corrective action taken to NCDENR, and participate in a second PT study meeting the criteria listed previously in this policy. The corrective action response must include the laboratory's root cause analysis and a copy of any objective evidence (e.g., calibration curves, revised procedures, records, training records, standard operating procedures, etc.) to indicate that the corrective actions have been implemented/completed. The results of the remedial PT must be received in this office within 60 days from the date the failed results are issued by the accredited proficiency testing provider. A laboratory failing the second (or remedial) PT study may be decertified for that parameter method technology (not necessarily for all technologies for that parameter).

For multi-analyte parameters (e.g., organic analyses), when greater than 80% of analytes are acceptable, but one or more individual analytes are graded unacceptable, acceptable performance has been demonstrated for the parameter method technology. The laboratory must, however, analyze a remedial PT for the individual analytes that were graded unacceptable. When a remedial PT is graded unacceptable for an individual analyte (constituting a second unacceptable result), the laboratory must qualify data for those individual analytes as "estimated" (whether detected or not) until acceptable results are obtained on two consecutive remedial PTs for the analyte in question.

5.6.1.3 Performance Audits

5.6.1.3.1 In order to maintain certification in many states, to comply with commercial contracts, and to satisfy many agency requirements, AES, Inc. must undergo initial and ongoing audits performed by external auditors. These audits may take the form of technical and/or evidentiary audits. Every section of the laboratory, both analytical and clerical, should be ready at all times to participate in these audits.

5.6.1.3.2 In the event that adverse findings or deficiencies are discovered, or observations and/or recommendations are made during an audit, QA and laboratory management shall review the comments and submit a response, including corrective actions, to the audit report.

5.6.1.4 State Audits

5.6.1.4.1 State Audits are performed in accordance with each individual state's certification program. These audits are generally performed to determine the laboratory's suitability to perform environmental analyses according to the parameters dictated by that state.

5.6.1.5 Commercial Audits

5.6.1.5.1 Audits performed by commercial clients may be scheduled on a pre-award basis for a contract. Once the contract is awarded, audits may be scheduled at the request of the client or at a pre-determined frequency. The client, as well as professional audit teams, may perform audits required by commercial clients.

5.7 Internal Quality Control

5.7.1 The internal quality control program serves two primary functions. One function is to monitor the reliability of the data (e.g., accuracy and precision). The other function is to control and maintain the quality of the data (e.g., the use of ACS grade reagents, traceable standards, etc.).

5.7.2 The following sections outline the specific actions and procedures employed to monitor the process for producing and reporting quality data that is consistent with the Quality Control Program. Processes such as, but not limited to, verification of operator competence, recovery of known spikes, analysis of reagent blanks, calibration with traceable standards, analysis of duplicates, and maintenance of quality control charts must be employed and continually monitored. The laboratory may also adopt additional quality assurance procedures; however, the minimum requirements are discussed below. The QA Manager and Technical Director, under restrictions by the methodology and in conjunction with the appropriate laboratory management staff, shall determine which requirements shall be implemented for each section.

5.7.3 Training & Certification of Operator Competence. Quality Control begins with the establishment of basic laboratory techniques and skills. It is imperative that analysts receive proper training before performing independent laboratory analyses. Each analyst must demonstrate proficiency of laboratory techniques and skills. Records to that effect are kept in the employee's personal training files.

5.7.4 Documentation. Regardless of which analytical procedures are used in the laboratory, the methodologies employed shall be carefully documented.

5.7.4.1 Standard Operating Procedures (SOPs) and approved methods may be periodically modified, updated, or replaced in their entirety due to advances in technology, regulatory protocols, or at the discretion of laboratory management. All proposed changes, however, are reviewed by the Technical Director to ensure compliance with all regulatory protocols.

5.7.4.2 If a client requests a change of procedure, the change must be pre-approved by the laboratory prior to use. The change must be documented in writing and kept on file as part of the laboratory project records.

5.7.4.3 If a method is modified such that it no longer complies with the provisions set forth by the accrediting agencies, the client will be informed.

5.7.4.4 Documentation of analytical procedures for generating laboratory data shall be clear, concise, adequately referenced, and reflect the actual steps employed by the analyst.

5.7.5 Standard Operating Procedures (SOP). Methodologies employed in the laboratory are documented in SOPs. (Table 5-3 shows a Summary of Calibration and QC Procedures for Various Tests.) See Chapter 8 gives detailed information on SOPs.

5.7.6 Initial Calibration Verification (ICV) Standard. Individual component recovery of the ICV standard is calculated using the following equation:

$$\text{ICV Standard Percent Recovery} = \frac{A}{T} x100$$

where:
A = concentration measured
T = true value of the spiking concentration

5.7.6.1 The ICV must be made from a different source than the calibration curve standards.

5.7.6.2 The acceptable recovery limits for the ICV standards vary based on the individual procedure and are specified in Table 5-3.

5.7.6.3 If the recoveries of any of the ICV standards are not within the limits specified in Table 5-3, the test method may not be performed. The analyst must follow the out-of-control procedures discussed in Section 5.8 before initiating any analyses.

5.7.7 Continuing Calibration Verification (CCV) Standard. Individual component recovery of the CCV standard is calculated using the following equation:

$$\text{CCV Standard Percent Recovery} = \frac{A}{T} x100$$

where:
A = concentration measured
T = true value of the spiking concentration

5.7.7.1 The acceptable recovery limits for the CCV standards are procedure dependent and are specified in Table 5-3.

5.7.7.2 If the recoveries of any of the CCV standards are not within the limits specified in Table 5-3, the testing must be discontinued. The analyst must follow the out-of-control procedures discussed in Section 5.8 before continuing any analyses.

5.7.8 The Laboratory Control Sample (LCS)

5.7.8.1 The individual test methods describe the preparative procedures and suppliers for the LCS & LCSD standards. The LCS & LCSD samples are prepared in either reagent grade water or sand in accordance with the procedural steps followed for the preparation of a matrix spike sample.

5.7.8.2 Individual component recovery of the LCS(D) is calculated using the following equation:

$$\text{LCS (LCSD) Spike Percent Recovery} = \frac{A}{T} x100$$

where:
A = concentration measured
T = true value of the spiking concentration

5.7.8.3 Precision between the LCS and LCSD recoveries is calculated using the following equation:

$$\% \text{ RPD} = \frac{\text{Difference between LCS and LCSD recoveries}}{\text{Average of LCS and LCSD recoveries}} \times 100$$

5.7.8.4 The acceptable recovery limits for the LCS standards vary based upon the individual procedure and are specified in LIMS test codes.

5.7.8.5 If recoveries of any of the LCS standards are not within the limits specified in the table, the testing must be stopped. If the precision between the two recoveries is not within the limits specified in the table, the testing must be stopped. The analyst must follow the out-of-control procedures discussed in Section 5.8 prior to continuing any analyses.

5.7.9 Matrix spike (MS) and matrix spike duplicate (MSD). Individual component recovery of the matrix spike is calculated using the following equation:

$$\text{Matrix Spike Percent Recovery} = \frac{(A-B)}{T} \text{x}100$$

where:

A = concentration measured after spiking
B = background concentration
T = true value of the spiking concentration

5.7.9.1 MS and MSD sample recovery limits are used to determine matrix affects on the recovery target analytes. The acceptable recovery limits for the MS and MSD standards are indicated in LIMS test codes.

5.7.9.2 It is the discretion of the department manager to have a batch re-processed or re-analyzed after assessment of the matrix spike recovery values and other batch QC data. The analyst must follow the out-of-control procedures discussed in Section 5.8 prior to continuing any analyses.

5.7.9.3 In the event that insufficient sample is provided for MS/ MSD analysis, the narrative of the final report must be amended to indicate lack of sample for analysis of MS and / or MSD.

5.7.10 An Initial Demonstration of Capability (IDOC) study is performed to establish the ability of an analyst and/or analytical system to generate acceptable precision and accuracy data. An IDOC study is performed on each certified method and matrix analyzed in the laboratory where applicable. Samples prepared for the IDOC studies are made from a second source independent of the standard source used for the calibration determination. A second source standard may be a standard purchased from the same manufacturer but a different lot or batch. Four LCS's are prepared and analyzed. To establish the ability to generate acceptable accuracy and precision, the analyst must perform the following operations:

5.7.10.1 Because of the nature of several test methods, IDOCs cannot be performed. These tests represent methods where samples of known concentrations cannot be prepared in the laboratory. Specific requirements for these test methods are described in Table 5-1***.

5.7.10.2 Calculate the average recovery (x) in µg/L, and the standard deviation of the recovery(s) in µg/L, for each analyte using the four results. Demonstration of Capability must be updated and documented annually or more frequently if required by method with a Continuing Demonstration of Capability (CDOC). Other options for CDOC include the use of successfully passed third party Proficiency Test (PT) studies and Method Detection Limit studies that meet recovery and reporting limit criteria. (See Table 5-1)

5.7.10.3 The Method Performance Section of the individual SOP provides laboratory recovery and precision data for the method. Similar results from spiked water should be expected. Results are considered comparable if the calculated standard deviation of the recovery does not exceed the single laboratory RSD or 10% (20% for some organic analytes), whichever is greater and the mean recovery lies within the interval indicated by the test method, or X ± 15%, whichever is greater. Specific requirements for each NELAP certified test method as well as those required by AIHA-LAP, LLC are described in Table 5-1***.

Table 5-1 Demonstration of Capability Acceptance Criteria

Certified Method	DOC Requirement	Control Limits/ Acceptance Criteria*
SM2120B Color	4 LCS or PT	LCS Control Limits or PT acceptance Criteria
SM2120E Color ADMI	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
E120.1 Conductivity	4 LCS or PT	LCS Control Limits or PT acceptance Criteria
SM4500H$^+$B pH	4 LCS or PT	LCS Control Limits or PT acceptance Criteria
SM2540C TDS	4 LCS or PT	PT acceptance Criteria

Certified Method	DOC Requirement	Control Limits/ Acceptance Criteria*
SM2540D TSS	4 LCS or PT	LCS Control Limits or PT acceptance Criteria
SM2540B TS	4 LCS or PT	LCS Control Limits or PT acceptance Criteria
E160.4 VS	PT	PT acceptance Criteria
SM2540F Settleable Solids	PT	PT acceptance Criteria
E1664B Oil and Grease_TPH	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
E180.1 Turbidity	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
E200.7 ICP AES Metals	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
E200.8 ICP MS Metals	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
E245.1 Mercury	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
E300 Anions by IC	4 LCS or PT; LCR / MDL	LCS Control Limits, MDLs or PT acceptance Criteria
SM2310B Acidity	4 LCS or PT	LCS Control Limits or PT acceptance Criteria
SM2320B Alkalinity	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
E310.2 Alkalinity	4 LCS or PT; LCR / MDL	LCS Control Limits, MDLs or PT acceptance Criteria
SM4500Cl G Residual Chlorine	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SM4500CN G Amenable Cyanide	4 LCS	LCS Control Limits
SM4500CN E Total Cyanide	4 LCS or PT	LCS Control Limits or PT acceptance Criteria
E350.1 Ammonia (as N)	4 LCS or PT; LCR / MDL	LCS Control Limits, MDLs or PT acceptance Criteria
E351.2 TKN	4 LCS or PT; LCR / MDL	LCS Control Limits, MDLs or PT acceptance Criteria
E353.2 Nitrate (as N)	4 LCS or PT; LCR / MDL	LCS Control Limits, MDLs or PT acceptance Criteria
E353.2 Nitrate_Nitrite (as N)	4 LCS or PT; LCR / MDL	LCS Control Limits, MDLs or PT acceptance Criteria
E353.2 Nitrite (as N)	4 LCS or PT; LCR / MDL	LCS Control Limits, MDLs or PT acceptance Criteria
SM4500NO2 B Nitrite (as N)	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SM4500O G Dissolved Oxygen	4 LCS	LCS Control Limits
E365.1 Ortho Phosphorus	4 LCS or PT; LCR / MDL	LCS Control Limits, MDLs or PT acceptance Criteria
E365.1 Total Phosphorus	4 LCS or PT; LCR / MDL	LCS Control Limits, MDLs or PT acceptance Criteria
E365.3 Ortho Phosphorus	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SM4500S2 F Sulfide	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SM4500SO3 B Sulfite	4 LCS or PT	RSD Limit ≤ RPD Limits
SM5210B BOD	4 LCS or PT	LCS Control Limits or PT acceptance Criteria
E410.4 COD	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SM5310B TOC	4 LCS or PT; LCR / MDL	LCS Control Limits, MDLs or PT acceptance Criteria
E420.1 Total Phenolics	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
E420.4 Total Phenolics	4 LCS or PT; LCR / MDL	LCS Control Limits, MDLs or PT acceptance Criteria
SM5540C MBAS Surfactants	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
E608.3 Pesticides PCBs	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
E610 PAHs	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
E615 Herbicides	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
E624.1 VOCs	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
E625.1 SVOCs	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
FL-PRO	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
PMOIST	4 LCS or PT	Demonstration using Real World Samples
RSK-175 Dissolved Methane, Ethane, Ethene	4 LCS	MDLs or LCS Control Limits

Certified Method	DOC Requirement	Control Limits/ Acceptance Criteria*
SM10200H Chlorophyll	4 LCS	LCS Control Limits
SM2340B Hardness	4 LCS or PT	LCS Control Limits or PT acceptance Criteria
SM3500Cr B Hexavalent Chromium	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SM3500Fe B Ferrous Iron	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SM5210B CBOD	4 LCS or PT	LCS Control Limits or PT acceptance Criteria
SM9222B Total Coliforms	PT	PT acceptance Criteria
SM9222D Fecal Coliforms	PT	PT acceptance Criteria
SM9223B E.Coli / Total Coliforms	PT	PT acceptance Criteria
SW1010 Flash Point	4 LCS or PT	LCS Control Limits or PT acceptance Criteria
SW1030	DUP	Demonstration using Real World Samples
SW1311 TCLP & 1312 SPLP	SOP Signoff/AES Training	N/A
SW6010 ICP AES Metals	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SW6020 ICP MS Metals	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SW7196 Hexavalent Chromium	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SW7470 Mercury in Water	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SW7471 Mercury in Soils	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SW7473 Mercury in Soils	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SW8011 EDB DBCP	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SW8015 DAI	4 LCS	LCS Control Limits
SW8015 DRO or GRO	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SW8081 Pesticides	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SW8082 PCBs	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SW8151 Herbicides	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SW8260 Oxygenates	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SW8260 VOCs	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SW8270 SVOCs	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SW8310 PAHs	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SW8315 Formaldehyde and Acetaldehyde	4 LCS	MDLs or LCS Control Limits
SW9010_9014 Cyanide	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SW9030_9034 Sulfide	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SW9040 pH in Water	4 LCS or PT	LCS Control Limits or PT acceptance Criteria
SW9045 pH in Soil	4 LCS or PT	LCS Control Limits or PT acceptance Criteria
SW9050 Conductivity	4 LCS or PT	LCS Control Limits or PT acceptance Criteria
SW9056 Anions by IC	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SW9060 TOC	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SW9065 Total Phenolics	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SW9070 Oil and Grease_TPH in Water	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SW9071 Oil and Grease_TPH in Soils	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SW9081 Cation Exchange Capacity	SOP Sign-Off Only	Demonstration using Real World Samples
SW9095 Free Liquids by Paint Filter	SOP Sign-Off Only	Demonstration using Real World Samples
TO-14A, TO-15		MDL or LCS Control Limits

*LCS Control Limits and RPD Limits as per LIMS Test Code Limits

Table 5.1 (Cont.) - Demonstration of Capability Acceptance Criteria

AIHA-LAP, LLC METHODS		
Certified Method	DOC Requirement	Control Limits/ Acceptance Criteria*
SW3050B / N7082 (Lead Paint)	IDOC: 4 sets of 5 Ref CDOC: Batch QC or PT	75% within 80-120%Rec LCS Control Limits, MDLs or PT Acceptance Criteria
SW3050B / 7420 (Lead in Soil)	IDOC: 4 sets of 5 Ref CDOC: Batch QC or PT	75% within 80-120%Rec LCS Control Limits, MDLs or PT Acceptance Criteria
SW3050B / 7000B (Lead in Soil)	IDOC: 4 sets of 5 Ref CDOC: Batch QC or PT	75% within 80-120%Rec LCS Control Limits, MDLs or PT Acceptance Criteria
N7082 (Lead in Dust Wipe)	IDOC: 4 sets of 5 Ref CDOC: Batch QC or PT	75% within 80-120%Rec LCS Control Limits, MDLs or PT Acceptance Criteria
N7303 (Lead in Air)	IDOC: 4 sets of 5 Ref CDOC: Batch QC or PT	75% within 80-120%Rec LCS Control Limits, MDLs or PT Acceptance Criteria
N7400 (Asbestos PCM)	PT Samples	PT Acceptance Criteria
Fungal Air Direct Exam (Micro)	PT Samples	PT Acceptance Criteria
Fungal Bulk Direct Exam (Micro)	PT Samples	PT Acceptance Criteria
Fungal Surface Direct Exam (Micro)	PT Samples	PT Acceptance Criteria

5.7.10.4 The large number of analytes in multi-element analyses presents a substantial probability that one or more will fail at least one of the acceptance criteria when all analytes of a given method are determined. Should this occur, re-analyze only the failed analytes, following the procedures discussed in this section.

5.7.10.5 When one or more of the analytes tested fails at least one of the acceptance criteria, the analyst must proceed according to the out-of-control procedures discussed in Section 5.8.

5.7.10.6 Due to the nature of several test methods, IDOCs cannot be performed. These tests represent methods where samples of known concentrations cannot be prepared in the laboratory. Tests that are included in this category are EPA 110.2, 160.3, 160.4, 160.5, 150.1, 9040, 9045, 1010, SM 2340B, SM2340G, SM9223, and SM9222. To complete IDOCs for these tests, the analyst(s) must satisfactorily pass available PE samples for all appropriate matrices.

5.7.10.7 Analyst Demonstration of Capability and training includes the following:

Quality Assurance Manual Training (annually)
Legal & Ethical Training (annually)
SOP Training (initially and as updated)
ICNs associated with the SOPs (initially and as updated)
Demonstration of Capability (program specific)
Procedure and Checklist Training (initially and as updated)

Individuals are authorized to perform analysis when these documents have been completed and signed by the individual(s) and referenced managers.

5.7.10.8 AIHA-LAP, LLC Training Requirements
AIHA-LAP, LLC Technician/Analyst Training Requirements. All technicians and analysts must complete training and demonstrate proficiency prior to analysis of any ELLAP or IHLAP program samples. The training and proficiency demonstrations must meet the requirements specified in the AIHA-LAP, LLC LQAP Policy Document, Modules 2A, 2B and 2C and are described in Section 1.2 and 1.3 below.

5.7.10.8.1 ELLAP Specific Technician/Analyst Training Requirements:

5.7.10.8.1.1 Initial demonstration of capability.

Each technician/analyst must complete at least 20 days work/training in the prep and / or metals analysis lab using technologies/instrumentation similar to that to be used for ELLAP samples under the direct supervision of an ELLAP trained technician / analyst prior to unsupervised prep / analysis of ELLAP regulated client samples.

Each analyst/technician must read, understand & agree to follow the laboratory SOP as documented using the SOP Acknowledgement sign-off form. Each technician / analyst must prep and/or analyze as appropriate at least 2 blind reference material test samples (concentration unknown to the technician/analyst). These samples may be AIHA-LAP, LLC provided PT samples or laboratory prepared Certified Reference Material of the appropriate matrix, i.e. soil, paint, wipe(spiked with baghouse dust) or air filter. Results must fall within the PT acceptance range or laboratory LCS range as appropriate.

Each technician/analyst must complete a minimum of 4 independent test runs of sample preparation/analysis prior to prepping/analyzing actual samples. This test is performed through the digestion/analysis of four separate groups of 5 replicate, matrix specific Certified Reference Material samples, with each group separated by at least one day. To be deemed acceptable per ELLAP requirements, 75% of the replicates in each group must recover within 90-110% of the true value. Any individual group that fails to meet the ELLAP criteria must be repeated in its entirety (all 5 replicates repeated).

Once all requirements in 5.7.10.8.1.1 have been met, the technician/analyst will be approved to begin unsupervised prep/analysis of client samples. Documentation of approval to begin work is defined as the date signed by the Technical Director (or designee) on the Demonstration of Capability Certification form.

5.7.10.8.1.2 Continuing Demonstration of Capability (CDOC). Each technician/analyst must demonstrate continued capability at least every 6 months through the analysis of AIHA-LAP, LLC provided PT samples or in house laboratory QC samples, i.e. LCS samples. Results must fall within the AIHA-LAP, LLC PT acceptance criteria or Policy Module 2C, Table 2C-1 LCS control limits per samples used.

5.7.10.8.1.3 All IDOC and CDOC documentation for ELLAP related procedures is maintained and available for review for at least 5 years.

5.7.10.8.2 IHLAP Chemistry Specific Technician/Analyst Training Requirements:

5.7.10.8.2.1 Initial demonstration of capability.

Each technician/analyst must complete at least 20 days of work/training in the prep and/or metals analysis lab using technologies/instrumentation similar to that used for IH samples under the direct supervision of an IH trained technician/analyst prior to unsupervised prep and/or analysis of IH regulated client samples. Each analyst /technician must read, understand and agree to follow the laboratory SOP as documented using the SOP Acknowledgement sign-off form. Each technician / analyst must prep and/or analyze as appropriate at least 2 blind reference material samples (concentration unknown to the technician/analyst). These samples may be AIHA-LAP, LLC provided PT samples or laboratory prepared Certified Reference

Material added to the method specific media used for client samples. Results must fall within the PT acceptance range or laboratory LCS range as appropriate.
Once all requirements in 5.7.10.8.2.1 have been met, the technician/analyst will be approved to begin unsupervised prep/analysis of client samples.
Documentation of formal approval to begin work is defined as the date signed by the Technical Director on the Demonstration of Capability Certification form.

5.7.10.8.2.2 Continuing Demonstration of Capability (CDOC). Each technician/analyst must demonstrate continued proficiency at least every 6 months through the analysis of AIHA-LAP, LLC provided PT samples or in house laboratory QC samples, i.e. LCS samples. Results must fall within the AIHA-LAP, LLC PT acceptance criteria or laboratory established LCS control limits as appropriate. CDOCs are documented via AIHA-LAP, LLC PT reports or LIMS LCS data as appropriate.

5.7.10.8.2.3 All IDOC and CDOC documentation for IHLAP related procedures is maintained and available for review for at least five (5) years.

5.7.10.8.3 IHLAP Asbestos by PCM Specific Technician/Analyst Training Requirements:

5.7.10.8.3.1 All PCM technicians/analysts must complete a NIOSH 582 equivalent training course and successfully pass the course examination during their training period and prior to beginning unsupervised work on client samples.

5.7.10.8.3.2 Initial demonstration of capability.
Each technician/analyst must complete at least 20 days of work/training in the PCM analysis lab using technologies/instrumentation similar to that to be used for IH/PCM samples under the direct supervision of an IH/PCM trained technician / analyst prior to unsupervised prep and/or analysis of IH/PCM regulated client samples.
Each analyst/technician must read, understand and agree to follow the laboratory SOP as documented using the SOP Acknowledgement sign-off form.

Each technician/analyst must prep and/or analyze as appropriate at least 2 blind reference material test samples (concentration unknown to the technician/analyst). These samples may be an AIHA-LAP, LLC provided PT samples or laboratory prepared Reference Slides. Results must fall within the PT acceptance range or laboratory reference slide counting acceptance ranges as appropriate.

Once all requirements in 5.7.10.8.3.2 have been met, the technician/analyst will be approved to begin unsupervised prep/analysis of client samples.
Documentation of formal approval to begin work is defined as the date signed by the Technical Director on the Demonstration of Capability Certification form.

5.7.10.8.3.3 Continuing Demonstration of Capability (CDOC).
Each technician/analyst must demonstrate continued proficiency at least every 6 months through the analysis of AIHA-LAP, LLC provided PT samples or laboratory prepared Reference Slides. Results must fall within the AIHA-LAP, LLC PT acceptance criteria or laboratory reference slide counting acceptance ranges as appropriate. CDOCs are documented via AIHA-LAP, LLC PT reports or in the QC data log books maintained in the PCM laboratory as appropriate.

5.7.10.8.3.4 All IDOC and CDOC documentation for IHLAP related procedures is maintained

and available for review for at least 5 years.

5.7.10.8.4 EMLAP Specific Technician Training Requirements:

5.7.10.8.4.1 EMLAP laboratory technicians must meet minimum educational requirements of a high school diploma or GED.

5.7.10.8.4.2 Initial demonstration of capability.
Each technician must complete at least 6 months documented training for Air Direct Exam (spore trap) and work/training in the EMLAP microbiology laboratory under the direct supervision of an EMLAP trained technician/analyst prior to performing unsupervised technician level work on EMLAP regulated client samples.

Each technician must read, understand and agree to follow the laboratory SOP as documented using the SOP Acknowledgement sign-off form.
Technician level personnel are limited to preparatory operations and assistance in all steps leading to the identification of microorganisms and may not perform analyses or be responsible for the final decisions related to the identity of microorganisms, except as described below:
"Technicians may function as analysts for Air-Direct Examination (spore traps) analysis after completion of 12 months documented on the job training and demonstrated proficiency. During the 12 month analyst training period, the trainee may perform work under the direct supervision of another qualified analyst. All work must be reviewed by another qualified analyst prior to release of data."

Technicians functioning as analysts shall demonstrate proficiency by successful analysis of EMLAP PT samples or laboratory reference slides to document their ability to identify genus/groups of fungi reported. The technician must also complete and pass the laboratory Fungal Identification Examination/Quiz as administered by the Micro Dept. Manager. Once all requirements in 5.7.10.8.5.2 have been met, the technician will be approved to begin unsupervised prep/analysis of client samples. Documentation of formal approval to begin work is defined as the date signed by the Technical Director on the Demonstration of Capability Certification form.

5.7.10.8.4.3 Continuing Demonstration of Capability (CDOC).
Each technician must demonstrate continued proficiency at least every 6 months through the analysis of AIHA-LAP, LLC provided PT samples or laboratory prepared Reference Slides. Results must fall within the AIHA-LAP, LLC PT acceptance criteria or laboratory reference slide counting acceptance ranges as appropriate. CDOCs are documented via AIHA-LAP, LLC PT reports or in the QC data log books maintained in the microbiology laboratory as appropriate.

5.7.10.8.4.4 All IDOC and CDOC documentation for EMLAP related procedures is maintained and available for review for at least 5 years

5.7.10.8.5 EMLAP Specific Analyst Training Requirements:

5.7.10.8.5.1 EMLAP laboratory analysts must meet minimum educational requirements of a baccalaureate degree in microbiology, biology or related life science.

5.7.10.8.5.2 Initial demonstration of capability.
Each analyst must complete at least 3 months of documented training fro Air

Direct Exam (spore trap) and at least 6 months of work/training in the EMLAP microbiology laboratory prior to performing unsupervised work on EMLAP regulated client samples. Each analyst must read, understand and agree to follow the laboratory SOP as documented using the SOP Acknowledgement sign-off form. Each analyst must prep and/or analyze as appropriate at least 2 blind reference material test samples. These samples may be an AIHA-LAP, LLC provided PT samples or laboratory prepared Reference Slides. Results must fall within the PT acceptance range or laboratory reference slide counting acceptance ranges as appropriate and document proper identification of genus/species and genus/groups of fungi reported.

Once all requirements in 5.7.10.8.5.2 have been met, the technician/analyst will be approved to begin unsupervised prep/analysis of client samples. Documentation of formal approval to begin work is defined as the date signed by the Technical Director on the Demonstration of Capability Certification form.

5.7.10.8.5.3 Continuing Demonstration of Capability (CDOC). Each technician/analyst must demonstrate continued proficiency at least every 6 months through the analysis of AIHA-LAP, LLC provided PT samples or laboratory prepared Reference Slides. Results must fall within the AIHA-LAP, LLC PT acceptance criteria or laboratory reference slide counting acceptance ranges as appropriate. CDOCs are documented via AIHA-LAP, LLC PT reports or in the QC data log books maintained in the microbiology laboratory as appropriate.

5.7.10.8.5.4 All IDOC and CDOC documentation for EMLAP related procedures is maintained and available for review for at least 5 years.

5.7.11 The Method Detection Limit (MDL). MDL studies are performed initially for a test and verified quarterly. Reverification occurs annually within 13 months of the initial MDL study. The MDL Procedure is as follows:

5.7.11.1 Estimate the MDL

5.7.11.1.1 Use the previous MDL study.

5.7.11.1.2 Use 3 times the standard deviation of (low level ideally) spikes.

5.7.11.1.3 Determine the concentration or region of your calibration curve where there is a significant change in sensitivity and use that concentration. (This could also be at your instrument's limitation to detect.)

5.7.11.2 Determine the Initial MDL

5.7.11.2.1 Determination of the Blank MDL (MDL_b) using method blank values for certain analytes is the first step to determining an MDL. For those analytes that show identified concentrations in Method Blanks, enter the values into the MDL spreadsheet (that is posted with the MDL procedure) and determine the MDL. If some but not all of the method blanks for individual analytes give numerical results, set the MDL equal to the highest result.

5.7.11.2.2 Determination of the Spiked MDL (MDL_S) - Next perform the Spiked MDL (MDL_S) study in one of the following ways

5.7.11.2.2.1 <u>Single Instrument Spiked MDL</u>

5.7.11.2.2.1.1 Prepare and analyze at least seven replicates at a concentration determined by the estimated MDL procedure. These seven replicates must be prepared in at least three separate batches and analyzed (run) on three different days.

(Run each of the 3 batches on different days.) Enter the values obtained into the MDL spreadsheet (that is posted with the MDL procedure).

5.7.11.2.2.1.2 Use 2 or 3 study replicate values (for a total of 5) from the previous two MDL studies performed within the last 24 months assuming the spike concentration used for those studies is the same concentration to be used for the initial MDL determination. In addition, prepare and analyze at least two more replicates at the same concentration. Populate the MDL spreadsheet with those values.

5.7.11.2.2.1.3 Submit both spreadsheets to the Department Manager or the QA Manager for review and approval.

5.7.11.2.2.2 Multiple Instrument Spiked MDL

5.7.11.2.2.2.1 Prepare and analyze at least two replicates per instrument (minimum seven total replicates) at a concentration determined by the estimated MDL procedure. Replicates must be prepared in at least three separate batches and analyzed (run) on three different days. Enter the values obtained into the MDL spreadsheet (that is posted with the MDL procedure).

5.7.11.2.2.2.2 Use 2 or more study replicate values per instrument from the previous two instruments' MDL studies performed within the last 24 months assuming the spike concentration used for those studies is the same concentration to be used for the initial MDL determination. Enter these values into the MDL spreadsheet.

5.7.11.2.2.2.3 Submit both spreadsheets to the Department Manager or the QA Manager for review and approval.

5.7.14.1 Method Blank (MB). For each method, the analyst must analyze reagent water blank daily to demonstrate that interferences from the analytical system is under control. The method blank is treated in the same manner as any sample, including any sample preparations such as digestions and extractions.

5.7.12.1 In the method blank, the concentration of any analyte of interest should not exceed the laboratory established practical quantitation limit (PQL). If contamination is detected in the blank, one of the following conditions must be met, or re-analysis of all associated samples is required (Section 5.8, Out of Control Procedures).

5.7.12.1.1 With documentation of client approval, the PQL may be increased above the level of contamination in the method blank & associated samples. Report data with a "B" qualifier.

5.7.12.1.2 For sample results greater than or equal to 10 times the concentration of the method blank, the data may be reported with a flag indicating that low level contamination was detected in the method blank. Report data with a "B" qualifier.

5.7.13 Surrogates and Surrogate Recovery measured during the analysis of organic compounds. In order

to monitor sample extraction efficiency, all client samples, blanks, and QC samples are fortified with surrogate spiking compounds before extraction and injection into the instrument.

5.7.13.1 Acceptance Criteria: Acceptable surrogate recoveries are contained in LIMS.

5.7.13.2 At a minimum, the laboratory annually updates surrogate recovery limits on a matrix-by-matrix basis for each test method.

5.7.13.3 If the surrogate recovery fails the above stated acceptance criteria, the analyst must proceed according to the out-of-control procedures discussed in Section 5.8.

5.7.13.4 Calibration curves. At a minimum, a 5 point calibration curve must be developed for each surrogate that is used in a particular test method.

5.7.14.2 Internal standard retention time - The retention times of the internal standards in the calibration verification standard must be evaluated immediately after or during GC or GC/MS acquisition.

5.7.14.2.1 If the retention time for any internal standard changes by more than 30 seconds from the retention time of the mid-point standard in the most recent initial calibration sequence, then the chromatographic system must be inspected for malfunctions and corrections must be made. Proceed according to the out-of-control procedures discussed in Section 5.8.

5.7.14.2.2 Internal standard response – If the area for any of the internal standards in the ICV or CCV changes by more than a factor of two (-50% to +100%) from that of the mid-point standard level in the most recent initial calibration sequence, the mass spectrometer or GC system must be inspected for malfunctions and corrections must be made unless the exceedance is caused by matrix interference. Proceed according to the out-of-control procedures discussed in Section 5.8.

5.7.14.3 Determination of Retention Time Window. Before establishing windows, be certain that the GC, GC/MS, or HPLC system is within optimum operating conditions. To determine the retention time window, make three injections of the sought for standard(s) or analyte(s) throughout the course of a 72 hour period. Serial injections over less than a 72-hour period result in retention time windows that are too tight.

5.7.14.3.1 Calculate the standard deviation of 3 absolute retention times for standard(s) in question.

5.7.14.3.2 The retention time window for individual peaks is defined as plus-or-minus (+/-) three (3) times the standard deviation of the absolute retention time.

5.7.14.3.3 In those cases where the standard deviation for a particular analyte is zero, the laboratory should use +/- 0.05 minutes as a retention time window.

5.7.14.3.4 The laboratory must calculate retention time windows for each standard on every existing GC column and on each new GC column when it is installed. The data is be retained by the laboratory for a period of 5 years.

5.7.14.4 For TCLP analysis, a matrix spike should be prepared and analyzed for each waste type (e.g., oil, solid) associated with a batch of 20 or fewer samples of similar matrix.

5.7.15 Additional Quality Control Parameters Required for Metals Analysis by 7000 Series Methods.

5.7.15.1 Dilution test. For each analytical batch, select one typical sample for serial dilution to determine whether interferences are present. The concentration of the analyte should be at least 25 times the estimated detection limit.

5.7.15.1.1 Determine the apparent concentration in the undiluted sample. Dilute the sample by a

minimum of five fold (1 + 4) and reanalyze.

5.7.15.1.2 If all of the samples in the batch are below 10 times the detection limit(s), perform the spike recovery analysis.

5.7.15.1.3 Agreement within 10% between the concentration of the undiluted sample and five times the concentration of the diluted sample indicates the absence of interferences, and such samples may be analyzed without using the method of standard additions.

5.7.15.2 Spike Recovery Test. If results from the dilution test do not agree (or if none of the samples in the batch are at a concentration level that is 10 times the MDL) the spike recovery test must be performed.

5.7.15.2.1 Withdraw another aliquot of the test sample and add a known amount of analyte to bring the concentration of the analyte to 2 to 5 times the original concentration.

5.7.15.2.2 If all of the samples in the batch have analyte concentrations below the detection limit, spike the selected sample at 20 times the detection limit.

5.7.15.2.3 Analyze the spiked sample and calculate the spike recovery. If the recovery is less than 85% or greater than 115%, the method of standard additions shall be used for all samples in the batch or data qualified and narrated with client report.

5.7.16 Additional Quality Control Parameters Required for Metals Analysis by ICP Methods.

5.7.16.1 The upper limit of the linear dynamic range must be established for each wavelength utilized. This is accomplished by measuring the signal response of a standard that is 10% higher than the upper range of the calibration curve.

5.7.16.2 The laboratory must establish and verify every six months an inter-element spectral interference correction routine to be used during sample analysis. See the individual ICP method SOPs for instructions on performing this test.

5.7.16.3 Duplicate or matrix spike duplicate samples. For all target metals, one sample per analytical batch is digested and analyzed in duplicate or as matrix spike duplicate. The results are compared and should meet the precision control limits established.

5.7.16.4 An instrument blank should be run after any sample giving a response that exceeds the calibration range of the instrument. This is done to show that there is no carry-over to the next analysis. The instrument blank shall consist of a high purity solvent (e.g., hexane for pesticide analysis by GC/ECD, methylene chloride for semi-volatiles analysis by GC/MS).

5.7.17 Additional Quality Control Parameters Required for Microbiological Test Methods.

5.7.17.1 Laboratory water quality must be checked and documented at the frequency indicated in the following table.

Table 5-2 Laboratory Water Quality Criteria

Requirement	Criteria	Frequency
pH	5.5-7.5	Each day test is performed
Residual Chorine	<1.0 mg/L	Each day test is performed
Conductivity	<2.0 µmho/cm @25°C	Each day test is performed
Heterotrophic Plate Count	<500 colony forming units/ml	Monthly
Bacteriological Ratio	0.8-3.0	Annually
Cd, Cr, Cu, Ni, Pb, Zn	<0.05 mg/L each, total <1.0 mg/L	Annually
NH_3, Organic Nitrogen	<0.1 mg/L	Monthly
TOC	<1.0 mg/L	Monthly
Student's t value	<2.78 (Annual use test)	Annually

5.7.17.2 The laboratory maintains records of monthly checks on sterile water and membrane filters as evidence of trends in contamination levels for microbiology through Heterotrophic Plate Count measurements. If the contamination level exceeds 1000 CFU/ml, all equipment should be checked for sterility and re-sterilized as necessary. In addition, if additional testing indicates that the problem is still present, then the room used for bacteriological testing should be cleaned with a disinfectant soap and plate counts measured again. Repeat the process as necessary.

5.8 Procedures for Assessing and Treating Out-of-Control Situations.

5.8.1 Quality control analyte samples consist of the following: MB, LCS, LCSD, MS, MSD, ICV, CCV, BFB and DFTPP tunes, internal standards, surrogates, post digestion spikes, and dilution tests.

5.8.2 If any of the quality control analyte recovery values are outside either the laboratory or method-established control limit(s), they are considered to be out-of-control.

5.8.3 The resolution of an out-of-control situation, with identification and correction of the root cause, must be documented prior to initiating subsequent analyses. Documented corrective action (which may or may not require re-analysis) must also be performed if any of the recovery values in the LCS exhibit any "out-of- control" patterns.

5.8.4 Out-of-control conditions include the following special situations:

5.8.4.1 When the acceptance criteria for the continuing calibration verification has a high bias and there are associated samples that are non-detects, then the non-detects may be reported. Otherwise, the samples affected by the unacceptable calibration verification shall be re-analyzed after the source of the problem has been corrected.

5.8.4.2 When the acceptance criteria for the continuing calibration verification have a low bias, those sample results may be reported if they exceed a maximum regulatory limit or decision level. Otherwise, the samples affected by the unacceptable verification shall be re-analyzed after the source of the problem has been corrected.

5.8.4.3 The root cause of such failures must be investigated and documented in a Non-Conformance Report (NCR). Any corrective actions identified as a result of the investigation must be implemented and documented in a Corrective Action Report (CAR) prior to reprocessing the affected sample batch.

5.8.4.4 The QC requirements for each test method are listed LIMS test codes. They are also posted as charts and tables on the portal server. Unless otherwise indicated, if tables and charts have been produced, the precision and accuracy limits were determined from laboratory data.

5.9 Inter-laboratory QA and QC

5.9.1 Each section of the laboratory may be given blind and double blind samples to analyze for requested parameters. Blind samples may be assigned in containers to be diluted, digested, and/or extracted and analyzed by the appropriate laboratory section. Double-blind samples arrive on a pre-scheduled basis from a "client" as real samples to be analyzed by designated analytical sections for specific analytes.

5.9.2 Blind QC samples may be used as a test of proficiency for analysts needing certification and/or qualification for performing an analysis. The Section Supervisor should obtain the QC sample from, either, the Quality Assurance Department or from a source independent of the source of standards for the analysis.

5.9.3 Double blind samples represent quality control samples whose analyte concentrations are known to, either, an outside source, such as a client, or an inside source, such as the Quality Control Manager, Project Managers, or the Technical Director.

5.9.3.1 Double blind samples will arrive in the lab as real samples and their identity will not be known to anyone as quality control samples except for Quality Assurance and Department Manager.

5.9.3.2 The results of these double-blind samples will be sent to the "client" to be compared to the true value of the samples. The laboratory's performance on these samples may be compared to other laboratories in the program (if applicable). These results will be mailed to the Quality Assurance Department.

5.9.3.3 When the double blind samples are created within the laboratory, a report will be generated by the Quality Assurance Manager or the Technical Director that indicates the true value of the analyte. These values will be compared to the reported value by the laboratory. The analysis of double blind samples is used as an aid to improve quality control within the laboratory.

5.10 Sample Dilution

5.10.1 All instruments are periodically calibrated with calibration curves. The calibrations typically are developed by comparison of area or intensity against sample concentration. Per the requirements of the various accreditation agencies, the calibrations are verified initially and periodically, usually every day or every 12 hours.

5.10.2 Various test methods additionally require that the linear range of the instrument is determined on a specified frequency.

5.10.3 In the event that a measured sample concentration exceeds the concentration of the highest calibration standard or the linear range of the instrument (where determined), the sample must be diluted per the following procedure.

5.10.3.1 The analyst should attempt to dilute the sample so that the measured concentration of the diluted sample is approximately 60% that of the highest standard in the calibration curve.

5.10.3.2 The sample must be diluted with the same matrix as the undiluted sample as indicated below.

5.10.3.2.1 Aqueous samples are diluted with reagent grade distilled water.

5.10.3.2.2 Extracts in solvents are diluted with the same solvent of the same purity.

5.10.3.2.3 ICP digestates are diluted with nitric acid or hydrochloric acid-water mixtures that emulate the original matrix.

5.10.3.3 The sample dilution is reported in the LIMS and on the data sheet. The results are reported to the client and the reporting limits are automatically adjusted by the LIMS system to account for the sample dilution.

Table 5-3 Summary of Calibration and QC Procedures for Various Tests

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action (3,4)
SW-8081B	Five-point initial calibration	Initial calibration prior to sample	RF = 20%	Correct problem then repeat initial
Pesticides	for all analytes	analysis		calibration
SW-8082A				
PCB			Linear - least squares regression	
SW-8151A			r>0.995	
Herbicides	Second source calibration	Once per five point initial	All analytes within 15% of	Correct problem then repeat initial
SW-8015C	verification standard (ICV)	calibration - from second source.	target value	calibration
Organics			GRO/DRO = 15% PRO = 20%	
GRO	Retention time window	System set-up	3 times standard deviation for	Correct problem then re-analyze
DRO	calculated for each analyte		each analyte retention time from	all samples analyzed since
FL-PRO			72 hour study	retention time check
SW-8315A	Continuing calibration	Before sample analysis, after	All analytes within 15% of	Correct problem then repeat initial
Carbonyls	verification	every 10 samples, and at the end	target value	continuing calibration verification
		the analysis sequence with	GRO/DRO = 20% PRO = 25%	and re-analyze all samples since
		varying concentrations	8081B/8082A = 20%	last successful CCV
		GRO/DRO Every 12 hours before		
		sample analysis, after every 10		
		samples, and at the end of the		
		analytical sequence		
		GRO/DRO = RT window		
		required analyzed at same		
		frequency as CCV		
	Breakdown check (Endrin	Daily prior to analysis of samples	Degradation <15%	Inlet column maintenance; repeat
	and DDT)(1)			breakdown check. Correct problem
	Method Blank	Once per analytical batch	No analytes detected > PQL	Then re-prep and analyze the method
				and all samples processed with the
				contaminated blank.
	LCS/LCSD	One per prep batch	See LIMS Test codes	Re-prep and analyze the LCS/LCSD
				& all samples in the affected batch
	Surrogate Spike	Every sample, spiked sample,	See LIMS Test codes	Check system, re-inject, re-extract
		standard, and method blank		
	MS/MSD	One per prep batch	See LIMS Test codes	None - Narrate the results in LIMS
	IDOC	Every time a new analyst	See LIMS Test codes	Analyst cannot perform the test
		performs the test method for the		method until the IDOC passes
		first time - second source.		method criteria
	LLOQ	Initial	LCS range ±20%	
		Annually	0.5-2 times established LLOQ	Re-evaluate, repeat study
	MDL	Initial Blank & Spike MDL Study	MDL < Spike Level	Reverification, repeat study
		Quarterly Verification. Annual	Analyte specific per test	
		MDL Study Reverification		
	Second column	100% for all positive results	Same results as primary	Only report the results that match.
	confirmation (2)	(not for 8015B)	column analysis	Use the highest results
SW-8260D	Tune BFB for 8260B	Prior to initial calibration		Analyst cannot perform the test until
SW-8270E	Tune DFTPP for 8270D	Prior to initial calibration		the tune passes method criteria
	Five-point initial calibration	Initial calibration prior to sample		Correct problem then repeat initial
	for all analytes	analysis.		calibration
	Second source calibration	Once per five point initial	All analytes within 30% of	Correct problem then repeat initial
	verification standard (ICV)	calibration-second source.	target value	calibration
	Retention time window	Each Sample	Relative retention time (RRT) of	Correct problem then re-analyze
	calculated for each analyte		the analyte within 0.06 RRT units	all samples analyzed since
			of the RRT	retention time check
	Continuing calibration	Daily prior to analysis of samples		Correct problem then repeat initial
	verification	and every 12 hours of analysis		continuing calibration verification
		time.		and re-analyze all samples since
				last successful CCV. If not met the

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action (3,4)
SW-8260D	Internal Standards	Every sample/standard	Target compounds ≤20%	system should be evaluated, and
SW-8270E			Retention Time RT +/-30 seconds	corrective action should be taken
			from RT of the mid- point in the	before analysis. If criterion is not met
			CCV/ICAL(sample/standard)	for more than 20% of the compounds
			EICP area within -50% to +100%	Included In the initial calibration, then
			of ICAL mid-point standard	corrective action must be taken prior to
	Internal Standards	Every sample/standard	Target compounds ≤20%	analysis of samples.Inspect GC/MS for
				malfunctions; mandatory re-analysis of
				samples analyzed while system was
				malfunctioning. Correct problem then
	Method Blank	Once per analytical batch	No analytes detected > PQL	re-prep and analyze method blank and
				all samples processed with the
				Contaminated blank.
	LCS/LCSD	One per prep batch	See LIMS Test codes	Re-prep and analyze the LCS/LCSD
				and all samples in the affected
				analytical batch
	Surrogate Spike	Every sample, spiked sample,	See LIMS Test codes	Check system, re-inject, re-extract
		standard, and method blank		
	MS/MSD	One per prep batch	See LIMS Test codes	None - Narrate the results in LIMS
	IDOC	Every time a new analyst	See LIMS Test codes	Analyst cannot perform the test
		performs the test method	LCS Accuracy for Limits	method until the IDOC passes
		for the first time - second source.		method criteria
	LLOQ	Initial	LCS range ±20%	
		Annually	0.5-2 times established LLOQ	Re-evaluate, repeat study
	MDL	Initial Blank & Spike MDL Study	MDL < Spike Level	Reverification, repeat study
		Quarterly Verification. Annual	Analyte specific per test	
		MDL Study Reverification		
SW-7000	3-point initial calibration	Daily initial calibration prior to	Correlation coefficient >0.995 for	Correct problem then repeat initial
Metals	(min. 3 stds and a blank)	sample analysis	linear regression	calibration
	Second source calibration	Once per initial daily calibration	All analytes within 10% of	Correct problem then repeat initial
	verification standard (ICV)	second source.	target value	calibration
	Continuing calibration	Before sample analysis, after	All analytes within 20% of	Correct problem then repeat initial
	verification	every 10 samples, and at the end	target value	continuing calibration verification
		the analysis sequence		and re-analyze all samples since
				last successful CCV
	Method Blank	Once per analytical batch	No analytes detected > PQL	Correct problem then re-prep and
				analyze method blank and all samples
				processed with that blank.
	LCS/LCSD	One per prep batch	See LIMS Test codes	Re-prep and analyze the LCS/LCSD
				and all samples in the affected batch.
	MS/MSD	One per prep batch	See LIMS Test codes	None - Narrate the results in LIMS
	IDOC	Every time a new analyst	See LIMS Test codes	Analyst cannot perform the test
		performs the test method	LCS Accuracy for Limits	method until the IDOC passes
		for the first time - second source.		method criteria
	LLOQ	Initial	Spike ±35%, RSD <20%	
		Quarterly	Spike ±35%, RSD <20%	Re-evaluate, repeat study
	MDL	Initial Blank & Spike MDL Study	MDL < Spike Level	Reverification, repeat study
		Quarterly Verification. Annual	Analyte specific per test	
		MDL Study Reverification		
	Dilution test: 1:4 dilution	Each preparatory batch	Five times dilution sample result	Perform post digestion spike
		Sample concentration must be	must be within 10% of the	addition
		20X MDL	undiluted sample result	
	Recovery Test	When dilution test fails or	Recovery within 15% of target	Perform method of standard
		sample concentration < 20X MDL	results	additions

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action (3,4)
SW-9010C	Initial calibration	Daily initial calibration prior to	Correlation coefficient >0.995 for	Correct problem then repeat initial
CN Distil	(six standards and a blank)	sample analysis	linear regression	calibration
Cyanide				
	Distilled standards (one	Once per initial daily calibration	All analytes within 10% of	Correct problem then repeat initial
	high and one low)		target value	calibration
	Second source calibration	Once per initial daily calibration	All analytes within 15% of	Correct problem then repeat initial
	verification standard (ICV)	second source.	target value	calibration
	Continuing calibration	Before sample analysis, after	All analytes within 15% of	Correct issue, repeat initial continuing
	verification	every 10 samples, and at the end	target value	calibration verification and re-analyze
		the analysis sequence - varying		all samples since last successful CCV.
		concentrations		
	Method Blank	Once per analytical batch	No analytes detected > PQL	Correct problem, re-prep and analyze
				method blank and all samples
				processed w/ contaminated blank.
	LCS/LCSD	One per prep batch	All analytes within 15% of	Re-prep, reanalyze the LCS/LCSD and
			target value	all samples in the analytical batch
	MS/MSD	One per prep batch (9010B)	All analytes within 30% of	None - Narrate the results in LIMS
		Every 10 samples (9012A)	target value	
	IDOC	Every time a new analyst	See LIMS Test codes	Analyst cannot perform the test
		performs the test method	LCS Accuracy for Limits	method until the IDOC passes
		for the first time - second source.		method criteria
	LLOQ	Initial	Spike ±35%, RSD <20%	
		Quarterly	Spike ±35%, RSD <20%	Re-evaluate, repeat study
	MDL	Initial Blank & Spike MDL Study	MDL < Spike Level	Reverification, repeat study
		Quarterly Verification. Annual	Analyte specific per test	
		MDL Study Reverification		
EPA-624.1	Tune BFB for 8260B	Prior to initial calibration and	See individual method for	Analyst cannot perform the test
EPA-625.1	Tune DFTPP for 8270C	continuing calibration verification	tune criteria.	method until the tune passes
		every 12 hours		method criteria
	5-point initial calibration	Initial calibration prior to sample	%RSD<35%	Correct problem then repeat initial
	for all analytes	analysis		calibration
	Second source calibration	Once per 5 point initial	All analytes within range of	Correct problem then repeat initial
	verification standard (ICV)	calibration	method criteria (SOPs/Methods)	calibration
	Continuing calibration	Daily prior to analysis of	All calibration analytes within	Correct problem then repeat initial
	verification	samples - varying concentration.	Range of method specified criteria	continuing calibration verification
			(SOPs/Methods)	and re-analyze all samples since
				last successful CCV
	Internal Standards	Every sample/standard	Retention time +/-30 seconds	Inspect GC/MS for malfunctions;
			from retention time of the mid-	mandatory re-analysis of samples
			Point in the CCV/ICAL	analyzed while system was
				malfunctioning.
	Retention time window	Each Sample	Relative retention time (RRT) of	Correct problem then re-analyze
	calculated for each analyte		the analyte within 30 seconds	all samples analyzed since
			of the RT	retention time check
			(sample/standard)	
			EICP area within -50% to +100%	
			of ICAL mid-point standard	
	Method Blank	Once per analytical batch	No analytes detected > PQL	Correct problem then re-prep and
				analyze method blank and all samples
				processed with this blank.
	LCS/LCSD	One per prep batch	See LIMS Test codes	Re-prep and analyze the LCS/LCSD
				and all samples in the affected
				analytical batch

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action (3,4)
	Surrogate Spike	Every sample, spiked sample,	See LIMS Test codes	Check system, re-inject, re-extract
		standard, and method blank		
	MS/MSD	One per prep batch	See LIMS Test codes	None - Narrate the results in LIMS
	IDOC	Every time a new analyst	See LIMS Test code or QC Charts	Analyst cannot perform the test
		performs the test method	LCS Accuracy for Limits	method until the IDOC passes
		for the first time - second source.		method criteria
	MDL	Initial Blank & Spike MDL Study	MDL < Spike Level	Reverification, repeat study
		Quarterly Verification. Annual	Analyte specific per test	
		MDL Study Re-verification		
TO-14A	New Canister Check	New - pressurize with humidified	demonstrate <0.2ppb of target	Re-clean canister and retest
TO-15		UHP nitrogen; analyze after aging	analytes	
VOC		24 hours to determine cleanliness		
	Canister Leak Check	Pressurize to 30 psig and check	Pressure should not vary more	Repair canister and retest
		pressure after 24 hours	than +/- 2 psig over 24 hours	
	Canister Blank Check	Pressurize to 30 psig with	demonstrate <0.2ppbv of target	Re-clean canister and retest
		humidified UHP nitrogen	analytes; requires 24 hours of	
			aging prior to analysis	
	Sampling System	Pass humidified UHP nitrogen	demonstrate <0.2ppbv of target	Re-clean canister and retest
	Certification	through sampling system and	analytes	
	(Zero Air Certification	demonstrate <0.2ppbv of target		
	using UHP Nitrogen)	analytes		
	Dynamic Calibration	Pass humidified UHP nitrogen	demonstrate <0.2ppbv of target	Clean system and retest
	System Certification	through the dynamic calibration	analytes	
		system		
	Sampler System	Use humidified gas standards to	Recovery between 90 and 110%	Clean system and retest
	Certification	compare results from a canister		
		collected with the sampling		
		system and on-line GC-MS		
	Instrument Performance	Prior to the analysis of any	Verify the mass spectral ion	Retune or perform routine
	Check (BFB Tuning)	samples, blanks, or calibration	abundance is in accordance with	maintenance then retune
		standards, load 50 ng or less of	Table 7-1 of SOP	
		BFB every 24 hours		
	Initial Calibration (ICal)	Prior to analysis of samples and	R^2>0.995	Correct problem and recalibrate
		blanks but after the instrument		
		performance check (following any		
		corrective action):		
		Variation of Relative Response	<30% RSD for the RRF each	Correct problem and recalibrate
		Factor (RRF)	target analyte	
		Variation of Relative Retention	Each standard within 0.06 RRT	Correct problem and recalibrate
		Time (RRT)	Units of mean for each analyte	
	Internal Standard (IS)	Each IS response	Must be within 40% of the mean	Correct problem and recalibrate
	ICAL Response		response over the ICAL	
		IS ICAL Retention Time	Each IS should be within 20 s of	
			the mean retention time over the	
			ICAL	
	Daily Calibration	Prior to the analysis of samples	Must be within +/- 30% for ICAL	Reanalyze; if still fails, perform
	(Continuing Calibration	and blanks but after tuning criteria	for each target analyte	instrument maintenance and reanalyze
	Verification-CCV)	have been met, analyze mid-level		
		standard		
	Laboratory Method Blank	Analyze one every 24 hours;	Blank should not contain any	Reanalyze; prepare new canister and

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action (3,4)
TO-14A	(LMB)	pressurize (2 atm) clean canister	target analyte greater than PQL.	analyze
TO-15		with >20% relative humidity UHP	Each IS response in the blank	
VOC		nitrogen	must be within +/- 0.33 minutes	
			of the most recent calibration	
	Sample Technical	Analyzed on a GCMS system	Meeting the BFB Tune, ICAL, and	Reanalyze sample. Qualify / Narrate
	Acceptance Criteria		continuing calibration criteria	data appropriately
			outlined in SOP	
		Analyzed with a LMB meeting	Must meet method in SOP. All	
		criteria	target analytes within ICAL range.	
			Ea. IS RT within+/- 30% minutes	
			of the most recent calibration.	
EPA-245.1	Initial calibration (minimum	Daily initial calibration prior to	Correlation coefficient >0.995 for	Correct problem then repeat initial
Mercury	5 standards and a blank).	sample analysis.	linear regression.	calibration.
	Linear Dynamic Range	Once Annually	Analyte within 10% of target	Calibration range lowered to meet
			value (not necessary if diluting	LDR results.
			within calibration curve).	
	Second source calibration	Once per five point initial	All analytes within 5% of	Correct problem then repeat initial
	verification standard (ICV)	Calibration - second source.	target value	calibration
	Continuing calibration	Before sample analysis, after	All calibration analytes within 10%	Correct problem then repeat initial
	verification	every 10 samples, and at the end	of target value before	continuing calibration verification
		of the analysis sequence -	sample analysis	and re-analyze all samples since
				last successful CCV
	Method Blank	Once per analytical batch	No analytes detected > PQL	Correct problem then re-prep and
				analyze method blank and all samples
				processed with that blank
	LCS/LCSD	One per prep batch	See LIMS Test codes	Re-prep and analyze the LCS/LCSD
				and all samples in that batch
	MS/MSD	One per prep batch	See LIMS Test codes	None - Narrate the results in LIMS
	IDOC	Every time a new analyst	See LIMS Test codes	Analyst cannot perform the test
		performs the test method for the	LCS Accuracy for Limits	method until the IDOC passes
		first time - second source.		method criteria
	LLOQ	Initial	Spike ±35%, RSD <20%	
		Quarterly	Spike ±35%, RSD <20%	Re-evaluate, repeat study
	MDL	Initial Blank & Spike MDL Study	MDL < Spike Level	Reverification, repeat study
		Quarterly Verification. Annual	Analyte specific per test	
		MDL Study Reverification		
EPA 200.7	Initial calibration (minimum	Initial calibration prior to sample	Not applicable	Correct problem then repeat initial
SW-6010D	1 standards and a blank)	analysis		calibration.
ICP Metals				
	CRI /LLICV/LLCCV	Set to PQL	Result must be greater than	Correct problem the repeat initial
			calibration blank, <PQL	calibration
			±30% for all analytes	
	Check Standard	Calibration verification	All analytes within 5% of	Correct problem, then reanalyze the
			target value	calibration standard and check std.
	Second source calibration	Once per initial calibration -	Mean value of all analytes	Fix problem, repeat initial calibration
	verification standard (ICV)	second source.	within 5% of target value for 200.7	
			within 10% for 6010D	
	ICSA	Interference analytes Ca, Fe, Mg, Al	Concentrations of analytes	Stop analysis; fix problem. Reanalyze
		Beginning, end & periodic intervals	within 20% of target value	ICS; reanalyze all affected samples.
	ICSAB	Interference analytes Ca, Fe, Mg, Al	Concentrations of analytes	Stop analysis; fix problem. Reanalyze

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action (3,4)
EPA 200.7		Beginning, end & periodic intervals	within 20% of target value	ICS; reanalyze all affected samples.
SW-6010D				
ICP Metals	Linear dynamic range	Every six months	All analytes within 10% of	Calibration range adjusted to meet
			target value.	calibration results.
	Calibration blank	After every calibration verification	No analytes detected within +/-	Correct problem then repeat initial
			one MDL	continuing calibration verification
				and re-analyze all samples since
				last successful calibration blank
	Continuing calibration	Before sample analysis, after	Analytes within 10% of target	Repeat calibration and re-analyze
	verification (CCV)	every 10 samples, and at the	value for method 200.7,	all samples since last successful
		end of the analysis sequence -	within 10% for method 6010D	calibration verification.
	Method Blank	Once per analytical batch	No analytes detected within +/-	Correct problem then re-prep and
			one MDL	analyze method blank and all samples
				processed with the contaminated blank
	Duplicate	One per batch	%RSD must be 20% for water	Reanalyze duplicate sample.
		Sample concentration must be	%RSD must be 30% for soil	Check system, re-prep, re-analyze
		4X MDL or greater for valid results		as needed
	LCS/LCSD	One per prep batch	All samples within 20% of	Re-prep and analyze the LCS/LCSD
			target value	and all samples in that batch
	Dilution test: 1:4 dilution	Each preparatory batch	Five times dilution sample result	Perform post digestion spike
		Sample concentration must be	must be within 10% of the	addition
		20X MDL	undiluted sample result for	
			6010D or C and 10% for 200.7	
	Recovery Test	When dilution test fails or	Recovery within 25% of target	Perform method of standard
		sample concentration < 20X MDL	value	additions
	MS/MSD	One per prep batch	All analytes within 20% RPD	Check system, re-prep, re-analyze
			MS- (200.7 70-130%)	as needed
			(6010D 75-125%)	
			PDS-(200.7 85-115%)	Sample Conc. > 10X spike Conc., if
			(6010D 80-120%)	not , cannot validate MS
	IDOC	Every time a new analyst	See LIMS Test code or QC Charts	Analyst cannot perform the test
		performs the test method	LCS Accuracy for Limits	method until the IDOC passes
		for the first time - second source.		method criteria
	LLOQ	Initial	Spike ±35%, RSD <20%	
		Quarterly	Spike ±35%, RSD <20%	Re-evaluate, repeat study
	MDL	Initial Blank & Spike MDL Study	MDL < Spike Level	Reverification, repeat study
		Quarterly Verification. Annual	Analyte specific per test	
		MDL Study Reverification		
EPA 200.8	Initial calibration (minimum	Initial calibration prior to sample	Not applicable	Correct problem then repeat initial
SW-6020 B	1 standards and a blank)	analysis		calibration.
Metals				
	CRI /LLICV/LLCCV	Set to PQL	Result must be greater than	Correct problem the repeat initial
			calibration blank, <PQL	calibration
			±30% for all analytes	
	Check Standard	Calibration verification	All analytes within 5% of	Correct problem, then reanalyze the
			target value	calibration standard and check std.
	Second source calibration	Once per initial calibration -	Mean value of all analytes within	Correct problem then repeat initial
	verification standard (ICV)	second source.	5% of target value for 200.8	calibration
			within 10% for 6020B	
	ICSA	Interference analytes Ca, Fe, Mg, Al	Concentrations of analytes	Terminate analysis; correct problem
		Beginning, end & periodic intervals	within 20% of target value	reanalyze ICS; reanalyze all affected
		(every 12 hours)		samples.
	Linear dynamic range	Every six months	All analytes within 10% of	Calibration range adjusted to meet
			target value.	calibration results.

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action (3,4)
EPA 200.8	Calibration blank	After every calibration verification	No analytes detected within +/-	Correct problem then repeat initial
SW-6020 B			one MDL	continuing calibration verification
Metals				and re-analyze all samples since
				last successful calibration blank
	Continuing calibration	Before sample analysis, after	Analytes within 10% of target	Repeat calibration and re-analyze
	verification (CCV)	every 10 samples, and at the	value for method 200.8,	all samples since last successful
		end of the analysis sequence -	within 10% for method 6020B	calibration verification.
	Method Blank	Once per analytical batch	No analytes detected within +/-	Correct problem then re-prep and
			one MDL	analyze method blank and all samples
				processed with the contaminated blank
	Duplicate	One per batch	%RSD must be 20% for water	Reanalyze duplicate sample.
		Sample concentration must be	%RSD must be 30% for soil	Check system, re-prep, re-analyze
		4X MDL or greater for valid		as needed
		results.		
	LCS/LCSD	One per prep batch	All samples within 20% of	Re-prep and analyze the LCS/LCSD
			target value	and all samples in the affected
				analytical batch
	Dilution test: 1:4 dilution	Each preparatory batch	Five times dilution sample result	Perform post digestion spike
		Sample concentration must be	must be within 10% of the	addition
		20X MDL	undiluted sample result for	
			6020 B or A and 10% for 200.8	
	Recovery Test	When dilution test fails or	Recovery within 25% of target	Perform method of standard
		sample concentration < 20X MDL	value	additions
	MS/MSD	One per prep batch	All analytes within 20% RPD	Check system, re-prep, re-analyze
			MS-(200.8 70-130%) (6020 B or A	as needed
			75-125%)	
			PDS-(200.8 85-115%) (6020 B / A	Sample Conc. > 10X spike Conc., if
			80-120%)	Not, cannot validate MS
	IDOC	Every time a new analyst	See LIMS Test code or QC Charts	Analyst cannot perform the test
		performs the test method	LCS Accuracy for Limits	method until the IDOC passes
		for the first time - second source.		method criteria
	LLOQ	Initial	Spike ±35%, RSD <20%	
		Quarterly	Spike ±35%, RSD <20%	Re-evaluate, repeat study
	MDL	Initial Blank & Spike MDL Study	MDL < Spike Level	Reverification, repeat study
		Quarterly Verification. Annual	Analyte specific per test	
		MDL Study Reverification		
EPA-608.3	Minimum 3-point initial	Initial calibration prior to sample	RF = 20%; Linear - least squares	Correct problem then repeat initial
Pest/PCB	calibration for all analytes	analysis	regression r>0.995	calibration
	Second source calibration	Once per five point initial	All analytes within 20% of	Correct problem then repeat initial
	verification standard (ICV)	calibration - from second source	target value	calibration
	Retention time window	Each day test is performed.	3 times standard deviation for ea.	Fix problem then reanalyze samples
	calculated for each analyte		analyte RT from 72 hour study	analyzed since retention time check
	Continuing calibration	Before sample analysis, after every		Fix problem. Repeat initial continuing
	verification	20 injections, at the end of analysis		calibration verification; reanalyze all
		sequence - varying concentrations		samples since last successful CCV
	Breakdown check (Endrin	Daily prior to analysis of samples	Degradation <20%	Inlet column maintenance; repeat
	and DDT)(1)			breakdown check
	Method Blank	Once per analytical batch	No analytes detected > PQL	Correct problem, re-prep and analyze
				method blank & all samples processed
				with the contaminated blank.
	LCS/LCSD	One per prep batch	All analytes within range of	Re-prep and analyze the LCS/LCSD
			method criteria (SOPs/Methods)	and all samples in the affected batch.

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action (3,4)
EPA-608.3				
Pest/PCB	Surrogate Spike	Every sample, spiked sample,	All analytes within range of	Check system, re-inject, re-extract
		standard, and method blank	method criteria (SOPs/Methods)	

	MS/MSD	Every batch	All analytes within range of	None - Narrate the results in LIMS
			method criteria (SOPs/Methods)	
	IDOC	Every time a new analyst	All analytes within range of	Analyst cannot perform the test
		performs the test method	method criteria (SOPs/Methods)	method until the IDOC passes
		for the first time - second source.		method criteria
	MDL	Initial Blank & Spike MDL Study	MDL < Spike Level	Reverification, repeat study
		Quarterly Verification. Annual	Analyte specific per test	
		MDL Study Reverification		
	Second column	100% for all positive results	Same results as primary	Only report the results that match.
	confirmation (2)		column analysis	Use the highest results
SM2540C	Verification standard	Each batch	All analytes within 10% of	Repeat test. If results are still not
TDS	Single standard		target value	within 10%, report result and narrate
SM2540D	(if available)		Flashpoint result 77-82°F	in LIMS.
TSS				
SM2540B	Method Blank	Once per analytical batch	No analytes detected > PQL	Correct problem, re-prep and analyze
T. Residue				method blank and samples processed
EPA-160.4				with the contaminated blank.
VS				
SM2540F	Duplicate	One per batch	%RSD must be 20% for water	Reanalyze duplicate sample. If results
Sett Solids		Sample concentration must be	and 30% for soil.	not within RSD limits, report QC
SM-2540E		2X MDL or greater for valid		failure in LIMS or flag as
SW-1010A		results.		non-homogenous for soils.
Flashpoint				
SW1030	IDOC	Every time a new analyst	See LIMS Test code or QC Charts	Analyst cannot perform the test
Ignitability		performs the test method	LCS Accuracy for Limits	method until the IDOC passes
EPA-350.1		for the first time - second source.		method criteria
Ammonia	Five-point initial calibration	Initial calibration prior to sample	RF = 10%	Correct problem then repeat initial
EPA-351.2	for all analytes	analysis	Linear - least squares regression	calibration
TKN	(Excludes BOD, CBOD)		r>0.99; ≥0.995 for 9056A	
EPA-353.2				
NO3/NO2				
EPA-365.1				
EPA-365.3				
Phosphorus	Second source calibration	Once per five point initial	All analytes within 10% of	Correct problem then repeat initial
Sulfate	verification standard (ICV)	calibration - from second source.	target value	calibration
SM4500S2F				
SW-9034				
Sulfide	Continuing calibration	Before sample analysis, after	All analytes within 10% of	Correct problem then repeat initial
SM4500SO3B	verification	every 10 samples, and at the end	target value	continuing calibration verification
Sulfite		the analysis sequence - varying		and re-analyze all samples since
EPA-410.4		concentrations		last successful CCV
COD	Method Blank	Once per analytical batch	No analytes detected > PQL	Correct problem then re-prep and
SM5310B				analyze method blank and all samples
SW-9060A				processed with the contaminated
TOC				blank.
EPA-420.1	LCS/LCSD	One per prep batch	See LIMS Test codes	Re-prep and analyze the LCS/LCSD
EPA-420.4				and all samples in the affected
SW-9065				analytical batch
Phenolics				
SM5540C				
MBAS				
EPA-300.0				
SW-9056A				
IC	MS/MSD	Every 10 samples (9038)	See LIMS Test codes	None - Narrate the results in LIMS
Oil & Grease		One per prep batch (remainder)		
SW-9071B				
SW-1664B	IDOC	Every time a new analyst	See LIMS Test codes	Analyst cannot perform the test
SM5210B		performs the test method	LCS Accuracy for Limits	method until the IDOC passes
BOD		for the first time - second source.		method criteria
SM5210B				
CBOD	LLOQ	Initial	Spike ±35%, RSD <20%	
		Quarterly	Spike ±35%, RSD <20%	Re-evaluate, repeat study

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action (3,4)
	MDL	Initial Blank & Spike MDL Study	MDL < Spike Level	Reverification, repeat study
	(Excludes BOD, CBOD)	Quarterly Verification. Annual	Analyte specific per test	
		MDL Study Reverification		

SM2310B	Verification standard	Each batch	All analytes within 10% of	Repeat test. If results are still not within
Acidity	Single standard (if available)		target value	10%, report result; narrate in LIMS
SM2320B				
Alkalinity	Method Blank	Once per analytical batch	No analytes detected > PQL	Correct problem, re-prep and analyze
SM9222D				method blank and samples processed
F. Coliform				with the contaminated blank.
SM9222B				
T. Coliform	Duplicate	One per batch	%RSD must be 20% for water	Reanalyze duplicate sample. If results not
		Sample concentration must be	and 30% for soil.	within RSD limits, report QC failure in LIMS
		2X MDL or greater for valid results.		or flag as non-homogenous for soils
				.
	IDOC	Every time a new analyst	See LIMS Test code or QC Charts	Analyst cannot perform the test
		performs the test method	LCS Accuracy for Limits	method until the IDOC passes
		for the first time - second source.		method criteria
EPA-120.1	Method Blank	Once per analytical batch	No analytes detected > PQL	Correct problem then re-prep and
Conductivity				analyze method blank and all samples
Color				processed with the contaminated blank.
SM2120F				
SM2120B	Single Standard	Once per analytical batch	All analytes within 10% of	Correct problem then repeat initial
SM4500H+B			target value	calibration
pH			Conductance and color standard	
EPA-180.1			within 5% of target value.	
Turbidity				
SM4500ClG				
Residual Chlorine				
SW-9095B	Duplicate	One per batch	%RSD must be 20%	Reanalyze duplicate sample. If results
Paint Filter			pH Duplicates <0.1 pH Units	not within RSD limits, report QC
SM4500OG				failure in LIMS
DO				
SW-1311	Method Blank	Once per analytical batch	No analytes detected > PQL	Correct problem then re-prep and
TCLP				analyze method blank and all samples
SW-1312				processed with the contaminated
SPLP				blank.
	Post extraction duplicate	One per batch	%RSD must be 20%	Reanalyze duplicate sample. If results
				not within RSD limits, report QC
				failure in LIMS
	Post extraction spike	Once per analytical batch	See individual test methods.	See individual test methods.

1. Endrin/DDT breakdown check for 8081B only.
2. Excludes chlordane, toxaphene, and PCB.
3. Sample data associated with QC non-conformances resulting in high bias may be reported if all target analytes are below reporting limits.
4. In the event that reanalysis is not possible, I.e. no remaining sample, holding times expired, etc., data may be reported with non-Conformance and its potential affect on the data described in a Case Narrative.

6.0 SAMPLE BOTTLE AND PRESERVATIVE PREPARATION

6.1 Analytical Environmental Services, Inc. does not provide sampling services, therefore, has no sampling plan or procedures. If requested by the client, AES does provide appropriate pre-cleaned sample containers. The laboratory assumes responsibility for supplying the proper containers and preservatives.

6.2 Sample Container Preparation. Table 6-1 provides a guideline for the correct containers needed for each analysis.

6.2.1 A laboratory label and proper preservative are added to the sample bottle prior to shipment or pick-up by the client. Some clients may request several cases of bottles, preservative in separate containers, and separate labels. Should this occur, the client would be responsible for label attachment and the addition of preservatives in the field. If the client performs these duties, this is indicated on the bottle label and the chain of custody.

6.2.2 If contamination is observed in trip blanks, a representative from each “lot” of sample containers may be analyzed for the detected parameter(s) to ascertain the cause.

6.2.3 Bottle contamination checks are typically accomplished by filling the bottle with DI water and analyzing for the analytes in question. If any results are above the reporting level, contamination is present and the source must be found.

6.2.3.1 A typical method of laboratory contamination is the introduction of volatile compounds into VOC vials by the use of extraction chemicals such as methylene chloride. Another means of laboratory contamination is the cross contamination of analytes into reagent bottles through poor analytical techniques. An example would be returning aliquots of reagents to their original containers after use. In this instance, contaminants in the reagents are measured as part of the sample result when the reagent is used in the test. Finally, cross contamination can occur during analysis when glassware that is used for the test is not been properly cleaned between samples.

6.2.3.2 If the analysis indicates that the contamination source is the bottle manufacturer, the vendor or manufacturer must be informed immediately. Use of the affected bottles must stop immediately and another lot of bottles used instead.

6.2.3.3 Methods of eliminating sample contamination are discussed in the individual analyte SOPs.

6.2.3.4 Procedures for checking sample bottles for sterility and metals contamination are outlined in the Sample Receiving SOP (Sec. 3.1.2.3).

6.3 When the addition of preservatives is performed by laboratory personnel, the preservation type and amount used is marked on the label. This procedure informs the sample collection agent that the sample bottle has pre-measured preservative in it. Additionally, it provides important safety information for the sample collection agent.

6.4 Preservatives prepared by the laboratory are documented in a Preparation Standard logbook. The logbook contains the preservative preparation information including the preservative lot number and if the chemical was used "as is" from the manufacturer or if it was prepared in the lab. See Sec. 6.7.

6.5 Proper packing of bottles is essential to prevent breakage during shipping. All bottles should be wrapped in bubble wrap and the container, usually a cooler, filled with packing material.

6.6 Certain biological analyses require a sterile bottle for sampling. This includes plate counts, E-coli, and Total Coliform analyses. The laboratory purchases sterilized bottles for these analyses. Never break the seal on these bottles or open them as this can contaminate the bottles.

6.7 Preservatives and removal of interferences.

6.7.1 There are several preservatives used to increase the holding time for an analysis. In most cases, these preservatives are required by the test method, and are added to alter the sample pH or to remove possible interferences. The preservatives used at AES include the following:

6.7.1.1 HCl: Concentrated Hydrochloric Acid (1 ml) is added to VOC vials and other sample bottles to lower the resultant pH to ≤ 2 after the addition of sample to the bottle.

6.7.1.2 H_2SO_4: Concentrated Sulfuric Acid (1 ml) is added to sample bottles to lower the resultant pH to ≤ 2 after the addition of sample to the bottle.

6.7.1.3 NaOH: Solid Sodium Hydroxide (one pellet) is added to sample bottles to raise the resultant pH to ≥ 12 after the addition of sample to the bottle.

6.7.1.4 HNO_3: Six ml per liter of sample of a 1:1 Nitric Acid (1 part concentrated Nitric Acid mixed with 1 part DI water) is added to sample bottles to lower the resultant pH to ≤ 2 after the addition of sample to the bottle.

6.7.1.5 EDTA: One ml per 100ml sample of a 2.5% EDTA solution (2.5g dissolved in 100 ml of DI

water) is added to various types of sample bottles to remove any metal interferences.

6.7.2 Low results can be expected when analyzing for BOD, Volatile Organics, and Pesticides in the presence of chlorine. These samples must be tested for the presence of chlorine. This procedure is performed by placing a sample drop on a starch-potassium iodide paper strip. If the strip turns blue, chlorine is present and treatment is needed. Chlorine removal is accomplished through the addition of sodium thiosulfate (usually 2 – 4 ml of a 0.008% or a 1 N solution). Following the addition of this compound, the destruction of chlorine is verified through a subsequent chlorine check.

6.7.3 Low results can also be expected when analyzing for BOD in the presence of cyanides. Testing for the presence of cyanide is performed by placing a drop of sample on a lead acetate paper strip. If the strip turns black, cyanide is present and treatment is needed. Cyanide removal is accomplished through the addition of ascorbic acid, a few grains at a time, until the paper does not turn black. A few more grains can be added to the sample to ensure cyanide removal.

6.8 Bottle Kit Preparation

6.8.1 The number of bottles required per test, type of preservatives, and bottle type are method specific.

6.8.2 Table 6-1 indicates the preservation, holding times, and containers required for the types of tests and matrices analyzed in the laboratory.

TABLE 6-1
Preservation, Holding Time and Containers

Analysis	Matrix*	Holding Time	Container	Preservative
Acidity	Water	14 days	P, G	0 - ≤6°C
Alkalinity	Water	14 days	P, G	0 - ≤6°C
Bicarbonate, Alkalinity	Water	14 days	P, G	0-≤6°C
Carbonate, Alkalinity	Water	14 days	P, G	0-≤6°C
Ammonia	Water	28 days	P, G	1:1 H_2SO_4(pH<2), 0 - ≤6°C
Ammonia	Soil	28 days	G	0 - ≤6°C
Base/Neutral/Acid (BNA)	Water	7 days (Ext)	G	0 - ≤6°C
Base/Neutral/Acid (BNA)	Soil	14 days (Ext)	G	0 - ≤6°C
BOD	Water	48 hours	P, G	0 - ≤6°C, check for Cl
Bromide	Water/Soil	28 days	P, G	0 - ≤6°C
BTEX	Water	14 days	G	1:1 HCl (pH<2), 0 - ≤6°C check for Cl^-
BTEX	Soil	48 hours to preserve, 14 days	Pre-weighed vials or Encore*	Sodium Bisulfate, 0 - ≤6°C or Methanol, 0 - ≤6°C
Carbonate	Water	14 days	P, G	0 - ≤6°C

Analysis	Matrix*	Holding Time	Container	Preservative
Cation Exchange Capacity (EPA 9080 and 9081)	Soil	180 days	G	0 - ≤6°C
CBOD	Water	48 hours	P, G	0 - ≤6°C, check for Cl
Chloride, Total	Water	28 days	P, G	0 - ≤6°C
Chloride, Total	Soil	28 days	P, G	0 - ≤6°C
Chlorine, Total Residual	Water	Immediately	P, G	None
Chlorophyll a	Water	Filtration: <48 hrs Analysis: 21 days	G (amber)	0 - ≤6°C
COD	Water	28 days	P, G	1:1 H_2SO_4, 0 - ≤6°C
Coliform, Fecal	Drinking Water	8 hours	P, sterilized	Sodium Thiosulfate, 0 - ≤6°C
Coliform, Fecal	Non-potable Water	8 hours	P, sterilized	Sodium Thiosulfate, 0 - ≤6°C
Coliform, Fecal	Soil / Sludge	24 hours	P, sterilized	Sodium Thiosulfate, 0 - ≤6°C
E.Coli	Drinking Water	30 hours	P, sterilized	Sodium Thiosulfate, 0 - ≤6°C
Coliform, Total	Drinking Water	30 hours	P, sterilized	Sodium Thiosulfate, 0 - ≤6°C
Coliform, Total	Non-potable Water	8 hours	P, sterilized	Sodium Thiosulfate, 0 - ≤6°C
Coliform, Total	Soil Sludge	24 hours	P, sterilized	0 - ≤6°C
Color	Water	48 hours	P, G	0 - ≤6°C
Color, ADMI	Water	48 hours	P, G	0 - ≤6°C
Conductivity	Water	28 days	P, G	0 - ≤6°C
Conductivity	Soil	28 days	P, G	0 - ≤6°C
Corrosivity (pH)	Soil Sludge	Immediately, 15 minutes	G	0-≤6°C
Cobalt thiocyaniate active substances (CTAS)	Water	48 hours	P, G	0 - ≤6°C
Cyanide, Amenable	Water	14 days	P, G	NaOH (pH>12), 0 - ≤6°C
Cyanide, Amenable	Soil	14 days	P, G	0 - ≤6°C
Cyanide, Reactive	Waste	14 days	P (opaque), G (amber)	0 - ≤6°C
Cyanide, Total	Water	14 days	P, G	NaOH (pH>12), 0 - ≤6°C
Cyanide, Total	Soil	14 days	P, G	0 - ≤6°C

Analysis	Matrix*	Holding Time	Container	Preservative
Density / Specific Gravity	Water	7 days	P, G	0 - ≤6°C
Density / Specific Gravity	Soil / Sludge	6 months	P, G	0 - ≤6°C
DRO	Water	7 days (ext)	G	0 - ≤6°C
DRO	Soil	14 days (ext)	G	0 - ≤6°C
EDB, DCBP	Water	14 days (Ext)	40 mL VOA	0 - ≤6°C
Ferrous Iron	Water	24 hours	P, G	None, 0 - ≤6°C
Flash Point/Ignitability	Liquid	6 months	P, G	None
Flash Point/Ignitability	Solid	6 months	P, G	None
Ignitability	Solids	6 months	P, G	None
FL-PRO	Water	7 days	G	1:1 H_2SO_4 (pH<2), 0 -≤6°C
FL-PRO	Soil	14 days	G	0 - ≤6°C
Fluoride	Water	28 days	P, G	None
FOC/FOM	Solid	28 days	G	0 - ≤6°C
Formaldehyde	Water	72 hrs, to tumble, 72 hrs. to analyze	250 mL G (amber)	0 - ≤6°C
Formaldehyde	Soil	From leachate 72 hours	G	0 - ≤6°C
GRO	Water	14 days	40 mL VOA	1:1 HCl (pH<2), 0-≤6°C
GRO	Soil	48 hours, 14 days after pres.	Pre-weighed vials or Encore*	Sodium Bisulfate, Methanol, 0-≤6°C
Hardness, calculation	Water	6 months	P, G	1:1 HNO_3 (pH<2)
Herbicides	Water	7 days (Ext)	G (amber)	0 - ≤6°C
Herbicides	Soil	14 days (Ext)	G	0 - ≤6°C
Hexavalent Chromium	Water	24 hours	P, G	0 - ≤6°C
Hexavalent Chromium	Soil	30 days (Ext)	P, G	0 - ≤6°C
Lead	Air	6 months	Cartridge**	None
Lead	Wipe	6 months	Bag***	None
Lead	Paint	6 months	Bag	None

Analysis	Matrix*	Holding Time	Container	Preservative
MBAS (Surfactants)	Water	48 hours	P, G	0 - ≤6°C
Mercury	Water	28 days	P, G	1:1 HNO_3 (pH<2)
Mercury, Dissolved	Water	28 days after filtration and preservation	P,G	Field filter or filter upon receipt, 1:1 HNO_3(pH<2)
Mercury	Soil	28 days	P, G	0 - ≤6°C
Metals (Total), except Mercury	Water	6 months	P, G	1:1 HNO_3 (pH<2)
Metals (Dissolved), except Mercury	Water	6 months after filtration and preservation	P, G	Field filter or filter upon receipt, 1:1 HNO_3(pH<2)
Metals (Total), except Mercury	Soil	6 months	P, G	None
Nitrate	Water	48 hours	P, G	0 - ≤6°C
Nitrate	Soil	48 hours	P, G	0 - ≤6°C
Nitrate-Nitrite	Water	28 days	P, G	1:1 H_2SO_4 (pH<2), 0 -≤6°C
Nitrate-Nitrite	Soil	28 days	P, G	0 - ≤6°C
Nitrite	Water	48 hours	P, G	0 - ≤6°C
Nitrite	Soil	48 hours	P, G	0 - ≤6°C
Nitrogen, Organic TKN minus Ammonia	Water	28 days	P, G	1:1 H_2SO_4 (pH<2), 0 - ≤6°C
Nitrogen, Organic TKN minus Ammonia	Soil	28 days	P, G	0 - ≤6°C
Oil and Grease (HEM)	Water	28 days	G (amber)	1:1 H_2SO_4 (pH<2), 0 - ≤6°C
Oil and Grease (HEM)	Soil	28 days	G	0 - ≤6°C
Oxygen, Dissolved (DO)	Water	Immediately, 15 minutes	P, G	None
PAH	Water	7 days (Ext)	G (amber)	0 - ≤6°C
PAH	Soil	14 days (Ext)	G	0 - ≤6°C
Paint Filter Liquids Test	Waste	28 days	G	0 - ≤6°C
PCB	Water	365 days	G (amber)	0 - ≤6°C
PCB	Soil	365 days	G	0 - ≤6°C
Pesticides, Chlorinated	Water	7 days (Ext)	G (amber)	0 - ≤6°C

Analysis	Matrix*	Holding Time	Container	Preservative
Pesticides, Chlorinated	Soil	14 days (Ext)	G	pH 5-9, 0 - ≤6°C
Pesticides, Special	Water	7 days (Ext)	G (amber)	0 - ≤6°C
Pesticides, Special	Soil	14 days (Ext)	G	0 - ≤6°C
pH	Water	Immediately, 15 minutes	P, G	None
pH	Soil	Immediately, 15 minutes	P, G	None
Phenolics	Water	28 days	G (amber)	1:1 H_2SO_4 (pH<2), 0 -≤6°C
Phenolics	Soil	28 days	P, G	0 - ≤6°C
Phosphorus, Ortho	Water	48 hours	P, G	0 - ≤6°C
Phosphorus, Total	Water	28 days	P, G	1:1 H_2SO_4 (pH<2), 0 - ≤6°C
Phosphorus, Total	Soil	28 days	P, G	0 - ≤6°C
Potassium Permanganate	Water	48 hours	40 mL VOA	0 - ≤6°C
RSK-175: Ethane, Ethene, Methane	Water	14 days	40 mL VOA	1:1 HCl (pH<2), 0 - ≤6°C
Semi-Volatiles	Water	7 days (Ext)	G (amber)	0 - ≤6°C
Semi-Volatiles	Soil	14 days (Ext)	G	0 - ≤6°C
Salinity	Water	28 days	P	0 - ≤6°C
Silica as SiO2	Water	6 months	P	1:1 HNO_3 (pH<2), 0 -≤6°C
Field to SPLP Extraction (Tumble): Semivolatiles	Liquid / Solid	14 days	G	0 - ≤6°C
Field to SPLP Extraction (Tumble): Mercury	Liquid/Solid	28 days	G	0-≤6°C
Field to SPLP Extraction (Tumble): Metals, except Hg	Liquid/Solid	180 days	G	0-≤6°C
FOR FLORIDA*** Field to SPLP ZHE Extraction (Tumble)	Solid	48 hours, 14 days after Freezing	25gram Encore****	0 - ≤6°C freeze upon receipt
OTHER STATES Field to SPLP ZHE Extraction (Tumble)	Solid	14 Days	G	0 - ≤6°C
Solids, Settleable	Water	48 hours	G	0 - ≤6°C
Solids, Total	Water	7 days	P, G	0 - ≤6°C
Solids, Total Dissolved	Water	7 days	P, G	0 - ≤6°C

Analysis	Matrix*	Holding Time	Container	Preservative
Solids, Total Suspended	Water	7 days	P, G	0 - ≤6°C
Solids, Total Volatile	Water	7 days	P, G	0 - ≤6°C
Sulfate	Water	28 days	P, G	0 - ≤6°C
Sulfate	Soil	28 days	P, G	0 - ≤6°C
Sulfide	Water	7 days	P, G	NaOH to pH>9 / Zinc Acetate, 0 - ≤6°C
Sulfide	Soil	7 days	P, G	0 - ≤6°C
Sulfite	Water	Immediately, 15 minutes	P, G	0 - ≤6°C
Sulfide, Reactive	Waste	7 days	P (opaque), G (amber/clear)	0 - ≤6°C
Field to TCLP Extraction (Tumble): Volatiles	Liquid / Solid	14 days	G	0 - ≤6°C
Field to TCLP ZHE Extraction (Tumble): Semi-Volatiles	Liquid / Solid	14 days	G	0 - ≤6°C
Field to TCLP Extraction (Tumble): Mercury	Liquid/Solid	28 days	G	0-≤6°C
Field to TCLP Extraction (Tumble): Metals, except Hg	Liquid/Solid	180 days	G	0-≤6°C
Temperature	Water	Immediately, 15 minutes	P, G	None
TKN	Water	28 days	P, G	1:1 H_2SO_4 (pH<2), 0 -≤6°C
TKN	Soil	28 days	P, G	0 - ≤6°C
Total Inorganic Carbon	Water	28 days	P, G	0 - ≤6°C
Total Organic Carbon	Water	28 days	P, G	1:1 H_2SO_4 (pH<2), 0 -≤6°C
Total Organic Carbon	Soil	28 days	P, G	0 - ≤6°C
TOX	Waste	7 days	P, G	1:1 H_2SO_4 (pH<2), 0 -≤6°C
TPH (SGT-HEM)	Water	14 days	G	1:1 H_2SO_4 (pH<2), 0 -≤6°C
TPH (SGT-HEM)	Soil	28 days	G	0-≤6°C
Turbidity	Water	48 hours	P, G	0 - ≤6°C
Volatile Organics	Air	30 days	Canister	None
Volatiles by SW8260D except 2-Chloroethylvinyl ether	Water	14 days	G (40 mL VOA)	1:1 HCl (pH<2), 0 - ≤6°C
Volatiles Analyte 2-Chloroethylvinyl ether by SW8260D	Water	7 Days	G (40 mL VOA)	0 - ≤6°C

Analysis	Matrix*	Holding Time	Container	Preservative
Volatiles Analytes Acrolein and Acrylonitrile by SW8260D	Water	7 Days	G (40 mL VOA)	1:1 HCl (pH 4-5), 0 - ≤6°C
Volatiles by E624.1 including 2-Chloroethylvinyl ether but not Acrolein and Acrylonitrile	Water	14 Days	G (40 mL VOA)	0 - ≤6°C
Volatiles Analyte Acrylonitrile by E624.1	Water	7 Days	G (40 mL VOA)	0 - ≤6°C
Volatiles Analyte Acrolein by E624.1	Water	3 Days	G (40 mL VOA)	0 - ≤6°C
Volatiles Analytes Acrolein and Acrylonitrile by E624.1	Water	14 Days	G (40 mL VOA)	1:1 HCl (pH 4-5), 0 - ≤6°C
Volatile Organics by SW8260D	Soil	48 hours, 14 days after preservation	Pre-weighed vials or Encore*	Sodium Bisulfate or methanol, 0 - ≤6°C

* Encore™ Samplers are approved by EPA and allow Volatile soil organics to be transported to the lab without preservative. If an Encore sampler is not used, the soil samples must be weighed in the field and preserved with sodium bisulfate or Methanol (5 ml). This will raise the detection limits considerably. See EPA SW-846 method 5035 for further information.

** Lead in air is usually sampled with a cartridge device that attaches to an air pump that samples an area for a given amount of time. There are several types of cartridges approved by NIOSH, but all are self-contained and require no special treatment.

*** Lead wipe material provided to clients meets the requirements of ASTM E1792, either Ghost Wipe, Environmental Express Cat#4210, or equivalent. A specified area, usually 1 square foot, is "wiped" with this material. The wipe is placed in a non-contaminating (non-metal) container for shipment to the lab.

**** Samples for FL SPLP VOCs are collected in 25 g Encore™ Sampler. If the sample is not frozen upon receipt by the laboratory, then the sample holding time is 48 hours and the SPLP extraction must be performed within 48 hours of sample collection. Sample may be frozen by the laboratory upon arrival and maintained at a temperature of -10ºC. If the sample is frozen, the holding time is 14 days from collection and the SPLP extraction must be performed immediately once the sample is thawed to 4ºC. NOTE: Neither the samples for SPLP extraction nor the samples for total analysis may be frozen prior to delivery to the laboratory in order to meet the 48-hour holding time.

P Plastic container
G Glass container

7.0 CUSTODY OF SAMPLES, EQUIPMENT, AND SUPPLIES

7.1 Review of New Work

7.1.1 The Laboratory Manager is primarily responsible for determining the capacity of the facility and its resources to handle new work, although other senior members of management may be called upon to provide expertise and input as needed. This determination consists of a comprehensive appraisal of the client's projected needs. Factors assessed are the ability of the laboratory to comply with the requirements of its accreditations while maintaining the expected level of legal defensibility and analytical validity of all reported data.

7.1.2 Prior to the acceptance of any new requests, tenders, or contracts by Analytical Environmental Services, Inc., the appropriateness of facilities and resources is considered utilizing the information in the following sections. If the facility and/or resources are inadequate to perform the work, the Laboratory Manager may exercise his discretion to refuse to perform all or part of a particular project. The Client Services Manager will be informed of this decision and the Project Managers will inform the client. The laboratory affords clients cooperation to clarify requests and to monitor the laboratory's performance in relation to the work performed (while ensuring confidentiality to other clients).

7.1.2.1 Facilities. The facility must be suitable for the proper receipt and storage of the number and type of samples proposed to be accepted.

7.1.2.2 Resources.

7.1.2.2.1 Stipulated methods, sample preparations, final reports, data packages, and deliverables are reviewed to determine the availability of suitable instrumentation and personnel.

7.1.2.2.2 The laboratory must be capable of meeting all analytical requirements for the selected test methods. The specified requirements and methods must be adequately defined, documented, and understood.

7.1.2.2.3 The laboratory shall advise and obtain approval from the client before subcontracting work to another laboratory.

7.1.3 Technical and Management Capability

7.1.3.1 The review of capability must establish that the laboratory possesses the necessary physical personnel, information, and resources to perform the tests in question. Additionally, the laboratory personnel must have the skills and expertise required for performing these tests.

7.1.3.2 The laboratory shall have adequate personnel at all times during the performance of analytical testing to ensure that clients receive data which meets the terms and conditions of the work agreement.

7.1.3.3 The review may consider the results of previous work of a similar nature or, where new testing is being implemented, the results of interlaboratory testing, trial tests, proficiency samples, MDL studies, etc.

7.1.4 Discrepancies

7.1.4.1 Any differences between the request or tender and the capability of the laboratory to fulfill the proposed work are resolved before any testing begins. (The Chain of Custody is used to verify discrepancies because it is a form of contract.)

7.1.4.2 Modifications are allowed upon consent of the client. Changes are documented in the contract prior to acceptance. Each contract shall be acceptable to both the laboratory and the client.

7.1.4.3 Problems encountered during any stage of reviewing the testing are addressed and resolved to the satisfaction of both the laboratory and the client.

7.1.5 Records

7.1.5.1 The laboratory maintains any records for the initial review of new work entering the laboratory, including any significant changes in the proposed work plan.

7.1.5.2 Communication logs (telephone calls, on-site visits, meetings, e-mails, etc.) are used to record all pertinent discussions concerning the client's requirements. Logs must include the date, time, brief details of the exchange, resolution of any complaints, and identification of the parties involved.

7.1.5.3 Subcontracted work is fully described and documented in advance of receipt of the work from the client.

7.1.6 Once work has been accepted, the Director of Project Management is responsible for setting up the client in the LIMS system, setting up an account with the client, and monitoring the project to ensure that all of the client's requirements are met.

7.2 Sample Receipt

7.2.1 The laboratory has defined protocols for receiving samples and for the "logging in" process. These protocols provide information to the analysts regarding requested analyses, holding times, types of

preservation, matrices, etc.

7.2.2 Sample Acceptance Policy - The laboratory will accept or reject samples for analytical testing based on presence, absence, or resolution of the required criteria specified for labeling, preservation, documentation, identification, hold time, container type, or volume. If this information is missing or comes into question, a corrective action report will be started to address any nonconformances. Upon completion of the corrective action, it will be determined if the laboratory accepts the samples. Samples will be considered accepted upon final login review. Unaccepted samples will be noted in the project narrative if other samples received meet the requirements.

7.2.2.1 The laboratory sample acceptance policy outlines circumstances under which samples are accepted and rejected. This policy is available to sample collection personnel and includes the following:

7.2.2.1.1 Documentation shall include sample identification, the location, date and time of collection, collector's name, preservation type, sample type and any comments concerning the samples.

7.2.2.1.2 Client samples should be properly labeled with unique identification. Indelible ink should be used along with water resistant labels.

7.2.2.1.3 Sample containers should be suitable for the requested test and the analysis hold time must be adhered to. (See table 6-1 for Preservation, Hold Time, and Containers required.)

7.2.2.1.4 Sufficient sample volume must be available for the requested tests. If the client does not provide enough sample for all the tests, it will be noted on the sample receipt checklist. The project manager will contact the client to determine which tests the lab is to perform on the sample and whether or not the client will provide additional sample for other tests.

7.2.2.1.5 If samples show signs of damage, contamination or inadequate preservation, or any other concern, a corrective action must be initiated to determine if samples are acceptable for the requested analysis. Project managers with the assistance of the Director of Project Management, Technical Director, Quality Assurance Manager, or the Laboratory Manager address and close the corrective action by either accepting or rejecting the samples. (Corrective Actions and Nonconformances section 13.0)

7.2.3 Upon receipt, each sample is identified by a laboratory-issued project number and a unique individual sample number. Properly followed, the preceding procedures provide court defensible documentation related to sample release to the lab, proper preservation and handling, and traceability throughout the analytical and reporting process.

7.2.4 Samples usually arrive at the laboratory in one of three ways: 1) delivered by carrier (UPS, Federal Express, and Mail), 2) delivered by courier, or 3) delivered by client personnel. In all cases, a document called a "Chain of Custody" (COC) must accompany the samples. This document, supplied by the laboratory to clients, is designed to provide to the laboratory all the necessary information about the client, samples, and which analyses are required. In addition, this document provides evidentiary information indicating who had samples in their possession at any time and when possession was changed. In some instances, the client provides their own chain of custody

7.2.5 Once samples have been relinquished to the laboratory, they are checked for condition including the type(s) of preservation employed (temperature, pH, etc.), correctness of containers, and if the COC has been properly completed and signed.

7.2.5.1 Almost all soil and water matrix samples require a transport temperature of (0 - ≤6°C.) The samples should be packed in ice in a thermal container. Typically, an insulated ice cooler is used for sample transportation. The cooler should have a temperature blank included for use

as a sample temperature check. The temperature blank is a plastic bottle filled with water.

7.2.5.1.1 Temperature is measured with a calibrated thermometer. The thermometer is individually identified and labeled with its calibration expiration date. The temperature of the blank must always be recorded during the login procedure. If the temperature is outside the 4 ± 2°C range, this should be annotated so that the project managers can notify the client.

7.2.5.1.2 Samples that are hand-delivered to the laboratory immediately after collection may not meet these temperature criteria. In these cases, the samples shall be considered acceptable there is evidence that the chilling process has begun (such as arrival on ice).

7.2.5.2 Before placement in the storage area, samples must be checked for integrity. If any bottles are broken or have leaked, the client must immediately be contacted. This is particularly important if there are no duplicates of the sample in order to obtain instructions from the client on how to handle the situation. It may be necessary to re-sample for the incomplete tests.

7.2.5.3 Sample labels are checked against the Chain of Custody for accuracy and discrepancies. Custody seals must be intact if used. This procedure is best accomplished by sorting samples by their location rather than by their testing requirements. For example, all samples labeled "MW-1A" are combined and may include VOCs, metals, SVOCs, etc. Make sure that all sample labels match the COC for number of analyses, sample ID, matrix, etc. If a discrepancy is found, the variance is noted on the Sample Receipt checklist and the client is contacted to clarify the problem.

7.2.5.4 Samples are checked for type and proper degree of preservation. This only applies to aqueous samples and never to volatile organic samples (VOC samples are checked after the vial has been opened and the sample analyzed). There are several types of preservation required for the different analyses. Most involve either a high or low pH.

7.2.5.4.1 To check the sample for pH, take a clean disposable Pasteur pipette and touch its tip to the top of the aqueous surface. Sample should be drawn by capillary action up the tube. Remove the pipette, recap the sample and touch the Pasteur pipette to some pH paper. Read the paper to the nearest pH unit.

7.2.5.4.2 Check the preservation chart (Section 6) to see if the pH is in the range required for the sample. If not, notify the Project Manager immediately. The Project Manager may require the addition of proper preservative to the sample. If the holding time is affected by inappropriate preservation, this should also be communicated to the client and analysts through the Project Manager.

7.2.5.5 Samples are checked for holding time. Holding times begin the moment the sample is taken, not when it is received. While most analyses have a holding time of several days, holding times vary widely from as little as 15 minutes to as long as 6 months. The time involved in shipment of a sample to the laboratory can greatly reduce the amount of time the analyst has to perform the procedure. It is therefore critical that holding times be noted accurately and the appropriate analyst or manager notified immediately if holding time is running out (less than 24 hours left).

7.2.5.6 Results of observations are noted on a "Sample Receipt Check List" at login.

7.2.5.7 If the COC matches the samples it represents, the sample custodian, through LIMS, will issue individual numbers for each sample received. These numbers are the project number followed by a single digit assigned to each bottle. This indicates that the samples are from the same site. For example, a group of samples is logged in as project "C8855". Each sample within the project is given a sequential number starting with the number "1". Thus, "C8855-1" is the first sample of this group.

7.2.5.7.1 The sample bottles are given a letter designator beginning with letter "A" that corresponds to each sample "fraction" received at the laboratory. For example, samples collected for metals and SVOC in two bottles would be designated as "A" and "B". The two sample bottles in the above example would be designated as "C8855-1A" and C8855-1B".

7.2.5.7.2 The assigned alphanumeric sample names are written on the COC, usually in the far right column, and on the sample label or top.

7.2.5.7.3 To ensure that sample identifiers remain intact, use an indelible ink pin, such as a Sharpie™, when marking samples.

7.2.6 All samples are properly logged into the computer with all pertinent information, including any comments about improper preservation or holding times. This information is compiled into a spreadsheet called the "daily" and the information is distributed to the analysts. A folder is prepared with a cover sheet that gives the project number and lists the analyses needed. All information pertaining to the project is placed inside the folder including the COC, client contact information, and any special documentation.

7.2.7 Samples are then placed in the sample holding area, either in the appropriate cooler or on the correct shelf. If the project requires a continuous Chain of Custody, they must be logged out of the area by the analyst and logged back in when analysis is completed using the logbook provided. If the sample is completely exhausted, this must be noted in the logbook.

7.2.8 Any deviations must be brought to the attention of the client and/or the Project Manager so the client may be contacted for directions on how to proceed. For example, some samples may be unsuitable for testing if the temperature has not been maintained.

7.2.9 After all sample information is logged into the computer, a printout of the entered data is made. A second individual must verify the accuracy of the sample information entered. If the log-in, COC, and all sample information are approved, the checking individual initials the work and the project folder is given to the Project Manager.

7.2.10 Occasionally, samples require special storage times after the analyses are complete. This should be noted when these samples arrive at the laboratory to avoid them being prematurely discarded. To apprise all affected personnel, annotate this information into LIMS. These samples are to be stored in the special holding area designated by the Sample Receiving Department. A Project Manager will notify the Sample Receiving Department which samples are required to be placed in this area.

7.2.11 Sample bottles are segregated according to their required analyses. Samples analyzed for volatile organics are placed in a separate cooler/refrigerator from semi-volatile organics or inorganics because of the high probability of cross-contamination from inorganic and waste samples. Samples for metal analyses do not require cooling. These samples may be placed on the shelf at room temperature.

7.2.12 Once samples have been removed from a cooler, the cooler must be cleaned before reuse. Typically, rinsing and air drying of the cooler will be sufficient. Make sure to return clients' coolers.

7.3 Review of Sample Login

7.3.1 When samples (a project) arrive at the laboratory, a project is created in the laboratory information management system (LIMS) and reviewed by a project manager as discussed in the Section 7.3.3.

7.3.1.1 A "Review of Sample Login" report is filled out by the sample custodian and this report is

turned in to the project manager. The project manager reviews the information to ensure that all analyses, sample IDs, etc. are correct.

7.3.1.2 If any problems were found, they are corrected. A copy of the problem and its resolution is transmitted to the Sample Receiving Manager.

7.3.2 Sample Receipt Checklist (SRCL)

7.3.2.1 The sample receipt checklist (Appendix VIII) is a list of all information pertaining to the arrival of a project at the laboratory. If any problems are found, such as errors on the chain-of-custody (COC), or any situation does not comply with the procedure or method, such as problems with sample preservation or holding time, the project manager is notified immediately in order to contact the client. The following list represents the questions asked on the SRCL:

7.3.2.1.1 Was the shipping container/cooler in good condition?

7.3.2.1.2 If there were custody seals on the shipping container/cooler, were they intact?

7.3.2.1.3 If there were custody seals on the samples, were they intact?

7.3.2.1.4 Was the container/temperature blank in compliance?

7.3.2.1.5 Was the chain-of-custody present?

7.3.2.1.6 Was the chain-of-custody signed when relinquished and received?

7.3.2.1.7 Did the chain-of-custody agree with sample labels?

7.3.2.1.8 Were samples received in the appropriate containers to perform the requested analysis? If VOA vials were received, were all vials void of headspace?

7.3.2.1.9 Were all sample containers received intact?

7.3.2.1.10 Was sufficient sample volume received to perform requested analysis?

7.3.2.1.11 Were all samples received within the EPA recommended holding times and within the recommended temperature ranges?

7.3.2.1.12 Was turnaround time marked on the chain-of-custody?

7.3.2.1.13 If samples were submitted for volatiles analysis, did they have zero headspace?

7.3.2.1.14 Was the pH acceptable for water samples upon receipt?

7.3.2.1.15 Were samples in good condition?

7.3.2.1.16 Is a known blank included for diffusive samples or AIHA-LAP, LLC lead analysis?

7.3.2.2 All information at the top of the SRCL, such as client name, date/time received, and carrier name, must also be checked for accuracy. All out-of-compliance and non-conforming events are documented on the SRCL as well as in the PM non-conformance corrective action in LIMS. The client is contacted to discuss the issue or conflict. Resolution, as agreed upon by the client, is documented in the PM corrective action in LIMS and SRCL. Either the Director

of Project Management or the Laboratory Manager closes out all corrective actions.

7.3.3 Procedure for Creating and Reviewing Projects in LIMS

7.3.3.1 Open the project in LIMS and verify that the client name listed on the COC is the client selected in the LIMS. Check for any client related notes, such as "report samples on a dry-weight basis" or "provide final report in duplicate" in the "Client ID" field. Verify that this information has been passed on in the work order.

7.3.3.2 Check the project name and check for any project specific requirements in the project notes. Ensure that this information has been carried over into the work order.

7.3.3.3 Go to the "ReportOptions" screen and, if known, enter the state where the samples were collected. In the field "Rpt Name", select the proper reporting format. The preferred format is "AES base report". However, try to select the format that will reduce the overall size of the report, such as "base report consolidated". Unless the client has requested "J" flags, turn off the "Qualifiers" selection key.

7.3.3.4 Go to the "InvoiceInfo" screen. Enter the P.O. number if the client has provided one. If the client has pre-paid, enter this information into the "PrePaid" field and ensure that the accounting department has been informed. Enter any markups for rush fees. Enter into the "MiscCharges" field any sample media charges, courier fees, shipping charges or other expenses. Enter appropriate comments into the "MiscComments" field. The following information is entered into LIMS using the following format:

7.3.3.4.1 Rush Fees: Rush fees applied for same business day TAT.

7.3.3.4.2 Rush fees applied for next business day TAT.

7.3.3.4.3 Rush fees applied for two business day TAT.

7.3.3.4.4 Sample Media Charges: Current charges apply.

7.3.3.4.5 Shipping Fees: FED-EX shipping fees included.

7.3.3.4.6 Courier Fees: Courier fees included.

7.3.3.4.7 Sampling Fees: Sampling fees included.

7.3.3.5 Select the "LOGIN" key. Remove the COC from the folder. Systematically check each sample and fraction in the following order:

7.3.3.5.1 Verify the date and time received.

7.3.3.5.2 Verify the sample I.D. on the COC against the information that is entered into the LIMS.

7.3.3.5.3 Verify the sample description against what is entered for the tag number. If no sample description is given put "N/A" in the field.

7.3.3.5.4 Verify the date and time collected.

7.3.3.5.5 Verify the sample matrix.

7.3.3.5.6 Verify container type. Container type should match the type of container requested for the analysis. Any discrepancies should be noted on the SRCL.

7.3.3.5.7 Verify the number of containers.

7.3.3.5.8 Verify the storage area. This should be consistent with AES' storage policy. Volatile samples are stored in R8, Wet chemistry samples are stored in R1, extractable organic samples are stored in R10, and metal samples are stored on S1.

7.3.3.5.9 Enter essential sample or analytical information into the sample comments field, such as "expect high concentrations", "perform 5x concentration", or "perform library search".

7.3.3.5.10 Verify that each sample and fraction is logged in for the requested analysis. This must be done independently of the above steps. Attempting to perform both tasks at the same time will only increase the probability of errors.

7.3.3.5.11 Expand the test field column so that the entire code for every analysis is visible.

7.3.3.5.12 Verify, one sample fraction at a time, that each of the appropriate test codes and their corresponding prep code are entered. If there is a test code that is missing a prep code, return to the project and pull the appropriate prep code. Add the prep code to the test field column. If the test code does not appear to have a prep code, inform the Director of Project Management.

7.3.3.5.13 For each test, check the selection list and ensure that the appropriate compounds have been chosen. Check every test.

7.3.3.5.14 If you are aware that a project requires specific detection limits, verify them at this time.

7.3.3.5.15 If air samples are received, click on the "Air Data" screen and verify the air volume in liters against what is listed on the COC.

7.3.3.5.15.1 If no sample volume is given, enter the sample flow rate in liters, change the units to L/min and enter the time sampled in hours and minutes. Hit the "Calc Air Unknowns" to calculate the volume.

7.3.3.5.16 Enter the media type and size. This information is found in the "tests" screen in the media field. If the media provided by the client is not the same media as listed in the method, inform the Director of Project Management immediately.

7.3.3.6 After the above information for all samples is complete, the work order is ready for approval.

7.3.3.7 Return to the main window of the work order.

7.3.3.8 Enter the date and time that you are approving the login review.

7.3.3.9 You will be prompted to enter your password. Enter your password and the work order will now appear in the "work to be completed" list.

7.4 A Corrective Action Report is generated in LIMS for any sample receiving non-conformance. Section 13 of this Manual describes the Corrective Action Process in detail.

7.5 Health and Safety

7.5.1 All samples should be considered to be hazardous. Until a sample is analyzed, it is impossible to determine what type of contamination is involved. With this in mind, always wear the following safety equipment when handling samples.

7.5.1.1 Safety Glasses: OSHA approved safety glasses must be worn when working with samples. Safety glasses prevent an invasion of the sample into the eye and protect the eyes in case of a sample explosion.

7.5.1.2 Latex Gloves: Latex Gloves must be used when handling samples. Latex gloves protect the hands from the effects of corrosive materials, such as strong acids or bases. In addition, gloves prevent the introduction of hazardous materials into the body by absorption through the skin.

7.5.1.3 Sensible Clothing: Long pants and close-toed shoes (no sandals) must be worn at all times while working in the sample receiving area. Many of the samples received by the laboratory are 1 liter or greater in size. A liter of water weighs slightly more than 2 pounds. Dropping a liter of water on an unprotected toe from waist height can fracture the toe. Never wear any clothing that you are not afraid to ruin. Many of the preservatives used in the laboratory are acidic and will eat a hole in most natural materials. If the fiber is man-made, such as nylon, any strong solvent will melt it.

7.5.1.4 Lab Coat: Required when in the laboratory or handling samples or chemicals. Not only does it protect your clothing, but it also provides an additional cloth barrier against splashes and spills.

7.6 Sample Custody

7.6.1 AES has implemented sample chain-of-custody procedures to provide accurate, verified, and traceable records of sample possession and handling, from sample container shipment through laboratory receipt and sample disposition.

7.6.2 Documentation of sample collection, shipment, laboratory receipt and custody is accomplished utilizing a chain-of-custody record. A sample is considered in custody if the following conditions have been met.

7.6.2.1 The sample(s) are in the physical possession of the sampler or courier.

7.6.2.2 The sample(s) are in view after being in the physical possession of the sampler or courier.

7.6.2.3 The cooler(s) or sample bottle(s) are sealed, so that sample integrity is maintained, while in the possession of the sampler or transferee.

7.6.2.4 The cooler(s) or sample bottle(s) are in a secured area restricted to authorized personnel.

7.6.3 Custody Record Maintenance

7.6.3.1 Laboratory records, including copies of the chain-of-custody forms and any associated documentation, are maintained in a secure area with any associated project records.

7.6.3.2 Laboratory data are recorded in bound notebooks and entries are made in waterproof ink.

7.6.3.3 Laboratory data entry errors are deleted with a single-line through the error. The correction is initialed and dated by the analytical staff member making the change.

7.6.3.3.1 Correction tape or other substances designed to obliterate documentation are strictly prohibited in the laboratory and custody areas.

7.6.3.4 Laboratory information is documented on prepared forms. All forms for recording laboratory

data include a space for the date and for initials that must be completed by the data recorder. Laboratory documentation not recorded on pre-prepared forms is also dated and initialed.

7.6.4 The sample custodian, under either routine or special legal chain-of-custody procedures, receives all samples. Legal custody is a special type of sample custody in which all events associated with a specific sample are documented in writing.

7.6.5 Laboratory Provided Sample Containers

7.6.5.1 Sample containers provided by AES are manufactured from EPA-designated materials, contain EPA-prescribed preservatives, and are affixed with an AES identification label.

7.6.5.2 Pre-cleaned sample containers are purchased by AES. When deemed necessary by the Technical Director, containers from each lot are pre-certified in house prior to use. A lot number is affixed to each container for purpose of traceability.

7.6.6 Chain of Custody Documentation, Traceability, and Sample Integrity

7.6.6.1 Formal chain-of-custody procedures are initiated by a sample custodian responsible for the organization and relinquishing of sample containers to the client or field personnel.

7.6.6.2 Properly record all fields of information on the chain-of-custody form. Proper completion of the form is the responsibility of the client's field sampling manager and is required prior to relinquishing the samples.

7.6.6.3 If the site location is different from the client address, the site location is recorded in the "Project Name" space on the chain-of-custody form, or on the right hand side of the form if additional space is required. The sample identifications assigned in the field are recorded in the "Sample Identification" column.

7.6.6.4 Common carriers may identify themselves by signing the "Relinquished By" space on the chain-of-custody form.

7.6.6.5 Maintain chain-of-custody for samples transported from the field to the laboratory by common carrier. Completed custody forms must accompany each sealed cooler by placing them in a plastic bag taped to the inside lid of the cooler.

7.6.6.6 Maintain a copy of each air bill package tracking form associated with a shipment of samples in the appropriate client files.

7.6.6.7 The custody-technician is responsible for the inspection of shipping containers upon laboratory receipt for overall integrity to ensure that the contents have not been altered or tampered with during transit. If tampering is apparent, the sample custodian immediately contacts the assigned project manager who is responsible for notifying the client.

7.6.6.7.1 The cooler inspection form, filed by the sample custodian, describes the deficiency and annotates any corrective action required by the client. Document any appropriate changes on the accompanying project chain-of-custody form, which is dated and signed by the sample custodian or project manager.

7.6.6.8 If shipping containers arrive intact, the sample custodian in the receiving area immediately opens them. The chain-of-custody form and temperature bottle are removed for inspection. Upon receipt, the container temperature is documented in a sample registry or, if requested by the

client, documented on the chain-of-custody form.

7.7 Continuous Chains of Custody

7.7.1 A "Continuous Chain of Custody" sets protocols for keeping an unbroken, or continuous, chain of custody. The intent of this procedure is to enable AES employees to track samples from the time and date of receipt to the time and date of disposal, particularly where legal cases are involved. In doing this, a constant record is kept of when and by whom samples are removed from the Sample Receiving Department. AES will use its standard Chain of Custody (CoC)internally as a "Continuous Chain of Custody" if requested by a client.

7.7.2 Project Managers will notify the Sample Receiving Department when jobs require this unbroken Chain of Custody.

7.7.3 A sequential laboratory identification number is assigned to the project and recorded on the chain-of-custody form, on each sample container submitted with the project, and in the Sample Registry.

7.7.3.1 Accurate and complete sample documentation must be provided on the chain-of-custody form in order to log samples into the sample registry. The sample registry includes all information necessary to maintain chain-of-custody including laboratory ID, client (field) ID, and initials of the sample receipt custodian.

7.7.3.2 Ancillary information, such as sample collection date and requested analyses, is transferred directly from the chain-of-custody form into the LIMS and appears on the client project-specific acknowledgement.

7.7.4 Once the chain of custody is verified, the project is logged into the LIMS to transfer the desired work order request to the laboratory.

7.7.4.1 The sample custodian checks the information on each sample's label against that on the chain-of-custody form for discrepancies.

7.7.4.2 The sample custodian also inspects all samples for leakage or obvious seal (if provided) tampering. All samples are unpacked in a well-ventilated sample receipt area.

7.7.4.3 Samples received in plastic containers, or those that appear to be accumulating or evolving gas, are treated cautiously and inspected under a chemical hood since they may contain toxic fumes or be of an explosive nature.

7.7.4.4 A "Cooler Receipt Form" is completed to document custodial concerns at sample login.

7.7.5 Custody discrepancies noted by the sample custodian are transmitted to the project and sample manager and are resolved with the client prior to laboratory work assignment. Discrepancies are documented on the Anomaly Report.

7.7.5.1 The Project Manager and the Sample Custodian attempt to resolve custody discrepancies expeditiously to avoid holding time compromises. After a decision concerning a sample has been made, the Project Manager or Sample Custodian makes an initialed note in the work order narrative. The person, who was notified, time, date, and resolution, if applicable, is documented. This information is also documented on the Sample Custody Excursion form.

7.7.5.2 A faxed or hard copy of custodial resolutions or project order alterations is secured from the client prior to work initiation. Copies of this documentation are mailed to the client and maintained in the client file.

7.7.6 After addition of the project sequential identification number, the samples are distributed to the appropriate sample storage areas. Sample storage temperature logs are maintained for all sample storage refrigerators to assure proper temperature maintenance throughout the analytical process.

7.7.7 As soon as possible, all samples received by AES are checked, by the appropriate preparation or analytical department, for proper pH adjustment. The pH of each sample is measured, documented, and adjusted if necessary. To avoid compromising sample integrity, volatile samples are checked for proper pH adjustment only at the time of analysis. The pH of volatile samples is not adjusted.

7.7.8 Only authorized personnel are permitted within the laboratory areas where sample access is possible. Sample storage areas are designed to segregate volatile and non-volatile samples. Standards and extracts are also departmentally controlled and stored separately.

7.7.9 The set of analyses required for a group of samples is project-dependent. After sample registry login and verification, samples are transferred from the receiving area to the appropriate sample preparation area. Those samples not requiring preparation are immediately sent to the sample analysis storage area. Using LIMS-generated sample preparation worksheets for guidance, samples are extracted, digested, or distilled as appropriate. The extracts, digestates, or distillates are then transferred to the appropriate analysis section, where analysis is performed.

7.7.10 For projects where the client requires in-laboratory custody records, the AES project manager informs the sample custodian that they need to coordinate custody activities prior to sample receipt. For these samples, staff complete department-specific in-laboratory sample tracking forms. Samples and sample preparations are stored in approved sample storage areas.

7.7.11 Sample holding times are tracked via the LIMS. Sample collection dates are routinely entered into the LIMS with all sample logins. This information allows holding times specific to each departmental analysis to be tracked by department managers, supervisors, chemists, and analysts through the use of daily status sheets, reference sheets, and preparation worksheets.

7.7.11.1 Date analyzed is recorded via instrument outputs as an integral part of the raw data.

7.7.11.2 The date of analysis is entered into the LIMS and compared to the date sampled to validate that holding times were not compromised.

7.7.12 Upon completion of analytical work, custody of unused sample portions, extracts, or digests is relinquished to a central secured storage area. Here the samples, digests, or extracts await disposal, which is performed with assistance of the LIMS. The LIMS stores client specific disposal instructions, compiles results from the analyses of composite samples, prepares sample disposal lists, invoices for disposal and sample return costs, and provides a disposal record for all excess samples.

7.7.13 By careful assignment of user passwords and file access/lock codes, AES maintains a high level of data security in the LIMS. Thus, only authorized AES personnel can access client files to view data. In addition, data entry and editing is restricted to highly trained data management personnel.

7.7.13.1 Data may be downloaded in a variety of standard formats including ASCII, spreadsheet, database, and text files, such as *.ASC, *.WK1, *.DBF, *.TXT, etc.

7.7.13.2 Additionally, laboratory data may be formatted to match client-specific requirements. These requirements are defined and agreed upon prior to project commencement.

7.7.13.3 Laboratory data is thoroughly reviewed prior to preparation of electronic or disc deliverables. The download process includes electronic and logical error check routines to confirm that the

data files delivered are consistent with the client's format and data content needs.

7.7.13.4 A signed hardcopy report is provided with all electronic or diskette deliverables and an electronic and documentation audit trail of each download event are maintained.

7.8 Data Security

7.8.1 Client information is confidential and should be protected during electronic storage and transmission of results. In order to ensure data integrity and security, all files selected for data downloads are transferred from the LIMS to an isolated PC computer system. Access to downloaded files is then controlled via required matches of employee log-on sequences and confidential passwords. The entire download process is regularly reviewed and maintained by the computer department for system performance.

7.8.2 The LIMS manager maintains internal documentation for all LIMS programs. This documentation includes descriptions of any program additions, deletions, or modifications, the dates of revisions, and the initials of the responsible programmer. To verify proper functioning of the program hardware and software, a simulation account is maintained. When hardware or software is modified, the LIMS uses actual data in the simulation account to verify that the modifications are functioning as anticipated. Anti-virus software serves as an additional protective measure.

7.8.3 Data is entered into the LIMS through direct instrument interfaces and manual entry of data from the chemists' worksheets. Immediately following data entry, approval sheets are printed with the entered data as it appears in the LIMS. Assistant project managers compare all data on the approval sheets against the chemists' worksheets for data transcription errors.

7.8.4 Data worksheets, data approval forms, and final reports are routinely printed for verification and signatures. Hard copies of final reports, field data, chain-of-custody forms, and any ancillary documentation pertinent to the project are kept in a secured storage area and placed chronologically within alphabetically arranged client files.

7.8.5 AES maintains a security policy. Under this policy, all external doors are either visually monitored by AES staff or kept locked. Visitors are required to sign in. They are accompanied at all times by an AES staff member.

7.9 Container Receipt

7.9.1 When the laboratory receives containers, they are entered into the Received Container Logbook. An AES ID Container number unique to that case of containers is issued. Contamination is checked for in containers that do not include a Certificate of Quality Environmental Compliance.

7.9.2 The following is a step-by-step guide for entering all information associated with the container:

7.9.2.1 A unique AES ID # is given to each box of containers. This number is given in numerical sequence by adding one to the previous number.

7.9.2.2 Under "Container Description", enter a brief description of the bottle type. Include: bottle size, plastic or glass, clear or amber, preservatives, and pre-cleaned, if noted.

7.9.2.3 Enter the date that the containers were received at the laboratory in the "Date Received" box.

7.9.2.4 Under "Vendor Name", enter the name of the vendor that the containers were ordered from. The sample-receiving manager has this information.

7.9.2.5 Enter the vendor lot number under the "Vendor Lot #" box. This number is found on a vendor provided label on the outside of each case of bottles.

7.9.2.6 Under "Date Expires", enter the date that the containers will expire. This date will be one year after the containers were received at the laboratory, unless otherwise stated by the manufacturer.

7.9.2.7 Enter the number of containers in each case under the "No. of Containers in Lot" box. This information is found on a vendor provided label on the outside of each case of bottles.

7.9.2.8 A Certificate of Quality Environmental Compliance is found inside of each box of glass containers. This information is filed in the sample-receiving department. All plastic containers will be checked for contamination in each new lot that is received by the laboratory. The AES lab number will be written in the "Contamination check OK" box. The information for the contamination check will be found in the LIMS system.

7.9.2.9 Enter the initials of the person that received the containers in the "Initials" box.

7.9.2.10 After each case of containers has been properly entered into the Received Container Logbook, the AES ID # and the expiration date should be written clearly on each case of containers in permanent ink. The containers should then be placed in the for use bottle storage area.

7.9.3 A logbook of records shall be kept in the sample-receiving department. It should be checked periodically by the sample receiving department manager to ensure that it is properly maintained.

7.10 Subcontracting to Other Laboratories

7.10.1 Subcontract Laboratories

All subcontract laboratories are required to supply the Quality Assurance Manager, upon written request, with adequate proof of accreditation in applicable state, AIHA-LAP, LLC, TNI, or other programs, depending upon the client and origination of the samples. Documents shall be requested from all subcontract laboratories. The requested documents will include, but may not be limited to, a current Quality Assurance Manual, the scope of approved testing, proof of insurance, and AIHA-LAP, LLC, TNI and/or other applicable state accrediting authority certificates.

7.10.1.1 A list of subcontract laboratories can be found in Attachment 7.

7.10.2 Protocol for subcontracting work received at the laboratory to another facility.

7.10.2.1 When samples are received which have testing requirements that cannot be performed in-house, the samples must be sub-contracted to another laboratory. The laboratory will advise the client that samples will be subcontracted via email to get approval. The laboratory is responsible to the customer for the subcontractor's work in that due diligence shall be done to confirm the subcontractor is accredited by AIHA-LAP, LLC (or the appropriate regulatory authority) for the parameters that will be performed and the laboratory shall retain records demonstrating that this requirement was met.

7.10.2.2 The sample-receiving department prepares an aliquot and a chain-of-custody to send the sample(s) to the sub-contracted facility. This chain-of-custody will be submitted to the sub-contract facility. All information, including project name, project number, sample ID, collection date, collection time and analysis must be included on the COC. The project manager must review the chain-of-custody before the sample is sent out. Also, a purchase order number must be obtained from the accounting department and placed with the COC.

7.10.2.3 If the client did not provide sufficient sample to send out, the sample must be split. See the procedure for splitting samples to correctly obtain a representative portion of the sample contained within individual standard operating procedures (SOPs).

7.10.2.4 The client must be contacted in writing of the intent to subtract any portion of the testing to another party. The results from the subcontracted laboratory must be reported utilizing a copy of the original report received from the subcontract laboratory.

7.10.2.5 The project is entered into the LIMS system in the Sample Login Procedure with a note in the comment section "SUB OUT."

7.10.2.6 Fill out a FedEx label with the name, address, and phone number of the subcontracting facility, and all the necessary information for the shipper. Prepare a cooler with packing material to ensure that the containers will arrive at the facility unbroken and in a condition that meets the method requirements.

7.11 Purchasing Services and Supplies

7.11.1 Procurement Document Control

Vendors of analytical supplies to AES Inc. are regarded as a resource to and an extension of the laboratory. Standards for quality identified in this document shall be applicable to vendors.

7.11.2 The purpose of the procurement control document is to assure the quality and traceability of procured items (equipment, materials, or services) in instances in which the specifications could affect the quality of the services provided by AES, Inc. This includes such quality related items as the calibration of instruments by outside laboratories, purchase of standards, subcontracted services, and materials requiring testing before use.

7.11.3 Control of purchased materials, equipment, and services is a system designed to insure products and services conform to the procurement requirements. This system includes provisions for vendor evaluation and selection, objective evidence of quality furnished by the vendor, and examination of products or services upon delivery. Prior to the use of such products and services, documented evidence of conformation to the procurement requirements must be provided. This evidence is maintained in the analytical department office records.

7.11.4 It is the responsibility of the Accounting Department to insure the development and implementation of procedures to control purchased products and services. It is the responsibility of the purchasing agent to specify quality objectives for procured items and services. Purchased materials that fail to meet established criteria are documented by Non-conformance reports issued by the purchaser.

7.11.5 Procedures and Responsibilities

7.11.5.1 It is the responsibility of the purchasing agent to provide assurance, when required, that all applicable regulatory requirements, industry codes, and standards appear with the purchase documentation for the affected services and products.

7.11.5.2 The Purchasing Department retains Purchase Orders for control purposes.

7.11.5.3 Purchased items which do not meet the minimum standards set forth by the purchasing agent are processed according to procedures set forth in Section 13.0, "Corrective Action."

7.11.5.4 The appropriate manager or supervisor and QA Manager review purchase orders to insure that quality related services or products meet the criteria of the laboratory's accreditations.

7.11.5.5 Purchase orders for standard catalog items do not require QA review unless they include thermometers, thermistors, hydrometers, pipettors, or analytical balance weights.

7.11.5.6 Where possible, reference materials (such as calibration standards) are purchased from a supplier that conforms to ISO Guide 34 in combination with ISO/IEC 17025, accreditation by an ILAC recognized signatory. External Calibration services shall, wherever possible, be obtained from providers accredited to ISO/IEC 17025 by an ILAC recognized signatory.

8.0 ANALYTICAL PROCEDURES

8.1 Method Sources and supporting procedures include the following:

8.1.1 Analytical methods used are currently accepted and approved by the US EPA, NIOSH, and "Standard Methods".

8.1.2 Other reference procedures for non-routine analyses including methods stipulated by specific states, such as Underground Storage Tank methods, or by ASTM.

8.1.3 Appendix XI includes the list of controlled outside reference documents maintained by AES. Control and updating of the reference document is completed annually by the Technical Director. Electronic document updates or web links to current revisions are posted to the laboratory portal server library, and Appendix XI is updated with the annual update to the QA Manual.

8.1.4 The laboratory has a procedure (for the AIHA-LAP, LLC program) in the form of a Standard Operating Procedure (SOP) for the validation of methods in the event a laboratory designed method or a non-standard method is used.

8.1.5 Laboratory Standard Operating Procedures (SOPs) are located on the company's intranet archival system, commonly referred to as the "portal server". These procedures contain the description of the preparation, calibration, analysis and/or verification test procedures.

8.2 Document Control. This section describes the procedures for control and maintenance of documentation through a document control system, which ensures that standard operating procedures, manuals, and reference documents clearly indicate the time period during which the procedure or document was in force. Regardless of which analytical procedures are used in the laboratory, the methodology shall consist of carefully documented Standard Operating Procedures (SOPs) and approved methods which may be periodically modified, updated or replaced entirely due to advances in technology or changes in regulatory protocols. Some clients may require pre-approval of method revisions before modifications are used to generate data. Documentation of analytical procedures for generating laboratory data shall be clear, concise, adequately referenced, and reflect the actual steps employed by the analyst.

8.2.1 Procedures

Methodologies employed in the laboratory are documented by the creation of an SOP. This document provides the analyst with the information necessary to perform the analysis. Every SOP is created in accordance with this QA document. It follows the intent of the method it is patterned after, but provides any additional information essential to the specific instrument instructions, specific quality concerns, etc.

8.2.1.1 If an SOP is not available for a specific analysis, the analyst will follow EPA, Standard Methods, NIOSH, or other regulatory methodology as required. Deviations are not allowed.

8.2.1.2 Before a new method is accepted for routine use, adequate performance must be demonstrated. This includes an MDL study, IDOC, and related QA/QC procedures as required by the method.

8.2.1.3 Appropriate management personnel evaluate the merits of all new methods and recommend approval or rejection based on the available data. This committee includes, at a minimum, the Laboratory Manager and Technical Director. If the method is approved, a Standard Operating Procedure is created and the procedure is implemented.

8.2.1.4 All analytical procedures must provide documentation so that the complete process used to produce data can be reconstructed.

8.2.1.5 All deviations from an approved analytical procedure are authorized and documented by the Technical Director.

8.2.2 All changes to an approved procedure require, at a minimum, an Interim Change Notice. A complete revision and re-issuance of the SOP may be required. SOPs are reviewed at least annually.

8.2.3 A list of all current SOPs including their review and revision status is maintained electronically on AES_server\L\Current SOP\SOP Masterlist. Current SOPs are maintained electronically on the AES Portal Server in the Technical Management folder. All controlled documents are in "Read Only" format and password protected. The Vice-President of Operations, QA Manager, Technical Director and their appointees are the only laboratory employees with edit access to these folders. In addition, a master list of controlled documents is maintained for documents other than SOPs. This includes various forms, software, references, etc. It is located at AES_server\L\Current SOP\ Documents_Master_List_Non-SOPs.

8.3. Instructions and Procedures

It is the policy of AES Inc. that all analyses and operations are performed using approved written procedures which are to be available to the personnel conducting the analysis /operation. The procedures assume one of two general formats. These formats are "Temporary Procedures" and "Standard Operating Procedures."

8.3.1 Temporary procedures are designed to accommodate the transition from a developing analytical service or method to an established procedure in the most efficient manner. They are less than formal procedures but are adequate to document the procedural treatment of samples. Effective dates and expiration dates are documented. Temporary Procedures, approved by a manager and the Technical Director, can be handwritten procedures and contain at a minimum the following information:

8.3.1.1 Health and safety requirements to perform procedure (if necessary).

8.3.1.2 Actual analytical method (step by step).

8.3.1.3 Materials list (if necessary).

8.3.1.4 Reagents (if necessary).

8.3.1.5 Calculations needed to perform procedure.

8.3.1.6 Reference sources from which procedure was developed.

8.3.2 Standard Operating Procedures (SOPs) are a formal treatment of an analytical or administrative procedure. Analytical SOPs shall be generated using nationally recognized procedures and incorporate AES, Inc., operations and instrumentation. The SOPs are revised as required by the appropriate Managers and are reviewed and authorized for continued use at least annually. Analytical SOPs contain the following information:

8.3.2.1 Title, issue date and revision number

8.3.2.2 Approval signatures

8.3.2.4 Sample preparation, handling, storage and disposal

8.3.2.5 Definitions

8.3.2.6 Responsibilities

8.3.2.7 Hazards and safety requirements

8.3.2.8 Materials and equipment

8.3.2.9 Standardization and calibration requirements

8.3.2.10 QC sample frequency and performance criteria

8.3.2.11 Operating instructions

8.3.2.12 Example calculations and data sheets

8.3.2.13 References

8.3.3 Administrative Procedures contain the following sections

8.3.3.1 Contents Page

8.3.3.2 Purpose and scope paragraphs

8.3.3.3 Text

8.3.4 Emergency procedures are divided into three sections:

8.3.4.1 Symptoms

8.3.4.2 Immediate actions

8.3.4.3 Subsequent actions

8.3.5 Amendments of Documents by Hand:

8.3.5.1 SOPs are only amended via a permanent or temporary Interim Change Notice (ICN).

8.3.5.2 Spreadsheets, checklists, logbooks, and other documents that are templates which are filled in with data may be amended by a department manager, technical director, QA manager, or laboratory manager's approval. The manager/director should write the change on the document, then initial or sign and date the document.

8.4 Electronic Document Control

The laboratory SOPs are maintained electronically by the Technical Director through the electronic document control system. Hard copy signed originals of the procedures are Maintained by the Technical Director or appointee. Any staff member may request revision to the procedures.

8.5 Creating and Maintaining Standard Operating Procedures

"Standard Operating Procedures" describes the system for preparation, issue, implementation, and revision of formal Standard Operating Procedures for Analytical Environmental Services, Inc. Standard Operating Procedures are defined as written procedures for personnel to perform analyses, technical operations, tests, processes, administrative operations and tasks, or inspection of samples submitted to Analytical Environmental Services, Inc.

8.5.1 Procedures are tracked, issued, revised, and filed.

8.6 Responsibilities

All technical and administrative staff is familiar with the requirements of this procedure and is responsible for its implementation. To ensure uniform and accurate procedures, the following personnel are assigned with the stated responsibilities:

8.6.1 SOP Author - The Author, when writing SOPs ensures the following:

8.6.1.1 The SOP meets applicable regulatory requirements.

8.6.1.2 The SOP includes the actual instruments and materials associated with AES, Inc.

8.6.1.3 The SOP follows the requirements of the published standard method(s).

8.6.1.4 The SOP conforms to guidelines established in this document.

8.6.1.5 The SOP meets the applicable requirements of the laboratory's QA Manual.

8.6.1.6 That he responds to reviewer(s) comments in a timely manner.

8.6.2 Section Supervisor - The Section Leader is responsible for the following:

8.6.2.1 Review all new SOPs originating within their section.

8.6.2.2 Ensure the personnel in their department are aware of the SOP and understand their responsibility pertaining to the SOP.

8.6.3 Technical Director - The Technical Director is responsible for the following:

8.6.3.1 If a new SOP needs to be created, the Technical Director may assign the task of drafting SOPs to qualified individuals who possess the requisite experience and good communication/writing skills. The Technical Director may elect to write the SOP.

8.6.3.2 Ensures SOPs are in compliance with current regulations and established methods.

8.6.3.3 Reviews and approves all SOPs.

8.6.3.4 With the assistance of the QA Manager, maintains the SOP development, review, approval, and distribution system as stated in this procedure.

8.6.3.5 With the assistance of the QA Manager, maintains a protected archive of old SOP versions and current versions (controlled document system) for obsolete SOPs.

8.6.4 Laboratory Manager - the Laboratory is responsible for the following

8.6.4.1 Ensures that all sample analyses requested by the client have a current SOP. If a current SOP does not exist, the Laboratory Manager shall initiate a procedure for creation of an SOP.

8.6.5 QA Manager - the Quality Assurance Manager is responsible for the following:

8.6.5.1 With the assistance of the Technical Director, assists in SOP development, review, approval, and distribution system as stated in this procedure.

8.6.5.2 Ensures SOPs are in compliance with current regulations and established methods.

8.7 Definitions

8.7.1 Interim Change Notice (ICN) - A document accompanying any SOP or manual as a mandatory change, but is not included in the original text of the manual or SOP until the next revision.

8.7.2 Controlled Copy - A copy of an AES Document or SOP that is updated when revisions are issued. All controlled documents are electronic files.

8.7.3 Uncontrolled Copy - A printed copy that is labeled "uncontrolled" and is not updated when revisions are issued.

8.7.4 Technical SOPs - Any SOP that directly addresses the laboratory analysis procedure.

8.7.5 Non-Technical SOP - Any SOP that is used at AES but does not directly address the laboratory analysis procedures. Examples are QA SOPs, QC SOPs, Project Management SOPs, and Administrative SOPs.

8.8 New Procedure Initiation

8.8.1 Immediate Procedure Initiation
A Temporary SOP should be written when the laboratory receives projects which have requests for analytical procedures that do not have an SOP and the staff feels that the laboratory can perform the requested test procedure in-house.

8.8.2 Planned Procedure Initiation
The department manager/section supervisor, the Laboratory Manager, and the Technical Director determine the need for a new SOP.

8.8.3 As part of the New Procedure Request Form, the QA Manager and the Technical Director complete the following:

8.8.3.1 The Technical Director assigns the appropriate SOP number.

8.8.3.2 The Technical Director completes a Draft SOP or assigns an alternate author.

8.8.3.3 The draft SOP is forwarded to the affected laboratory personnel for review (see Section 8.11). The draft includes all of the text, tables, and attachments formatted as outlined in this SOP.

8.8.3.4 After review by the affected personnel, the Technical Director finalizes the SOP. A hard copy of the SOP is produced for signature and placed into a folder in the QA Managers office. Controlled electronic copies are made available to laboratory staff in "Read Only" format on the AES Server and Portal Server.

8.9 Standard Operating Procedure Formatting

8.9.1 Title Page

8.9.1.1 Standard Operating Procedure Title Page Format. (Every procedure is preceded by the Procedure Title sheet. See Attachment 2).

8.9.1.2 Title - The procedure is given a concise, descriptive title. When appropriate, Operational Procedure titles should include the parameter(s) analyzed, sample type, method (if applicable), and analysis technique description (e.g., "Fluoride in Water by Ion Selective Electrode, based on EPA Method 353.3").

8.9.2 Comments - This section includes any reasons for revisions and additional comments as necessary.

8.9.3 Approval Signatures

8.9.4 Header

8.9.4.1 All SOPs have the following header on each page:

AES, Inc.	SOP No:	XX - #####
3785 Presidential Pkwy	Date Initiated:	MM / YY
	Date Revised:	MM / YY
Atlanta, GA. 30340	Revision No:	#
	Page No:	## of ##

8.9.4.3 The following header fonts are used:

	Font	Font Size
AES, Inc.	Times New Roman – Bold	12
Address	Times New Roman	8
SOP No, etc	Times New Roman	9

8.9.4.4 Each procedure is uniquely identified by a five digit number preceded by one of the following identifiers to indicate the type of procedure:

Identifier	SOP Type	# Assignments
QA	Quality Assurance	01000 – 01999
AD	Administrative	02000 – 02999
HS	Health & Safety	03000 – 03999
EM	Emergency	04000 – 04999
QC	Quality Control	05000 - 05999
PM	Project Management	06000 – 06999
GL	General Laboratory	08000 – 08999
SR	Sample Receiving	09000 – 09999
OA	Organic Analytical	11000 – 11999
IA	Inorganic/Metal Analytical	13000 – 13999
LP	Leaching Procedure	14000 – 14999
MB	Microbiology	15000 – 15999
ABS	Asbestos	01000 - 01999
WM	Waste Management	17000 - 17999

8.9.4.5 Revision - The first issue of a procedure is not assigned a revision number. It is assigned an "N/A" entry. As revisions are made to the procedure, the revision number is increased sequentially starting with Revision 1 (one).

8.9.4.6 Effective Date - The date when the procedure becomes effective. Use following format: 12/97.

8.9.4.7 Revision Date - The date that the current revision became effective. Use the following format: 12/97.

8.9.4.8 Number of Pages - The correct form for this is, Page No.: x of y. Example the fifth page of a 24 page document would be formatted as: Page No.: 5 of 24.

8.10 Table of Contents

Section and sub-sections are listed in the Table of Contents using the font in the body of the SOP. See Attachment 5 for an example of an SOP. In addition, all Tables and Attachments are included in the Table of Contents.

8.10.1 Each Manual has a Table of Contents that includes the following information: SOP document number(s), name(s) of the SOP, date(s), revision number(s), and associated Method Number. When SOPs are revised, this list is edited to reflect the changes.

8.10.1.1 The Title of each SOP is Centered, All Capital letters, and in Boldface type on the Table of Contents page.

8.10.2 SOP Body - Technical Procedures.

8.10.2.1 All procedures are formatted using this section numbering system:

1.0 SECTION
1.1 Sub-Section
1.1.1 Sub-Sub-Section
1.1.1.1 Sub – Sub – Sub – Section
2.0 SECTION

8.10.2.2 To keep all the SOPs uniform, use Times New Roman, Font Size 12 for the body of the document

8.10.2.3 Each Section is underlined and all capital letters.

8.10.3 All Technical SOPs include the following sections in the same order:

TABLE 8-1 Technical SOPs

Section Number – Title	Purpose	Required Information
1.0 SCOPE AND APPLICATION	- Describes what the method does - Describes the matrices to which a method applies. -May also describe when the method is to be employed.	1. All matrices which may be analyzed using the method. 2. Analytes the method is capable of quantifying. 3. Quantitation range of analytes. 4. Reference to sample
2.0 SUMMARY OF METHOD	Provides a brief description of the procedure or method and the type of chemistry / instrumentation employed by the laboratory in performing the method.	
3.0 INTERFERENCES	List most common interferences which affect performance of the method. For preparative methods, include interferences which affect the sample analysis.	
4.0 SAMPLE COLLECTION, PRESERVATION , AND HOLDING TIMES	List preservation, storage, and holding time requirements for each matrix listed in Section 1.0.	1. Preservatives 2. Holding Times 3. Acceptable container types.

5.0 REAGENTS AND STANDARDS	List all reagents and standards.	1. Purity of reagents. 2. All concentrations of reagents and standards required. 3. Detailed preparation instructions for each reagent and standard to include initial concentration(s), aliquot volume(s) or weight(s), final volume, final concentration(s), and expiration dates. 4. Listing of the Vendor(s) used to purchase the reagent including the catalog number, vendor address, and telephone number.
6.0 APPARATUS AND MATERIALS	List all apparatus, materials, and equipment, inclusive of data collection and reduction systems.	List make and models or equivalents that might be used in the laboratory
7.0 PROCEDURE	1. This section defines the analytical procedure from start to finish. 2. Address QA/QC requirements when they are appropriate in the overall sequence of activities. 3. Addresses specific record keeping requirements (i.e. when and where to record specific information in run logs and other required laboratory documentation). 4. Includes the handling and disposal of waste when appropriate in the overall sequence of activities. 5. Calculations are included in the text where applicable following the example of SW-846 methods.	Includes at a minimum: 1. Instrument set-up and conditions. 2. Calculations of retention times if applicable. 3. Initial calibrations. 4. Continuing calibrations 5. Analysis sequence, including QC requirements. 6. Calculations – inclusive of conversions for solids. 7. Units required for reporting.
8.0 QUALITY ASSURANCE REQUIREMENTS	Defines additional QA requirements which must be met in addition to all criteria previously listed in the SOP.	Includes a minimum: 1. Blank requirements. 2. Laboratory Control Sample (LCS) requirements. 3. Matrix spike requirements 4. Matrix spikes duplicate or sample duplicate requirements. 5. Any method specific requirements (e.g. MSA for GFAA metals, surrogates for GC/MS procedures, tracers for alpha spectroscopy methods). 6. Corrective actions required when requirements are not met. 7. Frequency of QC samples

9.0 HEALTH AND SAFETY	Details specific health and safety requirements for the method and references any general health and safety requirements which may apply.	1. Protective clothing required. 2. Special hazards associated with chemicals or equipment used in the procedure. 3. Storage and / or disposal of all sample extracts and chemicals used.
10.0 DATA REPORTING	Defines the method for data reporting by the staff to clients.	Includes a minimum: 1. Reporting limits in LIMS. 2. Rounding of data.
11.0 FILE MAINTENANCE	Defines the procedures for data transfer and archiving of data for long term storage.	1. Frequency of data transfer from local computer to server. 2. Method used to transfer data to server. 3. Data storage requirements
12.0 INSTRUMENT MAINTENANCE	Defines the procedures for routine instrument maintenance and entry into logbooks.	
13.0 METHOD PERFORMANCE	Describes the acceptance criteria published in the method.	1. Spike, duplicate precision and accuracy.
14.0 POLLUTION MANAGEMENT	Describes the procedures required to dispose of hazardous wastes.	1. Waste disposal from received samples. 2. Waste disposal from laboratory generated wastes. 3. Required forms to be completed.
15.0 DEFINITIONS	Provides a definition for terms that are used in the SOP.	
16.0 REFERENCES	Provides the source(s) of the information from which the SOP was derived.	
17.0 VALIDATION DATA	Provides the location of information for method validation data.	

Note: The author may add any subsections that are necessary and do not fit in any of the above categories.

8.10.4 Copies of any forms or logbook pages used in conjunction with the SOP and unique to the SOP are attached as Tables or Attachments and sequentially numbered and referenced in the body of the SOP.

8.11 SOP Body - Non - Technical (Administrative)

8.11.1 See Sections 8.10 and 8.11

8.11.2 The author may add any subsections that are necessary.

8.11.3 Copies of any forms or logbook pages used in conjunction with and unique to the SOP are attached as Tables or Attachments, sequentially numbered, and referenced in the body of the SOP.

8.11.4 SOP Body - Immediate SOP (See section 8.8.6 for the definition of “Immediate SOP”).

8.11.5 Copy the Regulatory Method

8.11.6 Attach a procedure title sheet

8.11.7 Complete the following sections: 1.0 Health and Safety, 2.0 Reagents and Supplies, and 3.0 Step by Step Procedure. If these sections are included in the regulatory method, the following note can be included under each section: "See Regulatory Method attached section_____".

8.11.8 This is forwarded to the QA Manager who then initiates a new procedure, as described in 8.2.3.

8.12 Procedure Review And Revision

Procedures undergo periodic review and are updated whenever regulatory, programmatic requirements or internal process change.

8.13 Technical Review

8.13.1 A technical review of the draft SOP is performed by affected laboratory personnel and addresses the following items:

8.13.1.1 Does the SOP comply with the technical requirements of the regulatory agency (EPA, USACE, etc.) method?

8.13.1.2 Does the SOP state the step by step procedure of how AES completes the procedure?

8.13.1.3 Does the procedure formatting follow the procedures outlined in this section?

8.13.2 Comments are written directly on the Draft SOP or on another sheet of paper if needed.

8.13.3 The reviewer(s) discuss comments with the Technical Director and arrive at a finalized document.

8.13.4 The Technical Director makes the necessary changes electronically. The changes include any Interim Change Notices (ICNs) that have been generated for the SOP and are incorporated as stated in the ICN. The electronic copy is stored in the server in the appropriate year labeled folder.

8.13.5 The reviewed SOP is printed and all approval signatures are obtained on the original hard copy.

8.13.6 The approved SOP is electronically placed in the "Current Revisions" folder by the Technical Director. All employees have access to these files in a "read only" format.

8.13.7 SOP Acknowledgement forms (Attachment 1) are distributed to all area supervisors to distribute to all employees who will be using the procedure.

8.13.8 Employees using the new procedure sign SOP Acknowledgement forms and return them to their Supervisor who forwards them to the Technical Director for final approval and scanning.

8.14 Procedure Changes

8.14.1 Analysts, supervisors, or management have the ability to request changes to procedures as part of the continuing procedure maintenance using the "Interim Change Notice" (ICN) form (See Attachment 4).

8.14.2 To complete an ICN, make the required changes to a copy of each affected procedure page. Revise and edit these copies using appropriate standard editor's marks and symbols.

8.14.3 The employee requesting the change ensures the department manager signs the ICN and forwards the ICN to the Technical Director.

8.14.4 The Technical Director signs the ICN, supplies a copy to each applicable department supervisor, ensures that a copy is placed in the controlled SOP folders (see section 8.2), and files it with the controlled QA SOP files.

8.15 Standard Operating Procedures Electronic Document Control Process

8.15.1 All controlled documents are electronic files which are password protected and managed by the Technical Director or designee.

8.15.2 All laboratory personnel have access to a controlled, electronic copy of the SOPs applicable to their job description.

8.15.3 Only uncontrolled documents are issued to clients.

8.15.4 The electronic document control files are arranged such that laboratory personnel have access to only current revisions of controlled documents. All archived revisions, draft procedures, etc. are accessible only to authorized QA or Technical Direction personnel via password access.

8.16 Uncontrolled copies of Standard Operating Procedures are printed, working copies of the documents, and in that regard, are not monitored or tracked.

8.17 Procedure Archive

The Technical Director is responsible for archiving any procedures that are no longer used at AES.

8.17.1 Historic hardcopies of SOPs not in use are kept in the Technical Director's office. For SOPs associated with AIHA-LAP, LLC accreditation, the documents are marked "Void" so it is clear they are not in use.

8.17.2 Retired electronic SOPs related to the AIHA-LAP, LLC are marked as "Obsolete" via a watermark. All electronic SOPs are moved by the Technical Director to the designated archive directory.

8.17.3 The Technical Director removes the folder from the "active" files and places it in the archived files.

8.18 Temporary Change

Temporary changes to an SOP may be required for the following reasons: a sample matrix does not permit the SOP steps to be followed as written, or if a client desires a change to an SOP that is currently in use at AES.

8.18.1 The Temporary Change Notice is completed and approved prior to the use of a revised procedure. See Attachment 4.

Attachment 1

QUALITY ASSURANCE MANUAL
STANDARD OPERATING PROCEDURE
ACKNOWLEDGEMENT

Name (Printed): _____

SOP Title: Quality Assurance Manual

SOP Number: QA-01000 Rev. No. 24

The laboratory analyst signature on this approved SOP signifies the following: The analyst has read the SOP in its entirety and has read the analytical methods referenced in the SOP.

The analyst understands that the SOP is to be followed explicitly. Any deviation from the SOP must be noted in writing. Furthermore, the deviation from the SOP must be approved in writing by the laboratory supervisor and the QA staff prior to the analyst's adoption of the deviation from the SOP.

The controlled electronic copy of this SOP is located on the portal server at: Documents: Quality Assurance: QA Manuals: QA Manual: 2019_QA_Manual_Rev_24.pdf. If a hard copy is desired, you may request one from the Supervisor.

Do not make a copy or print out the QA Manual yourself. Printed copies are uncontrolled documents.

Print Name: _____ Date: _____

Analyst's Signature: _____ Date: _____

Department Manager Signature: _____ Date: _____

Technical Director's Signature: _____ Date: _____

Attachment 2
Example SOP Title Page

APPROVAL OF ATTACHED DOCUMENT FOR IMPLEMENTATION

NOTE: THIS IS A CONTROLLED ELECTRONIC DOCUMENT

PRINTED COPIES OF THIS DOCUMENT ARE UNCONTROLLED

ORIGINAL SIGNED DOCUMENT RESIDES IN AES QA OFFICE

DOCUMENT TITLE: STANDARD OPERATING PROCEDURES FOR FILTERABLE RESIDUE (TDS) BY SM2540C

DOCUMENT CONTROL NUMBER: Rev. 9

DOCUMENT DISTRIBUTION NUMBER: GL-08078

ELECTRONIC DOCUMENT LOCATION
AES Portal Server: http://Procedures/Standard Operating Procedures

The attached Document has been reviewed by the individuals listed below. By signature, each of these individuals acknowledges that the document is ready for distribution, in a controlled manner, to all responsible parties for use and/or reference.

By definition, a "Controlled Copy" of a document cannot be changed without review and approval by designated members of management. At no time may a "controlled copy" be written on or otherwise defaced with notes or other unauthorized additions.

If an uncontrolled copy of this document is desired, please see the Quality Assurance or Laboratory Manager. They will issue you an uncontrolled copy. DO NOT MAKE THE COPY YOURSELF.

By signature below the following employees of Analytical Environmental Services, Inc. have approved this document for distribution.

Technical Director: Date:

Laboratory Manager: Date:

Quality Assurance Manager: Date:

Department Supervisor: Date:

Attachment 3

Example SOP

STANDARD OPERATING PROCEDURES FOR FILTERABLE RESIDUE (TDS) BY METHOD SM2540C

TABLE OF CONTENTS

1.0 SCOPE AND APPLICATION

1.1 This procedure is applicable to drinking, and saline waters, domestic and industrial wastes.

1.2 The practical range of the determination is 10 mg/L to 20,000 mg/L.

2.0 SUMMARY OF METHOD

2.1 A well-mixed sample is filtered through a standard glass fiber filter. The filtrate is evaporated to dryness in a pre-weighed dish and dried to constant weight at 180°C. The increase in dish weight represents the total dissolved solids in the sample.

2.2 If Non-filterable Residue is being determined, the filtrate from that procedure is used for this procedure.

3.0 INTERFERENCES

3.1 Highly mineralized waters containing significant concentrations of calcium, magnesium, chloride, and/or sulfate may be hygroscopic and will require prolonged drying, desiccation and rapid weighing.

3.2 Samples containing high concentrations of bicarbonate will require careful and possibly prolonged drying at 180°C to ensure that all of the bicarbonate is converted to carbonate.

3.3 Too much residue in the evaporating dish will crust over and entrap water that will not be driven off during drying. Limit sample to no more than 200 mg residue.

3.4 Results for residue high in oil or grease may be questionable because of the difficulty of drying to constant weight in a reasonable time.

4.0 SAMPLE COLLECTION, PRESERVATION, AND HOLDING TIMES

4.1 Use glass or plastic bottles provided that the material in suspension does not adhere to container walls.

4.2 Refrigerate samples at 4 ± 2°C to minimize microbiological decomposition of solids. Bring samples to room temperature before analysis.

4.3 Preservation of the sample is not practical; analysis should begin as soon as possible. The maximum holding time is 7 days form the time of sampling.

5.0 REAGENTS AND STANDARDS

5.1 DI water with conductivity less than 1 µmhos.

5.2 Demonstration of Capability Standard (DOC), certified conductivity standard. Any certified standard with TDS concentration of 100 – 500mg/L may be used.

6.0 APPARATUS AND MATERIALS

6.1 Glass fiber filter discs, 4.7 cm or 2.1 cm, without organic binder such as Whatman grade 934AH, Gelman type A/E, Millipore type AP40, E-D Scientific Specialties grade 161 or any other equivalent product.

6.2 Filter holder, membrane filter funnel or Gooch crucible adapter.

6.3 Suction flask of sufficient capacity for sample size selected.

6.4 Beakers or any equivalent evaporating dishes, 100-mL volume.

6.5 Drying oven with temperature set at 105°C ± 2°C.

6.6 Drying oven with temperature set at 180°C ± 2°C.

6.7 Conductivity Meter (Orion 150)

6.8 Desiccator.

6.9 Analytical balance capable of weighing to 0.1 mg.

6.10 Assorted graduated cylinders and volumetric pipettes.

7.0 PROCEDURE

7.1 Preparation of Glass Fiber Filter Disc

7.1.1 Place the disc on the membrane filter apparatus.

7.1.2 Apply vacuum and wash the disc with three successive 20-mL volumes of reagent grade water.

7.1.3 Remove all traces of water by continuing to apply vacuum after water has passed through. Discard washings.

7.2 Preparation of beaker

7.2.1 Mark each beaker with a distinctive identification number.

7.2.2 If Volatile Residue, is also to be measured, heat a clean ceramic dish to 550 ± 50°C, for one hour in a muffle furnace. If only Filterable Residue is to be measured, heat the clean dish to 180 ± 2°C for one hour.

7.2.3 Cool in desiccator and store until needed.

7.3 Analytical Procedure

7.3.1 Record sample numbers and all initial information on to the TDS log book page. The typical analytical batch is arranged as follows:

-Method Blank
-Maximum of 20 samples
-Sample duplicate every 10 samples (at a frequency of 10%)

7.3.2 Perform conductivity on each sample. Use Table 7-1 to select the appropriate volume to filter for each sample.

Table 7-1
TDS Volume Selection

Conductivity (umhos/cm)	Volume (mL)
2000 or less	100
2000-4000	50
4000-8000	25
8000-20000	10
20000-40000	5
>40000	1

7.3.3 Weigh pre-dried beaker. Record weight in TDS log book.

7.3.4 Assemble the filtering apparatus and begin suction.

7.3.5 Thoroughly mix sample immediately before pouring aliquot for filtration.

7.3.6 Measure appropriate volume of WELL MIXED SAMPLE into a graduated cylinder for volumes ≥ 25mL or pipette for smaller volumes.

7.3.7 Record volume in TDS log book.

7.3.8 Quickly transfer and filter the sample through the glass fiber filter.

7.3.9 Remove all traces of water by continuing to apply vacuum after sample has passed through.

7.3.10 With suction on, rinse the graduated cylinder and filter funnel wall with three 20mL portions of de-ionized water allowing complete drainage between rinsing. Remove all traces of water by continuing to apply vacuum after sample has passed through.

7.3.11 Transfer all of the filtered sample plus rinsate to the weighed beaker.

7.3.12 Evaporate to dryness in the drying oven overnight at 105°C ± 2°C.

7.3.13 Dry the evaporated sample at 180°C ± 2°C for at least one hour.

7.3.14 Remove from the oven, cover and air cool for about 15 minutes.

7.3.15 Then cool in the desiccator for at least 30 minutes and weigh to 0.1mg.

7.3.16 Record weight as first weight.

7.3.17 Repeat steps 7.3.13 through 7.3.15until a constant weight is obtained or until the weight loss is less than 0.5mg (0.0005g).

7.3.18 Record final weight in the TDS log book.

7.4 Calculation

7.4.1 Calculate TDS (filterable residue) as follows:

$$\text{Filterable residue, mg/l} = \frac{[(D + S) - D] \times 1{,}000{,}000^*}{C}$$

where:

D + S = weight of dried residue + dish (g)
D = weight of dish (g)
C = volume of sample filtered (ml)

Note: In the above formula * 1,000,000 represents the unit conversion factor from g/mL to mg/L. The converting formula is presented below.

$$\frac{\cancel{g}}{\cancel{mL}} \left| \frac{1000\cancel{mL}}{L} \right| \frac{1000mg}{\cancel{g}}$$

Table 7-2
Checklist for TDS Analysis (SM2540C)

____ Record sample numbers and all initial information on the log book page.

____ Perform conductivity on each sample (See Table 7-1 to determine volume to filter).

____ Weigh pre-dried beaker. Record weight in TDS log book.

____ Assemble the filtering apparatus and begin suction.

____ THOROUGHLY MIX SAMPLE IMMEDIATELY BEFORE POURING ALIQUOT FOR FILTRATION.

____ Measure appropriate volume of WELL MIXED SAMPLE in a graduated cylinder for volume ≥ 25mL or pipette for smaller volume and quickly pour into filter apparatus. Record volume in TDS log book.

____ Remove all traces of water by continuing to apply vacuum after sample has passed through.

____ With suction on, rinse the graduated cylinder and filter funnel wall with three 20mL portions of DI water allowing complete drainage between rinsing. Remove all traces of water by continuing to apply vacuum after water has passed through.

____ Transfer all of the filtered sample plus rinsate to the weighed beaker

____ Place in the dry oven overnight at 105°C± 2°C.

____ Dry evaporated sample at 180 °C ± 2°C for at least one hour.

____ Remove from oven, cover and air cool for about 30 minutes.

____ Cool in a desiccator for at least 15 minutes and weigh to 0.1mg. Record weight as first weight

____ Dry evaporated sample at 180 °C ± 2°C again for at least another hour.

____ Remove from oven, cover and air cool again for about 30 minutes.

____ Cool in a desiccator again for at least another 30 minutes and weigh to 0.1mg.

____ Record final weight in the TDS log book.

____ Calculate TDS (filterable residue) as follows:

$$\text{TDS, mg/L} = \frac{[(D+S) - D] \times 1{,}000{,}000}{C}$$

where:

D + S = final weight of dried beaker + dry residue (g)
D = initial weight of dry beaker (g)
C = volume of sample filtered (mL)

8.0 QUALITY CONTROL REQUIREMENTS

8.1 Each person using this procedure is required to comply with the formal quality control program specified by AES. The minimum requirements of this program consist of an initial demonstration of capability, and the periodic analysis of laboratory reagent blanks, fortified blanks, and other laboratory solutions as a continuing check on performance. The laboratory, through the analyst, is required to maintain performance records that define the quality of the data that are generated. Detailed quality assurance procedures can be found in SOP# QA-01000, "Quality Assurance Manual," Section 5. Subsequent sections define portions of the quality control program.

8.1.1 Demonstration of Capability. Each analyst must demonstrate proficiency for each method performed by performing Initial Demonstration of Capability (IDOC) prior to unsupervised analysis of analytical samples and Continuing Demonstration of Capability (CDOC) at least annually. Detailed descriptions of IDOC and CDOC requirements and acceptance limits can be found in Section 5 of SOP#QA-01000, "Quality Assurance Manual".

8.1.2 Method Detection Limit (MDL) is not practical or required for this analysis.

8.1.3 A Method Blank (MB) must be analyzed with every batch of samples. A batch is defined as 20 or fewer samples prepared for incubation in a 24-hour period. FOR SOUTH CAROLINA SAMPLES, EACH BATCH MUST BE CLOSED WITH NO FURTHER SAMPLES ADDED WITHIN 12 HOURS.

8.1.4 A Laboratory Control Sample (LCS) is not practical or required for this analysis.

8.1.5 Sample duplicate (Dup) must be analyzed at a frequency of 10% of all samples (1 dup per 10 samples). Duplicate determination should agree within 5% of their average weight (RPD). RPD's outside specified range must be handled in accordance with Sec. 8.2.

8.1.5.1 Calculate % RPD as follows:

where:

$$\%RPD = \frac{|S - SD|}{(S + SD)} \times 200$$

S = sample result (mg/l)
SD = sample duplicate result (mg/l)

8.2 Out of Control Conditions and Corrective Actions. Contingencies for handling out-of-control or unacceptable data are included in Section 5 of SOP# QA-01000, "Quality Assurance Manual". The tables in this section include corrective actions for failing QC and/or acceptance criteria.

8.3 Documentation of data. Document and record all analytical sequence, standard preparation, instrument maintenance, and any procedural deviations in appropriate logbooks.

9.0 HEALTH AND SAFETY REQUIRMENTS

9.1 Health and Safety: Safety glasses and latex gloves must be worn when dealing with any chemicals, samples, or reagents. Lab coats are also required. Close-toed shoes and clothing that covers the legs (no shorts or dresses) must be worn at all times an analyst is working in the laboratory.

9.2 All health and safety concerns for any chemicals are listed in the Material Safety Data Sheets (MSDS) provided by the supplier or manufacturer of these chemicals. A copy of any MSDS is available for review at any time.

9.3 Proper disposal of all wastes is essential. Containers are provided for all waste according to the type. Section 17 of the Quality Assurance Manual discusses the disposal of various laboratory wastes in detail. Also, see Section 14.0 Pollution Management.

10.0 DATA REPORTING

10.1 The LIMS system automatically calculates the data based upon factors that are set up for each test code. Data for this test method is reported to three significant figures.

10.2 The estimated reporting limit is 10mg/L.

10.3 Out-Of-Control Data - Contingencies for handling out-of-control or unacceptable data are included in SOP #QA-01000, "Quality Assurance Manual" in Section 5 including corrective actions for failing QC and/or acceptance criteria.

10.4 As per NELAC Chapter 5, Appendix D.1.4.(a), a detection limit study is not required for any component for which spiking solutions or quality control samples are not available.

11.0 FILE MAINTENANCE

11.1 Data from this test is stored in logbooks. When the logbooks are complete, they are scanned and stored on the portal served for a period of 5 years.

11.2 New logbooks are either created or retired through the QA Manager.

11.3 Data is entered into the LIMS by the analyst performing the work

12.0 INSTRUMENT MAINTENANCE

12.1 Instrument logbooks. Instrument logbooks must be completed each time that any maintenance is performed upon the instrument.

12.2 Each instrument logbook must have a cover page that includes the following information.

Equipment name.	Example: GC-5
Manufacturers name.	Example: Hewlett Packard 6890 GC
Serial Number.	Example: 13226589A
Date Received.	Example: 11/01/00
Date Placed into Service.	Example: 11/05/00

12.3 Routine Maintenance: Typical routine maintenance consists of keeping the system clean.

12.4 Non-routine maintenance: Typical non-routine maintenance consists of repair to the drying oven.

13.0 METHOD PERFORMANCE

13.1 The Method Detection Limit (MDL) is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the value is distinguishable from method blank results. The reporting limit RL is defined as the concentration of a substance that is above the level of uncertainty. A method detection limit cannot be determined for this test method.

13.2 Precision and accuracy are not available for this test method.

14.0 POLLUTION MANAGEMENT

14.1 All laboratory analysis generates wastes. Some wastes can be hazardous such as acidic wastes, alkaline wastes, metal bearing wastes, and organic wastes.

14.2 Some wastes are generated due to the test procedure such as organic extractions & acid digestions.

14.3 The following procedures should be adhered to when disposing of hazardous wastes.

14.3.1 Wastes with pH levels above 12 or less than 4 should be neutralized prior to disposal.

14.3.2 Wastes with other pH levels may be directly discharged into the sinks.

14.3.3 Sec. 17 of the QAM further discusses methods for disposal of samples and waste materials.

14.4 When disposing of laboratory wastes, the waste disposal log must be completed. To complete this log, supply the following information.

Sample Number
Method of disposal and treatment prior to disposal
Date of sample disposal
Name of person performing the disposal duty

15.0 DEFINITIONS

15.1 Primary Grade - Dry chemical dried at 250°C for 4 hours cooled and stored in a desiccator.

15.2 LCS - Laboratory Control Sample. A known amount of sought for analyte is added to distilled water or clean soil and the concentration is measured after all procedures are applied to the sample. The resulting determined concentration must fall within test specified limits.

15.3 DI water - De-ionized water

15.4 RSD - Relative Standard Deviation

15.5 MS- Matrix Spike. Procedure where a known amount of sought for analyte is added to a sample and the resulting concentration measured. The recovery is defined as the measured result of the spiked sample less the concentration of the same analyte in the unspiked sample multiplied by 100 percent.

15.6 MSD- Matrix Spike Duplicate.

15.7 CCV - Continuing Calibration Verification Standard. Must be varied thoughout the daily runs, that is the concentration must be low, middle, and sometimes at the upper end of the calibration curve.

15.8 ICV – Initial Calibration Verification Standard. This standard must be prepared from a second source than that used for the calibration curve. That is, it must be from a different manufacturer or lot that the calibration standard.

15.9 LCSD - Laboratory Control Sample Duplicate

16.0 REFERENCES

16.1 SM2540C-1997, "Total Dissolved Solids Dried at 180ºC", Standard Methods for the Examination of Water and Wastewater, 22nd Edition, 2012.

16.2 SM2540C-2011, "Total Dissolved Solids Dried at 180ºC", Standard Methods for the Examination of Water and Wastewater, 22nd Edition, 2012.

17.0 VALIDATION DATA

17.1 Method validation data in the form of IDOC/CDOC study data when applicable is available at AES Portal Server: http://portal/Technical Management/DOC and SOP Sign Forms.

18.0 SOP REVISION HISTORY

Revision Date	Revision #	Summary of and Reason for Changes/Updates	Responsible for Revision
5/29/2003	3	Update	Greg Jones
6/15/2005	4	Update	Greg Jones
4/28/2009	5	Update	Dana Till
10/3/2011	6	Update	Dana Till
4/22/2013	7	MUR II reference update; Biannual Update	Dana Till
8/7/2014	8	Update	Dana Till

Attachment 4

Temporary SOP or Interim (Temporary or Permanent) Change Notice (circle one as appropriate)

Date:
Employee Requesting Change:
SOP Number:
Reference Method Number:
SOP Title:
Permanent Change Requested:

Technical Director: Date:

Laboratory Manager: Date:

Quality Assurance Manager: Date:

Department Supervisor: Date:

9.0 CALIBRATION PROCEDURES AND FREQUENCY

9.1 Identification and Control of Materials, Parts and Components

General. Materials, components or items that are used directly in the production of samples or data that, if not controlled, could jeopardize data quality must be identified.

9.1.1 Traceability of Measurement Policy (for AIHA-LAP, LLC and other accreditations)

Under Analytical Environmental Services' various accreditations (i.e. AIHA-LAP, LLC accreditation), the laboratory shall demonstrate, when possible, that calibrations of critical equipment and hence the measurement results generated by that equipment, relevant to their scope of accreditation, are traceable to the SI (International System of Units) through an unbroken chain of calibrations.

9.1.1.1 External Calibration services shall, whenever possible, be obtained from providers accredited to ISO/IEC 17025 by an ILAC recognized signatory, a CIPM recognized National Metrology Institute (NMI), or a State Weights and Measures Facility that is part of the NIST Laboratory Metrology Program. Calibration certificates shall be endorsed by a recognized accreditation body symbol or otherwise make reference to accredited status by a specific, recognized accreditation body, or contain endorsement by the NMI. Certificates shall indicate traceability to the SI or reference standard and include the measurement result and if available the associated uncertainty of measurement.

9.1.1.2 Where traceability to the SI is not technically possible or reasonable, the laboratory shall use certified reference materials provided by a competent supplier, or use specified methods and/or consensus standards that are clearly described and agreed to by all parties concerned. A competent supplier is an NMI or an accredited reference material producer (RMP) that conform with ISO Guide 34 in combination with ISO/IEC 17025, or ILAC Guidelines for the Competence of Reference Material Producers, ILCA G12. Conformance is demonstrated through accreditation by an ILAC recognized signatory.

9.1.1.3 Reference materials shall have a certificate of analysis that documents traceability to a primary standard or certified reference material and associated uncertainty, when possible. Where possible, reference materials such as calibration standards should be purchased from a supplier that conforms to ISO Guide 34. When applicable, the certificate must document the specific NIST SRM® or NMI (National Metrology Institute) certified reference material used for traceability.

Calibrations performed in-house shall be documented in a manner that demonstrates traceability via unbroken chain of calibrations regarding the reference standard/material used, allowing for an overall uncertainty to be estimated for the in-house calibration.

Calibration shall be repeated at appropriate intervals, the length of which can depend on the uncertainty required, the frequency of use and verification, the manner of use, stability of equipment, and risk of failure considerations. Table 9-1 provides minimum frequencies.

Periodic verifications shall be performed to demonstrate the continued validity of the calibration at specific intervals between calibrations. The frequency of verifications can be dependent on the uncertainty required, the frequency of use, the manner of use, stability of the equipment, and risk of failure considerations. Internal calibrations and verifications are performed at the stated frequencies in Table 9-1. Reference thermometers, hygrometers, and masses, will be repurchased at the stated frequency rather than recalibrated. This has been determined to be more cost effective.

The laboratory has procedures describing their external and internal calibration and verification

activities and frequencies, and the actions to follow if equipment is found to be out of acceptable specification.

Laboratory staff performing in-house calibration and verifications shall have received documented training.

9.1.1.4 Standard tracking: Standards and reagents are tracked in the LIMS chemical inventory system for traceability and auditing purposes. The method of standard and reagent tracking is outlined in the subsequent sections.

9.1.1.4.1 When a standard or reagent is needed that is not already on the approved vendor / materials order list, supervisors forward purchase requests to the Technical Director and / or Laboratory Manager for approval. The standard or reagent is ordered from a reputable supply house (AES typically uses VWR).

9.1.1.4.2 The information supplied to the Technical Director and / or Laboratory Manager must have the supplier standard or reagent name, order number, size or amount of each unit, grade or purity, price, if possible, and quantity. Upon receipt, supplies (and services) are reviewed to ensure they comply with requirements. When a vendor has been approved for services, a note is placed in the comments field of the Vendors database within LIMS.

9.1.1.4.3 When the standard or reagent arrives, it is logged into the LIMS, usually by the department supervisor or by the sample custodian. All reagents and standards received are electronically tracked and documented by computer via the Laboratory Information Management System.

9.1.1.4.4 Each standard or reagent is given a unique chemical inventory number upon receipt. The next available number in the LIMS is automatically assigned, starting with #5001. The computer entry is completed by entering the correct information in the required fields.

9.1.1.4.4.1 The expiration date for neat standards and reagents is determined using the manufacturer's expiration date, if available. Otherwise, a 1 year expiration date is assigned to volatile organic compounds and standards and 5 year date for acids, dry chemicals, solvents, reagents, and other chemicals. Each standard and reagent is clearly and permanently labeled with its expiration date in indelible ink. The assigned expiration date for intermediate standards will not exceed the manufacturer's expiration date of the stock standard.

9.1.1.4.4.2 Secondary standard containers are labeled with the corresponding LIMS tracking number of the source material, the date the contents were prepared, the six month expiration date, the name of the analyte(s), the concentration of each component of the solution, the matrix and the initials of the person who prepared it.

9.1.1.4.4.3 The chemical inventory number must appear on both the standard and reagent container, and the upper, right-hand corner of the certificate of analysis. It must also be included, if applicable, in standard/preparation, analyses or sample preparation log books.

9.1.1.4.4.4 Secondary standard labels include the LIMS chemical inventory number, the standard name, intended use (spiking, surrogate, reference or calibration solution), and concentration with units, matrix, expiration date and initials of the person who prepared it. As long as this is available, all other information can be found in the LIMS.

9.1.1.4.4.5 Spiking, surrogate, reference and calibration solutions and calculations are recorded in the appropriate "Standard/Preparation Log Book." Logbooks cover the following areas:

Organics, Organics Preparation, Semi-Volatile Organics, Microbiology, Metals, Mercury & Wet Chemistry.

9.1.1.4.4.6 Some containers such as standards containers for organics are small and there may not be enough room to list all of the required information on the container. Should this occur, it is permissible to attach a label to the bottle.

9.1.1.4.4.7 When a standard or reagent is added to a sample for any reason, the LIMS chemical inventory number of that standard or reagent and the amount added must be recorded in the appropriate logbook. For example, if a stock standard MET #33-89-5431 of 1000 mg/L is diluted to 100 µg/L, the following line is entered: 1 ml MET #33-89-5431 to 100 ml DI water, 1 ml of 100x to 100 ml DI water, final conc. = 100 µg/L. (NOTE: "MET #33-89-5431" = Metals Department Standard/ Preparation Log Book 33, page 89, LIMS Chemical Inventory Number 5431).

9.1.1.4.4.8 If the standard is used as a stock standard and aliquots of it are diluted to produce working standards, the stock standard's LIMS chemical inventory number is used. The standard concentration or a designator such as "1" or "A" is used to differentiate between each serial dilution.

Table 9-1
Minimum Calibration / Verification Frequency Requirements (for AIHA-LAP, LLC and other accreditations)

Reference Standard / Equipment	Calibration Frequency	Verification Frequency
Balances	Initial and Annually	Each day of use
Mechanical Pipettors	Initial and when verification fails*	Quarterly
Reference Thermometers	Initial and every 5 years**	Not applicable
Reference Hygrometers	Initial and every 5 years**	Not applicable
Digital Thermometers	Initial and when verification fails*	Quarterly
Alcohol-Hg-Spirit Thermometers	Initial and when verification fails*	Semi-annual
Reference Masses	Initial and every 5 years**	Not applicable
Stage Micrometer	Initial, if damaged, and every 7 years	Not applicable

*Verified internally.
**These reference standards will be repurchased instead of recalibrated in-house.

9.1.2 Control of Materials, Parts and Components
When appropriate, identification of each item is maintained by part number, serial number, or other appropriate methods, either directly on the item, or by labels or records traceable to the item. The system is designed to prevent the use of incorrect or defective items and to maintain identify and control inventory. When appropriate, the system controls items by batch number rather than by individual item. Instrumentation not currently in use or equipment undergoing repair is labeled as "Out of Service."

9.1.3 Handling, Storage and shipping

9.1.3.1 General
This criterion establishes requirements for the proper handling, storage, preservation and shipping of materials, supplies and equipment.

9.1.3.2 Procedures and Responsibilities
All items affecting quality are handled and stored in such a manner as to prevent deterioration and damage to the quality. Items that require shipping are packed to prevent damage. Managers and supervisors are responsible for items under their control.

9.1.4 Procurement Document Control

9.1.4.1 General

9.1.4.1.1 Vendors of analytical material supplied to AES are regarded as a resource to, and an extension of the laboratory organization. The standards for quality identified in this document shall be applicable to vendors.

9.1.4.1.2 The purpose of the procurement control criterion is to ensure the quality and traceability of procured quality related items (equipment, materials, or services), whose specification could affect the quality of the services of AES. This includes such quality related items as the calibration of instruments by outside laboratories (when appropriate), purchase of standards, subcontracted services and materials requiring testing before use, as determined by the QA Manager.

9.1.4.2 Procedures and Responsibilities

9.1.4.2.1 It is the responsibility of the purchasing agent to provide assurance, when required, that all applicable regulatory requirements, industry codes and standards appear in the purchase documentation for affected services and products.

9.1.4.2.2 The Purchasing Department retains purchase orders for control purposes.

9.1.4.2.3 Purchased items which do not meet the minimum standards set forth by the purchasing agent are processed according to procedures set forth in Section 13, “Corrective Actions.”

9.1.4.2.4 The appropriate Manager/Supervisor and QA Manager review purchase orders, which may affect quality-related services or products.

9.1.4.2.5 Purchase orders for standard catalog items except those described herein, are exempt from QA review.

9.1.5 Non-conformance

The purpose of this criterion is to establish a system to control materials, parts, or components that do not conform to established requirements in order to prevent their inadvertent use. When significant deficiencies in analytical procedures, materials or components has or may lead to the release of incorrect analytical results to the customer, a Corrective Action Report (CAR) is issued.

9.1.5.1 Procedures and Responsibilities

The Laboratory Manager and the purchaser perform the inspection of the newly received material and equipment. Nonconforming items that fail incoming receipt inspection are identified and segregated until disposition is determined and documented by the Non-Conformance Report. Copies of these documents are maintained by the Purchasing Department or the QA Department, as applicable.

9.2 Instrumentation List

Appendix III, “Equipment List,” summarizes the laboratory equipment used to analyze for the parameters specified in Section 5.0 and indicates (to the extent the information is available) each ID number, instrument number, type of equipment, manufacturer, model, serial number, condition when purchased, in-service date and present location. It also lists in-house standards of traceability such as certified analytical balance weights and calibration thermometers.

9.3 Measurement Traceability and Calibration / Procedures for achieving Traceability of Measurements

9.3.1 General

The purpose of this criterion is to assure that instruments and other measuring and testing devices

used in activities affecting program quality are properly controlled, calibrated and adjusted at specified periods to maintain accuracy within design and/or procedure limits. Implementation procedures consist of the following as applicable:

9.3.1.1 Identification and control of the item

9.3.1.2 Creation of calibration schedules and procedures based on instrument type, planned use, and design limits and program requirements.

9.3.1.3 Development of any necessary calibration sources for use in confirming successful equipment operation.

9.3.1.4 Maintenance of equipment history records to indicate past and status, and to provide reproducibility and traceability of results.

9.3.2 Responsibility

Under the direction of the manager, the supervisors are responsible for the quality of measuring and test equipment under his/her control and for the maintenance of records of calibrations and checks.

9.3.3 General Requirements

All measuring operations and testing equipment having an effect on the accuracy or validity of tests shall be calibrated and/or verified before being put into service and on a continuing basis. The laboratory has an established program for the calibration and verification of its measuring and test equipment. This includes balances, thermometers and control standards.

9.3.4 Traceability of Calibration

9.3.4.1 The overall program of calibration and/or verification and validation of equipment ensures that, wherever applicable, measurements made by the laboratory are traceable to national standards of measurement.

9.3.4.2 Calibration certificates indicate the traceability to national standards of measurement and provide the measurement results and associated uncertainty of measurement. Certificates are maintained in the Quality Assurance office files.

9.3.4.3 The laboratory maintains calibration certificates that provide traceability to each standard chemical used within the laboratory. As these standards are purchased, the certificates that accompany the standards are stored in logbooks. Information included in the logbooks includes labels provided by the manufacturer, expiration date, lot number, etc. This information is stored separately for standards purchased by each department and can be accessed by all personnel within the department.

9.3.4.4 Where the traceability of national standards of measurement does not apply, AES shall provide satisfactory evidence of correlation of results by participation in a program of inter-laboratory comparisons, proficiency testing studies or independent analysis.

9.3.5 Reference Standards

9.3.5.1 Reference standards, as Class 1 weights or traceable thermometers, are used for calibration only and no other purpose, unless it can be demonstrated that their performance as reference standards will not be invalidated. AES, Inc., maintains certified Class 1 weights, thermometers which have been calibrated by outside agencies that can provide traceability to national standards of measurement. The stage micrometer will be calibrated by a NIST traceable reference.

9.3.5.2 The calibration and verification of reference standards occurs every five years for Class1 weights and thermometers and every seven years for stage micrometers.

9.3.5.3 Where relevant, reference standards and measuring and testing equipment shall be subjected to in-service checks between calibrations and verifications. These reference materials shall, where possible, be traceable to national or international standard reference materials. Table 9-2 lists the major standards (traceable to NIST) which are used in the laboratory and their sources.

Table 9-2

Chemical Standard	Manufacturer/Vendor
PAH Mix	VWR-Restek, Supelco
Toxaphene	ERA, Accustandard, Absolute Stds
Chlordane	ERA, Accustandard, Absolute Stds
Hexavalent Chromium	ERA, Accustandard, Absolute Stds
LAS (MBAS)	ERA, Accustandard, Absolute Stds
Calcium Carbonate	ERA, Accustandard, Absolute Stds
TSS	ERA
O&G	ERA, Accustandard, Absolute Stds
Aroclor Mix (PCB)	ERA, Accustandard, Absolute Stds
8260B Matrix Spike	VWR-EM Science
EPA 625 Kit	Restek
Sodium Nitroferricyanide	VWR-Mallinckrodt
Sodium salicylate	VWR-J.T. Baker
Phosphate (P) Standard	Labchem, Inc.; Ricca
Mercuric Oxide	VWR-J.T. Baker
Multi-element Metals Std	SCP
Chemical Standard	Manufacturer/Vendor
Antimony Standard	SCP
Furan	Aldrich Chemical
Herbicides Mix	ERA, Accustandard, Absolute Stds
DRO/GRO	ERA, Accustandard, Absolute Stds
EDB, DBCP	ERA, Accustandard, Absolute Stds
turbidity	ERA, Accustandard, Absolute Stds
8270C Mix	ERA, Accustandard, Absolute Stds
Semi-Vols Mix	RTC
1,2-diphenylhydrazine	Restek

9.3.6 Calibration- Calibration requirements are divided into two parts: 1) requirements for analytical support equipment, and 2) requirements for instrument calibration. In addition, the requirements for instrument calibration are divided into initial instrument calibration and continuing instrument calibration verification.

9.3.6.1 Instrument Calibration - Analytical instruments are calibrated in accordance with the proper analytical procedure to determine the analyte(s) of interest. After initial calibration of an instrument, a continuing calibration standard is analyzed at specific intervals. The calibration standards must meet the specified QC requirements associated with each test method (see Section 5).

9.3.7 Control of Measuring and Test Equipment

9.3.7.1 General - The purpose of this criterion is to assure that instruments and other measuring and testing devices used in activities affecting program quality are properly controlled, calibrated and adjusted at specified periods to maintain accuracy within design and/or procedure limits. Implementation procedures consist of the following as applicable:

9.3.7.1.1 Identification and control of the item.

9.3.7.1.2 Creation of calibration schedules and procedures based on instrument type, planned use, design limits and program requirements.

9.3.7.1.3 Development of any necessary calibration sources for use in confirming successful equipment operation.

9.3.7.1.4 Maintenance of equipment history records to indicate past and current status, and to provide reproducibility and traceability of results.

9.3.7.2 Equipment calibration specific to microbiological analysis.
The laboratory, under the direction of the section leader, determines and documents temperature stability, uniformity of temperature distribution, and time required to achieve equilibrium conditions in incubators and water baths. This procedure is performed during the following two conditions.

9.3.7.2.1 When new equipment is purchased

9.3.7.2.2 On an annual basis for existing equipment

9.3.7.3 Volumetric accuracy checks for disposable pipettes used in microbiological analysis. The laboratory, under the direction of the section leader, determines and documents volumetric accuracy of disposable pipettes. This is accomplished by checking 5 pipettes per case lot.

9.3.7.4 Mechanical timer accuracy checks. The laboratory, under the direction of the section leader, determines and documents the accuracy of mechanical timers. This is done by the following method and frequency.

9.3.7.4.1 Accuracy check is performed on an annual basis and is documented in the logbook.

9.3.7.4.2 Accuracy is compared against an electronic timing device such as a stopwatch.

9.3.7.5 General Responsibility

Under the direction of the manager, the supervisors are responsible for the quality of measuring and test equipment under his/her control and for the maintenance of records of calibrations and checks.

9.3.8 Reference Measurement Standard List

Reference measurement standards must originate, wherever possible, from sources traceable to NIST. Table 9-3 describes the major standards used in the laboratory and their sources:

Table 9-3
Reference Measurement Standard List

Chemical Standard	Manufacturer/Vendor
PAH Mix	VWR-Restek, Supelco
Toxaphene	ERA, Accustandard, Absolute Stds
Chlordane	ERA, Accustandard, Absolute Stds
Hexavalent Chromium	ERA, Accustandard, Absolute Stds
LAS (MBAS)	ERA, Accustandard, Absolute Stds
Calcium Carbonate	ERA, Accustandard, Absolute Stds
TSS	ERA
O&G	ERA, Accustandard, Absolute Stds
Chemical Standard	Manufacturer/Vendor
Aroclor Mix (PCB)	ERA, Accustandard, Absolute Stds
8260B Matrix Spike	VWR-EM Science
EPA 625 Kit	Restek

Sodium Nitroferricyanide	VWR-Mallinckrodt
Sodium salicylate	VWR-J.T. Baker
Phosphate (P) Standard	Labchem, Inc.; Ricca
Mercuric Oxide	VWR-J.T. Baker
Multi-element Metals Std	SCP
Antimony Standard	SCP
Furan	Aldrich Chemical
Herbicides Mix	ERA, Accustandard, Absolute Stds
DRO/GRO	ERA, Accustandard, Absolute Stds
EDB, DBCP	ERA, Accustandard, Absolute Stds
turbidity	ERA, Accustandard, Absolute Stds
8270C Mix	ERA, Accustandard, Absolute Stds
Semi-Vols Mix	RTC
1,2-diphenylhydrazine	Restek

10.0 PREVENTIVE MAINTENANCE

10.1 Instrument Maintenance

All instrument maintenance is recorded in an instrument specific logbook. Entries are dated and initialed by the analyst making the entry.

10.1.1 Routine

All analytical instruments have a routine schedule of maintenance specified by the manufacturer. Routine maintenance is designed to keep the instrument in good operating condition with as little "down-time" as possible. All Analysts should be proficient in maintaining the instruments for which they are responsible.

10.1.2 Non-Routine

Any maintenance which must be performed in order for sample analysis to proceed, but is not part of the systematic maintenance schedule, is considered non-routine. Non-routine maintenance must be reported to the Section Supervisor immediately so that is its impact on production can be determined. If the ability to analyze samples is adversely affected, the Section Supervisor notifies the Client Services Manager so that alternative action can be coordinated with the client.
(Note: See Appendix II for a complete instrument maintenance summary.)

10.2 Preventive Maintenance

10.2.1 Maintenance Schedule

AES is equipped with up-to-date computerized instrumentation. In order to gain maximum performance and minimize downtime, regular inspection, maintenance, cleaning, and servicing of all laboratory and field equipment is performed according to the manufacturers' recommendations.

10.2.2 A maintenance log is kept for each piece of laboratory and field instrumentation, detailing all maintenance performed on the instrument.

10.2.1.1 Routine repairs and maintenance are performed and documented by the analyst responsible for the particular instrument.

10.2.1.2 A log of non-routine maintenance is kept in the instrument repair logbook. As part of this information, the analyst or repair technician signs and dates the logbook.

10.2.1.3 Routine maintenance procedures for laboratory instrumentation are given in Appendix II. The service intervals listed in Appendix II are as follows: D = daily; W = weekly; M = monthly; Q = quarterly; SA = semi-annually; and AN = as needed. (A list of all laboratory equipment may be found in Appendix III.)

10.2.3 An extensive approved spare parts inventory is maintained for routine repairs at the facilities, consisting of GC detectors, AA lamps, fuses, printer heads, flow cells, tubing, certain circuit boards and other common instrumentation components.

10.3 Glassware used in general laboratory operations must be of high quality borosilicate glass (e.g. Pyrex or Kimax). Volumetric dispensing glassware must be Class A wherever possible.

Glassware Cleaning. Laboratory glassware cleaning procedures & guidelines are described in Table 10-1.

TABLE 10-1
LABORATORY GLASSWARE CLEANING PROCEDURES

Analysis/Parameter	Cleaning Procedure (In Specified Order)
Extractable Organics (including	Solvents: 13, 1, 2, 3, 4, 7, (6 or 8 optional), 15, 17
Pesticides and Herbicides)	Or, Muffle Furnace: 13, 1, 2, 3, 4, 14, 15, 17
	Or, Oxidizer: 13, 1, 2, 3, 16, 3, 4, 15, 17
Analysis/Parameter	Cleaning Procedure (In Specified Order)
Purgeable Organics	1, 2, 3, 4, (7 optional), 11
	Or, 1, 2, 3, 4, (8 optional), 11
Trace Metals	1, 2, 3, 4, 10, 4
Nutrients, Other Wet Chemistry	1, 2, 3, 4, 9, 4
TKN	1, 2, 3, 4, 18, 4
Minerals, Demands, CN and Phenols	1, 2, 3, 4
Microbiology	1, 2, 3, 4
Residues	1, 2, 3, 4, 12

Key to Laboratory glassware cleaning procedures:

1 Remove all labels with cotton ball dampened with acetone
2 Wash with hot tap water, scrub stopcocks, small parts with brush and using a laboratory-grade detergent
Organics – Liquinox, Alconox or equivalent
Inorganic Anions – Liquinox or equivalent
Inorganic Cations – Liquinox, Acationox, Micro or equivalent
3 Rinse thoroughly with hot tap water
4 Rinse thoroughly with Deionized (DI) water
6 Rinse thoroughly with pesticide-grade methylene chloride
7 Rinse thoroughly with pesticide-grade methanol
8 Rinse thoroughly with pesticide-grade hexane
9 Rinse thoroughly with Deionized (DI) water
10 Rinse or soak with 1:1 HCl
11 Rinse thoroughly with Deionized (DI) water
12 Rinse or soak with 10% HNO_3
13 Rinse thoroughly with Deionized (DI) water
14 Bake at 105°C for 3-4 hours (Note: Class A volumetric glassware must NOT be baked!)
15 Bake crucibles at 105 °C or 180 °C for 1 hour (prior to use, as per method)
16 After use, rinse with same solvent used

17 Drain, let air dry
18 then heat in muffle furnace for 15-30 minutes
19 Store inverted or capped with suitable material or container stopper
20 Soak in oxidizing agent: chromic acid or equivalent
21 Rinse with solvent used in analysis as the last step prior to use
22 Rinse or soak with 1:1 H_2SO_4

Note: Do not let it run continually while washing glassware due to a limited supply of Deionized Water.

11.0 QC CHECKS AND ROUTINES TO ASSESS PRECISION, ACCURACY AND METHOD DETECTION LIMITS

11.1 Control of Special Processes

11.1.1 In certain processes, the existence of a required level of quality cannot be assured by the examination of the end result alone. Such special processes that relate to the conduct of programs include performance of detailed chemical procedures, interpretation of raw data and the use of advanced data analysis techniques.

11.1.2 For such processes, quality assurance is obtained through the development of thorough analytical and operational procedures. QA is also obtained by personnel screening and documented training to insure the necessary level of personnel qualifications and capabilities and by the use of QC samples. This section describes how personnel are qualified in accordance with specified requirements.

11.2 Quality Control in the Laboratory

11.2.1 Various types of quality control samples are used at AES, Inc., in each of the following areas:

- Bulk Asbestos
- Air Asbestos
- Gas Chromatography/Mass Spectrometry
- Gas Chromatography
- Inorganic Analysis
- Wet Chemistry
- Microbiology
- Sample preparation

11.2.2 Some of the activities used to qualify the procedures (and data) are described:

11.2.2.1 Standards

The Section Supervisor (or designee) is responsible for the preparation and documentation of stock standards and working standards. Standard reference materials are obtained from suppliers and have Certificates of Analysis to certify the analyte concentrations. When available, traceable reference materials are to be used. As a minimum, information on reference materials includes manufacturer, lot or batch number, date of receipt, expiration date, and any other accompanying preparation or assay information. The most recent release of the NIST standards library shall be used for mass spectral interpretation.

11.2.2.2 Calibration and Performance Check of Instruments

Different types of reference material are used to calibrate the various analytical instruments in the laboratory areas. For most of the analytical instruments used in the laboratory, calibration and performance checks are conducted at the beginning of an analytical run, periodically throughout the run and at the end of the run, (e.g., Atomic Absorption Spectrophotometers), while others are calibrated once then checked daily. The performance checks must be from an outside source, such as an alternate manufacturer, or may be from the same manufacturer as long as it originates from a different lot or batch. Calibration is also performed when the analytical method is initially set-up, when an instrument has been through major maintenance, or the instrument fails its QC check.

11.2.2.3 Inter-Laboratory Analysis of QC Samples
Client and method requirements determine the frequency and type of spikes, blanks, splits, method standards, surrogate standard, internal standard and external source analyses. These normally account for 10 – 20% of the data points generated by the laboratory.

11.2.2.4 Inter-Laboratory Analysis
AES, Inc. participates in various accreditation programs that require the analysis of either agency-supplied performance samples or proficiency test study samples purchased from a TNI or AIHA-LAP, LLC approved PT provider as required. Results of these performance results are reported and maintained in QA files. Results which are evaluated as "Not Acceptable" are documented and reviewed by the Quality Assurance department and resolved through discussion with analysts and their supervisors, examination of all raw data, re-assessment of sample preparation directions and techniques, and a review of data and calculations.

11.2.2.5 Computational Checks
Any hand calculations are checked by a second individual, in most cases the section supervisor. The person performing the crosscheck must be qualified in the relevant technical discipline. For computations performed automatically using verified software, and which contain a hard copy of the entered computation, only the entries are checked.

11.2.2.6 Review and Analysis of Data
The review and analysis of data for analytical measurements are performed on a timely basis using Quality Control checklists. The data is checked for reasonableness and consistency by the section Supervisor and/or the manager.

11.2.2.7 Detection Limit Studies
The detection limit of an analyte is defined as the smallest amount of an analyte that can be detected (for instrumentation, above the background noise) within a stated confidence limit. There are several types of detection limits that may be applicable to a given method. The Instrument Detection Limit (IDL) is the amount of analyte needed to produce an adequate response above an instrument's baseline noise. The IDL may be use to estimate a Method Detection Limit (MDL). The Practical Quantitation Limit (PQL), also called the Reporting Limit (RL) is defined as the lowest level of quantitation achievable during routine laboratory operations. Some agencies define the PQL more rigidly as 3.33 times the MDL. However, the PQL is highly matrix dependent.

11.2.2.8 Recovery of Known Additions (Spikes)
Recoveries of known additions of analytes are used to determine the effect of the sample matrix on the given analytical procedure. The Laboratory Control Sample (LCS) and sample Matrix Spike/Spike Duplicate (MS/MSD) are used to monitor and control the analytical process. The recovery of spiked analytes in the sample matrix gives a definitive measure of the sample preparation processes.

11.2.2.8.1 LCS data is used to monitor the laboratory's performance in respect to sample preparation and equipment operation. It is prepared in an analyte free matrix similar to the sample, i.e. water or soil. Recovery limits for the LCS are established by the laboratory through control charting of each analyte.

11.2.2.8.2 A matrix spike/matrix spike duplicate pair is analyzed to determine the effect of the sample matrix on extraction efficiency and analyte recovery. One MS/MSD pair should be prepared and analyzed in every batch of 20 or fewer samples when possible. In some cases, the client may specify which sample is to be used for the MS/MSD. If not, the laboratory picks a representative sample at random. Advisory MS/MSD recovery

limits are established for aqueous and soil matrices. For TCLP analysis, a matrix spike is prepared and analyzed for each waste type (e.g. oil, solid) associated with a batch of 20 or fewer samples of similar matrix.

11.2.2.9 Surrogates

As a means of monitoring individual sample extraction efficiency, one or more surrogate compounds are added to each blank, LCS, client sample, and QC sample prior to preparation. Recovery limits for surrogate compounds are established by the laboratory through control charting of each analyte. Typically, one of the following actions will be required when a sample surrogate recovery is out of the established control limits.

- Re-extract and/or reanalyze the sample
- Flag the results as estimated

11.2.2.10 Clients may specify the required action to be taken for recovery failure. Client specific requirements are conveyed to the analytical sections through project management.

11.2.3 Tracking Internal QC Samples

The tracking of internal QC samples through the LIMS provides laboratory personnel with various types of information. This information is used for the following purposes:

11.2.3.1 Long term trends are monitored through the use of quality control charts. Any upward or downward change in the recovery of analytes signifies that some procedural change has taken place. If trending is observed, the Technical Director reviews all test procedures and makes any corrections as required.

11.2.3.2 The number of quality control samples as a function of total laboratory samples is monitored so as to ensure that the laboratory analyzes the adequate number of Quality Control samples for each extraction or analytical batch.

11.2.3.3 The following guidelines are followed when implementing and utilizing QC Charts:

11.2.3.3.1 Through LIMS the Technical Manager plots the percent recovery of the LCS analyte versus the date of preparation or analysis; whichever is most appropriate.

11.2.3.3.2 For organic analyses employing surrogates, the LCS surrogate % recoveries are monitored on QC Charts. The recovery of at least one target Aroclor (PCB) in the Pesticide/PCB LCS is monitored on a QC Chart (e.g. TPH).

11.2.3.3.3 For trace metals determined by inductively coupled plasma (ICP) at least three metals spiked in the LCS are monitored on QC Charts (e.g. Cd, Cr, Ni). For trace metals determined by graphite atomic absorption (GFAA) and cold vapor atomic absorption (CVAA), an LCS for each element is monitored on a QC chart.

11.2.3.3.4 For General Chemistry, an appropriate LCS for each method is used. Each LCS analyte recovery method is monitored on a control chart.

11.2.3.3.5 Each section, prior to the calculation of in-house limits, establishes initial control limits. These preliminary limits are derived from published method criteria if available. If no such criteria are available, the preliminary limits will be mutually set and agreed to by the Section Supervisor, Laboratory Manager, Technical Director, and Quality Assurance Manager. A minimum of 20 points is recommended to establish the initial calculated control limits. In some cases, it may be appropriate to use fewer data points to establish the first set of calculated limits, however, at no time should fewer than seven data points are used.

11.2.3.3.6 Control chart limits are updated periodically when sufficient additional data points are

available. Typically, limits are updated for each set of 20 to 50 new data points. More frequent updates may be warranted in some cases

11.2.3.3.7 Each control chart has upper and lower warning limits established at ± 2 standard deviations ($2\sigma_{n-1}$) from the mean % recovery (centerline)

11.2.3.3.8 Each control chart has upper and lower control limits established at ± 3 standard deviations ($3\sigma_{n-1}$) from the mean % recovery (centerline).

11.2.3.3.9 The analyst performing the method enters the data into LIMS. The data is evaluated frequently to identify trends that might occur in an "out of control" situation

11.2.4 The method blank is an analyte–free matrix to which all reagents are added in the same volumes or proportions as used in sample processing. The method blank is carried through the complete sample preparation and analytical procedure. The method blank is used to document contamination resulting from the analytical process.

For the method blank to be acceptable for use with the accompanying samples, the concentration of the blank of any analyte of interest can not exceed the method detection limit or required reporting limit. Section 5 lists certain conditions in which contaminated blanks may be used for quality control purposes.

11.2.5 An instrument blank may be run after any sample that gives a response that exceeds the calibration range for the instrument to show that there is no carry-over to the next analysis. The instrument blank shall consist of high purity solvent (e.g. hexane for pesticide analysis by GC/ECD, methylene chloride for semi-volatiles analysis by GC/MS).

11.2.6 An Initial Calibration Blank (ICB) is analyzed before sample analysis begins to verify there is no carryover contamination or instrument drift. ICB samples usually accompany inorganic instrumental analysis.

11.2.7 The analysis of sample duplicates that contain detectable quantities of analytes is an effective means for assessing the precision of an analysis. Refer to the individual analytical procedures or LIMS test codes for guidance concerning the frequency and criteria for sample duplicate analyses.

11.3 Inter-laboratory Quality Control

Each section of the laboratory may be given blind and double blind samples to analyze for requested parameters. Blind samples may be assigned in containers to be diluted, digested, and/or extracted and analyzed by the appropriate laboratory section. Double-blind samples may arrive on a pre-scheduled basis from a "client" as real samples to be analyzed by designated analytical sections for specific analytes.

11.3.1 Blind QC Samples

Blind QC samples may be used as a test of proficiency for analysts needing certification and/or qualification for performing an analysis. The Section Supervisor should obtain the QC sample from either the Quality Assurance Department of from a source independent from the source of standards for the analysis.

11.3.2 Double - Blind QC Samples

Quality Control samples may arrive from a "Client" to be analyzed for specific analytes. These samples will arrive as real samples and will not be known to anyone outside Quality Assurance and Project Management. The results of these double-blind samples will be sent to the "client" to be compared to the true value of the samples. The laboratory's performance on these samples will

be compared to other laboratories in the program. These results will be mailed to the Quality Assurance Department. Results are used to identify areas needing improvement.

11.4 Out-of-Control Conditions in Laboratory Control Samples

11.4.1 Any of the following control chart conditions indicates the loss of process control:

11.4.1.1 Any one point that is outside of the control limits.

11.4.1.2 Any three consecutive points that are outside one of the warning limits.

11.4.1.3 Any eight consecutive points on the same side of the centerline.

11.4.1.4 Any obvious cyclic or repetitive pattern seen in the points.

11.4.2 Reactions to "Out-of-Control" Conditions

In the event of an "out-of-control" condition, the analyst should respond to the condition in the following manner:

11.4.2.1 Stop analysis.

11.4.2.2 Investigate the root cause of the failure

11.4.2.3 Implement any required corrective action.

11.4.2.4 Document the situation in a non-conformance memo prior to initiating subsequent analyses.

11.5 Identification of Analytes

11.5.1 Organic Analyses

The identification of analytes is accomplished by comparison of unknown samples with known standards. All standards shall be traceable as specified by the applicable analytical procedure.

11.5.1.1 Gas Chromatography

All sample identifications are made by a comparison of the retention time of the standard peak to the retention time of the unknown peak. The identification of any analyte, which is identified during the primary analysis, is verified through the use of a confirmation column or by GC/MS unless specifically exempted in the applicable procedure.

11.5.1.2 Gas Chromatography/Mass Spectrometry (GC/MS)

For positive identification of an analyte by GC/MS, the spectrum of the analyte must conform to a spectrum of the authentic standard obtained after satisfactory tuning of the mass spectrometer. The appropriate analytical methods should be consulted for specific criteria for matching the mass spectra, relative response factors and relative retention times to those of authentic standards. Tentative identifications may be made based on conformance to published mass spectra in reference texts or spectral library databases.

11.5.2 Inorganic Analyses

The identification of analytes is accomplished by comparison of unknown samples with known standards. All standards shall be traceable as specified by the applicable analytical procedure.

11.5.2.1 Metals

The concentration of a metal analyte is based on the absorption or emission of light measured at a specific wavelength. The wavelength selected is in accordance with the applicable procedure. Standards used to generate the calibration curve are traceable to NIST or other nationally recognized (e.g. EPA).

11.5.2.2 Wet Chemistry

Standards used to prepare calibration curves or to standardize instruments are traceable to

NIST or other national sources (e.g. EPA).

11.6 Quantitation and Reporting of Analytes

11.6.1 Reduction of Sample Data

Data reduction is defined as the processing of instrument generated numbers by an analyst to achieve a final result. Data reduction is used for sample analysis as well as for quality control criteria. Processing of numbers may be achieved using manual and/or computer aided calculations.

11.6.1.1 All data reduction follows calculations found in approved procedures for the analysis.

11.6.1.2 An analyst who is qualified to perform the analysis performs all data reduction. If a Section Supervisor performs data reduction, another qualified analyst reviews the data.

11.6.1.3 All numbers used in the reduction of data are present on data reports and are easily retrievable.

11.6.1.4 All computer-generated calculations are performed using a validated program/spreadsheet.

11.7 Reporting Data

11.7.1 Significant Digits

All digits in a reported result are considered to be definite, except for the last digit, which may be in doubt. Such a number is said to contain only significant figures. If more than a single doubtful digit is carried, the extra digit or digits are not significant. The following rules apply to all reported analytical results from all laboratory sections:

11.7.1.1 All digits from a measurement are recorded. These numbers are used in the calculation of the results. After all calculations have been performed, the number is rounded to the required number of significant digits.

11.7.1.2 The number zero may or may not be a significant digit, depending on its placement of the reported result.

11.7.1.3 Final zeros, after a decimal, are always significant (Ex. 9.80 has three significant figures).

11.7.1.4 Zeros before a decimal point with non-zero digits preceding them are significant. Zeros with no non-zero digits before them are not significant (e.g. 10.3 has three significant digits, 0.53 has two significant digits).

11.7.1.5 If there are no non-zero digits preceding a decimal point, the zeros after the decimal point but preceding other non-zero digits are not significant. These zeros only indicate the position of the decimal point.

11.7.1.6 The final zero in a whole number may or may not be significant.

11.7.1.7 When mathematical functions are performed on multiple numbers, the number with the least number of significant digits dictates how many significant digits the end result should have.

11.7.2 Rounding Rules

11.7.2.1 Once the number of significant figures obtainable from a particular analysis is established, data resulting from the analysis are reduced according to the standard rules for rounding which state: If the number value to be rounded is 5 or greater, round up. If the number value is less than 5, round down.

11.7.2.2 Rounding off numbers is a necessary operation in all analytical sections of the laboratory. It is automatically applied by the limits of measurement of every instrument and all glassware.

11.7.3 Reporting Units

The appropriate unit of measurement shall accompany all sample results reports.

11.7.4 Reporting on a Wet vs. Dry Weight Basis
When required, solid sample results are reported on a dry weight basis and documented in the report. When results are reported on a wet weight basis, the results are reported "as is".

11.7.5 Reporting % Recovery and RPD
Unless otherwise directed by the customer, the Technical Director, or the QA Manager, the % Recovery and RPD are reported to one decimal place.

11.8 Storage of Quality Related Data
The laboratory retains all data and information that pertains to a project for a period of 5 years. The data may be stored electronically, as hard copy, or both.

11.8.1 Calibration Data
All calibration data, which pertains to a specific project, is stored in an easily retrievable manner. Easily retrievable manner is defined as retrievable in the same day for current projects, or within 24 hours for archived projects.

11.8.2 Quality Control Data
All quality control related data (i.e. blanks, blank spikes/duplicates, matrix spikes/duplicates, etc.) is stored in the associated project file. If more than one project is associated with the QC data, copies are made and stored with each associated project.

11.8.3 Logbooks (Notebooks)
Laboratory logbooks are kept in the laboratory while in use. Once completed, the logbooks are archived in an easily retrievable location.

11.8.4 QC Charts
While in use, QC charts are stored in LIMS. When the QC Chart is no longer being used, it is archived by the section in a central location in the Server.

11.9 Internal Performance Audits
Internal performance audits are a means for the Quality Assurance Department to determine the applicability, effectiveness, and utilization of procedures by all sections. Designated personnel perform the performance audits. At the beginning of each year, and on an on-going basis, a schedule of audits and surveillance is developed and updated by the Quality Assurance Section. Surveillance is performed on an unannounced basis with the sections so that objectivity may be maintained. Findings from audits and surveillance are documented and corrective actions are implemented. Additional surveillance is scheduled to ensure that all deficiencies are corrected.

11.10 Failure of Quality Control Indicators
When there is a quality control failure that impacts data quality, the event must be documented using the procedures described in Section 13 of this document.

12.0 DATA REDUCTION, REVIEW AND REPORTING

12.1 Introduction: In order to provide the highest quality data possible, an extensive system for data reduction, review, and reporting has been implemented.

12.2 Sample Analysis and Data Reduction
Through the use of the worksheets, the samples are prepared following the procedures given in each of the SOPs that follow EPA's approved methods. The preparation information is recorded in logbooks throughout the laboratory.

12.2.1 Data Reduction

Most sample concentration results are read directly from instrumentation without further reduction or calculations. Dilution factors are applied upon the dilution of samples having concentrations above the calibration range. In many cases, these are input into the instrument computer and correct results are calculated automatically. In other cases, a manual calculation may be made. Data from methods requiring manual reduction prior to reporting include titrimetric methods, BOD, COD, conductivity, manual UV/VIS/IR and residue. All laboratory pH meters are temperature compensated.

The laboratory raw data containing the instrument-generated reports, manually calculated results, and all supporting preparation, calibration, and analytical data are scanned as pdf file and posted in laboratory archives (portal server).

12.2.2 Chromatographic and Data File Identification

Chromatograms and data files are given a unique alphanumeric identification by the chemists initiating the analyses in each section. These file identification numbers reflect either the date the sequence was initiated (GC sections), the order in which samples were analyzed (GC/MS sections), and/or the sample identification and log numbers given by the client and listed on the LIMS.

12.3 Data Transfer and Review

12.3.1 Data Transfer to LIMS

The analytical results are entered on the department worksheets after review or by direct electronic transfer from the instrument data system. The analysts enter the worksheet data into the LIMS. After the data is entered into the LIMS, approval sheets are printed and checked against the information entered into the LIMS for transcription errors and anomalies.

12.3.2 Data Review

Laboratory analytical results are reviewed by at least two analysts or a section supervisor prior to entering the reportable data into the LIMS. The review of the data includes checking the extraction, digestion, distillation, and other preparation logs, ensuring that all precision and accuracy requirements are addressed, and ensuring that all steps of the analyses have been completed. If any problems were indicated during the analysis of the sample batch, it is the responsibility of the analyst and the section supervisor to bring this to the attention of the project manager, section manager and QA manager through a written corrective action report.

12.3.3 Data flags

Data flags are used on reports as needed to inform the project manager and the client of any additional information that might aid in the interpretation of the data. The data flagging system incorporates data qualifiers which are similar to flags specified in the Contract Laboratory Program protocols, as well as additional flags used to help explain batch specific events.

12.3.4 Final Report

When data acquisition and reporting have been completed, the project manager reviews and prepares the final report. Because the project managers have extensive experience in evaluating analytical data, they have developed both objective and subjective techniques for data review. Each value reported is reviewed in the context of the respective environmental matrix and all available QC/QA data.

12.3.4.1 The QA Manager will periodically review test reports in compliance to AIHA-LAP, LLC LQSR prior to issuance and document this review via a tracking spreadsheet and by adding a comment to the work order.

12.3.4.2 Abnormal values are carefully scrutinized, and samples are reanalyzed if the abnormalities cannot be explained.

12.3.4.3 If the results from spiked samples suggest interferences (low or high bias), attempts are made to remove the interferences, or the data is flagged and/or a project narrative is included with the report. Laboratory qualifiers are defined as follows:

* - Value exceeds maximum contaminant level
B - Analyte detected in the associated method blank
BRL - Below Reporting Limit
E - Estimated (Value reported above quantitation range)
H - Holding times for preparation or analysis exceeded
J - Estimated value detected below Reporting Limit
N - Analyte not NELAC (TNI) certified
Narr - See Case Narrative
NC - Not Confirmed
R - RPD outside accepted recovery limits
Rpt Lim - Reporting Limit
S - Spike recovery outside accepted recovery limits
> - Greater than Result value
< - Less than Result value

12.3.4.3 Clients are instructed to provide sufficient sample for the analysis of Matrix Spike and Matrix Spike Duplicate analysis, however there are times when the laboratory does not receive sufficient aqueous sample volume to perform these analyses. If an aqueous sample batch is analyzed without the inclusion of a spike/spike duplicate sample(s), this fact is added to the report narrative per TNI requirements. Example verbiage is as follows:

The TNI requirement for the analysis of a matrix spike/matrix spike duplicate could not be performed on Batch (#) due to insufficient sample volume submitted.

12.4 Special Project or Data Package Review

If the client requests special handling and/or data packages, the Laboratory Director, Technical Director, or Quality Assurance Manager may also review the project report and the raw data. This review includes checking holding time requirements and calibrations, reviewing all quality control data and/or control charts, and initiating any corrective actions or re-analyses that might be appropriate.

12.5 Quality Control Reports

AES, Inc. offers four levels of quality control reporting. Each level contains all the information provided in the preceding level, in addition to its own specific requirements. The quality control packages provide data in the following levels:

12.5.1 Level I - method references, preparation and analysis dates, surrogate(s) recoveries and reporting limits.

12.5.2 Level II - Level I information plus results for the blank, LCS and MS/MSD and sample duplicates.

12.5.3 Level III - Level I and II information plus all raw data associated with sample preparation, instrument calibration (if applicable) and sample analysis.

12.5.4 Level IV - Level I, II and III information in a CLP “look-alike” format, and all sample raw data.

12.6 Reporting Criteria

The final report is printed and signed by the Laboratory Manager, the Director of Project Management or a Project Manager after all review has been completed. The Laboratory Manager, the Director of

Project Management and Project Managers serve as designees for technical director for report signing. The data flags that may appear in a project report are defined and any additional comments are included in the Case Narrative.

12.6.1 If requested by the client or a project specific QA Plan, custom reports or data packages can be provided. When data packaging is requested, a paginated data package is provided in addition to the project report. The format of the project report and/or data package can be adjusted to meet the needs of the client. All LIMS reports can be downloaded onto diskettes or to most clients' computers.

12.6.2 When the project report must meet TNI requirements, the report will include a certification statement indicating the results meet TNI standards, an estimated uncertainty statement, and a format that includes the total number of pages in the report.

12.6.3 AES, Inc., will not intentionally divulge to any person (other than a client or person designated by a client in writing) any information regarding the services provided by AES or any information disclosed to AES by the client. Any information *known* to be potentially endangering to national security or any entity's proprietary rights will NOT be released.

12.6.3 Test results are reported according to client requirements. If a client requests to have reports or information sent by fax, the client is notified in advance of the transmission, whenever possible, and all documents include a cover sheet with the following statement:

NOTICE OF CONFIDENTIALITY
The information contained in this facsimile message may be legally privileged and is confidential information intended only for the use of the individual or entity named above. If the reader of this message is not the intended recipient, you are hereby notified that any use, dissemination, distribution or copy of this facsimile message is strictly prohibited. If you have received this facsimile message in error, please contact us by telephone at (770) 457-8177 and return the facsimile message to us at the address above via the US postal service.

All documents sent by email should include the following statement:
NOTICE OF CONFIDENTIALITY: The information in this email and / or attachments may be legally privileged and is confidential information intended for the use of the individual or entity named in the email address. If the reader of this message is not the intended recipient, you are hereby notified that any use, dissemination, distribution, or copy of this email and / or attachments is strictly prohibited. If you have received this email in error, please notify Analytical Environmental Services Customer Service by telephone at (770) 457-8177 or by email at info@aesatlanta.com and delete the message. Thank you.

12.7 Record Keeping

Procedures are in place to ensure that all records required under TNI Chapter 5 and AIHA-LAP, LLC program requirements are retained. The laboratory maintains a record keeping system that can produce unequivocal, accurate records that document all laboratory activities.

12.7.1 When an analytical batch is prepped and analyzed, the analyst enters the data into the LIMS system and gives the raw data, quality control data and a copy of the prep log (if applicable) to the department manager to review.

12.7.2 Any problems encountered during sample preparation and analysis are corrected and brought to the attention of the department manager.

12.7.3 Once the department manager has reviewed the data, it is validated in the LIMS system for

reporting to the client.

12.8 Records of Analysis

12.8.1 Sample Preparation, Extraction, Distillation, and Digestion

All steps of the preparation, extraction, distillation and/or digestion of samples are thoroughly documented. Documentation is determined by the QA Manager, Laboratory Manager, and the Technical Director and includes (if applicable):

12.8.1.1 Standard Identification

12.8.1.2 Dilution Factors

12.8.1.3 Sample Identification

12.8.1.4 Reagent Identification

12.8.1.5 Date the extraction, digestion, and or analysis was performed

12.8.1.6 Initials of the analysts performing the digestion, extraction, and or analysis

12.8.1.7 Volume/weight of sample used

12.8.1.8 Final volumes/weights

12.8.1.9 Initial and final review signatures, where required

12.8.1.10 Instruments used

12.8.2 Preparation of Standards and Reagents

12.8.2.1 The preparation of all standards and reagents are documented. The lot numbers of all standards associated with a particular project are traceable either through the instrument logbook, a QC check list, a worksheet, or another approved document.

12.8.2.2 Original vendor Certificates of Analysis are distributed by the Shipping and Receiving Office to the intended departments.

12.9 Standard and Reagent Traceability

Standards and reagents are tracked in the LIMS chemical inventory system for traceability and auditing purposes. The method of standard and reagent tracking is outlined in the subsequent sections.

12.9.1 When a standard or reagent is needed that is not already on the approved vendor / materials order list, supervisors forward purchase requests to the Technical Director and / or Laboratory Manager for approval. The standard or reagent is ordered from a reputable supply house (AES typically uses VWR). The laboratory attempts to use certified reference materials from providers who conform to ISO Guide 34.

12.9.2 The information supplied to the Technical Director and / or Laboratory Manager must have the supplier standard or reagent name, order number, size or amount of each unit, grade or purity, price, if possible, and quantity. Upon receipt, supplies (and services) are reviewed to ensure they comply with requirements. When a vendor has been approved for services, a note is placed in the comments field of the Vendors database within LIMS.

12.9.3 When the standard or reagent arrives, it is logged into the LIMS, usually by the department supervisor or by the sample custodian. All reagents and standards received are electronically

tracked and documented by computer via the Laboratory Information Management System.

12.9.4 Each standard or reagent is given a unique chemical inventory number upon receipt. The next available number in the LIMS is automatically assigned, starting with #5001. The computer entry is completed by entering the correct information in the required fields.

12.9.4.1 The expiration date for neat standards and reagents is determined using the manufacturer's expiration date, if available. Otherwise, a 1 year expiration date is assigned to volatile organic compounds and standards and 5 year date for acids, dry chemicals, solvents, reagents, and other chemicals. Each standard and reagent is clearly and permanently labeled with its expiration date in indelible ink. The assigned expiration date for intermediate standards will not exceed the manufacturer's expiration date of the stock standard.

12.9.4.2 Secondary standard containers are labeled with the corresponding LIMS tracking number of the source material, the date the contents were prepared, the six month expiration date, the name of the analyte(s), the concentration of each component of the solution, the matrix and the initials of the person who prepared it.

12.9.4.3 The chemical inventory number must appear on both the standard and reagent container, and the upper, right-hand corner of the certificate of analysis. It must also be included, if applicable, in standard/preparation, analyses or sample preparation log books.

12.9.4.4 Secondary standard labels include the LIMS chemical inventory number, the standard name, intended use (spiking, surrogate, reference or calibration solution), and concentration with units, matrix, expiration date and initials of the person who prepared it. As long as this is available, all other information can be found in the LIMS.

12.9.5 Spiking, surrogate, reference and calibration solutions and calculations are recorded in the appropriate "Standard/Preparation Log Book." Logbooks cover the following areas: Organics, Organics Preparation, Semi-Volatile Organics, Microbiology, Metals, Mercury & Wet Chemistry.

12.9.6 Some containers such as standards containers for organics are small and there may not be enough room to list all of the required information on the container. Should this occur, it is permissible to attach a label to the bottle.

12.9.7 When a standard or reagent is added to a sample for any reason, the LIMS chemical inventory number of that standard or reagent and the amount added must be recorded in the appropriate logbook. For example, if a stock standard MET #33-89-5431 of 1000 mg/L is diluted to 100 µg/L, the following line is entered: 1 ml MET #33-89-5431 to 100 ml DI water, 1 ml of 100x to 100 ml DI water, final conc. = 100 µg/L. (NOTE: "MET #33-89-5431" = Metals Department Standard/ Preparation Log Book 33, page 89, LIMS Chemical Inventory Number 5431).

12.9.8 If the standard is used as a stock standard and aliquots of it are diluted to produce working standards, the stock standard's LIMS chemical inventory number is used. The standard concentration or a designator such as "1" or "A" is used to differentiate between each serial dilution.

12.10 Standard Verification

12.10.1 Certificates of Analysis

12.10.3.1 Each department is responsible for maintaining all certificates of analysis received with its standards and reagents. The LIMS-assigned chemical inventory number is written in the upper, right-hand corner of each COA. The certificates are maintained on the portal server. The certificates are held for a minimum of five years.

12.10.3.2 Most accrediting authorities require that a certificate of analysis is kept on file for all

standards used in the laboratory. If at all possible, a certificate for reagents should also be obtained. This documentation serves two purposes; 1) it gives further traceability for the standard or reagent, and 2) it provides a manufacturer's guarantee that the standard is comprised of the compounds at the levels listed.

12.11 Estimation of Uncertainty (for AIHA-LAP, LLC accreditation)

Estimation of Uncertainty is the parameter associated with the result of a measurement that characterizes the dispersion of the values that could reasonably be attributed to the measurement. A reasonable 'Estimation of Uncertainty' shall be based on knowledge of the performance of the method and on the measurement scope and shall make use of, for example, previous experience and validation data. It is monitored by the monthly checks, proficiency exam results and error rates. The estimate of day-to-day precision is determined by comparison of duplicate samples (or matrix spike duplicates). Results of the two analyses are compared by their relative percent difference, RPD: (A-B) / (Average of A and B)

Estimation of Uncertainty Limits may be method / program specified (e.g. AIHA-LAP, LLC ELLAP) or based on historical laboratory limits. Interim limits are used until enough data points have been generated to set representative limits. The actual limits are calculated annually and are posted on the portal server.

This Estimation of Uncertainty Policy follows the AIHA-LAP, LLC Accreditation Program requirements with respect to the estimation of uncertainty measurement for tests associated with their scope of accreditation. The requirement which underlies this policy is found in ISO/IEC 17025, Clauses 5.4.6 and 5.10.3.1 c).

AIHA-LAP, LLC Uncertainty and Uncertainty Limits Determinations

The Measurement Uncertainty (or Uncertainty of Measurement) is the result of the evaluation aimed at characterizing the range within which the true value of a test result is estimated to lie, generally within a given likelihood. Non-negative parameter characterizing the dispersion of the quantity values being attributed to the measurand, based on the information used.

12.11.1 Definitions of Terms used by the laboratory

Bias is the total systematic error manifested as a consistent positive or negative deviation from the true value.

Measurand is the quantity intended to be measured or analyte concentration.

Precision is the closeness of agreement between measured quantity values obtained by replicate measurements under the same conditions. Precision is commonly expressed as standard deviation or relative percent difference and can be evaluated by the analysis of duplicate samples or duplicate sampling media spikes.

Type A evaluation of measurement uncertainty: Evaluation of a component of measurement uncertainty by a statistical analysis of measured quantity values obtained under defined measurement conditions. This approach uses existing data from routine laboratory quality control samples such as certified reference material, laboratory control samples, duplicates, or data from method validation studies and proficiency testing (PT) study results.

Type B evaluation of measurement uncertainty: Evaluation of a component of measurement uncertainty determined by means other than a Type A. This approach involves the estimation and compilation of individual uncertainties for each contributing measurement.

Contributors to consider for measurement uncertainty are listed in Table 12-1.

12.11.2 The laboratory utilizes Type A approach for the Estimation of Uncertainty. One or more of the following options are utilized:

12.11.2.1 Uncertainty specified within a standard method. In those cases where well recognized test method (such as NIOSH, OSHA, etc. method), specifies limits to the values of the major sources of uncertainty of measurement and specifies the form of presentation of calculated results, laboratories need not do anything more than to follow the reporting instructions as long as they can demonstrate they follow the reference method without modification and can meet specified reliability.

12.11.2.2 Laboratory Control Samples (LCS) and Matrix Spikes. In cases where matrix specific LCS (CRM or media spikes) and/or matrix spike data are available, include uncertainty estimated from the standard deviation of long term data collected from routine sample runs for existing test methods or from the standard deviation of the LCS or matrix spike data for method validation/verification studies for new test methods.

12.11.2.3 Duplicate Data. In cases where sub-sampling occurs and there are data over the reporting limit, include uncertainty estimated from long term duplicate data collected from routine sample runs for existing test methods or method validation/verification studies for new test methods.

12.11.2.4 Proficiency Testing (PT) Sample Data. In cases where the previous options are not available and where PT samples are analyzed with sufficient data above the reporting limit, pooled PT sample data can be used to estimate uncertainty.

12.11.3 Uncertainty determinations specific to each type of testing for AIHA-LAP, LLC is as follows:

12.11.3.1 Industrial Hygiene Chemical/Gravimetric Analysis.
The laboratory uses the Type A approach to Measurement Uncertainty. Acceptance limits are determined using historical LCS (CRM or media spikes) data for each procedure/target analyte. Once at least twenty values are available, the mean and standard deviation of the data set are calculated. Bias is noted and available for reporting. The data is evaluated for outliers using standard Grubbs Outlier calculations with statistical outliers omitted. Control limits are set at ±3 standard deviation and for measurement uncertainty k=2, or ± 2 standard deviation are used.

Where target analyte spiking is not applicable such as for gravimetric testing, only precision limits are used for uncertainty determinations. If less than 50 points are available for calculation, the limits are considered interim limits.

12.11.3.2 Industrial Hygiene Asbestos by PCM Analysis. Ranges of uncertainty for IH asbestos by PCM testing are determined for precision only using daily reference slide and blind recount analyses as described below.

12.11.3.2.1 The laboratory's set of reference slides includes slides from previous PAT rounds, Round Robins and field samples. The laboratory acceptance limits have now been determined from data accumulated from blind recounts of these reference slides and established at 95% confidence limits. From blind repeat counts of reference slides, Sr values obtained for 3 following ranges: 5-20 fibers in 100 graticule fields; 20.5-50 fibers in 100 graticule fields; 50.5-100 fibers in 100 graticule fields.

12.11.3.3 Environmental Lead Analysis for reporting under the ELLAP Program. Ranges for uncertainty for ELLAP testing for precision and accuracy are determined by the laboratory. Monitoring of method performance and bias is accomplished using statistical process control (charts or database) for monitoring AES laboratory performance with QC sample analysis (LCS/LCSD, MS/MSD). SOPs (Sec. 13) for Lead in Paint, Lead in Wipes, Lead in Soil

(SW 7000D), and Lead in Airborne Dust describe the required minimum performance criteria for QC sample analysis and the method performance for the laboratory. Method performance and bias are evaluated on an annual basis by the QA Manager. If the calculated limits are more stringent than the required minimum performance criteria listed in the SOP tables, then the limits are updated in LIMS. All monitoring data in the form of control charts are maintained/posted to the portal server, the laboratory's archival system.

12.11.3.4 Quantifiable Fungal Analysis for reporting under the EMLAP Program. Ranges for uncertainty for quantifiable fungal testing are determined for precision only. Duplicate samples are counted for at least 5% of samples for inter-analyst precision monitoring and replicates samples are counted by different analysts for intra-analyst precision monitoring. Uncertainty ranges are determined using the mean of the range of the logarithm of each count obtained from a minimum of 20 duplicate/replicate pairs. This mean value is multiplied by 3.27 to obtain the final control limit. Once the control limit is determined, the logarithmic range for each ongoing duplicate/replicate pair is determined and must be < control limit value. Specific information used for control limits for each individual EMLAP test method are provided in Table 5-1.

The lab determines the measurement of uncertainty associated with Spore Trap Analysis by using the Type (A) methodology. QC reference slides are used that have varying spore count levels. 30 data points are used for each QC slide. From these counts the Mean and Standard Deviation are determined. Then the Coefficient of Variation (CV) is calculated for each set of data by dividing the standard deviation by the mean. Then the pooled CV is calculated by adding the squares of the CV values, averaging them and taking the square root. The expanded Measurement of Uncertainty (MU) is calculated by multiplying the pooled CV value by the appropriate coverage factor k. For a confidence level of 95%, k is approximately 2 for a data set of 30 points or more. This RSD value is then multiplied by the calculated or observed value of the sample to be expressed as a measurement of uncertainty. When reporting results for expanded Measure of uncertainty the test results and the expanded measurement of uncertainty are expressed in the same units.

Example with a calculated CV pooled of 0.114:

Expanded MU @ 95% C.L. (k=2) equals CV *pooled (.114)* X 2 = 0.23 (23% RSD)

Bias cannot be determined. No quantitative reference material available
Example analytical uncertainty for air sample with 500 spores/m3:

Expanded analytical uncertainty = 500 spores/m3 X 0.23 = 115 spores/m3
Example of reporting for air sample with 500 spores/m3:

500 spores/m3 with an analytical uncertainty of +/- 115 spores/m3 at the 95% confidence level

12.11.3.5 Qualitative Fungal Analysis for reporting under the EMLAP Program. In order to monitor consistency with regard to genus/species identification, acceptability criteria for taxon identification and taxon abundance ranking are described below. These are laboratory determined; interim criteria as no regulatory guidance or method specified criteria are available.

12.11.3.5.1 Taxon identification acceptability: On the replicate and duplicate analyses, daily reference slide analyses, monthly reference culture analyses and round robin study analyses with at least 3 different organisms present, 60% of all genus/species of fungi and/or genus/group of fungi identified on the original sample at levels >10x LOD should also be identified on the recount.

12.11.3.5.2 Taxon abundance ranking acceptability: On the replicate and duplicate analyses, daily

reference slide analyses and round robin study analyses, the top three genus/species of fungi and/or genus/group of fungi by abundance and >10x LOD will be ranked. The recount data should identify these same fungi for the identification to be considered acceptable.

12.11.3.5.3 Consistent fungal ID is also monitored through participation in the Direct Exam Fungal Analysis PT programs administered by EMLAP. Acceptability limits are currently set at 85% correct identification by AIHA-LAP, LLC.

12.11.3.5.4 It should also be recognized that other, non-quantifiable factors may also add additional uncertainty. These factors may include media selection, organism competition, etc. and are not directly measurable.

12.11.4 The reporting procedure.

Typically, measurement uncertainty is reported per the client's request or when the *known compliance* to a specification limit is affected. The result and the expanded measurement uncertainty are reported in the same units. Both the result and expanded measurement uncertainty will be rounded to the same number of significant figures.

12.11.4.1 Reporting test results the Expanded Measurement Uncertainty

When the reporting of uncertainty is required or requested by a client to be included in the analytical report, the test result and the expanded measurement uncertainty will be reported in the same units. The test result and the expanded measurement uncertainty should both be rounded in a similar manner, meaning the same number of significant figures. A description of the coverage factor should be included as in the following example:

Total Lead in Air concentration of 50 ug/sample ±5.3 ug/sample at 95% confidence level (k=2)

Where bias is present, report it along with the uncertainty as a probable bias such as:

Total Lead in Air concentration of 50 ug/sample ±5.3 ug/sample at 95% confidence level (k=2) This method has an average recovery of 99 %, or a probable bias of -0.5 ug/sample.

An example template for the expanded measurement uncertainty calculation is in Table 12-2.

Table 12-1 Contributors to Measurement Uncertainty (Applicable AIHA-LAP, LLC methods SW700B, N7082, N7300, and N7303)

Example of Contributors to Measurement Uncertainty Chemical Analyses of Lead (Pb) using ICP-AES and FAA See Example Calculations (to the right of the table)

Contributors to Uncertainty	Representative and Applicable QC Data	Comments to Clarify Contributor Effects
Transportation/Storage/Handling		
shipping time, container & temperature	NA	No impact on bulk paint samples from transportation, storage or normal handling
lab storage time, conditions & temperature	NA	
contamination in lab storage areas	NA	
Laboratory Subsampling		
sample nonhomogeneity	DUP	Sample composition, etc.
blending techniques	DUP	Stirring, sieving, grinding, etc
sample size	DUP	Large enough to allow adequate subsampling
Sample Preparation:		
volumetric glassware	LCS, DUP	NA for Class A; applies for graduated tubes or cylinders, etc.
dispensing device	LCS, DUP	pipettes, and other types of dispensers not Class A
balance	LCS, DUP	balance error is often insignificant compared to other MU sources
temperature	LCS, DUP	Hot plate or ashing temperatures
sample extraction	LCS, DUP	Applies to LCS or DUP if goes through sample preparation
extractant background	LCS, DUP, MB	Analyte or interferant in acids, or other reagents
Lab Environmental Conditions:		
temperature variance	NA	No impact on bulk paint samples
humidity variance	NA	No impact on bulk paint samples
Analysts:		Analyst contributors affect all aspects of analysis from subsampling through data manipulation
different analysts	LCS, DUP	
analyst training level & experience	LCS, DUP	
data interpretation by analyst	LCS, DUP	
Measuring Instruments:		
instrument stability	LCS	Baseline drift, repeatability of averaged readings, etc
carry over effects	LCS, DUP	Impact of high samples on following sample readings; can be monitored by proper use of CCBs
day to day calibration differences	LCS	
interferences	DUP, MS	Due to matrix, inter-element effects, etc. Cannot be routinely determined for typical industrial hygiene sampling media
Calibration Standards/Reference Materials:		
preparation variances	LCS, DUP	Due to analysts, balances, dispensing devices used, etc
calibration stock material uncertainty	CERTIFICATE	Obtain from certificate or estimate

LCS reference material uncertainty	NA	Sample results not corrected for LCS recovery
Test Procedure Variations		
variation within and between reagent lots	LCS	Similar to extractant background effects under Sample Preparation above
extraction or digestion times and temps	LCS	May affect complete dissolution of analyte or loss of material in some cases
sample dependent modifications	LCS	Changes in conditions due to sample size, customer requests, etc
desorption efficiencies within and between lots for sorbent tubes	NA	
Data Manipulation:		
sampling media blank correction	NA	No sampling media with bulk samples
instrument blank correction	LCS	when allowed
Accuracy of calculations	LCS	Manual, spreadsheet, LIMS, etc

DUP = Duplicate, resulting from sub-sampling of a bulk (NOTE: NOT LCS/LCSD duplicate spiked sampling media)
FB = Field Blank
FS = Field Spike
LCS = Laboratory Control Standard, matrix matched and typically taken through the entire analytical process, with each sample batch
MB = Method or matrix blank
NA = Not Applicable

Table 12-1 Contributors to Measurement Uncertainty (AIHA-LAP, LLC methods Air SOPs MB-15019, MB-15022, MB-15028; Bulk SOPs MB-15020; and Surface Direct (SOP MB-15020) Exam

Example Contributors to Measurement Uncertainty – Direct Air Environmental Microbiology Analyses
(representative list - may not include of all contributors)
(QC sample types in this list are typical of those utilized in AIHA-LAP, LLC laboratories) See Example Calculations (to the right of the table) and tabbed sheets for additional examples

Contributors to Uncertainty	Representative and Applicable QC Data	Comments to Clarify Contributor Effects
Temperature, Storage, Handling:		
shipping time, container & temperature	NA	No impact on direct air exam samples
lab storage time, conditions & temperature	NA	No impact on direct air exam samples
contamination in lab storage areas	NA	No impact on direct air exam samples
Laboratory Subsampling:		
sample nonhomogeneity	NA	Not applicable to direct air exam samples
blending techniques	NA	Not applicable to direct air exam samples
sample size	NA	Not applicable to direct air exam samples
Sample Preparation:		
slides & coverslip contamination	MB	With proper care there should be no contamination of daily blanks; therefore, no impact
mounting medium	MB	With proper care there should be no contamination of daily blanks; therefore, no impact
Lab Environmental Conditions:		
seasonal background spore variances	MB	Samples are not exposed to air for any length of time; therefore there should be no impact
Analysts:		
different analysts	RS	Reference slides analyzed by multiple analysts
analyst training level & experience	RS	Reference slides analyzed by multiple analysts
data interpretation by analyst	RS	Reference slides analyzed by multiple analysts
Measuring Instruments:		
microscope magnification level used	RS	Reference slides analyzed with multiple microscopes
eye piece graticule & field of view calibration	RS	Reference slides analyzed with multiple microscopes
Test Procedure Variations:		
portion and fields of sample analyzed	RS	Varies by analyst
microbial density	RS	High concentrations or clumps of spores may impact results
interferences	RS	Debris level and resolution of spores in field of view
ranges (high, medium, low)	RS	Uncertainty may be concentration dependent. Lab should evaluate this as part of method validation.
Data Manipulation:		
reading, interpreting & reporting results	RS	
Accuracy of calculations	RS	Manual, spreadsheet, LIMS, etc
area or air volume sampled	NA	Typically provided by the customer. This is not part of analytical uncertainty, but must be considered by labs providing sampling and providing combined sampling and analytical uncertainty.

MB = Daily method blank
RS = Daily reference slides

Please note that the original column I (CV of the pair) of the "culturable analyses" tabbed worksheet had a formula incorrectly entered. The worksheet has been corrected and any affected values have been highlighted in yellow.

Table 12-2 Expanded Measurement Uncertainty Calculation Template

Examples of Analytical Measurement Uncertainty for Metals in Air

Metals in Air using hotblock acid digestion and ICP-AES

Analysis by NIOSH 7300M/7303 Target LCS Recovery of Lead in Air AES 18434 at 50.0 +/- 0.40 ug, Total

Sample duplicate data in ug, Total for Metals in Air using hotblock acid digestion and ICP-AES by NIOSH 7300M/7303

Lead

LCS ug, Total	True value ug, Total	LCS % Rec	ug, Total LCS	ug, Total LCSD	Std Dev (S)	CV	CV2
51.9	50.0	103.8	51.9	52.9	0.7071	0.0135	0.0002
49.6	50.0	99.2	49.6	48.7	0.6364	0.0129	0.0002
48.5	50.0	97.0	48.5	50.6	1.4849	0.0300	0.0009
49.2	50.0	98.4	49.2	48.2	0.7071	0.0145	0.0002
50.9	50.0	101.8	50.9	51.7	0.5657	0.0110	0.0001
51.4	50.0	102.8	51.4	47.7	2.6163	0.0528	0.0028
47.4	50.0	94.8	47.4	47.1	0.2121	0.0045	0.0000
47.2	50.0	94.4	47.2	49.8	1.8385	0.0379	0.0014
47.6	50.0	95.2	47.6	47.8	0.1414	0.0030	0.0000
50.0	50.0	100.0	50.0	50.4	0.2828	0.0056	0.0000
50.2	50.0	100.4	50.2	50.8	0.4243	0.0084	0.0001
47.1	50.0	94.2	47.1	46.8	0.2121	0.0045	0.0000
48.3	50.0	96.6	48.3	46.0	1.6263	0.0345	0.0012
46.3	50.0	92.6	46.3	48.2	1.3435	0.0284	0.0008
45.8	50.0	91.6	45.8	49.1	2.3335	0.0492	0.0024
51.0	50.0	102.0	51.0	53.1	1.4849	0.0285	0.0008
47.9	50.0	95.8	47.9	47.7	0.1414	0.0030	0.0000
55.8	50.0	111.6	55.8	55.4	0.2828	0.0051	0.0000
47.8	50.0	95.6	47.8	49.3	1.0607	0.0218	0.0005
50.3	50.0	100.6	50.0	49.9	0.0707	0.0014	0.0000
52.6	50.0	105.2	52.6	49.0	2.5456	0.0501	0.0025
49.8	50.0	99.6	49.8	49.2	0.4243	0.0086	0.0001
48.5	50.0	97.0	48.5	51.8	2.3335	0.0465	0.0022
50.2	50.0	100.4	50.2	47.2	2.1213	0.0436	0.0019
49.2	50.0	98.4	49.2	49.8	0.4243	0.0086	0.0001
52.2	50.0	104.4	52.2	49.2	2.1213	0.0418	0.0018
48.1	50.0	96.2	48.1	48.2	0.0707	0.0015	0.0000
49.2	50.0	98.4	49.2	47.8	0.9899	0.0204	0.0004
48.1	50.0	96.2	48.1	46.7	0.9899	0.0209	0.0004
52.7	50.0	105.4	52.7	48.4	3.0406	0.0601	0.0036
	30 point Mean % Rec.	99.0				$\sum CV^2$	0.0246
	30 point Std Dev	4.4			CV *pooled* = $\sqrt{(\sum CV^2/30)}$ =		0.0287
	RSD	4.4%					

Combined Rel. Std Dev (SDc) = $\sqrt{[SD1^2 + SD2^2]}$ 2.87% RSD

SDc = $\sqrt{[(4.4)^2 + (2.87)^2]}$ = 5.25%

Expanded MU @ 95% Conf (k=2) = 10.5%

Bias @ 99.0% Rec of LCS = -1.0%

Example analytical uncertainty for 50 ug, Lead in Air sample:
Expanded analytical uncertainty of 50 ug, Lead in Air = 50 X 0.105 = 5.25 ug, Total

Bias = 50 ug, Total X -0.010 = 0.500 ug, Total

Example of reporting for 50 ug, Total of Lead in Air:
50 ug, Total of Lead in Air with an analytical uncertainty of +/- 5.3 ug, Total at the 95% confidence level and a probable bias of -0.50 ug, Total

Table 12-3
Estimation of Uncertainty Requirements for non-AIHA-LAP, LLC

Method	Uncertainty Based On
SM2120B Color	NA
E120.1 Conductivity	Method Limits
SM4500H+B pH	NA
SM2540C TDS	NA
SM2540D TSS	NA
SM2540B TS	NA
E160.4 VS	NA
SM2540F Settleable Solids	NA
E1664B Oil and Grease_TPH	Method Limits
E180.1 Turbidity	Method Limits
E200.7 ICP AES Metals	Method Limits
E200.8 ICP MS Metals	Method Limits
E245.1 Mercury	Method Limits
E300.0 Anions by IC	Method Limits
SM2310 B Acidity	NA
SM2320 B Alkalinity	Method Limits
E310.2 Alkalinity	Method Limits
SM4500Cl G Residual Chlorine	Method Limits
SM4500CN G Amenable Cyanide	Method Limits
SM4500CN E Total Cyanide	Method Limits
E350.1 Ammonia	Method Limits
E351.2 TKN	Method Limits
E353.2 Nitrate_Nitrite	Method Limits
SM4500NO2B Nitrite	Method Limits
SM4500O G Dissolved Oxygen	NA
E365.1 Ortho Phosphorus	Method Limits
E365.1 Total Phosphorus	Method Limits
E365.3 Ortho Phosphorus	Method Limits
SM4500S2F Sulfide	Method Limits
SM4500SO3 B Sulfite	NA
SM5210B BOD	Method Limits
E410.4 COD	Method Limits
SM5310B TOC	Method Limits
E420.1 Total Phenolics	Method Limits
E420.4 Total Phenolics	Method Limits
SM5540C MBAS Surfactants	Method Limits
E608.3 Pesticides PCBs	Method Limits
E608.3 Methoxychlor	Method Limits
E615 Herbicides	Historical Limits
E624.1 VOCs	Method Limits

Method	Uncertainty Based On
E625.1 SVOCs	Method Limits
FL-PRO	Method Limits
RSK-175 Dissolved Methane, Ethane, Ethene	Method Limits
SM10200H Chlorophyll	Historical Limits
SM2340B Hardness	Method Limits
SM2540G Total, Fixed and Volatile Solids	NA
SM3500Cr B Hexavalent Chromium	Method Limits
SM3500Fe B Ferrous Iron	Method Limits
SM5210B CBOD	Method Limits
SM9222B Total Coliforms	NA
SM9222D Fecal Coliforms	NA
SM9223B E.Coli	NA
SW1010 Flash Point	NA
SW1030 Ignitability	NA
SW1311 TCLP	Historical Limits
SW1312 TCLP	Historical Limits
SW6010 ICP AES Metals	Method Limits
SW6020 ICP MS Metals	Method Limits
SW7.3 Reactive Cyanide	Method Limits
SW7.3 Reactive Sulfide	Method Limits
SW7196 Hexavalent Chromium	Method Limits
SW7470 Mercury in Water	Method Limits
SW7471 Mercury in Soils	Method Limits
SW7473 Mercury in Soils	Method Limits
SW8011 EDB DBCP	Historical Limits
SW8015 DAI	Historical Limits
SW8015 DRO	Historical Limits
SW8015 GRO	Historical Limits
SW8081 Pesticides	Historical Limits
SW8082 PCBs	Historical Limits
SW8151 Herbicides	Historical Limits
SW8260 VOCs	Historical Limits
SW8270 SVOCs	Historical Limits
SW8310 PAHs	Historical Limits
SW8315 Formaldehyde and Acetaldehyde	Historical Limits
SW9010_9012 Cyanide	Method Limits
SW9010_9014 Cyanide	Method Limits
SW9030_9034 Sulfide	Method Limits
SW9038 Sulfate	Method Limits
SW9040 pH in Water	NA
SW9041 pH by Paper	NA
SW9045 pH in Soil	NA

Method	Uncertainty Based On
SW9050 Conductivity	Method Limits
SW9056 Anions by IC	Method Limits
SW9060 TOC	Method Limits
SW9065 Total Phenolics	Method Limits
SW9070 Oil and Grease_TPH in Water	Method Limits
SW9071 Oil and Grease_TPH in Soils	Method Limits
SW9081 Cation Exchange Capacity (Sodium)	NA
SW9095 Free Liquids by Paint Filter	NA
TO-14A, TO-15	Method Limits

12.12 Recommended Storage Conditions

The locations for the storage of all standards, reagents, and working solutions are based upon compatibility of the material with other materials, flammability, and intended use of the material. The following general guidelines apply to the storage of standards and reagents.

12.12.1 The locations for the storage of all standards, reagents, and working solutions are based upon compatibility of the material with other materials, flammability, and intended use of the material. The following general guidelines apply to the storage of standards and reagents.

12.12.2 The recommended storage conditions are included in the chemical inventory of LIMS when adding information pertaining to new standards and reagents.

12.12.3 Each department maintains storage locations for standards, reagents, working solutions, and samples. Department supervisors ensure that all chemicals are properly kept. Department supervisors periodically audit storage areas for possible hazards and violations.

12.12.4 Samples are never stored in the same location as standards or reagents.

12.12.5 The following major categories of chemicals, compressed gases, and samples determine standard and reagent storage conditions in the laboratory:

12.12.5.1 Flammables

12.12.5.2 Oxidizer

12.12.5.3 Acids

12.12.5.4 Bases

12.12.5.5 Compressed flammable gas cylinders

12.12.5.6 Compressed non-flammable gas cylinders

12.12.5.7 VOC Samples

12.12.5.8 Inorganic and SVOC Samples

12.12.6 The certificate of analysis or Material Safety Data Sheet provides relevant information regarding recommended storage conditions for all standards and reagents.

12.13 Handling Standards and Reagents

12.13.1 Safety glasses and latex type gloves must be worn at all times when handling chemicals, samples, standards or reagents. A lab coat is also highly recommended. Closed-toe shoes and clothing that cover the legs (no shorts or dresses) must be worn whenever an analyst is working in the lab.

12.13.2 The toxicity or carcinogenicity of each reagent used in the laboratory has not been fully established. Each chemical should be regarded as a health hazard and exposure to it should be kept as low as reasonably possible. All health and safety concerns for these and any other chemicals are listed in the Material Safety Data Sheets (MSDS) provided by the supplier or manufacturer of these chemicals. A copy of any MSDS is available for review at any time in notebooks maintained in the Sample Receiving Department.

12.13.3 Proper disposal of all wastes is essential. Containers are provided for all waste according to the type. Follow the waste disposal guidelines found in Section 17.0 for disposing of chemicals.

12.14 Record Keeping Definitions

12.14.1 Prep Log: A prep log is defined as a log of the preparation process that is applied to samples before they are analyzed. This log includes initial volume/weight, final volume, date prepped, batch number, spike amount, all spike information and any comments pertaining to the sample preparation.

12.14.2 Back Log Report: A backlog report is defined as a list of all the samples that need to be analyzed for a specific department. This list is generated from the LIMS system. The list is used by each department manager to create a batch for analysis.

12.14.3 Extraction or Digestion Log: An extraction or digestion log is defined as a log of samples that are either extracted or digested for subsequent analysis. This log includes initial volume/weight, final volume, date prepped, batch number, spike amount, all spike information and any comments pertaining to the sample preparation.

12.15 Procedures for Record Keeping

12.15.1 The record keeping system allows for historical reconstruction of all laboratory activities that produced the analytical data. All raw data (including Quality Control information) from the instrumentation is both posted to the laboratory archive system, referred to as the "Portal Server", and backed up weekly by the IT Department. In addition, instrument sequences are posted to the portal server by instrument, year, month, and sequence. Prep logsheets are posted by batch number, while logbooks are additionally scanned and posted by the QA Department as a backup copy. In addition, electronic data associated with each instrument is periodically stored off site.

12.15.1.4 Project Management: Each project manager has a project folder with the COC and sample receipt checklist (SRCL) in their office until the project is completed. Once the project is completed, either a hardcopy or PDF file of the report and invoice are printed, along with a cover letter and case narrative (if necessary). If everything is correct, the project is reported to the client via email or hardcopy mailing. The PDF files of the COC, Sample Receiving Checklist and invoice are posted to the portal server by work order number, year, and month. Any revisions are posted in the same folder with the revision having "REVISON" in the file name. If the client requires an Electronic Disc Deliverable (commonly referred to as an EDD) or a Data Package, this information is also posted on the Portal Server. Reports are kept for five years.

12.15.1.5 LIMS System: The LIMS system holds all the information relevant to each project that is received at the laboratory, including all client information, and prep and analysis information for each test preformed. LIMS data is backed up daily onto CDs. Copies are stored both on and off site.

12.15.1.6 Entries in manually recorded records are not obliterated by methods such as erasures, overwriting, whiteout or markings. All corrections to record-keeping errors are made by one line marked through the error. The individual making the correction initials and dates the correction.

12.15.1.7 Corrections to electronic records are made by a manual notation that indicates the change to the record. This notation is kept with the affected record.

12.16 Record Storage

12.16.1 All records for each project that is received at the laboratory must be held for a minimum of five years (also, now 5 years for lead analysis records per AIHA-LAP, LLC). Final reports are maintained electronically on computer hard drives and daily back-up tapes.

12.16.3 Electronic records are stored by department on the laboratory's portal server after scanning or converting the documentation to a PDF file format using Adobe Acrobat®. Customer Service stores the client reports by work order number. Laboratory data is downloaded and stored by department (Asbestos, Inorganic Chemistry, Metals, Microbiology, Sample Prep, Semi-Volatile Organics, Volatile Organics, and Wet Chemistry). Data contained in the Laboratory Information Management System (LIMS) and on other servers is backed up daily onto CDs. There is also a second server that contains a duplicate of this information.

12.16.4 Archive areas are protected against fire, theft, loss, environmental deterioration and vermin. Electronic records are also protected from electronic or magnetic sources. Access to recent records is limited and maintained by logon and password. In addition, a portion of the portal server has been designated specifically as an "Archive area". These Archive areas house information that that is older and has additional access restrictions. Archive areas are regularly inspected as part of the Internal Audit program. Representatives of an accrediting authority may have access to archived information.

12.16.5 In the event that AES, Inc. transfers ownership, the new proprietors retain sole custody and responsibility for all records. If AES were to close, records shall be maintained at a commercial archive facility or maintained by another laboratory within the network. Records may also be transferred back to clients, if requested.

12.17 Quality Assurance Records

Where necessary, records are generated and maintained for all quality associated activities conducted during all phases of the analytical work. QA records provide sufficient evidence that all specified QA requirements have been accomplished and satisfied and provide sufficient documentation to substantiate all reported findings and conclusions. These records are retained by AES, Inc. after the initial issuance of the report for a minimum of five years in accordance with AIHA-LAP, LLC and TNI requirements. This ensures the availability of the QA historical information. The following types of records shall be identifiable and retrievable:

12.17.1 General QA Records - Records pertaining to procurement activities; results of reviews & audits; qualifications of personnel; Standard Operating Procedures and Document Control Records.

12.17.2 Inspection and Test Data Records - Records pertaining to in-process inspection and tests, Equipment Logs and Maintenance Logbooks.

12.17.3 Generated raw data, reports, etc.

13.0 CORRECTIVE ACTION AND NON-CONFORMANCES

Deficiencies or non-conformances in analytical procedures, materials, components or methodology may lead to the release of incorrect analytical results to the customer. Once a deficiency or non-conformance has been identified, corrective actions must be implemented to insure proper data qualification and narration on the final client report and, when possible, prevent the deficiency being repeated. To document and track the non-conformance, a Corrective Action Report (CAR) is issued through the LIMS system. An example of a Corrective Action Report is contained in Appendix VII.

13.1 Standard Procedure for Defining, Implementing, and Closing a Corrective Action Report (CAR).

13.1.1 Non-conformance: A non-conformance is defined as any situation that is either outside acceptable limits (data) or does not comply with the procedure/method in some way (preservation, matrix, etc.). The following are examples of situations considered non-conformances for which the completion of a CAR report is required.

13.1.1.1 Contamination in the Blank: The presence of target analytes in the blank that are above the reporting limit or in some cases, the MDL.

13.1.1.2 Failing Laboratory Control Spike (LCS): When the percent recoveries of target analytes in an LCS fail to meet the acceptable limits for an analysis.

13.1.1.3 Failing Matrix Spike (MS): When the percent recovery of a target analyte in a MS fails to meet the acceptable limits of analysis.

13.1.1.4 Failing Duplicate: When the relative percent difference (RPD) of results between two aliquots of the sample exceed the maximum allowable RPD.

13.1.1.5 Improper sample preservation: When a sample does not have the correct preservation (usually this involves temperature or pH).

13.1.1.6 Exceeding EPA recommended holding time: When a sample is prepared (extracted or digested) and or analyzed after holding time has expired.

13.1.1.7 Sample integrity has been compromised: When a sample container is broken, is improperly sealed, is inappropriate for the analysis, or has headspace (volatiles).

13.1.1.8 Surrogates/Internal standards fail (organic analysis): When a surrogate(s) or internal standard fails to meet the acceptable quality control limits associated with the test method.

13.1.1.9 Dilution test (metals analysis): When the sample dilution test fails to meet the acceptable quality control limits associated with the test method.

13.1.1.10 Failure to meet batch requirements (insufficient sample volume for MS/MSD, etc.)

13.1.1.11 Poor chromatography or missing analytes.

13.1.1.12 Expired standards and reagents.

13.1.1.13 Failed Proficiency Test (PT) analyte.

13.1.2 Procedure for the issuing, completing, and closing of an analytical or technical related CAR.

13.1.2.1 When a non-conformance occurs, the employee performing the work, the initial data reviewer, a Project Manager, or the Department Manager must issue a CAR in the LIMS system as indicated below.

13.1.2.1.1 From the "Categories" menu select "Quality Control". Then from the "Options" menu select "Corrective Action Reports".

13.1.2.1.2 Click "Add" and the LIMS will create a new CAR and automatically number it. Fill in the fields for "Department", "Instrument ID", "Batch ID", "Initiated By" and "Initiated On" as appropriate.

13.1.2.1.3 Fill in the "Summary" field with a brief description of the non-conformance.

13.1.2.1.4 Fill in the "Complete Description of Non-conformance" field with a detailed description of the non-conformance including batch numbers, affected samples by number, recoveries and control limits if applicable, etc.

13.1.2.1.5 The complete data file or log book is then forwarded to the Dept. Manager for review. This file must include raw data, prep information, review checklists, etc. and a reference to the CAR by number.

13.1.2.1.6 The Dept. Manager brings the Corrective Action Report to the Laboratory Manager, who determines whether the non-conformance is a "deficiency" or "anomaly". An anomaly is an occurrence that affects only the group of data in the associated batch or sequence. Human errors or mistakes are usually anomalies. A deficiency is an occurrence that is system related and may affect more than the batch and may require more extensive corrective actions which could include retraining, replacing equipment, revising SOPs, etc. If the CAR is anomaly, the Department Manager is instructed to document required corrective action in the "Corrective Action Required" field. If the CAR is a deficiency, enter a statement in the "Corrective Action Required" section that the CAR will be forwarded to the QA Manager for review. The QA Manager performs an investigation and documents the root cause investigation in the "Corrective Action Required" section of the CAR form. Monitoring requirements of actions and the need for additional audits are also documented in this section. If no root cause investigation is required, the QA Manager may instead comment with a "QA Statement". When the QA Manager completes the review, the CAR is closed or Laboratory Manager or Technical Director is notified to review the data and perform the required corrective action (which is documented in the "Corrective Action Required" field).

13.1.2.1.7 These corrective actions may include narrating the non-conformance to the affected jobs, sending affected samples to be re-prepped and/or reanalyzed, performing instrument maintenance, etc. Non-conformances may also be referred directly to the QA Dept. for more extensive action if necessary. The person filling in the "Corrective Action Required" field then fills in the "Completed By" and "Date" fields.

13.1.2.1.8 If the non-conformance is determined to be an anomaly, the Dept. Manager completes the "CAR Closed By" and "Date" fields at the end of the CAR form.

13.1.2.1.9 If the non-conformance is determined to be a deficiency, full QA review and documented corrective action to prevent recurrence is required. A root cause will be

identified for deficiencies. Root cause analysis typically addresses those issues which historically have been addressed again and again with quick fixes but it may also be applied in those instances where a process or methodology is affected. Working harder and faster on the same items does not increase efficiency. Root cause analysis allows one to think through the problem and address the causes rather than its effects. By eliminating the root cause, time and money are saved.
Steps for a root cause analysis include:

1. Identifying the problem. You must define the problem accurately to address the true root cause.
2. Understand the problem. Check the data regarding the problem to gain a clear understanding of the underlying issues. This can be accomplished by using several root cause analysis techniques such as brainstorming, use of control charts, or the "5 Whys" technique.
    a. With the Brainstorming technique, ideas are collected from people associated with problem. All ideas should be considered and more is better because of not knowing what might work. Brainstorming utilizes a set time limit. Discussion about the ideas takes place after brainstorming is complete. Those involved build on the ideas to resolve the root cause.
    b. Control Charts can be used to study trends associated with data over time to draw conclusions as to whether a process is consistent (within defined limits) or is unpredictable (outside of defined limits). Where applicable, control charts can pinpoint when a problem started and/or stopped.
    c. "5 Whys" refers to the practice of asking, 5 times, why the failure has occurred in order to get to the root cause of the problem. Each "Why" brings one closer and closer to the root cause. It should be noted that sometimes more or less "Whys" are required to get to the root cause. The use of five is a guide.
3. Corrective Action. Determine the probable underlying cause(s) of the problem. Take corrective action(s) to eliminate the causes.

Root causes will be categorized as one of the following: personnel, (LIMS) database, Quality Control, procedure, or laboratory controls.

13.1.2.1.9.1 Personnel: Root causes attributed to personnel may require training or retraining to insure individuals understand their responsibilities in the process.

13.1.2.1.9.2 Database: A Root cause from a database issue primarily refers to the Laboratory Information Management System (LIMS). This type of nonconformance will require the database to be updated. This may include method information (test codes), client information, project information, login entries, calculations, audit trail, and reports among others. Database root cause will also include individual instrument databases and software (GCs, ICPs, AA, Lachat autoanalyzers, etc.)

13.1.2.1.9.3 Quality Control: QC root causes result from incorrect QC acceptance ranges in logbooks, LIMS or are the result of trend changes. These will be reviewed and updated as necessary.

13.1.2.1.9.4 Procedure: This root cause covers procedures, policies, checklists, standard operating procedures (SOPs) that will be reviewed for modifications.

13.1.2.1.9.5 Laboratory Controls: Root causes from instrumentation, software and equipment will be investigated. These may require maintenance, repair, or updates.

13.1.2.1.9.6 A deficiency may require halting analysis on the affected test, notifying clients when previous data may have been affected or other significant corrective actions.

13.1.2.1.10 Once the required corrective actions associated for a deficiency have been completed, fully documented and systems deemed back in control the QA Dept or Technical Director will close the CAR and affected procedure may again be used. The CAR is then printed out, signed by the Technical Director or QA Manager, placed with the data and scanned and posted to the portal server.

13.1.2.1.11 The Technical Director, QA Manager, or any employee may determine that a potential nonconformance requires a preventive action report. Preventive actions are potential sources of nonconformance and needed improvements. "Preventive Action Report" can be initiated by an employee from the results of employee suggestions, data review, audits, etc. and then reviewed by the Technical Director or the QA Manager. Preventive actions are incorporated in the corrective action template (due to software limitations). When the corrective action template is to be used for a preventive action report, the phrase 'PREVENTIVE ACTION' is typed in the "QA Action" field. This distinguishes a preventive action template from a corrective action template. Where appropriate, action plans shall be developed; implemented and monitored that will reduce the likelihood of nonconformance. Action plans shall include the application of controls to ensure that actions taken are effective, and may involve the analysis of data, additional auditing, control charts and trends, additional proficiency or QC testing, and issuance of correspondence to clients.

13.1.2.2 The CAR must be prepared at the time the analytical batch has been calculated. Do not wait until all data from the batch is completed. This will lead to unnecessary delay in reprocessing the batch (if necessary) and informing laboratory management, project management, and the client.

13.1.2.3 When completing a CAR, include all accompanying data, information, etc in a "Data Package" along with the NCR and submit this to the Technical Director or Quality Assurance Manager for review. Data packages include the following information.

- Digestion or extraction bench sheets
- ICP and other instrument data such as LACHAT printouts
- All chromatograms within the analytical batch including CCVs
- GC/MS tune criteria
- Analytical "run logs"
- MB, LCS, MS, CCV, post dilution spikes, etc which clearly indicate the results and or percent recoveries (where applicable).
- Any other test specific quality control criteria such as surrogate recoveries and method of additions results

13.1.3 Circumstances for initiating a customer service or project management related CAR.

13.1.3.1 The following types of client complaints or problems will be referred to as Laboratory

CARs and should be brought to the Vice President of Operations or the Laboratory Manager. These include but are not limited to:

13.1.3.1.1 Customer Service related complaints

13.1.3.1.2 Comments regarding laboratory services provided

13.1.3.1.3 Any requests after analyses have been completed and files archived

13.1.3.1.4 Client is questioning the results

13.1.3.1.5 Confirmation request

13.1.3.1.6 EDD or Data Package issue

13.1.3.1.7 H flags need to be removed

13.1.3.1.8 Question regarding method used

13.1.3.1.9 Carry over issue

13.1.3.1.10 Questions from regarding an unusual sample or matrix received

13.1.3.2 CARs are also required for internal issues. These must also be brought to the Vice President of Operations or the Lab Manager and will be referred to as Internal CARs:

13.1.3.2.1 Test code issue

13.1.3.2.2 Problem with LIMS

13.1.3.2.3 EDD Problem

13.1.3.3 Certain issues will be handled by the Assistant Vice President of Operations and not by the Vice President of Operations. These will be referred to as Customer Service CARs.

13.1.3.3.1 Reporting limits are missing

13.1.3.3.2 Analyses times incorrectly entered (especially for short holding time tests)

13.1.3.3.3 Discrepancies and errors found in the QC report

13.1.3.3.4 Analytes reported twice or missing from the report

13.1.3.3.5 Pricing or invoice error

13.1.3.3.6 Login error

13.1.3.3.7 Client wishes to add an analyte or test

13.1.3.3.8 Incorrect bottle order

13.1.3.3.9 Shipping Issues

13.1.3.3.10 Courier issues

13.1.3.3.11 In certain instances, as determined by the Assistant Vice President of Operations, a corrective action report will be initiated when jobs with 'Rush' turnaround times or some with routine turnaround times are 48 hours past due.

13.1.3.4 Summary of Procedure:

13.1.3.4.1 When any of the instances listed in the Scope and Application chapter of this SOP take place, corrective action should be initiated in LIMS (Laboratory Information Management System).

13.1.3.4.2 Each Corrective Action has unique control number automatically assigned by LIMS when form is initiated.

13.1.3.4.3 Project Manager initiates a corrective action and identifies the type as either 'Laboratory CAR', 'Internal CAR', or 'Customer Service CAR'. These types must be recorded in LIMS in the CAR Summary so responsibility of the person who is to address the CAR is established. The CAR should include details of the issue, incident or client's request, and forwards report with all supporting documents to either the Vice President of Operations/Laboratory Manager or the Assistant Vice President of Operations as outlined above. After decisions on how to handle the corrective action are made, information will be relayed to the client and necessary follow up are performed.

13.1.3.4.4 Corrective action number must be entered into the comments section of the appropriate work order number in LIMS.

13.1.3.5 Responsibilities: It is the responsibility of each project manager to ensure the following

13.1.3.5.1 Be pro-active and initiate CAR in a timely manner

13.1.3.5.2 Enter CAR number into the comment section of the work order number in LIMS. Initials of the project manager and the date should accompany it.

13.1.3.5.3 Gather all supporting information

13.1.3.5.4 Follow up on all open CARs to make sure all issues are resolved promptly

13.1.3.5.5 Once the Vice President of Operations or the Assistant Vice President of Operations review the CAR and make their recommendations, write down these actions under "Corrective Action Required" area. Remember to mark the 'Notify Clients' box in the CAR and include the name of the individual who did so. There is also a space for a comment, if needed. If follow-up is required by the QA Manager or the Technical Director as instructed by the Vice President of Operations, enter a statement in the "Corrective Action Required" area that the CAR will be forwarded to the appropriate person, who will then address their portion and close the CAR and notify the Assistant Vice President of Operations.

13.1.3.5.6 If no action is required by the QA Manager or Technical Director, the Project Manager will notify either the Vice President of Operations or the Assistant Vice President of Operations for review depending on what type of CAR it is. The Vice President of Operations will close all Laboratory and Internal CARs while the Assistant Vice President of Operations will close all Customer Service CARs.

13.1.3.6 It is the responsibility of the Assistant Vice President of Operations to ensure the following:

13.1.3.6.1 Review CARs and all supporting paperwork on a daily basis

13.1.3.6.2 As appropriate, come up with necessary decision/recommendations and document them in the Corrective Action Required field in LIMS.

13.1.3.6.3 Review "Corrective Action Required" completed by PM

13.1.3.6.4 Make sure CARs promptly closed upon resolution

13.1.3.6.5 Review all CARs on an ongoing basis to assure all CARs have been closed and necessary follow up took place (follow up with QA Manager and Technical Director, if needed)

13.1.3.7 Procedure to generate CAR in LIMS, follow the following steps:

13.1.3.7.1 From Main Menu go to Quality Assurance

13.1.3.7.2 Select Corrective Action Reports

13.1.3.7.3 Click "Add" and number will be automatically assigned through the LIMS

13.1.3.7.4 Enter PM under Department

13.1.3.7.5 Enter Client ID

13.1.3.7.6 Fill in the "Summary" field by writing short description of the CAR

13.1.3.7.7 Fill in the "Initiate By" and "Initiated On" fields

13.1.3.7.8 Write a complete and thorough description of the Nonconformance in the "Complete Description of the Non-Conformance" field. The following details must be included for all CARs:

13.1.3.7.8.1 Client's company name

13.1.3.7.8.2 Work order number and all sample number(s).

13.1.3.7.8.3 Date, time and name of all communications with client representative regarding this issue.

13.1.3.7.8.4 If the problem is internal, make sure to include laboratory department involved and names of laboratory analysts, etc.

13.1.3.7.8.5 If CAR is related to the bottle order or quote, please make sure to include bottle order or quote number

13.1.3.7.8.6 If a credit needs to be issued please make sure to include explanation why, prices used, new prices and documentation supporting new prices, such as quotes, or previous invoice, etc.

13.1.3.8 Once CAR number is assigned, this number must be entered in the comment section of LIMS under work order/work orders associated with the CAR! (please note that in some cases, no work order may be associated with the CAR)

13.1.3.9 Every CAR must be detailed and contain supporting documentation. This documentation must be present in order for the CAR to be closed. CAR that has missing info or details will be returned to the PMs and will not be closed until all the info is provided. Complete CAR must be forwarded to the Assistant Vice President of Operations or Laboratory Manager in case of the Assistant Vice President of Operations' absence. These are some of the examples for the supporting documentation required:

13.1.3.9.1 In case of CAR about additional analytes requested after final report has been mailed to the client, please do the following:

13.1.3.9.1.1 Describe client's request in the CAR and e-mail the Assistant Vice President of Operations (when possible, forward the client's email).

13.1.3.9.1.2 the Assistant Vice President of Operations will review the CAR and determine if AES can fulfill the request

13.1.3.9.1.3 If AES can fulfill the request, the Assistant Vice President of Operations will e-mail to PM to make necessary changes in the log in

13.1.3.9.1.4 Assistant Vice President of Operations will then email the appropriate lab manager referencing the CAR number, and the requested changes to be made.

13.1.3.9.1.5 After changes are made, necessary corrections will be made to the report.

13.1.3.9.1.6 Once corrections are made, the Assistant Vice President of Operations will inform PM to proceed with report revision. Make sure to issue revision note on the cover letter. We are required by NELAC and other certifying / accrediting agencies to document any changes that were made after final copy of the report is mailed to the client.

13.1.3.9.1.7 If revision reflects in a price change, M invoice must be generated or old invoice amended, depending on the arrangements made with a client. It is PM's responsibility to list any additional charges when submitting CAR and provide a decision if new M invoice or changes to an old invoice are required.

13.1.3.10 In case of CAR about incorrect prices or invoice please make sure to provide the:

13.1.3.10.1 Old invoice

13.1.3.10.2 COCR

13.1.3.10.3 Copy of COC

13.1.3.10.4 Price quote (if any)

13.1.3.10.5 If invoice is being changed in the LIMS system please make sure to save as a revised invoice on portal. The revised invoice, and COCR are then email to Accounts Receivable, referencing the CAR number. Accounts receivable will then update Peachtree, COCR, and add comments to CAR indicating this.

13.1.3.11 For a CAR about bottle order or shipping, provide a copy of the bottle order tracking number and any other documentation that will support the CAR, such as client's fax, etc.

13.1.3.12 The Assistant Vice President of Operations will address issues that involve pricing, inclusion of an additional analyte from the existing method, addition of another test to the work order, or a request for another report format (i.e. MDL Report). All other issues should initially be brought to the Vice President of Operations or Laboratory Manager for review. When the Vice President of Operations or Laboratory Manager has assessed the corrective action report, he will either give it back to the Project Manager with the action to resolve the issue or forward it to another person to continue the investigation. Typically, these CARs will go to the Department Directors, the Technical Director, or the QA Manager.

When CAR is completed by the laboratory personnel, the CAR file will be returned to the

PM for client resolution (i.e. price changes, report reissued, etc.). The Assistant Vice President of Operations must be notified about the completion of all PM CARs. All PM CARs that have not been closed by the QA Manager or Technical Director are closed by the Assistant Vice President of Operations.

13.1.4 Per AIHA-LAP, LLC LQSR section 4.8, any complaint about the quality of reported results may be referred to the accrediting body if such complaints cannot be resolved directly with the customer.

13.2 General Procedures and Responsibilities for Corrective Action Reports Involving Deficiencies.

13.2.1 When the QA Dept. or Technical Director issues a corrective action report (CAR) for a non-conformance classed as a deficiency, the Laboratory Manager, Assistant V.P. of Operations or Technical Director will be informed immediately.

13.2.2 The QA Manager will track the completion of the corrective actions required to correct the deficiency. The assigned personnel are responsible for completing the corrective action within the specified time frame.

13.2.3 The chain of custody and the Sample Receipt Forms are used to document non-conformance during log-in.

13.3 Method Suspension or Restriction

13.3.1 In some cases, it may be necessary to suspend or restrict the use of a method that constitutes significant risk and or liability to AES. Suspension or restriction procedures can be initiated by the Quality Assurance Manager, Technical Director, Laboratory Manager, or VP of Operations.

13.3.1.1 Prior to suspension or restriction, confidentiality is respected, the problem and the required corrective action is stated in writing on the associated CAR and presented to the Laboratory Manager.

13.3.1.2 The Laboratory Manager, Technical Director, Quality Assurance Manager, and the affected supervisor are notified.

13.3.1.3 The Laboratory Manager arranges for the appropriate operations people to speak with the Quality Assurance Manager or Technical Director the day of notification. This meeting is held to confirm that there is a problem, and that suspension or restriction of the method is required.

13.3.2 The suspension or restriction meeting will conclude with a discussion of the steps necessary to bring the method or test fully back on line if the method is suspended or restricted. The Quality Assurance Manager will also specify any documentation necessary to verify that corrective action has occurred.

13.3.3 After suspension or restriction, the laboratory will hold all reports to clients pending review. No faxing, mailing or distributing through electronic means may occur. It is the responsibility of the Laboratory Manager to hold all reports. Clients will not generally be notified at this time. Analysis may proceed in some instances depending on the non-conformance issue.

13.3.4 Upon completion of the required corrective actions per the CAR, laboratory management will determine if the affected systems are back in control. Once documentation and data associated with the CAR have been reviewed and approved by upper management, the VP of Operations, Laboratory Manager, Quality Assurance Manager, or Technical Director will notify laboratory personnel to

resume testing. At that time, reports can be released. If systems are still deemed out of control, further corrective actions are required. A team, with all principals involved can devise a start up plan to cover all steps from client notification through compliance of method and release of reports.

13.3.5 If the QA Dept. or Technical Director recommends client notification regarding affects on past or current data quality, all associated information is forwarded to the Laboratory Manager and VP of Operations. They will review the data and determine appropriate actions.

13.3.6 Client notifications are the responsibility of the Laboratory Manager and VP of Operations.

13.4 Procedure for the issuing, completing, and closing of a Project Management or Customer Service related CAR.

13.4.1 CAR should be opened for the following reasons:

a) Any client complaints regarding prices, customer and laboratory service provided, courier service, bottle orders, shipping, invoices, analyses, additional requests after reports have been issued and files archived, etc.
b) Any situation that might have occurred within the laboratory such as results not reported on time, missing information (i.e. reporting limits, analysis dates and times, missing samples, missing analytes, etc.).

13.4.2 CAR must be generated through LIMS as follows:

a) From Main Menu go to "Quality Assurance"
b) Select Corrective Action Reports
c) Click "Add" and number will be automatically assigned through the LIMS
d) Enter PM under Department
e) Enter Client ID
f) Fill in the "Summary" field by writing short description of the CAR
g) Fill in the "Initiate By" and "Initiated On" fields
h) Write a complete and thorough description of the Nonconformance in the "Complete Description of the Non-Conformance" field. For all CARs details must include: client's name, work order number, date, time and name of the person spoken to. If the problem is internal, make sure to include laboratory department involved and names of the laboratory analysts, etc. If CAR is related to the bottle order or quote, please make sure to include bottle order or quote number. If a credit needs to be issued please make sure to include explanation why, prices used, new prices and documentation supporting new prices, such as quotes, previous invoice, etc.

13.4.3 Once the CAR number is assigned, this number must be entered in the comment section of LIMS under Work order / Work orders associated with the CAR.

13.4.4 Every CAR must contain supporting documentation. This documentation must be present for the CAR to be closed. CARs that are missing information or details will be returned to the PM. Complete CARs must be forwarded to the Director of Project Management or Laboratory Manager if Director of Project Management is absent.

13.4.4.1 Examples of supporting documentation are as follows:

13.4.4.1.1 In case of NCR about incorrect prices or invoice please make sure to provide following info: old invoice; Chain of Custody Record (COCR), copy of COC, price quote. If invoice is being changed in the LIMS system please make sure to issue revision note on the cover letter. We are required by TNI and AIHA-LAP, LLC to document any changes that were made after final copy of the report is mailed to the client. This cover letter is for in-house purposes only unless requested by client. All revised documents must be given to receptionist for rescanning.

13.4.4.1.2 In case of NCR about bottle order or shipping please provide a copy of the bottle order, tracking number and any other documentation that will support the NCR, such as client's fax, etc.

13.4.5 After all the facts and documents are gathered, they must be turned in to Director of Project Management or the Laboratory Manager. They will review all the information and come up with the decision that will be recorded under "Description of the Corrective Action". QA Manager is notified, if QA Action is required. All Project Manager or Customer Service CARs must be closed by the Director of Project Management or his designee within 3 business days.

13.5 Exceptionally Permitted Departures from Documented Policies and Procedures

13.5.1 Due to the frequently unique nature of environmental samples, it may be necessary to depart from documented policies and procedures when dealing with the sample(s). When the analyst encounters this type of situation, he presents the problem to his supervisor for advice. The supervisor may elect to discuss it with the Technical Director or have a technical representative contact the client to decide on a logical course of action. Once an approach is agreed upon, the analyst notes it in the raw data folder. This information can then be supplied to the client in the form of a footnote or a case narrative with the report.

13.6 Addressing Complaints

13.6.1 Addressing complaints is a normal function of conducting business and a valuable tool to improve services to and relationships with clients. The goal of AES is to provide expeditious resolution of complaints. At AES, the supervisor and the management team handle complaints related to sample results. Client Services resolves specific complaints concerning container orders, shipping, expected report dates, and results. This information is documented in LIMS. The procedure used for addressing complaints follows the Corrective Action Report.

13.6.2 In the event that a complaint is related to the laboratory's compliance with its own policies and procedures, the rules of an accrediting agency, or the validity of data, the Quality Assurance Manager and or Technical Director initiate an internal audit of the areas involved. These personnel document the complaint, audit findings and recommendations.

13.7 Immediate and Long Term Corrective Action

Immediate corrective actions are necessary to correct or repair non-conforming equipment and systems. This type of corrective action is usually identified by the section supervisor through the use of calibration checks and QC sample analysis.

13.7.1 Long term corrective actions are necessary to eliminate causes of non-conformance. The need for such actions may be identified by audits. Examples of this type of action include:

13.7.1.1 Staff training in technical skills or in implementing the quality assurance program.

13.7.1.2 Rescheduling of laboratory routines to ensure analyses are performed within holding times.

13.7.1.3 Identifying vendors to supply reagents of sufficient purity.

13.7.1.4 Revision of quality assurance system or replacement of personnel.

13.7.2 Various auditing authorities may also initiate a corrective action, when deemed necessary.

13.7.3 For either immediate or long term corrective actions, the steps comprising a closed loop corrective action system are as follows:

13.7.3.1 Define the problem.

13.7.3.2 Assign responsibility for investigating the problem.

13.7.3.3 Investigate and determine the cause of the problem.

13.7.3.4 Determine a corrective action plan to eliminate the problem.

13.7.3.5 Assign and accept responsibility for implementing the corrective action.

13.7.3.6 Establish effectiveness of the corrective action and implement the correction.

13.7.3.7 Verify that the corrective action has eliminated the problem.

13.8 Responsibility for Document Control

The QA department is responsible for document control for the laboratory. Critical documents include the QA Manual, the SOPs, the Corrective Action forms and reports, internally used forms and information, the training files, the MDL studies, the retention time studies, safety training files, performance evaluation reports, certification correspondence and manuals, audit reports and responses, and traceability certificates.

14.0 PERFORMANCE AND SYSTEM AUDITS

14.1 Purpose

The purpose of conducting audits is to monitor and verify compliance and overall effectiveness of the QA Program. Communication of audit findings to management is required for timely consideration and implementation of corrective actions.

14.2 External Audits

14.2.1 External audits are performed when certifying agencies or clients conduct on-site inspections. It is AES' policy to cooperate fully with certifying agencies. It is also AES' policy to comply fully with system audits conducted by regulatory agencies and clients.

14.2.2 The laboratory is involved in external performance audits conducted semi-annually through the analysis of Performance Testing (PT) samples provided by a third party. EPA performance testing studies have been referred to as Water Pollution Study (WP) and Water Supply Study (WS). Additional PTs including soil studies are analyzed per the requirements of TNI and AIHA-LAP, LLC.

14.2.3 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 must always be clearly identified. Confidential business considerations may be purged of references to client identity by the responsible laboratory official at the time of removal from the laboratory. Sample identifiers may not be obscured from the information.

14.3 System Audits

14.3.1 It is the responsibility of the Quality Assurance Manager to plan and organize audits as required by a predetermined schedule and as requested by management. Such audits are carried out by trained and qualified personnel who are, whenever resources permit,

independent of the activity to be audited.

System audits are split into smaller audits that are performed within the calendar year at the specified frequency. Audits are performed monthly, quarterly and by the Quality Assurance Manager, the Quality Assurance Officer or an appointed representative. Internal audits can be categorized into three types: annual audit, quarterly audit and monthly audit. During the annual internal audit, compliance with the ISO standard and AIHA-LAP, LLC requirements will be verified using the current ISO Guide and AIHA-LAP, LLC Site Assessment checklist. An example audit checklist can be found in Figure 14-1. Additional audits may be necessary throughout the year to address specific project requirements or issues that arise from other audits. Findings of all audits are presented in management reports.

14.3.2 Routine report audits are the responsibility of the laboratory Quality Assurance Manager. The Quality Assurance Manager performs an independent systems review of reports generated by the laboratory. Comments from this review are recorded on Figure 14-1.

14.3.2.1 The reviewer is not expected to pursue the correctness of every reference in the file contents, but instead concentrates on the internal consistency of the data package.

14.3.2.2 Areas that are reviewed include the chain-of-custody, correspondence with the analytical request, batch QC status, completeness of any corrective action statements, calculations, format, holding time, sensibility and completeness of the project, and file contents. A list of reports reviewed is maintained in an audit file.

14.3.3 Internal audits are planned and conducted in accordance with a schedule developed by the QA Manager. Unscheduled audits or surveillance are also conducted when the QA Manager or the Vice-President of Operations deems it necessary.

14.3.4 The responsible management personnel are required to make all personnel, records, reports and documents available to the audit team.

14.3.5 Responsible management of the areas audited is required to provide prompt corrective action in accordance with the provisions of this manual.

14.3.6 Follow-up audits or surveillance is performed, as required, to verify the implementation of corrective action.

14.3.7 When the required corrective action is not implemented within the specified time period, the QA Manager notifies the Vice-President of Operations. A Corrective Action Notice form is used for this purpose. The Vice-President of Operations performs any required corrective actions.

14.3.8 Audit planning and findings are recorded and filed as part of the QA records.

14.3.9 At the discretion of the Vice-President of Operations, impacted clients are notified in writing if the audit result findings indicate any reported data has been compromised.

14.4 Blind Sample Audits

14.4.1 Blind sample audits are performed through the submittal of QC samples to the analyst along with the sample true values, which are only made known to the analyst after the test is complete. Blind sample audits are carried out by the Quality Assurance Manager, Technical Director, clients and certifying agencies as necessary to assure the laboratory is capable of achieving success with a blind QC sample. For continuing TNI and AIHA-LAP, LLC

accreditation, the laboratory must, on a continuous basis, successfully complete two of the last three consecutive proficiency rounds for a given PT field of testing.

14.4.2 In addition to the PT samples submitted to the laboratory through third party vendors, the laboratory may also participate in a company-wide internal PT program to evaluate methods that are not commonly included in the semi-annual PT studies. These studies usually occur between January and February and more frequently if deemed necessary.

14.4.3 It is recognized that PT samples are often not representative of "real world" samples either in their form (e.g., vials), content (e.g., multiple target analyte hits), or documentation (e.g., no chain of custody) and, as such, present the laboratory with special challenges.

14.4.4 It is the policy of AES that PT samples are treated as typical samples in the normal production process wherever possible. Further, if PT samples present special or unique problems in the normal production process, then they should be treated differently, as would any special or unique request submitted by any client. Holding time begins when the vial is opened. Full volume PT samples follow normal holding time procedures and storage requirements.

14.4.5 Login obtains the normal COC information from the documentation provided with the PT samples with review by QA or other designated staff.

14.4.6 Vials are prepared as required in the instruction set provided with the samples. After preparation to full volume, the samples may be spiked, digested, and or concentrated as necessary in a manner similar to normal samples received at the laboratory.

14.4.7 In special cases, the following procedures may be required for the analysis and reporting of PT samples.

14.7.7.1 PT samples will not undergo multiple preparations, multiple runs, multiple methods (unless they are being used to evaluate multiple methods), or multiple dilutions, unless these are the procedures that are normally applied to typical client samples.

14.7.7.2 PT sample(s) will not be subjected to special reviews by operational staff or QA unless this would be normal laboratory practice. To the degree that special report forms or login procedures are required by the PT supplier, it is reasonable that the laboratory would apply special review procedures as would be performed for any client requesting unusual reporting or login processes.

14.4.8 Special QC samples can be included in any analytical run.

14.5 Quality Systems and LIMS Management Review

14.5.1 The Laboratory Manager, Quality Assurance Manager, and Technical Director conduct an annual review of the laboratory's quality systems and LIMS to ensure their continuing suitability and effectiveness in meeting client and regulatory requirements and to introduce any necessary changes or improvements.

14.5.2 The quality systems and LIMS management review uses information generated during the preceding year to assess the total laboratory and ensures that routine quality actions taken and reviewed on a quarterly basis are not components of larger systematic concerns. The quarterly review (see section 15) is designed to keep the quality systems current and effective.

14.5.3 Significant issues from the following documentation are summarized by the Quality Assurance Manager prior to the review meeting:

14.5.3.1 Matters arising from the previous annual review.

14.5.3.2 Prior Quarterly Quality Assurance Reports.

14.5.3.3 Review of report reissue requests.

14.5.3.4 Minutes from prior management and staff meetings

14.5.3.5 Minutes from prior senior management meetings that discuss adequacy of staff, equipment and facility resources.

14.5.3.6 Prior customer service or business development meeting information.

14.5.3.7 Internal and external audits, including computer audits performed during the past year.

14.5.4 The annual review can occur anytime during the year. Based upon an annual review, a report is generated by the Quality Assurance Manager. This report includes the following information.

14.5.4.1 The date of the review and the names and titles of participants.

14.5.4.2 References to the existing documents and topics that were covered in the review process.

14.5.4.3 Quality system or LIMS changes/improvements that will be made as a result of the review.

14.5.4.4 An implementation schedule including assigned responsibilities for the changes.

14.5.5 Following any review, the Quality Assurance Manual or SOPs may be revised to reflect any significant changes made to the quality systems.

14.6 Corrective Action

14.6.1 All deficiencies found during audits are reported to the Laboratory Manager, Quality Assurance Manager, and the Technical Director (see Section 15, “Quality Assurance Reports to Management”). The Laboratory Manager, Technical Director, and Quality Assurance Manager agree upon a time frame for correction. The laboratory's response and corrective action procedures are evaluated by the Quality Assurance Manager and when acceptable, are attached to each audit and filed. If issues arise that may require method suspension or restriction, the procedures outlined in Section 13, “Corrective Action,” are followed.

14.6.2 External audits often require written reports that include proof of correction. The Quality Assurance Manager coordinates the written response to the external auditing facility.

14.6.3 Written responses to PT results are required. The response must address the reason for any unacceptable or "Check for Error" result. In some cases it may be necessary for blind QC samples to be submitted to the laboratory to show a return to control.

14.6.4 Whenever a laboratory fails a study, it shall determine the root cause for the failure and take any necessary corrective action. If a laboratory fails two out of the three most recent studies for a given PT field of testing, its performance is considered unacceptable under the TNI and AIHA-LAP, LLC standards for that field. The laboratory shall then need to meet the requirements of initial accreditation. For initial studies, the PT samples shall be analyzed at least 15 days apart. The laboratory must successfully complete two PT studies out of the most recent three rounds attempted for each requested PT field of testing. If analytes are on the Experimental Fields of Testing, participation is mandatory but passing the PT studies is not.

Figure 14-1
Internal Audit Checklist (Annual)

Month: Year:

Balances Maintenance	Performed (√)	Date	Certificate Posted	Type
AES #1089	____	_____	____	Top Loader
AES #1182	____	_____	____	5 Place Analytical
AES #1717	____	_____	____	Analytical
AES #1700	____	_____	____	Analytical
AES #1841•	____	_____	____	Analytical
AES #1999	____	_____	____	Top Loader
AES #2003	____	_____	____	Analytical
AES #2004	____	_____	____	Top Loader
AES #2005	____	_____	____	Top Loader
AES #2065	____	_____	____	Analytical
AES #2067	____	_____	____	Analytical
AES #2248	____	_____	____	Top Loader
AES #2249	____	_____	____	Top Loader
AES #2250	____	_____	____	Analytical
AES #2332	____	_____	____	Analytical
AES #2382	____	_____	____	Analytical

•1.0 g & 0.002 g weights used for 1664 O&G / TPH should be checked twice daily in the logbooks

Annual Incubator Temperature Study	Performed (√)	Date	Posted	Comments
	____	_____	____	

Annual TSS Manifold Cleaning	Performed (√)	Date	Verified in Maintenance Log
	____	_____	____

Define Linear Portion of Non-Linear Curve	Performed (√)	Date
IC2 Chloride	____	_____
IC2 Sulfate	____	_____
IC3 Chloride	____	_____
IC3 Sulfate	____	_____

Annual PTs per Analyst (Drinking Water)

Study	Analyst	Method	Date	Passed	Posted
_____	_____	SM9223B	_____	____	____
_____	_____	SM9221D	_____	____	____
_____	_____	SM9223B	_____	____	____
_____	_____	SM9221D	_____	____	____

Annual Laboratory Water Acceptance Criteria:

Heavy Metals	Performed (√)	Date	Passed	Posted	Comments
Cd, Cr, Cu, Ni, Pb, Zn	____	_____	Y or N	____	

Heavy Metals	Performed (√)	Date	Passed	Posted	Comments
Aggregate	____	_____	Y or N	____	

Bacterial Growth	Performed (√)	Date	Passed	Posted	Comments
Ratio	____	_____	Y or N	____	

Computer Audits	Performed (√)	Date	Posted	Comments
Software	____	_____	____	
Hardware	____	_____	____	

Annual Inhibitory Residue Test	Performed (√)	Date	Passed Y or N	Posted	Comments
	____	_____		____	

Stage Micrometer Calibration	Date Last Calibrated	Due for Calibration	Performed (√)	Date
	3/18/2014	3/18/2021	____	_____

Imhoff Cone (E160.5) Calibration	Date Last Calibrated	Due for Calibration	Performed (√)	Posted
	_____	_____	____	_____

Annual Spectrophotometer Wavelength Verification	Performed (√)	Date	Posted
	____	_____	____

IDL (Instrument Detection Limit)	Check Performed (√)	Posted	Comments
EPA 6020 (ICP/MS-TJA)	____	____	
EPA 6020 (ICP/MS-Agilent)	____	____	
EPA 6010 (ICP_Agilent)	____	____	
EPA 6010 (ICP_Varian)	____	____	

QC Acceptance Limits Updated	Performed (√)	Date	Posted	Comments
	____	_____	____	

Update SOPs	Performed (√)	Date	Posted	Comments
QA Manual	____	_____	____	
Data Integrity SOP	____	_____	____	

Check for Outstanding Logbooks
Email Sent & Logbooks Collected — Check Performed (√) ____

CARs Completed for Missing Books
CAR #'s: _____

Verify Compliance	Performed (√)	Date	Comments
ISO 17025 Standard	____	_____	Refer to Current ISO Guide
AIHA-LAP, LLC Requirements	____	_____	Refer to Site Assessment Checklist

SOPs Revised See Tech. Mgmt Summary

Annual Training	Performed (√)	Date	Posted	Comments
QA Manual	____	_____	____	
Legal & Ethical	____	_____	____	
Temp. Recording	____	_____	____	
Correction Factor	____	_____	____	

Annual Report to Management Submitted	Performed (√)	Date	Posted
____	_____	____	

Annual Management* Review Completed	Performed (√)	Date	Posted
	____	_____	____

* Remember to check the bullets in ISO 17025 (and AIHA Policy Modules) to make sure all items covered.

Subcontractor Info	Available (√)	Date	Posted
Current Certificate	____	_____	____
Current Scope	____	_____	____

NVLAP	Performed (√)	Date	Posted
Annual Bulk (PLM) Audit Checklist: Handbook 150-3	____	_____	____
Annual Airborne (TEM) Audit Checklist: Handbook 150-13	____	_____	____
Annual General Audit Checklist: Handbook 150	____	_____	____
Annual PLM Control Charts	____	_____	____
Annual PLM Point Count Comparison	____	_____	____
Annual Refractive Index Control Charts	____	_____	____
Annual PLM Precision and Accuracy	____	_____	____

Audit Performed by: Date:

Figure 14-1 (cont.)
Internal Audit Checklist (Quarterly)

Quarter: Year:

Balances	Calibrated Daily (√)	Failures Addressed (√)	Posted	Comments
AES #1089	____	____	____	Top Loader
AES #1182	____	____	____	5 Place Analytical
AES #1700	____	____	____	Analytical
AES #1717	____	____	____	Analytical
AES #1841•	____	____	____	Analytical
AES #1999	____	____	____	Top Loader
AES #2003	____	____	____	Analytical
AES #2004	____	____	____	Top Loader
AES #2005	____	____	____	Top Loader
AES #2065	____	____	____	Analytical
AES #2067	____	____	____	Analytical
AES #2248	____	____	____	Top Loader
AES #2249	____	____	____	Top Loader
AES #2250	____	____	____	Analytical
AES #2332	____	____	____	Analytical
AES #2382	____	____	____	Analytical

•1.0 g & 0.002 g weights used for 1664 O&G / TPH should be checked twice daily in the logbooks

Include copy of current Balance Weights Stage Micrometer Log

Weights	ID	Last Calibrated	Calib. Due	Schedule Calibration Circle Yes	Comments
Primary 2 mg	2377	4/30/18	Apr. 2023	Yes	
Primary 20 mg	2269	8/16/16	Aug. 2021	Yes	
Primary 100 mg	2268	8/16/16	Aug. 2021	Yes	
Primary 1g	2328	9/21/17	Sept. 2022	Yes	
Primary 10 g	2270	8/16/16	Aug. 2021	Yes	
Primary 100 g	2271	8/16/16	Aug. 2021	Yes	
Primary 1000 g	2256	8/16/16	Aug. 2021	Yes	
Backup 2 mg	2377	4/30/18	Apr. 2023	Yes	
Backup 1 mg	2330	9/21/17	Sept. 2022	Yes	
Backup 20 mg	2220	2/9/16	Feb. 2021	Yes	
Backup 100 mg	2335	10/31/17	Oct. 2022	Yes	
Backup 1 g	2329	9/21/17	Sept. 2022	Yes	
Backup 10 g	2336	10/31/17	Oct. 2022	Yes	
Backup 100 g	2337	10/31/17	Oct. 2022	Yes	
Backup 1 mg	2331	9/21/17	Sept. 2022	Yes	

Thermometers	ID	Last Calibrated	Calib. Due	Schedule Calibration Circle Yes	Comments
NIST Traceable	2403	8/10/2018	8/10/2023	Yes	
Backup NIST Trace.	1884	7/7/2014*	7/7/2019	Yes	*Internally Checked
Backup NIST Trace.	1597	7/7/2014*	7/7/2019	Yes	*Internally Checked

Include copy of Current Thermometer Log

Evaluation of Critical Suppliers: Check with Managers and review vendor list against ISO 17025 Sec. 4.6.4 to determine if any additional suppliers should be identified as critical suppliers. Fill out evaluation for any identified.

Newly Identified Critical Suppliers	Evaluation Completed	Posted
_____	Y or N	____
_____	Y or N	____

Pipettors - Copy of Current Pipettor Log

Employee Training Forms	Performed (√)	Posted	Comments
QA Manual SOP Form	____	____	
QA Manual Training Form	____	____	
Legal & Ethical Training Form	____	____	
Employee Signature	____	____	

Bottle Checks	Check Performed (√)	Lot #'s	Posted	Comments
Micro Coliform	____	_____	____	See Annual W.O.
Certificate at Receipt		_____	____	Contamination
(See portal: QA>Bottles>Sample_Receipt_)		_____	____	Also see next page
		_____	____	QT Sterility check
Metals	____	_____	____	
(See bottle check W.O.)		_____	____	Contamination or
		_____	____	Volume
TOC - for NC	____	_____	____	
(See bottle check W.O.)		_____	____	Contamination
		_____	____	
IC	____	_____	____	
(See portal: QA>Bottles>IC)		_____	____	Contamination or
		_____	____	Volume

AIHA-LAP, LLC 5% Inter/Intra Analyst Checks:	5% Inter	5% Intra	Posted
Air-Direct Exam (MB-15019, MB-15022, MB-15028)	____	____	____
Bulk & Surface - Direct Exam (MB-15020)	____	____	____

AIHA-LAP, LLC IH environmental micro	Performed (√)	Posted	Comments
Direct Exam Blank Tape Slide performed daily	____	____	

Mechanical Timers	Performed (√)	Posted	Comments
Autoclave Cycle Time is <45 minutes	____	____	
Mechanical Time checked vs. Digital Timer	____	____	

AIHA-LAP, LLC Controlled Documents	Performed (√)	Posted	Comments
Review & Update Documents Database	____	____	

UV Bulb Replaced	Check Performed (√)	Posted	Comments
UV Bulb	____	____	

Micro. Materials Checks	Performed (√)	Posted
Brilliant Green Media Lot	____	____
Dilution Containers Tolerance Check	____	____

EC Media Lot	____	____
EC Media w/MUG Lot	____	____
HACH P/A Broth Lot	____	____
IDEXX Colilert Media Lot	____	____
Lauryl Tryptose Lot	____	____
M-Endo Lot	____	____
M-FC w/Rosalic Acid Lot	____	____
Plated Media Lot and Reagents		
Positive Control / Negative	____	____
Media Check for Materials > 90 Days		
Positive Control / Negative	____	____
SIM Plate Broth Lot	____	____
Tryptic Soy Double Strength Broth Lot	____	____
Tryptic Soy Single Strength Broth Lot	____	____

Membrane Filter	Check Performed (√)	Lot #'s	Posted	Comments
Sterility Checks____	_____		____	
		_____	____	
		_____	____	

Micro Aseptic Technique — Alcohol Burner Used
Double Check the use of sterilization of pipette tips — Y or N

Micro Use Test	Performed (√)	Date	Passed	Posted	Comments
Student t Test	____	_____	Y or N	____	

Audit Items from CARs

1. Remember to create CARs based on observations from internal audit
   CARs generated: _____
2. Follow up on previous CARs
   a. Ferrous Iron Narrative present — CAR 120097 — W.O. confirmed: _____
   b. MBAS reported in "mg/L-LAS" units and Molecular Weight (e.g. MW 340) — CAR 121283 — W.O. confirmed: _____
   c. — CAR _____ — W.O. confirmed: _____
   d. — CAR _____ — W.O. confirmed: _____

Hotblock Temperature Distribution Studies

Performed for the Quarter	Posted
____	____

Quarterly Instrument Specific Checklists

Performed for the Quarter	Posted
____	____

Quarterly Control Chart Check for Infrequently Performed Tests

Test (e.g. 365.1_S TP)	QC Type (LCS, MS, MSD, etc.)	Trend Normal (circle)
_____	_____	Y or N
_____	_____	Y or N

TCLP Tumbler	Check Performed (√)	Posted	Comments
Rates Recorded	____	____	
Dates Recorded Properly	____	____	From 2018 NELAP Audit

Asbestos Checks	Last Performed	Date Performed	Frequency Required	Comments
PLM Refractive Index Liquid Calibration	_____	_____	Semi-Annually	

Environmental Checks	Check Performed (√)	Posted	Comments
Lead Wipe	____	____	

Linear Calibration Range	Check Performed (√)	Posted	Comments
LCR for 180.1 (Required Semi-annually)	____	____	Check performed with ea Batch

Other Observations General: Review of CARs. Follow up on QA CARs and Action Plan from Preventive Actions. _____

Sample Receipt: Check login to confirm pH is recorded in LIMS for samples received the previous day. _____

Check of Logbooks. Logbooks are reviewed for completeness after scanning and prior to posting.

Dept.	Logbook ID	Dept.	Logbook ID	Dept	Logbook ID
Prep	_____	Semi-Volatiles	_____	Metals	_____
Wet Chemistry	_____	IC	_____	Volatiles	_____
Microbiology	_____				

Review of QA'ed data

Dept.	Run ID	Dept.	Run ID	Dept	Run ID
Wet Chemistry	_____	Semi-Volatiles	_____	Metals	_____
Microbiology	_____	IC	_____	Volatiles	_____

Ensure New Spreadsheets are locked

Spreadsheets that were found unlocked and then locked: _____

Check that Equipment that is not in Service is Tagged "Out of Service"

Equipment that has been tagged: _____

Audit Performed by: Date:

Figure 14-1 (cont.)
Internal Audit Checklist (Monthly)

Month: Year:

Temp. Checks	Unit ID	Recorded (√)	Post Logsheet (√)	Schedule Service	
Hotblocks					
Wet Chem	2374	____	____	Yes	
Wet Chem	1139	____	____	Yes	
Prep	1511	____	____	Yes	
Prep	1512	____	____	Yes	
Wet Chem	2362	____	____	Yes	
Micro	1849	____	____	Yes	
Prep	1691	____	____	Yes	
Micro	1692	____	____	Yes	
Wet Chem	2006	____	____	Yes	
Wet Chem	2017	____	____	Yes	
IC	2020	____	____	Yes	
Wet Chem	2147	____	____	Yes	
Incubators					
Semi-Volatiles	1084 (IN-1)	____	____	Yes	
Micro	1559 (IN-6, top shelf)	____	____	Yes	
Micro	1559 (IN-6, bottom shelf)	____	____	Yes	
Micro	2057 (IN-2)	____	____	Yes	
Wet Chem	2063	____	____	Yes	
Micro	2088	____	____	Yes	
Wet Chem	2195	____	____	Yes	
Semi-Volatiles	2316	____	____	Yes	
Micro	2349	____	____	Yes	
Ovens					
Organic Prep	2018	____	____	Yes	for baking Na2SO4
Wet Chem	2158	____	____	Yes	
Wet Chem	2165	____	____	Yes	
Wet Chem	2225	____	____	Yes	for baking Na2SO4
Wet Chem	2317	____	____	Yes	
Refrig/Freezers					
Micro	1880 (Sanyo)	____	____	Yes	
Sample Receipt	2027 (New Walk-In)	____	____	Yes	
Metals Prep	2078	____	____	Yes	
Prep	2041 (R-16)	____	____	Yes	
Semi-Volatiles	1631 (F-9/R-25)	____	____	Yes	
Semi-Volatiles	1074 (R-6)	____	____	Yes	
Semi-Volatiles	2056	____	____	Yes	
Wet Chem	1081 (F-3/R-5)	____	____	Yes	
Wet Chem	1541 (R-23)	____	____	Yes	
Wet Chem	2245	____	____	Yes	
Volatiles	2283	____	____	Yes	
Volatiles	2036 (Walk-in)	____	____	Yes	
Volatiles	1076 (R-19)	____	____	Yes	
IC	2007	____	____	Yes	
Metals Prep	2259	____	____	Yes	
IC	2431	____	____	Yes	

IC	2432	____	____	Yes
Volatiles	2433	____	____	Yes
Micro	2420	____	____	Yes
Org Prep	2409	____	____	Yes

Waterbaths	Unit ID	Recorded (√)	Post Logsheet (√)	Schedule Service
Wet Chemistry	1934 (WB-2)	____	____	Yes
Org Prep	2025	____	____	Yes
Org Prep	2026	____	____	Yes
Asbestos				
Asbestos Lab	1915 (Counter)	____	____	Yes
TCLP				
Non-Volatiles	Metals Prep	____	____	Yes
Volatiles ZHE	Volatiles	____	____	Yes
Sonicator Check				
Prep	#1 2091	____	____	Yes
Prep	#2 1889	____	____	Yes
Prep	#3 1890	____	____	Yes
Prep	#4 2085	____	____	Yes

AIHA-LAP, LLC Monthly Blind Culture	Check Performed (√)	Posted
Blind culture from collection Per Analyst	____	____

AIHA-LAP, LLC Periodic Check of Test Reports (Work Orders) Prior to Issuance
See Attachment

	Check Performed (√)	Post Logsheet (√)	Comments
Coliform Bottle Sterility Check	____	____	
Dilution Vessel Sterility Check	____	____	
Fluorescence Check	____	____	

Labware pH Check	Check Performed (√)	Posted	Comments
	____	____	

DUPs, Positive & Negative Checks	Check Performed (√)	Post Logsheet (√)	Comments
SM 9223			
Duplicate	____	____	
Positive Control	____	____	
Negative Control	____	____	
SM 9222D			
Duplicate	____	____	
Positive Control	____	____	
Negative Control	____	____	
SM 9222B			
Duplicate	____	____	
Positive Control	____	____	
Negative Control	____	____	

Quanti Try 2000 Sealer Leak Check	____	____	
UV Lamp Bulb Replacement Log	____	____	We opt to replace bulb rather clean the lamp

Monthly Water Quality Checks Performed (Should be submitted on Form)

Parameter	Performed (√)	<500 CFU/mL	Posted	Comments
Heterotrophic Plate Count (HPC)	____	Y or N	____	
	Performed (√)	<0.1 mg/L	Posted	Comments
Ammonia (NH_3)	____	Y or N	____	
	Performed (√)	<0.1 mg/L	Posted	Comments
Organic Nitrogen	____	Y or N	____	
	Performed (√)	<1.0 mg/L	Posted	Comments
Total Organic Carbon (TOC)	____	Y or N	____	
	Performed (√)	<0.2 mg/L	Posted	Comments
Chlorine	____	Y or N	____	

Daily Water Quality Checks Performed (Located in Logbooks or on Logsheets)

Daily DI Water Check	Check Performed	Posted Logsheets	Comments
Water Unit #1 for Contamination	Y or N	____	for Volatiles
Water Unit #1 Daily Unit Check	Y or N	____	
Water Unit #2 Daily Unit Check	Y or N	____	Bldg B

Conductivity	All <1.0 umhos	Schedule Service	Posted Logsheets (√)	Comments
Water Unit #1	Y or N	Y or N	____	3080
Water Unit #2	Y or N	Y or N	____	Bldg B

Residual Chlorine	Checked Daily	<1.0 mg/L	Posted	Comments
In Micro Logbooks	Y or N	Y or N	____	
Test Strip Range 0-5 mg/L	Y or N			

Monthly Air Monitoring	Check Performed (√)	Posted	Comments
Micro Air Fungal	____	____	Posted w/ Health & Safety
Work order #: _____			

Titration against Primary Standard	Performed (√)	Dates (From Logbooks)
Ferrous Iron	____	_____
0.025N Sodium Thiosulfate for BOD, CBOD, DO, Sulfide	____	_____

Hood Cleaning	Performed (√)	Posted	Comments
Metals Prep (6)	____	____	
PCM Asbestos Prep (1)	____	____	
TEM Asbestos Prep (1)	____	____	
Sample Receiving (1)	____	____	

Asbestos Checks PLM	Required Frequency	Check Performed (√)	Posted
Instrument & Material for each microscope (Microscope Alignment Calibration)	Daily	____	
Contamination Control Testing (of instruments, blades, Petri dishes, etc.)	Daily	____	
Blind recounts (5% of daily analyses)		____	
Blank Contamination Control (Fiberglass / Cellulose check)	Weekly	____	
Monthly Precision Summaries (for each analyst)	Monthly	____	____
Summary of Monthly Accuracy (for each analyst)	Monthly	____	____

Asbestos Checks TEM	Required Frequency	Check Performed (√)	Posted
Monthly Quality Assurance Summary	Monthly	____	____

Asbestos Checks PCM	Check Performed (√)	Posted	Comments
Monthly PCM Air Check (W.O.# _____)	____	____	Posted w/ Health & Safety

Monthly Metals LCS / LCSD Checks - Since the concentrations in the test codes come from the standard in use, this check verifies that the lot number and concentrations have not changed.

Test Code	AES ID #	Catalogue #	Lot #	Pb Conc.	Units	Date
7420_S (7000B)	_____	_____	_____	_____	mg/Kg	_____
PAINT_LEAD	_____	_____	_____	_____	mg/Kg	_____
WIPE_MET_AA (Pb Only)	_____	_____	_____	_____	ug	_____

Audit Performed By: Date:

Figure 14-2
Annual Computer Audit Checklist

Software Audit (Part One)

LIMS

	Yes	No
1. Are quality control data referenced to sample results? (standards, blanks, calibrations, replicates, duplicates, spikes, instrument conditions, surrogates, internal standards, etc.)		
2. Are references to quality control data protected or can they be easily changed?		
3. Are references sufficient to associate quality data with individual sample results?		
4. Are data outside acceptance criteria flagged?		
5. Are the detection limits for target analytes clearly referenced in the LIMS data?		
6. Are the units correct?		
7. Can the results be traced back to the original data associated with a specific batch?		
8. Are all out of range results either prevented or flagged?		
9. Has security been maintained (old passwords, logons eliminated from the system)?		
10. Are data transfers periodically audited and documented?		

For data linked to an analytical instrument, is the following information available:
(Either in LIMS or with the instrument documentation)

	Yes	No
11. Date and time generated?		
12. Identification of instrument?		
13. QC flags indicating the level of acceptability of the data?		
14. Is there a computer generated record of the changed and unchanged data?		
15. Are all data quality flags defined? (QA Manual)		

	Yes	No
16. Are qualifying flags correct?		
17. Are printouts of report modifications routinely checked for accuracy? By whom: (Project Managers) _____		
18. Are final copies of reports properly archived with limited access, security, and protection against natural disaster (fire, flood, etc.)?		

Documentation

	Yes	No
19. Are there written backup procedure?		
20. Is there a disaster recovery procedure?		
21. Does the software management (LIMS) include validation? Vendor (Khemia)		
22. Have the mathematical calculations validated? How is this documented? Vendor (Khemia)		
23. Are software revisions tested to determine how the entire program is affected?		
24. Is there a logbook to document software revision implementation?		
25. Is a password required to access the system?		
26. Is there documented operator training? (Checklist)		

Backups

	Yes	No
27. Are system backups performed?		

What frequency?

	Daily	Weekly
LIMS		
AES Servers		
Portal Server		

Who performs backups? (When not Automatically) _____

	Yes	No
28. Are media storing backups properly labeled?		

	Yes	No
29. Is data from backups stored short term?		

How is it stored? (Network Attached Storage)

	Yes	No
30. Is data from backups stored long term?		

How is it stored? (Written to External Hard Drive)

	Yes	No
31. Is long term backup data stored off site?		

	Yes	No
32. Have report formats that are no longer in use been deleted or inactivated so that they are not mistakenly used?		

	Yes	No
33. Have past employees' names been removed for LIMS pick lists, internal email, and external email?		

Hardware Audit (Part Two)

	Yes	No
1. Are there procedures for performing and documenting preventive maintenance?		
2. Is there regularly scheduled preventive maintenance?		
3. Is preventive maintenance documented?		
4. Is non-routine maintenance performed by in-house staff?		
5. How is it documented? (Logbook)		
6. If the system fails because of electrical glitches or power outage, what happens to the system? (UPS Backup System)		
7. Is a backup power source available?		
8. Are problems documented after a power outage?		

Audit Performed By: Date:

15.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

15.1 Internal Reports

The Quality Assurance Manager submits quarterly reports regarding the status of QA/QC activities to the Vice-President of Operations. Section 15.3 lists the minimum content of this report. The Quality Assurance Manager also submits an annual report to the Vice-President of Operations.

15.2 External Reports

Certain projects under regulatory review require establishment of explicit quality assurance objectives and quarterly summaries of QA conformance and corrective action. The laboratory technical and quality assurance staffs provide the necessary information required to establish quality assurance objectives for particular projects. Once the QA deliverables options are selected for the project, sufficient quality control data will be provided in the individual analytical report to allow a periodic assessment of the overall progress of the project. Upon request, any information or reports needed are provided by laboratory management with review by the QA Manager.

15.3 Quarterly and Annual Reports

The quarterly or annual reports to management include the following information.

15.3.1 SOP. The report indicates any changes to existing SOPs or any new SOPs.

15.3.2 Corrective action reports. The report contains information about any corrective action reports that may have been written during the time period since the last QA report.

15.3.3 MDL. Any changes in MDL should be included in the QA report.

15.3.4 Audits. The QA report includes the results of any audits performed during the time period since the last report.

15.3.5 PE samples. The report includes the results of PE samples analyzed since the last report. The PE report indicates the status of performance as it relates to current laboratory accreditations.

15.3.6 Certifications. Changes or additions to the laboratory's certifications are addressed in the reports.

15.3.7 The annual report is reviewed and signed by the Vice President of Operations, Laboratory Manager, and the Technical Director. A copy of this report is kept for 5 years.

16.0 REAGENT STORAGE AND DOCUMENTATION

16.1 Safety and Shelf Life

Reagents are stored with consideration for safety and maximum shelf life. Storage conditions and documentation maintenance status for various classes of reagents are given in Table 16-1 and Table 16-2, and are discussed below.

16.1.1 All acids, except those poured into small marked containers for immediate use and those that are standardized for specific purposes, are stored in the original containers in acid storage cabinets.

16.1.2 All bases, except those poured into small containers for immediate use and those that are standardized for specific purposes, are stored in the original containers within designated areas or storage cabinets.

16.1.3 All flammable solvents, except those poured for immediate use, are stored in original containers in approved, vented, flammable storage cabinets, which are located indoors.

16.1.4 Dry reagents are stored in designated cabinets in cool, dry areas. Reactive chemicals, cyanides and sulfides are labeled and isolated from other chemicals.

16.1.5 All acids used for metal sample digestions and all solvents used for semi-volatile sample extraction may be tested prior to initial use. Lot numbers used for digestions or extractions are recorded in bound notebooks in the appropriate departments.

16.1.6 Reagent blanks are analyzed with each sample batch for all methods, validating the purity of all reagents. All reagent containers are dated when received, and dated and initialed when opened (except high use items consumed in less than one week). Documentation is maintained to provide traceability of the reagents used with the analysis of any batch to specific reagent lot numbers.

TABLE 16-1
STORAGE OF REAGENTS AND CHEMICALS

i. CHEMICAL REQUIREMENTS	STORAGE
ii. Concentrated acids and bases	1
ii) Standards for metals analysis	2
Standards for extractable organics	3
Standards for volatile organics	4
Bulk dry chemicals	5
Working solutions containing organic compounds	6
Working solutions containing only inorganics	7
Flammable solvents	8
Non-flammable solvents	9

Table 16-2
(a) STORAGE REQUIREMENT KEY

1. Stored in the original containers in acid/base cabinets. All organics must be stored separately.
2. Stored at room temperature in the standards cabinet of the metals department.
3. Stored below 0° C in the department.
4. Neat standards are stored at room temperature in the standard cabinet in the department. Stock solutions and working solutions are stored in the freezer.
5. Bulk reagents are stored at room temperature in reagent storage cabinets located throughout the laboratory.
6. Stored refrigerated at 1-4° C in the department.
7. Stored at room temperature in the department; refrigeration is optional.
8. Stored in solvent cabinets in the organic extraction laboratory.
9. Stored separately from the flammable solvents in cabinets in the organic extraction laboratory.

17.0 WASTE DISPOSAL

17.1 AES operates as a conditionally exempt, small quantity generator.

17.2 All waste disposal is carried out in accordance with AES Waste Disposal SOP, HS-03005. These documents include procedures for identification, storage, personnel training, tracking forms, report forms and safety, as well as details of the disposal. Hazardous waste disposal procedures are discussed below.

17.3 Hazardous Waste Requirements:

17.3.1 Hazardous waste is stored in non-leaking containers that are in good condition with close-fitting lids. The lids are kept closed when wastes are not being added or removed.

17.3.2 Hazardous waste storage containers are labeled with waterproof labels. The labels specify the words "Hazardous Waste", composition and physical state of the waste, hazardous properties of the waste (e.g., flammable, reactive, etc.), and the name and address of the generator.

17.3.3 Each hazardous waste container is clearly labeled with the date the period of accumulation began. The date is also documented on the Hazardous Waste Tracking Log Form (see Section 17.5.8).

17.3.4 All containers are handled in a way that minimizes the possibility of spills and escape of wastes into the environment.

17.3.5 Wastes are stored in an area that is regularly inspected for deteriorating or leaking containers.

17.3.6 All wastes are segregated during temporary accumulation, storage, and for disposal. Prior to disposal, waste materials are carefully combined into categories or waste streams based upon their compatibility.

17.3.7 The following three types of waste are stored in 55-gallon drums.

17.3.7.1 Halogenated solvents such as methylene chloride (closed cap metal drum)

17.3.7.2 Non-halogenated flammable solvents (closed cap metal drum).

17.3.7.3 Heavy metals or other aqueous wastes except cyanide (poly drum)

17.3.8 All other wastes are stored in the original container or 4-liter glass bottles and disposed of via a "lab pack" (i.e., packed by a disposal company in 55-gallon open top drums).

17.4 Sample Disposal (See also AES SOP HS-03005)

17.4.1 After completion of the analysis, unused sample portions, extracts, or digests are transferred to a central secured storage area until they are disposed. Unless a client requests that the project manager save unused samples, digests, or extracts, disposal from the central storage occurs 30 days after submission for test results.

17.4.1.1 Summary of sample disposal procedure:

17.4.1.1.1 Samples are initially put into labeled bins in the walk-in cooler for 30 days in case client decides to add test(s) that require refrigerated storage. All bins must be labeled. Labels include storage location and date of disposal.

17.4.1.1.2 Sample reporting date is used to initiate the 30 day time period. Samples that were put on hold upon receipt should use the date associated with the earliest reported test result unless otherwise indicated by the client or noted by the project manager.

17.4.1.1.3 When attaching labels to the bin, use both the adhesive on the label as well as a piece of clear tape as a second measure to ensure the label does not come off.

17.4.1.1.4 Sample Management Supervisor (a.k.a. Bottle Prep Supervisor) maintains a list of bin disposal dates. Supervisor must sign and date this sheet in order for bins to be disposed. No bins are to be disposed of by disposal technician without management approval.

17.4.2 Requests for extended sample, digest or extract storage must be provided by the client to the AES project manager in writing (contract form) prior to sample receipt. Extended storage may result in the charging of additional fees by the AES project manager prior to sample receipt.

AES is not responsible for evaporation or other deterioration of samples, extracts, or digests during extended storage periods.

17.4.3 Clients that desire the return of samples may pick them up at the laboratory, request shipment by Federal Express (at the client's expense for packaged shipping), or utilize any other legal means that they choose. Clients requesting the return of samples should provide detailed shipping instructions.

17.4.4 If a client, by contract, specifies sample disposal by a hazardous waste contractor, the client's name and EPA ID number will be used on the manifest and the client will be invoiced for all disposal-related costs.

17.4.5 Other excess sample portions are composited by the laboratory according to matrix (solids, soils or aqueous). Composited soils, sediments & other solid samples are sub-sampled and analyzed for hazardous waste characteristics (ignitability, reactivity, (releasable cyanide and sulfide), corrosivity (pH), toxicity (TCLP by SW-846 Method 1311) and PCBs). If the pooled sub-sample is characterized as hazardous by any of the hazardous waste characteristics or contains greater than 50 ppm PCBs, the excess sample is disposed of through the use of a hazardous waste contractor. If the pooled sub-sample is not deemed hazardous based upon the results of these tests, the composited excess material is disposed of in an industrial/municipal landfill.

17.4.6 Aqueous samples are neutralized and disposed of via the municipal sewer system, following all discharge requirements outlined in 40 CFR Part 261.3 (a)(2)(iv)(E).

17.5 Organic Waste Disposal (See also AES SOP HS-03005)

17.5.1 Similar waste disposal procedures for samples from the volatile, semi-volatile and GC/HPLC pesticide laboratories are employed at AES.

17.5.2 All personnel should be familiar with the SOP prior to the disposal of wastes in the laboratory.

17.5.3 AES is considered as a Conditionally Exempt, Small Quantity Generator under 40 CFR Part 261.5 (a generator who generates no more than 100 kilograms of hazardous waste or 1 kilogram of acute hazardous waste in a calendar month and accumulates no greater than 1000 kilograms of hazardous waste). Hazardous waste storage is limited to quantity and/or accumulation and must comply with RCRA regulations as specified in 40 CFR. These wastes are packaged and separated according to compatible groups (e.g., solvents, acids, etc.)

17.5.4 The pH of the discharged waste MUST be between 5 and 10. If the pH of the discharged waste is out of this range, it is diluted with water or treated with the appropriate acid or base.

17.5.5 Apparatus and Equipment

17.5.5.1 Respirator and gloves

17.55.2 5-gallon plastic buckets with lids

17.5.6 Reagents and Chemicals.

17.5.6.1 Marble chips for neutralizing acid waste

17.5.7 Procedure

Prior to the disposal of any waste, the Health and Safety Officer provides a sample disposal list to

the laboratory employee performing the task. Included in this list is the method of disposal and location of disposal for each sample. The Health and Safety Officer obtains this information from the AES LIMS system and categorizes the samples as hazardous or non-hazardous.

17.5.7.1 The procedure for the collection and disposal of expired organic chemicals and solutions is outlined in the subsequent sections.

17.5.7.1.1 Neat standards are sealed and labeled.

17.5.7.1.2 All stock standards, working standards and unused sample extracts are emptied into a properly labeled (contents are listed using the official waste storage labels) 4-L empty solvent bottle.

17.5.7.1.3 Waste standards or samples containing Silvex (2,4,5-TP), 2,4,5-T, or PCBs are stored separately from other waste standards. These compounds are potential dioxin wastes. All acid herbicide standards or sample waste are stored separately from other standard wastes.

17.5.7.1.4 HPLC/GC vials containing solvents, standards and extracts are stored in a labeled, 4-liter, empty solvent bottle.

17.5.7.1.5 Wastes are never allowed to accumulate in the laboratory for longer than 3 days. Wastes that are stored for longer time periods are stored in the waste storage room located at the back of the laboratory. All dated waste is disposed of in drums.

17.5.7.1.6 Each drum is labeled according to contents, i.e., chlorinated, non-chlorinated solvents, acid and mercury waste. Acid wastes are stored in the acid waste room that is separate from the solvent waste room.

17.5.7.1.7 All wastes are treated inside the fume hood using appropriate safety equipment such as a respirator, gloves, laboratory coat, and safety glasses.

17.5.7.1.8 The Safety Officer is notified in the event of any leaks or spills of hazardous wastes.

17.5.7.1.9 The waste drums available are:

Flammable Waste
Soil Waste
Acid Waste
Methylene Chloride Waste
Neutralized Waste

17.5.7.1.10 Autosampler vials full of sample waste are placed into an empty 4-liter solvent bottle, properly labeled, dated, and stored in waste room, where they are lab-packed.

17.5.7.1.11 High-level organic wastes are treated as hazardous substances and are placed in clearly labeled containers. Full containers are stored in the inorganic waste storage room.

17.5.7.1.12 Containers that have been used for the storage of high level wastes are not reused.

17.5.7.1.13 Soil samples are transferred to 55-gallon drums. When full, a composite sample is analyzed for TCLP and characterized for disposal through the use of a Hazardous Waste Contractor.

17.5.7.1.14 The contents of used VOC vials are neutralized prior to disposal in the sanitary sewer system.

17.5.7.2 The neutralization of alkaline or acidic wastes is performed with the following procedure.

17.5.7.2.1 A 5-gallon bucket with a strainer bottom is placed directly into a sink.

17.5.7.2.2 The bucket is filled with 6 to 8 inches of marble chips.

17.5.7.2.3 Pass a generous flow of water through the bucket containing the marble chips.

17.5.7.2.4 The samples are added to the bucket at the same time that the water is flowing allowing the samples to drain through the chips and become neutralized.

17.5.8 The Waste Disposal Logbook is located in close proximity to each drum. The following information is added to the logbook:

AES WORK ORDER Number
Client Sample I.D. Number
Employee(s) Name(s)
Nature of Disposal

17.5.9 The Health and Safety Officer maintains a separate waste disposal record file. These files contain the master list of samples that have been disposed, TCLP analytical results, raw data, and disposal manifest receipts.

17.6 Inorganic Waste Disposal (See also AES SOP HS-03005)

The procedure for the collection and disposal of expired inorganic chemicals and solutions is outlined in the subsequent sections.

17.6.1 AES is considered as a Conditionally Exempt, Small Quantity Generator under 40 CFR Part 261.5 (a generator who generates no more than 100 kilograms of hazardous waste or 1 kilogram of acute hazardous waste in a calendar month and accumulates no greater than 1000 kilograms of hazardous waste). Hazardous waste storage is limited to quantity and/or accumulation and must comply with RCRA regulations as specified in 40 CFR. These wastes should be packaged and separated according to compatible groups (e.g., solvents, acids, etc.). Waste water containing toxic waste from the laboratory that does not exceed 1% of total waste water flow can be disposed of into the sanitary sewer system as specified in 40 CFR part 261.3E.

17.6.2 The pH of the discharged waste MUST be between 5 and 10. If the pH of the discharged waste is out of this range, it is diluted with water or treated with the appropriate acid or base.

17.6.3 Apparatus and Equipment

17.6.3.1 Large polyethylene tank (250 gallon)

17.6.3.2 Latex gloves

17.6.3.3 Stirring rod (glass or wood)

17.6.4 Reagents and Chemicals

17.6.4.1 Soda Ash, sodium carbonate ($NaCO_3$)

17.6.5 Procedure

Prior to the disposal of any waste, the Health & Safety Officer provides a sample disposal list to the laboratory employee performing the task. Included in this list is the method of disposal and location of disposal for each sample. The Health and Safety Officer obtains this information from the AES LIMS system and categorizes the samples as hazardous or non-hazardous.

17.6.5.1 All inorganic aqueous waste is poured into a 250 gallon tank in the disposal room by disposal personnel. When the tank is approximately half full, the solution can be neutralized.

17.6.5.2 Soda Ash is slowly added to the waste solution while it is stirred. The solution will effervesce as the Soda Ash neutralizes the acid in the solution.

17.6.5.3 When the pH of the liquid has been sufficiently neutralized, the waste is drained slowly. The tank is flushed with copious amounts of water.

17.6.5.4 Samples with observed concentrations of measured analyte above the calibration level of the various instruments are treated as hazardous waste. This includes the sample waste generated from the flame AA or ICP instrument. This waste is collected in a storage bottle and is disposed of as an acidic waste when the bottle is filled.

17.6.5.5 High-level inorganic wastes in organic solvents are treated in the following manner:

17.6.5.5.1 The high-level waste is placed into a clearly labeled container. When the container is full, the container is placed into the waste storage room.

17.6.5.5.2 Containers used for the storage of high-level wastes are not reused.

17.6.6 The Waste Disposal Logbook is located in close proximity to each drum. The following information is added to the logbook:

AES WORK ORDER Number
Client Sample I.D. Number
Employee(s) Name(s)
Nature of Disposal

17.6.7 The Health and Safety Officer maintains a separate waste disposal record file. These files contain the master list of samples that have been disposed, TCLP analytical results, raw data, and disposal manifest receipts.

APPENDIX I

WASTE DISPOSAL PROCEDURES

Waste Type	Associated Analytical and Sample Prep Methods	Storage Procedures	Disposal Procedures
Halogenated Solvents Methylene Chloride	Pesticides, Herbicides, BNA, GPC, etc.	Store in glass bottles, then in drums.**	Reclaimed by HW contractor.
Freon	Oil & Grease, Petroleum Hydrocarbons	Store in glass bottles.	Reclaimed by laboratory.
Mixed Solvents (Flammable & nonhalogenated)	VOC Standards, Herbicides, Pesticides	Store in glass bottles, then in drums.	Disposal by HW contractor.
All neat standards	All analyses	Store in original bottles of glass/plastic bottles, then lab pack.	Disposal by HW contractor (Packed by also)
Heavy Metals Solutions	Metals, COD, Chloride	Store in glass bottles, then in drums.	Disposal by HW contractor.
Acid Solutions	Metals, General Inorganics, Extractions	Store in glass bottles or add to neutralizing chambers.	Neutralize; sanitary sewer.
Alkaline Solutions	General Inorganics, Extractions	Store in glass bottles.	Neutralize; sanitary sewer.
All samples containing Organics or Inorganics exceeding hazardous waste standards*	All analytical groups	Store in original bottles or jars in sample custody storage area.	Return to client or disposal by HW contractor.

* Hazardous Waste Characteristics (D001-D017) (40 CFR Part 261), HCN>250 mg/kg, TCLP Toxicity Characteristics (Federal Register, 55FR 11798), March 29, 1990, or contains greater than 50 ppm PCBs.

** Bottles are kept in each laboratory and are periodically moved to the hazardous waste storage area.

APPENDIX II

LABORATORY EQUIPMENT PREVENTIVE MAINTENANCE SCHEDULE

	Service Interval							
EQUIPMENT ITEM	D	W	M	Q	SA	A	AN	SERVICE LEVEL
ICP-AES and ICP-MS								
Pump Tubing				X				Change
Nebulizer			X					Clean
Filters			X				X	Inspect - clean or replace.
Spray Chamber			X					Clean
Quartz Torch					X			Clean and realign.
D-Shaped Mirrors			X				X	Inspect - clean or replace
MERCURY ANALYZER AND AUTOSAMPLER								
Pump Tubing	X						X	Inspect – replace
Standard Cups	X						X	Inspect – replace
Drying Tube	X							Repack
Mixing Coil		X						Inspect - clean or replace
Sample Probe			X					Inspect - clean or replace
Mercury Lamp							X	Clean or replace
CONDUCTIVITY METER								
Battery							X	Check or replace
Probe Contacts							X	Clean or replace
pH METER								
Probe(s)	X							Check fluid levels and fill
Connectors	X							Check for corrosion and clean if necessary
AUTOANALYZER (TRAACS/LACHAT)								
Pump Platen							X	Replace
Pump Tubes				X				Replace
Flow Cell				X				Inspect and clean.
Autosampler	X							Check alignment
Cobalt Column							X	Inspect for channeling and repack
BLOCK DIGESTER								
Heating Elements							X	Replace as needed
Thermostat					X			Check against calibrated thermometer for accuracy
UV/VIS SPECTROPHOTOMETER								
Light Source							X	Replace
Belt	X							Check for wear, replace if frayed
Cuvettes	X						X	Check for scratches and buildup - replace
ION SELECTIVE ELECTRODE								
fluid filled probe	X						X	Check fluid level - empty and replace if crystals form
solid probe	X							Check for salt build-up on tip, clean if necessary
BOMB CALORIMETER								
Thermometer						X		Calibrate Thermometer
Seals	X							Check for breaks in seals and replace if needed
GAS CHROMATOGRAPH – SEMIVOLATILES								
Autosampler System							X	Syringe and tubing cleaned – Needles/ tubing replaced
Septa		X						Replace
Column/Injector							X	Chance sleeve and cut front of guard column.
Gas Cylinder	X							Inspect - change when pressure reads <500 psi.
GAS CHROMATOGRAPH - MASS SPEC SEMIVOLATILES								

APPENDIX II

LABORATORY EQUIPMENT PREVENTIVE MAINTENANCE SCHEDULE

	Service Interval							
EQUIPMENT ITEM	D	W	M	Q	SA	A	AN	SERVICE LEVEL
Column/Injector		X						Chance sleeve and cut front of column.
Septum		X						Replace
Splitless Disc					X			Replace
Autosampler	X					X		Syringe and tubing cleaned Needles and tubing replaced
Rough Pump						X		Oil change by HP service
Mass Spectrometer							X	Clean
Gas Cylinder	X							Inspect - Change when pressure reads <500 psi.
Hard Drive		X						Archive
ATOMIC ABSORPTION								
Pump	X							check for leaks and corrosion
Lamps							X	If intensity drops, replace
Nebulizer		X						Clean, sonicate
Tubing	X							If leaking or weak, replace
Burner Head		X						Clean, sonicate
Bottled Gases	X							Replace if pressure reaches 500 psi.
Spray Chamber			X					Clean, sonicate
GAS CHROMATOGRAPH – VOLATILES								
Column							X	Replace
Septum			X					Replace
Gas Cylinder	X							Inspect - change when pressure reads <500 psi.
Hydrocarbon/Moisture Trap						X		Replace
GAS CHROMATOGRAPH - MASS SPEC VOLATILES								
Column							X	Replace
Rough Pump						X		Oil change by HP service
Gas Cylinder	X							Inspect - change when pressure reads <500 psi.
Septum			X					Replace
Transfer Line							X	Check for leaks
GAS CHROMATOGRAPH – ECD								
Autosampler	X					X		Syringe cleaned Needles and tubing replaced
Column							X	Replace
Septa							X	Replace
Glass Insert							X	Replace
Gold Disk							X	Replace
Gas Cylinder	X							Inspect - change when pressure reads <500 psi.
EC Detector(s)						X		Send off for replacement of radioactive nickel foil.
GAS CHROMATOGRAPH – FID								
Autosampler	X						X	Syringe and tubing cleaned Needles and tubing replaced
Column							X	Replace
Septa							X	Replace
Gas Cylinder								Inspect daily, change when pressure reads <500 psi.
Glow Plug								Determine if glow is enough to ignite Hydrogen

APPENDIX II

LABORATORY EQUIPMENT PREVENTIVE MAINTENANCE SCHEDULE

	Service Interval							
EQUIPMENT ITEM	D	W	M	Q	SA	A	AN	SERVICE LEVEL
Housing and chimney								Check for rust and corrosion that will cause a short, and clean if necessary.
Glass Insert							X	Replace
Column							X	Replace
PURGE AND TRAP								
Sorbent Trap					X			Change
Heater Pockets	X							Check, replace if defective
Transfer Lines							X	Inspect and replace if needed
Purge Flow					X			Inspect, adjust as needed
TCLP EQUIPMENT								
Volatile Rotator	X							Check rotation (± 30 rpms)
Semi-volatiles/Metals Rotator	X							Check rotation (± 30 rpms)
BALANCES								
Balances	X							Calibrate, service annually
Auto-Pipettors				X				Calibrate
BALANCE WEIGHTS – for daily balance checks								
Set "B" – 10 weights								Verified every 5 years by a body that can prove traceability to NIST
THERMOMETER (CERTIFIED) – for in-house thermometer calibrations								
HB #28199 (CMI #32478) –1 to 200ºC							X	Certified every 5 years by a body that can prove traceability to NIST
DISSOLVED OXYGEN METER								
Batteries	X							Check for strength, if < 13.20 replace
Membrane				X				Replace. Sooner if signal will not stabilize
Spill housing and stirrer	X							Clean

The service intervals listed in Appendix II are as follows: D = daily; W = weekly; M = monthly; Q = quarterly; SA = semi-annually; and AN = as needed.

APPENDIX III
LAB EQUIPMENT LIST

ID No.	Instrument	Type	Manufacturer	Model	Serial Number	Age
1000	MS-4	Auto Sampler	Varian	Archon	13405	1999
1001	MS-4	Sample Concentrator	OI Analytical	4560	J448460426	1999
1002	MS-4	GC	HP	6890	430021BJ4	1999
1003	MS-4	MS	HP	5973	US82311468	1999
1004	MS-5	Auto Sampler	Varian	Archon	12110	2001
1005	MS-5	Sample Concentrator	OI Analytical	4560	H413460123	2001
1695	MS-5	Sample Concentrator	OI Analytical	4660	D63646651P	2006
1006	MS-5	GC	Agilent	6850	US00001050	2001
1007	MS-5	MS	Agilent	5973	US94240080	2001
1008	MS-7	Auto Sampler	Varian	Archon	12999	1999
1009	MS-7	Sample Concentrator	OI Analytical	4560	D310211	1999
1838	MS-7	Sample Concentrator	OI Analytical	4660	D807466325P	2008
1010	MS-7	GC	Agilent	6850	US00001051	2001
1011	MS-7	MS	Agilent	5973	US94240092	2001
1012	MS-8	Auto Sampler	Varian	Archon	13322	2001
1013	MS-8	Sample Concentrator	Tekmar	3000	98259003	2000
1623	MS-8	Purge & Trap	OI Corporation	Eclipse 4660	D524466126P	2005
1014	MS-8	GC	Agilent	6850	US00001100	2001
1015	MS-8	MS	Agilent	5973	US94240107	2001
1020	GC-2	GC	HP	5890SII	3336A5502	1994
1021	GC-2	Auto Sampler	HP	18596M	3209A27907	1994
1022	GC-2	Tower	HP	18593B	3202A29321	1994
1023	GC-3	GC	HP	5890SII	3140A38355	1995
1024	GC-3	Auto Sampler	HP	18596M	3433A36260	1995
1025	GC-3	Tower	HP	18593B	3341A36564	1995
1026	GC-4	GC	HP	5890SII	302218A29420	1997
1027	GC-4	Autosampler	HP	18596B	3320A32113	1997
1028	GC-4	Tower	HP	18593B	3013A22544	1997
1029	GC-5	GC	HP	5890SII	3140A39201	1998
1030	GC-5	Auto Sampler	HP	18596B	3050A23709	1998
1031	GC-5	Tower	HP	G1513A	US81205611	1998
1643	GC-6	GC	HP	5890SII	3235A46102	1995
1644	GC-6	A Sampler Controller	HP	7673 / 18594B	3318A32045	1995
1645	GC-6	Tower	HP	7673 / 18593B	3442A40453	1995
1537	GC-7	Computer	Agilent	MXZ3460BJW	MXZ3460BJW	2004
1538	GC-7	GC (ECD)	Agilent	6890N	CN10427041	2004
1539	GC-7	Tower	Agilent	7683	CN42437159	2004
1032	MS-6	GC	HP	6890	US00021363	1999
1033	MS-6	MS	HP	5973	US80310957	1999
1034	MS-6	Auto Sampler	Agilent	G2614A	US00807551	1999
1035	MS-6	Tower	Agilent	G2613A	US00811878	1999
1036	MS-3	GC	HP	5890SII	336A55978	1995
1037	MS-3	MS	HP	5972A	3501A02369	1995
1038	MS-3	Auto Sampler	HP	18596B	3342A33508	1995
1039	MS-3	Tower	HP	18593B	3013A22290	1995
1040	HPLC-1	Degasser	HP	G1322A	JP73017078	1999
1041	HPLC-1	Quatpump	HP	G1311A	DE91606476	1999
1042	HPLC-1	ALS	HP	G1313A	DE91608580	1999

ID No.	Instrument	Type	Manufacturer	Model	Serial Number	Age
1043	HPLC-1	Colcom	HP	G1316A	DE91609970	1999
1044	HPLC-1	UV Detector	HP	G1314A	JP92108737	1999
1045	HPLC-1	Fluorescence Detector	Jasco	FP-920	D398 1892	1999
1046	HPLC-1	Interface	HP	35900E	CNDDQ1250	1999
1047	TOC-1	TOC Analyzer	Shimadzu	TOC5050A	36201577A	1999
1048	TOC-1	Auto Sampler	Shimadzu	ASI5000A	36N02328A	1999
1089	Balance 5	Top Loader	Denver Inst	AL500	B039416	2002
1090	Balance 3	Analytical	Denver Inst	XA100	17311	1998
1099	MIDI Distillation	Distillation	Lachat	1700	2000-419	2002
1100	Flash Point	Flash Point Analyzer	Precision Scientific	74537	BD-010	
1113	Lachat-1	Lachat	Lachat	RAS	8A1004-165	2002
1114	Lachat-1	Auto Analyzer	Lachat	QuikChem8000	A83000-1018	2002
1115		Reagent Pump	Lachat	1115	A82000-403	2002
1129		Concentrator	Zymark	TurboVap II	TV9909N8714	
1132		Flash Point Analyzer	Precision Scientific	74537	10AZ-4 393745-0012	
1137	O2	Bomb Calorimeter	Parr	13031	1422	1994
1139	Hot Block	COD Reactor	Hach	4500	960500014 152	2000
1153	Meter	Conductivity Meter	Orion	150	19462	2001
1148	FAA	AA	Varian	Spectra 220	EL97103119	1998
1149		Auto Sampler	Varian	SPS-5	94031199	1998
1153	Meter	Conductivity Meter	Orion	150	19462	2001
1171	ZHE #1	ZHE		N/A	N/A	
1172	ZHE #2	ZHE		N/A	N/A	
1173	ZHE #3	ZHE		N/A	N/A	
1174	ZHE #4	ZHE		N/A	N/A	
1175	ZHE #5	ZHE		N/A	N/A	
1176	ZHE #6	ZHE		N/A	N/A	
1177		Velometer	Alnor	Jr.	N/A	
1182	Balance 4	Analytical	Mettler	AE100-240	L39952	
1888		Concentrator	Zymark	TurboVap II	TV0116N10262	
1187	MS-9	GC	Agilent	6890N	US10133113	2000
1188	MS-9	MS	Agilent	5973	US10441238	2000
1189	MS-9	Auto Sampler	Agilent	G2614A	US12419350	2000
1210	MS-10	GC/MS	Agilent	5973	US82311282	1998
1211	MS-10	GC/MS	Agilent	6890	US00024777	1998
1212	MS-10	Autosampler	Agilent	7683	US84302879	2001
1217	TOC-2	TOC	Rosemount	DC-190	L9408399	2002
1218	TOC-2	Auto Sampler	Rosemount	183	9401165	2002
1221	FIMS	Auto Sampler	Perkin Elmer	AES-90		1999
1224	MS-11	Auto Sampler	Varian	Archon	12536	1999
1225	Autosampler	Auto Sampler	Varian	Archon	12535	
1226	MS-11	Sampler Concentrator	OI Corporation	4560	3515A10291	1999
1227	MS-11	GC	Agilent	5890	3336A56613	1994
1228	MS-11	MS	Agilent	5973	3435A01886	1994
1229	Concentrator	Concentrator	OI Corporation	4560	94284012	
1627	Spectrophotometer	Hach DR 3000	Hach	19600-00	900402416	1990
1248	ICP/MS-TJA	ICP/MS	Thermo Elemental	X-7	X0199	2002
1249	Autosampler	Autosampler	Cetas Technologies	510	120102 ASX	2002
1250	FAA (Hg)	Vapor Generator	Varian	VGA 77	95081021	

ID No.	Instrument	Type	Manufacturer	Model	Serial Number	Age
1251	ICP/MS-TJA	Chiller	Thermo NSLAB	M75	101365502-1	
1942	Balance 6	Toploader	Ohaus	G4000D	4303	1994
1265	Microscope	M2 LabScope	LW Scientific	LW 200	301473	
1472	Chromatography	Refrigerator	Forma Scientific	3791	786550420	
1473	Sterilizer (Autoclave)		Market Forge/Sterilmatic	STM-E	5185	
1502	Microscope	M2 LabScope	LW Scientific	LW 200	30H584	1998
1503	MS-12	5973	HP	5973	US81221559	2003
1504	MS-12	6890/GC	HP	6890	DE00020822	2003
1505	MS-12	Sample Concentrator	OI Corporation	4660	A350466159	2003
1620	MS-13	GC	Agilent	6850N	US10506012	2005
1621	MS-13	MS	Agilent	5973N	US52047399	2005
1622	MS-13	Autosampler	Varian	Archon	14371	2005
1602	MS-13	Purge Press/4660	OI Analytical	4660	B421466132P	2004
1624	MS-13	Computer	HP Compaq	HP Compaq	2UA5160HR7	2005
1625	MS-13	Monitor	HP 9500	HP 9500	CNC44205ZC	2005
1626	MS-13	Printer	HP Laser Jet 2420	HP Laser Jet 2420d	CNGK800775	2005
1506	Balance	Analytical	Sartorius	BP110	60804869	2003
1507	ICP-Varian	ICP-OES	Varian	VISTA-PRO	EL00123003	
1511	HotBlock (1)	Digestor	CPI	MOD	05C0530-0029	2000
1512	HotBlock (2)	Digestor	CPI	MOD	05C0530-0029	2001
1513	Block Digestor	BD-46 Block Digester	Lachat	BD-46	1 800 703	2002
1518	DO Meter	Diss. Oxygen Meter	YSI	SI 5100	04C371	2003
1519	Lachat-2	YXZ	Lachat	ASX-500 Series	A81010-774	2003
1520	Lachat-2	Autoanalyzer	Lachat	QuickChem FIA+ 800 Series	A8300-2107	2003
1521	Lachat-2	Reagent Pump	Lachat	RP-100Series		2003
1522	Autosampler	YXZ	Lachat	ASX-500 Series	A81010-774	
1523	Autosampler	Autosampler	Varian	SPS 5	EL00043932	
1596	Thermometer	NIST Traceable			HB/B 28199	
1597	Thermometer	NIST Traceable			NIST #1	
1598	Thermometer	NIST Traceable			NIST #2	
1609	IC2	ICS 1000 Ion Chrom. Sys	Dionex	ICS-1000	5010499	2005
1610	IC2	AS 40 Auto Sampler	Dionex		4100492	2005
1633	Tray Seater	Quanti Tray Seater Model 2X	Idexx Labs	89-10894-02	3953	2005
1635	Balance 11	Toploader	Mettler	P2210	962061	2000
1657	Digital Reactor Block	Digital Reactor Block 200	Hach	LTG082.99.42001	1147550	
1672	Plasma Asher	Vacuum Chamber	March Inst, Inc.	Plasmo D	1352	
1674	GC-8	GC-8	Agilent	6890N	CN 10609020	2006
1675	GC-8	Injector (Tower)	Agilent	7683B	CN603330862	2006
1676	GC-8	ALS Sampling Tray	Agilent	G2614A	CN60638448	2006
1691	Hot Block	Hot Block #4	Environmental Express	SC154	4110CEC1933	2006
1692	Hot Block	Hot Block #5	Environmental Express	SC154	4110CEC1929	2006
1700	Balance 12	Analytical	Mettler	AL104	1227330378	2006
1707	MS-14	MS	Inert	5975B	US62714424	2006
1708	MS-14	GC	Inert	6890 N	CN10631084	2006
1709	MS-14	Autosampler	Inert	7683B	CN63835818	2006
1714	Microscope	Vision Microscope	Lab Essentials, Inc.	Vision	505007	2006
1715	Microscope	Vision Microscope	Lab Essentials, Inc.	Vision	505019	2006

ID No.	Instrument	Type	Manufacturer	Model	Serial Number	Age
1716	Microscope	Vision Microscope	Lab Essentials, Inc.	Vision	505029	2006
1717	Balance 13	Analytical	Mettler	AL104	1227300041	2007
1722	Stage Micrometer		Microscope Service, Inc.	L & W		2005
1725	SPE-DEX Extractor	3 Place 'Oil & Grease Machine'	Horizon Tech	SPE 3000XL Plus-SS	07-2081	2007
1726	SPE-DEX Controller	3 Place SPE-DEX Controller	Horizon Tech	SPC-3000	07-1387	2007
1728	MS-15	GC	Agilent	6850A	US10710001	2007
1729	MS-15	MS	Agilent	5973 Inert	US44610842	2007
1730	MS-15	Purge & Trap	OI Corporation	Eclipse 4660	D713466088P	2007
1731	MS-15	Autosampler	Varian	Archon	15099	2007
1732	MS-15	Computer	HP Compaq	ESO	USV3400DTH	2007
1837	Microscope	Meiji PLM Asbestos Microscope	MilesCo Scientific	ML6130	600091	2008
1841	Balance 14	Analytical	Ohaus	AP3105	M52542	2003
1849	Hot Block	Hot Block	Environ. Express			2005
1850	Rotator	Tumbler	Dayton	Motor 5k939A		2005
1851	Rotator	Tumbler	Dayton	Motor 1LPP4		2005
1852	Muffle Furnace	Furnace	Ney	6-160A		1999
1853	Distillation Unit	P/N 483-B000-01	WestCo Sci	EASY DIST	1072	2008
1857	COD Reactor	30 position; 120V; 200Wt	Bioscience	100 003	COD-B0203	2008
1863	Waterbath	KD Concentration	VWR	Primary in Prep		
1889		Ultrasonic Convertor	Fisher Scientific	F550	F2420	2000
1890		Ultrasonic Convertor	Fisher Scientific	F550		2000
1893	Flow Meter	Hi Flow Sampler	Gilian	HFS 113A	3702	2001
1895	Waterbath	KD Concentration	Thermo Scientific	2843	208984	2009
1899	FIMS	Flow Injection Hg Sys	Perkin Elmer	FIMS 100	101S9121001	2009
1900	Turbovap II	Concentrator	Caliper Life Sci	103187	TV0953N15641	2010
1908	Incubator	Low Temperature	VWR	2020	100696	2010
1910	DO Meter	BOD Meter	YSI	500-115V	07H101424	2010
1921	MS-16	Autosampler	OI Corporation	4552	MS1003W023	2010
1922	Conductivity Probe	Conductivity Meter Probe	Orion	11510	Lot OX7-10019	2010
1924	MS-16	Sampler Concentrator	OI Corporation	4660	E008466762P	2010
1925	IC3	Ion Chromatograph	Dionex	ICS1500	1598656	2010
1926	Oven	Used for FOC	Ney	M-525	AKN 9238 166	1989
1930	MS-16	GC	Agilent	7820A	CN10202030	2010
1931	MS-16	MS	Agilent	5975	US10200403	2010
1934	Waterbath	Hexavalent Chromium	Lab Line	18007	0202-0011	2010
1936	Injector	Injector (Tower)	HP	18593B	3531A43472	2010
1950	UV Lamp		Spectroline	EA-160		2003
1955	MS-8	Autosampler	EST Centurion	Cents221031111	416080003183	2011
1957	Rotator	Tumbler	Dayton	Motor 1LPP4		2005
1967	ICP-Varian	Chiller	Lytron			2010
1974	pH Meter	pH Meter	Fisher Scientific	925	20400058	2002
1982	Centrifuge	Clinical	International Clinical	CL	AF0124	1997
1986	GC-3	Tower	HP	18593B	Motor # PJ5001W-17	1995
1987	ORP Probe	Oxidation-Reduction Potential	Accumet	Cat. 13-620-115	SN2362021P	2013
1988	ICP/MS-Agilent	ICPMS	Agilent	7700X Series (G3281A)	JP11391304	2013

ID No.	Instrument	Type	Manufacturer	Model	Serial Number	Age
1989	ICP/MS Autosampler	Auto Sampler	Agilent	ASX-500 Series (G3286A)	US10167A520	2013
1990	ICP/MS Chiller	Recirculating Chiller	Agilent	QC3292-80000 (G3292A)	3K10B1258	2013
1991	ICP/MS Vacuum Pump	ICPMS	Agilent / Edwards	G1833-81003 / A36324904	119496740	2013
1995	Deionized Water System	DI Water	ELGA	Centra-R200	CN200RL220228	2013
2003	Balance	Analytical	Mettler Toledo	AB104-S	1121311765	2003
2004	Balance	Toploader	Mettler Toledo	PM4800	M86379	2004
2005	Balance	Toploader	Mettler Toledo	S12000S	2644872	2005
2006	COD Reactor	Block	HACH	Part #45600-00	9.512E+11	2002
2017	COD Reactor	Hot Block	HACH	45600-00	1030021841	2000
2018	Oven	Drying	Quincy Labs	10GC	NG1-009030	2011
2020	Hot Block	Hot Block	Env. Express	SC154	8826CECWC789	2013
2021	Simple Dist #1	Distillation Apparatus	Env. Express	C6000	N/A	2013
2022	Simple Dist #2	Distillation Apparatus	Env. Express	C6000	N/A	2013
2025	Waterbath	KD Concentration	Thermoscientific	2843	208983-244	2013
2026	Waterbath	KD Concentration	VWR	1245	1101101	2013
2027	Walk-in Cooler #2	Cooler	Trenton	CS18K6ETF5256/T EHA030E6HT3BB	13GCE793M/130 311991T	2013
2029	Waterbath	Waterbath	Lab Line	N/A	N/A	2013
2036	Volatiles Cooler	Walk-in	Commercial Refrigeration	4G3	5605266	2000
2057	INCUBATOR 2	Oven	Fisher Scientific	655G	N/A	2002
2060	Electron Microscope	TEM	Philips	EM-420	943206007001	1985
2061	Water Chiller	for TEM lab	Haskris	R075	HA0058	1990
2064	pH Probe	pH Meter Probe	Orion-Thermo Scientific	Cat. 9102BNWP	Lot #SX1	2014
2065	Balance	Analytical	Fisher	Item # ALF64	N0588330030008P	2010
2067	Balance	Analytical	Mettler	AE160	0578	2002
2068	Chiller	Neslab	Thermo Scientific	ThermoFlex2500	0110975101140313	2014
2069	Lachat-3	Quick Chem QC8500	Lachat	Series 2	140600001703	2014
2070	Reagent Pump	RP-1500	Lachat	SM1135	549285-2	2014
2085	Sonicator	EDP No. 100-132-1640R	Fisher	500	BCK08014450A	2008
2086	Hach Incutrol	115v, 60Hz		2150	1752	2014
2087	Incubator	Kenmore		253.2274241	WB43851388	2014
2088	Waterbath	for Liquid Liquid	Thermo Electric	2866	201405	2008
2090	Vacuum Manifold	for Oil & Grease	UCT	cat. # ECUCTVAC6		2013
2091	Sonicator	Output 550watt	Fisher	F500	F1657	2008
2092	MS-17	GC	Agilent	7890B	CN14403051	2014
2093	MS-17	MS	Agilent	5977A	US1441M401	2014
2100	Turbidity Meter	Turbidimeter	Lovibond	Lot# 7374	3078	2014
2101	MS-17	Cleaning Module	Entech	3100D	1687	2014
2102	MS-17	Oven	Entech	09-0V6L-12	0135	2014
2103	MS-17	Diluter	Entech	4700	0026	2014
2104	MS-17	Concentrator	Entech	7200	1217	2014
2105	MS-17	Autosampler	Entech	7650	0025	2014
2106	pH Probe	pH Meter Probe	Thermo Scientific	Cat. 10010-778	Lot # SS1-16273	2014
2107	pH Probe	pH Meter Probe	Thermo Scientific	Cat. 10010-778	Lot # SS1-16288	2014

ID No.	Instrument	Type	Manufacturer	Model	Serial Number	Age
2108	GC-9	GC	Agilent	7890B (G3440B)	CN14483265	2015
2109	GC-9	Auto Sampler Tray	Agilent	7693 (G4514A)	CN14380119	2015
2110	GC-9	Tower	Agilent	7693 (G4513A)	CN14490172	2015
2111	GC-9	ECD (Front)	Agilent	G2397A	U26039	2015
2112	GC-9	ECD (Back)	Agilent	G2397A	U26040	2015
2114	IC Autosampler	Automated Sampler	Dionex	AS40-1	96040432	1999
2119	Solvent Rec Inst.	Solvent Capture	Savant	RVT100	NA	2008
2120	MS-13	Autosampler	Centurion		CentW502100614	2014
2121	Burn Mold	Burn Mold	Associated Design	MOLD-173		2015
2122	Thermocouple	Thermometer	Cole Parmer/David Inst.	Easy View 11A Type K	131102916	2015
2124	Fridge # 2087	Temp. Controller	Digi-Sense	UX-94460-45	140638590	2015
2125	Fume Hood	Air Velocity Meter	Dwyer Instruments	660	660 Series	2014
2126	ZHE Vessel #7	ZHE Extractor	Millipore	ZHE		2014
2127	ZHE Vessel #8	ZHE Extractor	Millipore	ZHE		2014
2128	ZHE Vessel #9	ZHE Extractor	Millipore	ZHE		2014
2129	ZHE Vessel #10	ZHE Extractor	Millipore	ZHE		2014
2130	Hydrogen Generator	Whatman	Parker Balston	75-32		2013
2131	GC-9	ECD Cell	Agilent	G2397-60610	U25762	2015
2132	Chiller	Chiller	Polyscienece	N0772026	106500740	2015
2141	Incutrol 2 Regulator	BOD Incubator	HACH	2597A	961000010041	2015
2143	Zero Air Generator	FID	Whatman	76-803	76-803	2013
2145	Incutrol 2 Regulator	BOD Incubator	HACH	2597-00	9.304E+11	2015
2146	Zero Air Generator	FID	Whatman	76-830	E1523	2013
2147	Heating Unit	Smart Distillation Unit	WestCo	483-B000-01	1234	2015
2148	ICP-OES	ICP-OES	Agilent	5100	MY15120005	2015
2149	Auto Sampler	CETAC	CETAC	ASX-520	011552A520	2015
2150	Chiller	Recirculating	Agilent	G8481-80001	1A1531347	2015
2151	Computer	Workstation	HP	Z230	2UA4502RMP	2015
2156	Auto Sampler	Sample Prep System	Varian	SPS 5	EL 02056309	2010
2157	Vacuum Manifold	PVC	Adventec / MFS, Inc.	KMP3	313400	2015
2158	Oven	Drying	Quincy Lab, Inc.	S430`5	G4-007992	2015
2159	Vacuum Pump	Used for TSS & TDS	Welch Thomas	28552-50	EF0011164	2010
2165	Oven	Drying Oven	Quincy Labs, Inc.	GC Series S43015	G4-008013	2015
2168	Refrigerator	4.6 cu ft	HAIER Beverage	ZHBCN05FVS	1503000143	2015
2172	BOD Analyzer	BOD Auto EZ	Thermo Scientific	10060020 BODAUTOEZ	A0128	2015
2173	GC-10	6890 GC System	HP	G1530A	US00006903	2015
2174	GC-10	GC Auto-Sampler Controller	HP	G1512A	US70300684	2015
2175	GC-10	6890 ALS Tray	HP	18596C	4570100464	2015
2176	GC-10	7673 GC/SFC Injector	HP	18593B	3250A33325	2015
2177	GC-10	6890 Injector	HP	G15130	USZ0300Z10	2015
2178	GC-10	6890 Injector	HP	18593B	3042A23879	2015
2191	TKN Block Digestor	Block	Environmental Express	TKN100	2015TKNBC105	2015
2192	Carbon Coater	Vacuum Evaporator	SPI	Vacu-Prep II	None	1992
2193	Carbon Coater	Vacuum Evaporator	Akashi	VEF	2007	1973
2194	Data Logger	Wireless (Cat# 15060194)	Fisher	RF200A Series	P69076	2015
2195	Incubator	Refrigerator like	Thermo Scientific	815	300033500	2015

ID No.	Instrument	Type	Manufacturer	Model	Serial Number	Age
2196	Zero Air Generator	Zero Air Generator for FID Makeup gas	Peak Scientific	Precision Zero Air 3500cc	ZA15-09-457	2015
2208	Balance	Toploader	Sartorius	U6100	36040268	2015
2217	pH Probe	pH Meter Probe	Thermo Scientific	Cat. 10010-778	Lot # TO1-16409	2015
2218	pH Probe	pH Meter Probe	Thermo Scientific	Cat. 10010-778	Lot # TO1-16402	2015
2221	Oven	180L Ovn Gravity	Fisher	151030521	41880516	2016
2224	Portable Hood	5000C	Captair	CSA: LR 43145	13502	2016
2225	Oven	180L Ovn Grvty	Fisher	151030521	41921243	2016
2233	Spectrophotometer		Hach	DR3900	1669679	2016
2237	pH Meter	Benchtop	Thermo Electron	Orion 3 Star	S/N 008172	2007
2238	pH Meter	Benchtop	Thermo Electron	Orion 3 Star	S/N B38810	2011
2240	pH Meter	Benchtop	Orion	520A	S/N 005618	1992
2242	pH Meter	Benchtop	Orion	520A	S/N 038734	1998
2243	pH Meter	Benchtop	Orion	520A	S/N 008368	1993
2244	Zero Air Generator	Zero Air Generator for FID Makeup gas	VWR / Whatman	26000-020/ 76-803	S/N ZA10000190	2013
2245	Refrigerator	Small	Danby	DAR044A5BSLDD	4316053020234	2016
2246	Auto Sampler	for Lachat	Cetac Technologies	ASX-520	070570A520	2011
2247	Dilutor	for Lachat	Lachat	PDS 200	50700000344	2011
2248	Balance	BasBal	Mettler	BB1200	L96139	2005
2249	Balance	Precision Advanced	OHAUS	GT 4100	8709	2007
2250	Balance	Research	Sartorius	R200D	60095	2000
2254	Sonicator	Water Bath	Bransonic	5510E-MT	ENA070028318F	2007
2255	Sonicator	Dismembrator	Fisher Scientific	F550	F1808	2008
2257	Spectrophotometer	SPEC-5	Shimadzu	UV-1601	A10753782917	2016
2258	Vacuum Pump	Oil-Less Diaphragm	GAST	DAA-V716-EB	307612306	1996
2259	Refrigerator		Fisher Scientific	97-920-1	1422090216371	2009
2260	Freezer		VWR (Sanyo)	HF 5017	80701743	2009
2261	MS-7	Autosampler	Centurion	M/S	462071416	2016
2265	Vacuum Pump	Oil-Less Centrifical	GAST	5KH36KNA510X	E16750339	2016
2281	Timer	Traceable Calibration	Control company	5025	160613001	2016
2282	Turbidimeter	White Light/Tungsten Lamp	Lovibond	194200	3463	2016
2283	Freezer	Chest	Magic Chef	MCUF3W2	1607000632	2016
2285	GC-11	7890B GC System	Agilent	G3440B	CN16473170	2016
2286	GC-11	7890B ALS Tray	Agilent	G4567A	CN15030021	2016
2287	pH Probe	Orion-4 (for Alkalinity)	Thermo Scientific	Orion 9102BNWP	9102SC	2017
2288	pH Probe	Glass	Thermo Scientific	Orion 910	QR1-12852	2002
2291	TOC Analyzer	TOC-3	Shimadzu	TOC-L CPN	H54315432055 CS	2017
2292	TOC Autosampler	40 mL	Shimadzu	ASI-L	H57415401560 SA	2017
2293	Mercury Analyzer	Soil Combustion	Nippon	MS-3000	15740318	2017
2294	Reagent Module		Nippon	RD-3	13420832	2017
2295	Liquid Sampler	Autosampler	Nippon	SC-3	13410578	2017
2296	Hg Analyzer	CVAA	Nippon	RA-4500	15780180	2017
2297	Hygrometer	Digital	Fisher	11-661-12	170254699	2017
2298	MS-18	GC	Agilent	7890B GC	CN15173094	2017
2299	MS-18	MS	Agilent	5977B MSD	US1715M029	2017
2300	MS-18	Autosampler	Agilent	ALS	CN15250014	2017
2301	MS-18	vacuum pump	Pfeiffer	DUO2.5	22032890	2017

ID No.	Instrument	Type	Manufacturer	Model	Serial Number	Age
2302	Station 1	PLM Hood	Plexiglass	with Hepa-Filter		2017
2303	Station 2	PLM Hood	Plexiglass	with Hepa-Filter		2017
2304	Station 3	PLM Hood	Plexiglass	with Hepa-Filter		2017
2305	Station 4	PLM Hood	Plexiglass	with Hepa-Filter		2017
2306	Thermoanemometer	Velometer	Extech	AN300	Z350828	2017
2307	Vulcan Digestor	Automated Hot Block	Questron Technologies	V84-P	VU17-1027-V1.1.1	2017
2309	FAA	240 AA	Agilent	G8431A	MY17220002	2017
2310	FAA Autosampler	SPS 4	Agilent	G8410A	AU17112735	2017
2311	Soil TOC Analyzer	Soil Analyzer	Shimadzu	SSM-5000A	H52735400079 NK	2017
2312	Vacuum Manifold	for Oil & Grease	Advantec/MFS, Inc.	KMP6	Cat. #313600 (No. 1)	2017
2313	Vacuum Manifold	for Oil & Grease	Advantec/MFS, Inc.	KMP6	Cat. #313600 (No. 2)	2017
2314	Vacuum Manifold	for Oil & Grease	Advantec/MFS, Inc.	KMP6	Cat. #313600 (No. 3)	2017
2318	Centrifuge	Clinical	IEC		42832385	2017
2320	MS-4	Purge & Trap	EST Analytical	Evolution	EV806012517	2017
2321	MS-11	Purge & Trap	EST Analytical	Evolution	EV850061517	2017
2322	MS-15	Autosampler	EST Analytical	Centurion	CENTW597072017	2017
2325	Thermometer	Traceable IR Gun	Fisher	15-077-968 11759785	170508165	2017
2326	Hot Plate	Stable Temp	Cole-Parmer	03405-31	C10300270516330003	2017
2327	Shaker	Reciprocal Benchtop	Berbach	6010	030303	2017
2332	Balance	Analytical	U.S. Solid	USS-DBS5	USS-DBS1709029	2017
2333	pH Probe	Glass	Thermo Scientific	Orion 9104BNWP	UT1-17346	2017
2334	Evaporator	Speed Vap	Horizon Technology	Speed Vap IV	17-0109	2017
2339	Zero Air Generator	3500cc	Peak Scientific	Zero Air 3500cc	770004350	2017
2340	Nitrogen Generator	600cc	Peak Scientific	N2 Trace 600cc	770004363	2017
2341	C'prssd Air Generator	Compressed	Peak Scientific	Precision Air	770004231	2017
2342	Vacuum Manifold	for Oil & Grease	UCT	cat. # ECUCTVAC6		2017
2343	Vacuum Manifold	for Oil & Grease	UCT	cat. # ECUCTVAC6		2017
2344	Vacuum Manifold	for Oil & Grease	UCT	cat. # ECUCTVAC6		2017
2345	Hydrogen Generator	Precision	Peak Scientific	H2 Trace 500 cc	000000000770005503	2017
2346	Pipettor	Adjustable, 1-10 mL	Oxford	Benchmate II	A86010041	2017
2350	MS-19	GC	Agilent	7820A	CN1723204	2017
2351	MS-19	MS	Agilent	5977B MSD	US1741R002	2017
2358	pH Probe	Glass	Thermo Scientific	9157BN		2017
2359	ICP/MS	7900	Agilent	G8403A	JP17281926	2017
2360	ICP/MS Autosampler	SPS 4	Agilent	G8410A	AU17092619	2017
2362	Hotblock	Digital Reactor Block	Hach	DRB 200	17120C0305	2017
2363	Energy Disp. Spect.	EDAX (TEM Detector)	EDAX (Amtek)	Octane-T-Plus	5480	2018
2364	High Vac. Evaporator	Carbon Coater	Denton	DV-502A	19664	2018
2366	Pipettor	Adjustable, 1-10 mL	Oxford	Benchmate II	A7Z018771	2018
2367	Microwave Extractor	Ethox X	Milestone	49380	17122726	2018
2368	Discrete Analyzer	rAPID-T	Astoria-Pacific	4600	4660-1046	2018
2373	pH Meter	probe	Fisher Scientific	accumet AE150	ae95002608	2018
2374	Hotblock		Andrews Glass Co.	110-10-REG	A6Y0709	2018
2375	Oxygen Probe	BOD Probe	YSI	5010		2018
2380	Discrete Analyzer	rAPID-T	Astoria-Pacific	4600	4660-1053	2018
2381	Balance	Analytical	U.S. Solid	USS-DBS5	USS-DBS1803053	2018
2382	Balance	Analytical	U.S. Solid	USS-DBS5	USS-DBS1803045	2018

ID No.	Instrument	Type	Manufacturer	Model	Serial Number	Age
2395	Vulcan Metals Digestor	Automated Hot Block	Questron Technologies	V42P	VU18-1005-V1.1.1	2018
2396	Water Bath	Incubator Water Bath	Thermo Scientific	TSCOL35	300209073	2018
2397	Hg Digest Analyzer	CVAA	Nippon	RA-4500	17780287	2018
2398	Flashpoint	Pensky Marten	Stanhope-Seta	35000-0 U	1053813	2018
2400	ICP-OES	ICP-OES	Agilent	5100	MY15500001	2018
2401	Auto Sampler	CETAC	CETAC	ASX-520	101525A520	2018
2402	Chiller	Recirculating	Agilent	G8481A	1805-01431	2018
2407	pH Probe	Glass	Thermo Scientific	9102BNWP	WV1-16437	2018
2408	pH Probe	Glass	Thermo Scientific	9102BNWP	WV1-16423	2018
2409	Refrigerator	Designer	Danby	DAR110AWDD	4318043139922	2018
2410	Pump	Variable Flow Pump	Thomas Scientific	7886M14	181498834	2018
2420	Refrigerator	Free Standing	Danby	DAR110A1WDD	4318043139948	2018
2421	MS-17	Concentrator	Entech	7200CTS	1595	2018
2434	HPLC-1	ALS	HP	G1313A	DE65102508	2018
2438	Refrigerator	Free Standing	Dansby	DAR110A1WDD	4318063142040	2018
2439	Auto Titrator		Thermo Scientific	T910	T10147	2018
2440	ATC Probe		Thermo Scientific	927007MD		2018
2441	Ultra pH Electrode	ROSS	Thermo Scientific	8102BNUWP		2018
2442	Sonicator	Dismembrator	Fisher Scientific	F550	F1768	2018
2444	pH Meter	Digital Unit	Thermo Scientific	VSTAR10	V13409	2018
2445	pH Meter Module		Thermo Scientific	VSTAR-PH	VA18803	2018
2446	pH Electrode	Glass	Thermo Scientific	8302BNUMD	WR3	2018
2450	Waterbath	KD Concentration	Fisher Scientific	FSGPD20	300207609	2018
2452	ICP/MS	7900	Agilent	7900	SG1804244	2018
2453	Pump	Recirculating	VWR Scientific	1170	612206	2018
2454	Autosampler		OI Analytical	4100 Processor	D833410620	2018
2455	Purge/Trap Conc.		OI Analytical	4760 Eclipse	A832447935	2018
2458	Microscope	PLM Stereomicroscope	LW Scientific	Z4 Zoom	Z4H-BSF7-77SE	2018
2459	GC-12	6850A GC System	Agilent	6850A	US10540009	2018
2460	GC-12	6850A ALS Tray	Agilent	G2880A	CN53821085	2018
2462	Spectrophotometer		Thermo Scientific	Genesys 30	9A1W264118	2018
2463	Ultra pH Probe	ROSS	Orion	8102NUWP		2018
2464	Turbovap II		Zymark		04373	2018
2469	GC-14	6850A GC System	Agilent	6850A	US10406012	2018
2470	GC-14	6850 Autosampler	Agilent	6850 (G2880A)	CN14520114	2018
2471	pH Probe	Glass	Thermo Scientific Orion	8104BNUWP	XZ3-15334	2018
2472	Centrifuge		Intern'l Equiptment Co	Model CL	428-18881	2018
2473	Vacuum Manifold	for Oil & Grease	UCT	cat. # ECUCTVAC6		2018
2474	Vacuum Manifold	for Oil & Grease	UCT	cat. # ECUCTVAC6		2018
2475	Vacuum Manifold	for Oil & Grease	UCT	cat. # ECUCTVAC6		2018
2476	Vacuum Manifold	for Oil & Grease	UCT	cat. # ECUCTVAC6		2018
2477	Vacuum Manifold	For TSS-1	Advantec/ MFS, Inc.	KMP6		2018
2478	Vacuum Manifold	For TSS-1	Advantec/ MFS, Inc.	KMP6		2018
2479	Vacuum Manifold	For TSS-1	Advantec/ MFS, Inc.	KMP6		2018
2480	Vacuum Manifold	For TSS-1	Advantec/ MFS, Inc.	KMP6		2018
2481	Vacuum Manifold	For TSS-1	Advantec/ MFS, Inc.	KMP6		

APPENDIX IV - Chain of Custody

ANALYTICAL ENVIRONMENTAL SERVICES, INC.
3080 Presidential Drive Atlanta, GA 30340-3704
Phone: (770) 457-8177 / Toll-Free: (800) 972-4889 / Fax: (770) 457-8188

CHAIN OF CUSTODY

Work Order: _____

Date: _____ Page _____ of _____

COMPANY:	ADDRESS:
PHONE:	EMAIL:
SAMPLED BY:	SIGNATURE:

ANALYSIS REQUESTED

Visit our website www.aesatlanta.com for downloadable COCs and to log in to your AESAccess account.

#	SAMPLE ID	SAMPLED: DATE	SAMPLED: TIME	GRAB	COMPOSITE	MATRIX (see codes)	PRESERVATION (see codes)	REMARKS	Number of Containers
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									

RELINQUISHED BY: DATE/TIME:	RECEIVED BY: DATE/TIME:
1.	1.
2.	2.
3.	3.

SPECIAL INSTRUCTIONS/COMMENTS:

SHIPMENT METHOD

OUT: / / VIA:

IN: / / VIA:

client FedEx UPS US mail courier

other: _____

PROJECT INFORMATION

PROJECT NAME:

PROJECT #:

SITE ADDRESS:

SEND REPORT TO:

INVOICE TO (IF DIFFERENT FROM ABOVE):

QUOTE #:_____ PO#:_____

RECEIPT

Total # of Containers

Turnaround Time (TAT) Request

- ☐ Standard
- ☐ 2 Business Day Rush
- ☐ Next Business Day Rush
- ☐ Same-Day Rush **(auth req.)**
- ☐ Other _____

STATE PROGRAM (if any): _____

E-mail? ☐ Fax? ☐

DATA PACKAGE: I ○ II ○ III ○ IV ○

Submission of samples to the laboratory constitutes acceptance of AES's Terms & Conditions. Client assumes sole responsibility for damage or loss of samples before we accept them. Samples received after 3PM or on Saturday are considered as received the following business day. If no TAT is marked on COC, AES will proceed with standard TAT. Samples are disposed of 30 days after completion of report unless other arrangements are made.

Matrix Codes: A = Air GW = Groundwater SE = Sediment SO = Soil SW = Surface Water ST=Stormwater WW = Waste Water W = Water (Blanks) DW = Drinking Water (Blanks) O = Other (specify)

Preservative Codes: H+I = Hydrochloric acid + ice I = Ice only N = Nitric acid S+I = Sulfuric acid + ice S/M+I = Sodium Bisulfate/Methanol + ice O = Other (specify) NA = None

7.11.18_CO

White Copy - Original; Yellow Copy - Client

ANALYTICAL ENVIRONMENTAL SERVICES, INC.
3080 Presidential Drive, Atlanta, GA 30340-3704
Tel.: (770) 457-8177 (800) 972-4889
www.aesatlanta.com

CHAIN OF CUSTODY FORM FOR AIR SAMPLE ANALYSIS

Client Name: _____ Contact: _____ Project Name/# : _____
Address: _____ Phone: _____ Samplers Name: _____
_____ Fax: _____ Sampling Date: _____

SAMPLE ID	SAMPLE DESCRIPTION (e.g. Locations, Name, etc)	PUMP NUMBER	TIME		FLOW RATE (L/min)			VOLUME (L)	ANALYSIS REQUESTED/REMARKS
			START	END	INITIAL	FINAL	AVG		

Turnaround Time: Normal (5 days): ☐ 3 Days Rush: ☐ 2 Days Rush: ☐ Next Day Rush: ☐

Comments: _____

Relinquished By:		Date/Time	
Received By:		Date/Time	
Relinquished By:		Date/Time	
Received By:		Date/Time	

Delivered Direct to Lab: ☐ Shipped: ☐
Method of Shipment: _____
Lab Recipient: _____
Date: _____

SAMPLES RECEIVED AFTER 3PM OR SATURDAY ARE CONSIDERED AS RECEIVED ON THE FOLLOWING BUSINESS DAY; IF NO TAT IS MARKED ON COC AES WILL PROCEED AS STANDARD TAT.

ANALYTICAL ENVIRONMENTAL SERVICES, INC.
AES

Analytical Environmental Services, Inc.
3080 Presidential Drive Atlanta, GA 30340-3704
Phone: (770) 457-8177 / Toll-Free: (800) 972-4889 / Fax: (770) 457-8188

Work Order: _____

Page ____ of ____

CHAIN OF CUSTODY
BULK ASBESTOS ANALYSIS

Client Name: _____
Address: _____
City, State, Zip: _____
Contact: _____
Sampler's Name: _____
Report To: _____
Report To Email(s): _____

Project Name: _____
Project Number: _____
Sampling Date: _____
Phone #: _____
Invoice To: _____
Invoice To Email(s): _____
PO #: _____

	Sample ID	Sample Location/Description	Analysis Requested	Turnaround Time (TAT)	Comments
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

Relinquished by: _____ Date/Time: _____
Received by: _____ Date/Time: _____
Relinquished by: _____ Date/Time: _____
Received by: _____ Date/Time: _____

Submission of samples to the laboratory constitutes acceptance of AES's Terms & Conditions. Client assumes sole responsibility for damage or loss of samples before we accept them. Samples received after 3PM or on Saturday are considered as received the following business day. If no TAT is marked on COC, AES will proceed with standard TAT.

FOR LAB USE ONLY

Lab Recipient: _____ Date/Time: _____ Method of Shipment: _____

ANALYTICAL ENVIRONMENTAL SERVICES, INC
3080 Presidential Drive, Atlanta GA 30340-3704
TEL.: (770) 457-8177 / TOLL-FREE (800) 972-4889 / FAX: (770) 457-8188

VAPOR/AIR CHAIN OF CUSTODY

Work Order #: _____

Page ___ of ___

Company:	Address:	Bottle Order #:	Turnaround Time (Circle One): Standard 3 Day Rush 2 Day Rush Other
Phone:	Fax:		
Sampled by:	Signature:		

#	Sample ID	Sample Start Date	Sample Start Time (24hr)	Sample Finish Date	Sample Finish Time (24 hr)	Sample Matrix*	Canister Serial #	Flow Controller ID	Canister Pressure In Field ("Hg) Start	Canister Pressure In Field ("Hg) Stop	ANALYSIS REQUESTED TO-15							Remarks
1																		
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		

SPECIAL INSTRUCTIONS/COMMENTS:	RELINQUISHED BY: DATE/TIME:	RECEIVED BY: DATE/TIME:	PROJECT INFORMATION
If specialized list is required, list analytes here:	1:	1:	PROJECT NAME:
	2:	2:	PROJECT #:
	3:	3:	SITE ADDRESS:
	SHIPMENT METHOD OUT / / VIA: IN / / VIA: CLIENT FedEx UPS MAIL COURIER GREYHOUND OTHER_____		SEND REPORT TO: INVOICE TO: (IF DIFFERENT FROM ABOVE) PO#: STATE PROGRAM (if any): _____ E-mail? Y / N Fax? Y / N QUOTE #:_____ DATA PACKAGE: I II III IV

SAMPLES RECEIVED AFTER 3PM OR SATURDAY ARE CONSIDERED AS RECEIVED ON THE NEXT BUSINESS DAY; IF NO TAT IS MARKED ON COC, AES WILL PROCEED AS STANDARD TAT.
Visit our website www.aesatlanta.com to check on the status of your results, place bottle orders, etc.

*SAMPLE MATRIX: IA = Indoor Air AA = Ambient Air SS = Subslab SV = Soil Vapor O = Other (specify)

AES, Inc., assumes no liability with respect to the collection and shipment of these samples.

White Copy - Original; Blue Copy - Client

APPENDIX V

determine if the field or sample transporting procedures and environments have contaminated the sample.

GC—Gas chromatograph or gas chromatography.

Internal standard—A compound added to an extract or standard solution in a known amount and used as a reference for quantitation of the analytes of interest and surrogates. In this method the internal standards are stable isotopically labeled analogs of selected method analytes (Table 8). Also see Internal standard quantitation.

Internal standard quantitation—A means of determining the concentration of an analyte of interest (Tables 1–3) by reference to a compound not expected to be found in a sample.

DOC—Initial demonstration of capability (section 8.2); four aliquots of reagent water spiked with the analytes of interest and analyzed to establish the ability of the laboratory to generate acceptable precision and recovery. A DOC is performed prior to the first time this method is used and any time the method or instrumentation is modified.

Laboratory Control Sample (LCS; laboratory fortified blank; section 8.4)—An aliquot of reagent water spiked with known quantities of the analytes of interest and surrogates. The LCS is analyzed exactly like a sample. Its purpose is to assure that the results produced by the laboratory remain within the limits specified in this method for precision and recovery.

Laboratory fortified sample matrix—See Matrix spike.

Laboratory reagent blank—A blank run on laboratory reagents; *e.g.,* methylene chloride (section 11.1.5).

Matrix spike (MS) and matrix spike duplicate (MSD) (laboratory fortified sample matrix and duplicate)—Two aliquots of an environmental sample to which known quantities of the analytes of interest and surrogates are added in the laboratory. The MS/MSD are prepared and analyzed exactly like a field sample. Their purpose is to quantify any additional bias and imprecision caused by the sample matrix. The background concentrations of the analytes in the sample matrix must be determined in a separate aliquot and the measured values in the MS/MSD corrected for background concentrations.

May—This action, activity, or procedural step is neither required nor prohibited.

May not—This action, activity, or procedural step is prohibited.

Method blank—See blank.

Method detection limit (MDL)—A detection limit determined by the procedure at 40 CFR part 136, appendix B. The MDLs determined by EPA in the original version of the method are listed in Tables 1, 2 and 3. As noted in section 1.5, use the MDLs in Tables 1, 2, and 3 in conjunction with current MDL data from the laboratory actually analyzing samples to assess the sensitivity of this procedure relative to project objectives and regulatory requirements (where applicable).

Minimum level (ML)—The term ''minimum level'' refers to either the sample concentration equivalent to the lowest calibration point in a method or a multiple of the method detection limit (MDL), whichever is higher. Minimum levels may be obtained in several ways: They may be published in a method; they may be based on the lowest acceptable calibration point used by a laboratory; or they may be calculated by multiplying the MDL in a method, or the MDL determined by a laboratory, by a factor of 3. For the purposes of NPDES compliance monitoring, EPA considers the following terms to be synonymous: ''quantitation limit,'' ''reporting limit,'' and ''minimum level.''

MS—Mass spectrometer or mass spectrometry, or matrix spike (a QC sample type).

MSD—Matrix spike duplicate (a QC sample type).

Must—This action, activity, or procedural step is required.

m/z—The ratio of the mass of an ion (m) detected in the mass spectrometer to the charge (z) of that ion.

Preparation blank—See blank.

Quality control check sample (QCS)—See Laboratory Control Sample.

Reagent water—Water demonstrated to be free from the analytes of interest and potentially interfering substances at the MDLs for the analytes in this method.

Regulatory compliance limit (or regulatory concentration limit)—A limit on the concentration or amount of a pollutant or contaminant specified in a nationwide standard, in a permit, or otherwise established by a regulatory/control authority.

Relative retention time (RRT)—The ratio of the retention time of an analyte to the retention time of its associated internal standard. RRT compensates for small changes in the GC temperature program that can affect the absolute retention times of the analyte and internal standard. RRT is a unitless quantity.

Relative standard deviation (RSD)—The standard deviation times 100 divided by the mean. Also termed ''coefficient of variation.''

RF—Response factor. See section 7.2.2.

RSD—See relative standard deviation.

Safety Data Sheet (SDS)—Written information on a chemical's toxicity, health hazards, physical properties, fire, and reactivity, including storage, spill, and handling precautions that meet the requirements of OSHA, 29 CFR 1910.1200(g) and appendix D to § 1910.1200. United Nations Globally Harmonized System of Classification and Labelling of Chemicals (GHS), third revised edition, United Nations, 2009.

Selected Ion Monitoring (SIM)—An MS technique in which a few m/z's are monitored. When used with gas chromatography, the m/z's monitored are usually changed periodically throughout the chromatographic run, to correlate with the characteristic m/z's of the analytes, surrogates, and internal standards as they elute from the chromatographic column. The technique is often used to increase sensitivity and minimize interferences.

Signal-to-noise ratio (S/N)—The height of the signal as measured from the mean (average) of the noise to the peak maximum divided by the width of the noise.

Should—This action, activity, or procedural step is suggested but not required.

SPE—Solid-phase extraction; an extraction technique in which an analyte is extracted from an aqueous solution by passage over or through a material capable of reversibly adsorbing the analyte. Also termed liquid-solid extraction.

Stock solution—A solution containing an analyte that is prepared using a reference material traceable to EPA, the National Institute of Science and Technology (NIST), or a source that will attest to the purity, authenticity, and concentration of the standard.

Surrogate—A compound unlikely to be found in a sample, and which is spiked into sample in a known amount before extraction or other processing, and is quantitated with the same procedures used to quantify other sample components. The purpose of the surrogate is to monitor method performance with each sample.

* * * * *

■ 9. Appendix B to part 136 is revised to read as follows:

Appendix B to Part 136—Definition and Procedure for the Determination of the Method Detection Limit—Revision 2

Definition

The method detection limit (MDL) is defined as the minimum measured concentration of a substance that can be reported with 99% confidence that the measured concentration is distinguishable from method blank results.

I. Scope and Application

(1) The MDL procedure is designed to be a straightforward technique for estimation of the detection limit for a broad variety of physical and chemical methods. The procedure requires a complete, specific, and well-defined analytical method. It is essential that all sample processing steps used by the laboratory be included in the determination of the method detection limit.

(2) The MDL procedure is *not* applicable to methods that do not produce results with a continuous distribution, such as, but not limited to, methods for whole effluent toxicity, presence/absence methods, and microbiological methods that involve counting colonies. The MDL procedure also is *not* applicable to measurements such as, but not limited to, biochemical oxygen demand, color, pH, specific conductance, many titration methods, and any method where low-level spiked samples cannot be prepared. Except as described in the addendum, for the purposes of this procedure, ''spiked samples'' are prepared from a clean reference matrix, such as reagent water, spiked with a known and consistent quantity of the analyte. MDL determinations using spiked samples may not be appropriate for all gravimetric methods (*e.g.,* residue or total suspended solids), but an MDL based on method blanks can be determined in such instances.

II. Procedure

(1) Estimate the initial MDL using one or more of the following:

(a) The mean determined concentration plus three times the standard deviation of a set of method blanks.

(b) The concentration value that corresponds to an instrument signal-to-noise ratio in the range of 3 to 5.

(c) The concentration equivalent to three times the standard deviation of replicate instrumental measurements of spiked blanks.

(d) That region of the calibration where there is a significant change in sensitivity, *i.e.,* a break in the slope of the calibration.

(e) Instrumental limitations.

(f) Previously determined MDL.

Note: It is recognized that the experience of the analyst is important to this process. However, the analyst should include some or all of the above considerations in the initial estimate of the MDL.

(2) Determine the initial MDL.

Note: The Initial MDL is used when the laboratory does not have adequate data to perform the Ongoing Annual Verification specified in Section (4), typically when a new method is implemented or if a method was rarely used in the last 24 months.

(a) Select a spiking level, typically 2—10 times the estimated MDL in Section 1. Spiking levels in excess of 10 times the estimated detection limit may be required for analytes with very poor recovery (*e.g.,* for an analyte with 10% recovery, spiked at 100 micrograms/L, with mean recovery of 10 micrograms/L; the calculated MDL may be around 3 micrograms/L. Therefore, in this example, the spiking level would be 33 times the MDL, but spiking lower may result in no recovery at all).

(b) Process a minimum of seven spiked samples and seven method blank samples through all steps of the method. The samples used for the MDL must be prepared in at least three batches on three separate calendar dates and analyzed on three separate calendar dates. (Preparation and analysis may be on the same day.) Existing data may be used, if compliant with the requirements for at least three batches, and generated within the last twenty four months. The most recent available data for method blanks and spiked samples must be used. Statistical outlier removal procedures should not be used to remove data for the initial MDL determination, since the total number of observations is small and the purpose of the MDL procedure is to capture routine method variability. However, documented instances of gross failures (*e.g.,* instrument malfunctions, mislabeled samples, cracked vials) may be excluded from the calculations, provided that at least seven spiked samples and seven method blanks are available. (The rationale for removal of specific outliers must be documented and maintained on file with the results of the MDL determination.)

(i) If there are multiple instruments that will be assigned the same MDL, then the sample analyses must be distributed across all of the instruments.

(ii) A minimum of two spiked samples and two method blank samples prepared and analyzed on different calendar dates is required for each instrument. Each analytical batch may contain one spiked sample and one method blank sample run together. A spiked sample and a method blank sample may be analyzed in the same batch, but are not required to be.

(iii) The same prepared extract may be analyzed on multiple instruments so long as the minimum requirement of seven preparations in at least three separate batches is maintained.

(c) Evaluate the spiking level: If any result for any individual analyte from the spiked samples does not meet the method qualitative identification criteria or does not provide a numerical result greater than zero, then repeat the spiked samples at a higher concentration. (Qualitative identification criteria are a set of rules or guidelines for establishing the identification or presence of an analyte using a measurement system. Qualitative identification does not ensure that quantitative results for the analyte can be obtained.)

(d) Make all computations as specified in the analytical method and express the final results in the method-specified reporting units.

(i) Calculate the sample standard deviation (S) of the replicate spiked sample measurements and the sample standard deviation of the replicate method blank measurements from all instruments to which the MDL will be applied.

(ii) Compute the MDL_s (the MDL based on spiked samples) as follows:

$$MDL_S = t_{(n\ -\ 1,\ 1\ -\ \alpha\ =\ 0.99)} S_s$$

Where:

MDL_s = the method detection limit based on spiked samples

$t_{(n-1,\ 1\ -\ \alpha\ =\ 0.99)}$ = the Student's t-value appropriate for a single-tailed 99th percentile t statistic and a standard deviation estimate with n-1 degrees of freedom. See Addendum Table 1.

S_s = sample standard deviation of the replicate spiked sample analyses.

(iii) Compute the MDL_b (the MDL based on method blanks) as follows:

(A) If none of the method blanks give numerical results for an individual analyte, the MDL_b does not apply. A numerical result includes both positive and negative results, including results below the current MDL, but not results of ''ND'' (not detected) commonly observed when a peak is not present in chromatographic analysis.

(B) If some (but not all) of the method blanks for an individual analyte give numerical results, set the MDL_b equal to the highest method blank result. If more than 100 method blanks are available, set MDL_b to the level that is no less than the 99th percentile of the method blank results. For ''n'' method blanks where $n \geq 100$, sort the method blanks in rank order. The (n * 0.99) ranked method blank result (round to the nearest whole number) is the MDL_b. For example, to find MDL_b from a set of 164 method blanks where the highest ranked method blank results are . . . 1.5, 1.7, 1.9, 5.0, and 10, then $164 \times 0.99 = 162.36$ which rounds to the 162nd method blank result. Therefore, MDL_b is 1.9 for n = 164 (10 is the 164th result, 5.0 is the 163rd result, and 1.9 is the 162nd result). Alternatively, you may use spreadsheet algorithms to calculate the 99th percentile to interpolate between the ranks more precisely.

(C) If all of the method blanks for an individual analyte give numerical results, then calculate the MDL_b as:

$$MDL_b = \overline{X} + t_{n-1,1-\alpha\ =\ (0.99)} S_b$$

Where:

MDL_b = the MDL based on method blanks

$\overline{X}$ = mean of the method blank results (use zero in place of the mean if the mean is negative)

$t_{(n-1,\ 1\alpha\ =\ 0.99)}$ = the Student's t-value appropriate for the single-tailed 99th percentile t statistic and a standard deviation estimate with $n-1$ degrees of freedom. See Addendum Table 1.

S_b = sample standard deviation of the replicate method blank sample analyses.

Note: If 100 or more method blanks are available, as an option, MDL_b may be set to the concentration that is greater than or equal to the 99th percentile of the method blank results, as described in Section (2)(d)(iii)(B).

(e) Select the greater of MDL_s or MDL_b as the initial MDL.

(3) Ongoing Data Collection.

(a) During any quarter in which samples are being analyzed, prepare and analyze a minimum of two spiked samples on each instrument, in separate batches, using the same spiking concentration used in Section 2. If any analytes are repeatedly not detected in the quarterly spiked sample analyses, or do not meet the qualitative identification criteria of the method (see section 2(c) of this procedure), then this is an indication that the spiking level is not high enough and should be adjusted upward. Note that it is not necessary to analyze additional method blanks together with the spiked samples, the method blank population should include all of the routine method blanks analyzed with each batch during the course of sample analysis.

(b) Ensure that at least seven spiked samples and seven method blanks are completed for the annual verification. If only one instrument is in use, a minimum of seven spikes are still required, but they may be drawn from the last two years of data collection.

(c) At least once per year, re-evaluate the spiking level.

(i) If more than 5% of the spiked samples do not return positive numerical results that meet all method qualitative identification criteria, then the spiking level must be increased and the initial MDL re-determined following the procedure in section 2.

(ii) [Reserved]

(d) If the method is altered in a way that can be reasonably expected to change its sensitivity, then re-determine the initial MDL according to section 2, and the restart the ongoing data collection.

(e) If a new instrument is added to a group of instruments whose data are being pooled to create a single MDL, analyze a minimum of two spiked replicates and two method blank replicates on the new instrument. If both method blank results are below the existing MDL, then the existing MDL_b is validated. Combine the new spiked sample results to the existing spiked sample results and recalculate the MDL_s as in Section 4. If the recalculated MDL_s does not vary by more than the factor specified in section 4(f) of this

procedure, then the existing MDL_s is validated. If either of these two conditions is not met, then calculate a new MDL following the instructions in section 2.

(4) Ongoing Annual Verification.

(a) At least once every thirteen months, re-calculate MDL_s and MDL_b from the collected spiked samples and method blank results using the equations in section 2.

(b) Include data generated within the last twenty four months, but only data with the same spiking level. Only documented instances of gross failures (*e.g.,* instrument malfunctions, mislabeled samples, cracked vials) may be excluded from the calculations. (The rationale for removal of specific outliers must be documented and maintained on file with the results of the MDL determination.) If the laboratory believes the sensitivity of the method has changed significantly, then the most recent data available may be used, maintaining compliance with the requirement for at least seven replicates in three separate batches on three separate days (see section 2b).

(c) Include the initial MDL spiked samples, if the data were generated within twenty four months.

(d) Only use data associated with acceptable calibrations and batch QC. Include all routine data, with the exception of batches that are rejected and the associated samples reanalyzed. If the method has been altered in a way that can be reasonably expected to change its sensitivity, then use only data collected after the change.

(e) Ideally, use all method blank results from the last 24 months for the MDL_b calculation. The laboratory has the option to use only the last six months of method blank data or the fifty most recent method blanks, whichever criteria yields the greater number of method blanks.

(f) The verified MDL is the greater of the MDL_s or MDL_b. If the verified MDL is within 0.5 to 2.0 times the existing MDL, and fewer than 3% of the method blank results (for the individual analyte) have numerical results above the existing MDL, then the existing MDL may optionally be left unchanged. Otherwise, adjust the MDL to the new verification MDL. (The range of 0.5 to 2.0 approximates the 95th percentile confidence interval for the initial MDL determination with six degrees of freedom.)

Addendum to Section II: Determination of the MDL for a Specific Matrix

The MDL may be determined in a specific sample matrix as well as in reagent water.

(1) Analyze the sample matrix to determine the native (background) concentration of the analyte(s) of interest.

(2) If the response for the native concentration is at a signal-to-noise ratio of approximately 5–20, determine the matrix-specific MDL according to Section 2 but without spiking additional analyte.

(3) Calculate MDL_b using the method blanks, not the sample matrix.

(4) If the signal-to-noise ratio is less than 5, then the analyte(s) should be spiked into the sample matrix to obtain a concentration that will give results with a signal-to-noise ratio of approximately 10–20.

(5) If the analytes(s) of interest have signal-to-noise ratio(s) greater than approximately 20, then the resulting MDL is likely to be biased high.

TABLE 1—SINGLE-TAILED 99th PERCENTILE t STATISTIC

Number of replicates	Degrees of freedom (n − 1)	$t_{(n-1,\ 0.99)}$
7	6	3.143
8	7	2.998
9	8	2.896
10	9	2.821
11	10	2.764
16	15	2.602
21	20	2.528
26	25	2.485
31	30	2.457
32	31	2.453
48	47	2.408
50	49	2.405
61	60	2.390
64	63	2.387
80	79	2.374
96	95	2.366
100	99	2.365

III. Documentation

The analytical method used must be specifically identified by number or title and the MDL for each analyte expressed in the appropriate method reporting units. Data and calculations used to establish the MDL must be able to be reconstructed upon request. The sample matrix used to determine the MDL must also be identified with MDL value. Document the mean spiked and recovered analyte levels with the MDL. The rationale for removal of outlier results, if any, must be documented and maintained on file with the results of the MDL determination.

[FR Doc. 2017–17271 Filed 8–25–17; 8:45 am]

BILLING CODE 6560–50–P

APPENDIX VI
QUALITY ASSURANCE MANUAL TRAINING SUMMARY

Quality Assurance Manual Date and Revision Number:
Revision 24; February 20, 2019

Initial each section as reviewed. Please complete and return this form to Technical Director for placement in Employee's Training File:

_____ Section 3.0, Statement of Policy
_____ Section 4.0, Organization
_____ Section 5.0, Quality Assurance Program
_____ Section 6.0, Sample Bottle Preparation
_____ Section 7.0, Custody of Samples, Equipment and Supplies
_____ Section 8.0, Analytical Procedures
_____ Section 9.0, Calibration Procedures and Frequency
_____ Section 10.0, Preventative Maintenance
_____ Section 11.0, Quality Control Checks & Routines to Assess Precision, Accuracy & MDLs
_____ Section 12.0, Data Reduction, Review and Reporting
_____ Section 13.0, Corrective Action and Nonconformances
_____ Section 14.0, Performance and System Audits
_____ Section 15.0, Quality Assurance Reports to Management
_____ Section 16.0, Reagent Storage and Documentation
_____ Section 17.0, Waste Disposal
_____ Appendix I, Waste Disposal Procedures
_____ Appendix II, Lab Equipment Preventive Maintenance Schedule
_____ Appendix III, Lab Equipment List
_____ Appendix V, 40 CFR Part 136, Method Detection Limit
_____ Appendix VII, Corrective Action Form
_____ Appendix IX, List of all methods under which lab is Accredited
_____ Appendix XI (Outside Reference Documents)

Comments:_____
_____
_____

Print Name: _____ Date:_____

Signature: _____ Date:_____

Supervisor:_____ Date:_____

Technical Director:_____ Date:_____

Quality Assurance Manager:_____ Date:_____

APPENDIX VI
QUALITY ASSURANCE MANUAL TRAINING SUMMARY NON-TECHNICAL

Quality Assurance Manual Date and Revision Number:
Revision 24; February 20, 2019

Initial each section as reviewed. Please complete and return this form to Technical Director for placement in Employee's Training File:

_____ Section 3.0, Statement of Policy
_____ Section 4.0, Organization
_____ Section 5.0, Quality Assurance Program
_____ Section 6.0, Sample Bottle Preparation
_____ Section 7.0, Custody of Samples, Equipment and Supplies
_____ Section 13.0, Corrective Action and Nonconformances
_____ Section 14.0, Performance and System Audits
_____ Section 16.0, Reagent Storage and Documentation
_____ Section 17.0, Waste Disposal
_____ Appendix I, Waste Disposal Procedures
_____ Appendix VII, Corrective Action Form
_____ Appendix IX, List of all methods under which lab is Accredited

Comments:_____
_____
_____
_____

Print Name: _____ Date:_____

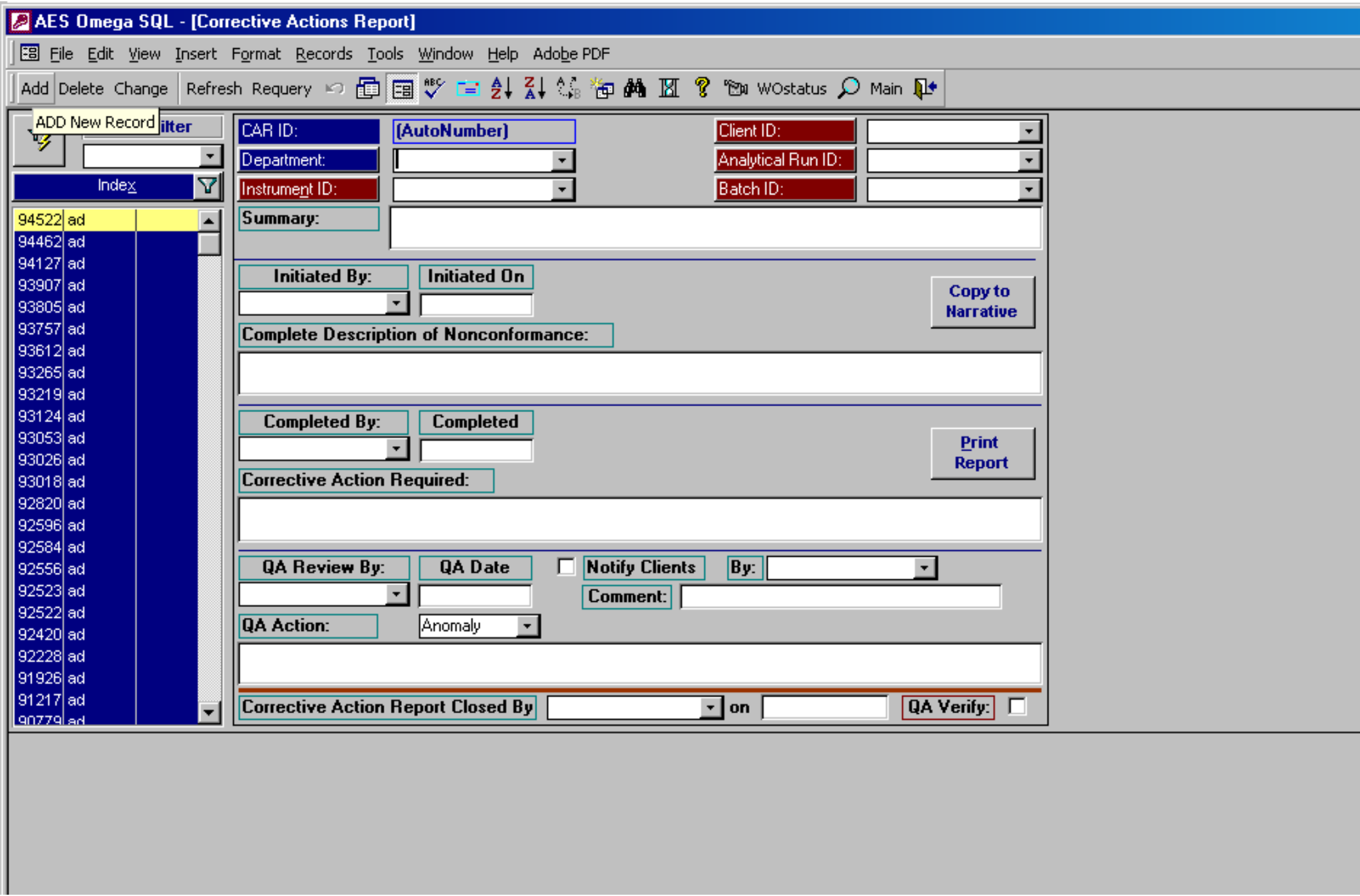
Signature: _____ Date:_____

Supervisor:_____ Date:_____

Technical Director:_____ Date:_____

Quality Assurance Manager:_____ Date:_____

APPENDIX VII - CORRECTIVE ACTION FORM


AES Omega SQL - [Corrective Actions Report]
File Edit View Insert Format Records Tools Window Help Adobe PDF
Add Delete Change Refresh Requery WOstatus Main
ADD New Record
Index
94522 ad
94462 ad
94127 ad
93907 ad
93805 ad
93757 ad
93612 ad
93265 ad
93219 ad
93124 ad
93053 ad
93026 ad
93018 ad
92820 ad
92596 ad
92584 ad
92556 ad
92523 ad
92522 ad
92420 ad
92228 ad
91926 ad
91217 ad
CAR ID:
(AutoNumber)
Client ID:
Department:
Analytical Run ID:
Instrument ID:
Batch ID:
Summary:
Initiated By:
Initiated On
Copy to Narrative
Complete Description of Nonconformance:
Completed By:
Completed
Print Report
Corrective Action Required:
QA Review By:
QA Date
Notify Clients
By:
Comment:
QA Action:
Anomaly
Corrective Action Report Closed By
on
QA Verify:

APPENDIX VIII - SAMPLE RECEIPT CHECKLIST

Clear Save as

ANALYTICAL ENVIRONMENTAL SERVICES, INC.

SAMPLE/COOLER RECEIPT CHECKLIST

1. Client Name: _____ AES Work Order Number: **1802**

2. Carrier: FedEx ☐ UPS ☐ USPS ☐ Client ☐ Courier ☐ Other _____

		Yes	No	N/A	Details	Comments
3.	Shipping container/cooler received in good condition?	○	○	○	damaged ☐ leaking ☐ other ☐	
4.	Custody seals present on shipping container?	○	○	○		
5.	Custody seals intact on shipping container?	○	○	○		
6.	Temperature blanks present?	○	○	○		
7.	Cooler temperature(s) within limits of 0-6°C? [See item 13 and 14 for temperature recordings.]	○	○	○	Cooling initiated for recently collected samples / ice present ☐	
8.	Chain of Custody (COC) present?	○	○	○		
9.	Chain of Custody signed, dated, and timed when relinquished and received?	○	○	○		
10.	Sampler name and/or signature on COC?	○	○	○		
11.	Were all samples received within holding time?	○	○	○		
12.	TAT marked on the COC?	○	○	○	If no TAT indicated, proceeded with standard TAT per Terms & Conditions. ☐	

13. Cooler 1 Temperature _____ °C Cooler 2 Temperature _____ °C Cooler 3 Temperature _____ °C Cooler 4 Temperature _____ °C

14. Cooler 5 Temperature _____ °C Cooler 6 Temperature _____ °C Cooler 7 Temperature _____ °C Cooler 8 Temperature _____ °C

15. Comments: _____

I certify that I have completed sections 1-15 (dated initials). _____

		Yes	No	N/A	Details	Comments
16.	Were sample containers intact upon receipt?	○	○	○		
17.	Custody seals present on sample containers?	○	○	○		
18.	Custody seals intact on sample containers?	○	○	○		
19.	Do sample container labels match the COC?	○	○	○	incomplete info ☐ illegible ☐ no label ☐ other ☐	
20.	Are analyses requested indicated on the COC?	○	○	○		
21.	Were all of the samples listed on the COC received?	○	○	○	samples received but not listed on COC ☐ samples listed on COC not received ☐	
22.	Was the sample collection date/time noted?	○	○	○		
23.	Did we receive sufficient sample volume for indicated analyses?	○	○	○		
24.	Were samples received in appropriate containers?	○	○	○		
25.	Were VOA samples received without headspace (< 1/4" bubble)?	○	○	○		
26.	Were trip blanks submitted?	○	○	○	listed on COC ☐ not listed on COC ☐	

27. Comments: _____

I certify that I have completed sections 16-27 (dated initials). _____

This section only applies to samples where pH can be checked at Sample Receipt.

		Yes	No	N/A	Details	Comments
28.	Have containers needing chemical preservation been checked? *	○	○	○		
29.	Containers meet preservation guidelines?	○	○	○		
30.	Was pH adjusted at Sample Receipt?	○	○	○		

* Note: Certain analyses require chemical preservation but must be checked in the laboratory and not upon Sample Receipt such as Coliforms, VOCs and Oil & Grease/TPH.

I certify that I have completed sections 28-30 (dated initials). _____

Lock Checklist

APPENDIX IX - List of all methods for which lab is Accredited

TNI Methods			
Matrix	Category	Method	Description
Potable or Drinking Water (Safe Drinking Water Act - SDWA)			
PW	Microbiology	SM9223B	Total Coliforms
PW	Microbiology	SM9221D	E. coli
PW	Microbiology	SM9221D	Fecal Coliforms
PW	Metals	EPA 200.8	Metals
Non-Potable Water (Clean Water Act - CWA)			
NPW	Microbiology	SM9222B	Total Coliforms
NPW	Microbiology	SM9222D	Fecal Coliforms
NPW	Microbiology	SM9223B	E. coli
NPW	Gen Chem	EPA 1010	Ignitability
NPW	Gen Chem	EPA 120.1 and EPA 9050	Conductivity
NPW	Gen Chem	EPA 160.4	Residue-volatile
NPW	Gen Chem	EPA 1664B and EPA 9070	Oil & Grease
NPW	Gen Chem	EPA 180.1	Turbidity
NPW	Gen Chem	EPA 300.0	Ion Scan
NPW	Gen Chem	EPA 310.2	Alkalinity as CaCO3
NPW	Gen Chem	EPA 350.1	Ammonia as N
NPW	Gen Chem	EPA 351.2	Kjeldahl nitrogen - total
NPW	Gen Chem	EPA 353.2	Nitrate as N and Nitrate-nitrite
NPW	Gen Chem	EPA 353.2 and SM4500NO2 B	Nitrite as N
NPW	Gen Chem	EPA 365.1	Orthophosphate as P
NPW	Gen Chem	EPA 365.1	Phosphorus total
NPW	Gen Chem	EPA 365.3	Orthophosphate as P
NPW	Gen Chem	EPA 410.4	Chemical oxygen demand
NPW	Gen Chem	EPA 420.1 and EPA 420.2	Total phenolics
NPW	Gen Chem	EPA 7196 and SM3500Cr B	Chromium VI
NPW	Gen Chem	EPA 9010/9014	Total cyanide
NPW	Gen Chem	EPA 9030/9034	Sulfide
NPW	Gen Chem	EPA 9040 and SM4500H+B	pH
NPW	Gen Chem	EPA 9056	Ion Scan
NPW	Gen Chem	EPA 9060	Total organic carbon
NPW	Gen Chem	EPA 9065	Total phenolics
NPW	Gen Chem	SM2310B Acidity	Acidity as CaCO3
NPW	Gen Chem	SM10200H	Chlorophylls
NPW	Gen Chem	SM2120B Color	Color
NPW	Gen Chem	SM2120E	Color ADMI
NPW	Gen Chem	SM2320B Alkalinity	Alkalinity as CaCO3
NPW	Gen Chem	SM2340B	Hardness
NPW	Gen Chem	SM2540B TS	Residue-total
NPW	Gen Chem	SM2540C TDS	Residue-filterable (TDS)
NPW	Gen Chem	SM2540D TSS	Residue-nonfilterable (TSS)
NPW	Gen Chem	SM2540G	Total fixed and volatile residue
NPW	Gen Chem	SM2540F Settleable Solids	Residue-settleable
NPW	Gen Chem	SM3500-Fe B	Ferrous Iron
NPW	Gen Chem	SM5210B BOD	Biochemical oxygen demand
NPW	Gen Chem	SM4500ClG Residual Chlorine	Residual free chlorine

Matrix	Category	Method	Description
NPW	Gen Chem	SM4500CN E Total Cyanide	Cyanide
NPW	Gen Chem	SM4500CN G Amenable Cyanide	Amenable cyanide
NPW	Gen Chem	SM4500O G Dissolved Oxygen	Dissolved Oxygen
NPW	Gen Chem	SM4500S2 F Sulfide	Sulfide
NPW	Gen Chem	SM4500SO3 B Sulfite	Sulfite-SO3
NPW	Gen Chem	SM5210B	Carbonaceous BOD (CBOD)
NPW	Gen Chem	SM5310B TOC	Total organic carbon
NPW	Gen Chem	SM5540C MBAS Surfactants	Surfactants - MBAS
NPW	Gen Chem	TKN - AMMONIA	Organic nitrogen
NPW	Metals	EPA 200.7 and EPA 6010	Metals
NPW	Metals	EPA 200.7	Total Phosphorus
NPW	Metals	EPA 6010	Total Phosphorus
NPW	Metals	EPA 200.8 and EPA 6020	Metals
NPW	Metals	EPA 245.1 and EPA 7470	Mercury
NPW	Ext Organics	EPA 8015	Diesel range organics (DRO)
NPW	Ext Organics	FL-PRO	Total Petroleum Hydrocarbons (TPH)
NPW	Ext Organics	EPA 610 and EPA 8310	Polynuclear Aromatic Hydrocarbons (PAHs)
NPW	Ext Organics	EPA 8315	Formaldehyde and Acetaldehyde
NPW	Ext Organics	EPA 625.1 and EPA 8270	Semi-Volatile (Base-Neutral-Acid) Organics
NPW	Ext Organics	RSK-175	GC Analysis of Gaseous Samples
NPW	Pest-Herb-PCB	EPA 608.3 and EPA 8081	Pesticides
NPW	Pest-Herb-PCB	EPA 608.3	Methoxychlor
NPW	Pest-Herb-PCB	EPA 608.3 and EPA 8082	Polychlorinated Biphenyls
NPW	Pest-Herb-PCB	EPA 615 and EPA 8151	Herbicides
NPW	Vol Organics	EPA 8011	EDB & DBCP
NPW	Vol Organics	EPA 8015	Gasoline range organics (GRO)
NPW	Vol Organics	EPA 8015	Various Nonhalogenated Volatile Compounds
NPW	Vol Organics	EPA 624.1 and EPA 8260	Volatile Organics

Matrix	Category	Method	Description
Solids & Hazardous Materials (Resource Conservation & Recovery Act - RCRA)			
Solids	Gen Chem	EPA 350.1 in Soil	Ammonia
Solids	Gen Chem	EPA 351.2 in Soil	Kjeldahl nitrogen - total
Solids	Gen Chem	EPA 365.1 in Soil	Total Phosphorus
Solids	Gen Chem	EPA 1010	Ignitability
Solids	Gen Chem	EPA 1030	Ignitability of Solids
Solids	Gen Chem	EPA 1311	TCLP
Solids	Gen Chem	EPA 1312	SPLP
Solids	Gen Chem	EPA 7196	Chromium VI
Solids	Gen Chem	EPA 9010/9014	Total cyanide
Solids	Gen Chem	EPA 9030/9034	Sulfide
Solids	Gen Chem	EPA 9040	pH
Solids	Gen Chem	EPA 9045	pH
Solids	Gen Chem	EPA 9050	Conductivity
Solids	Gen Chem	EPA 9056	Ion Scan
Solids	Gen Chem	EPA 9060	Total organic carbon
Solids	Gen Chem	EPA 9065	Total phenolics
Solids	Gen Chem	EPA 9071	Oil & Grease
Solids	Gen Chem	EPA 9081	Cation exchange capacity

Matrix	Category	Method	Description
Solids & Hazardous Materials (Resource Conservation & Recovery Act - RCRA)			
Solids	Gen Chem	EPA 9095	Paint Filter Liquids Test
Solids	Gen Chem	Sec. 7.3 SW-846	Reactive cyanide
Solids	Gen Chem	Sec. 7.3 SW-846	Reactive sulfide
Solids	Metals	EPA 6010	Metals
Solids	Metals	EPA 6020	Metals
Solids	Metals	EPA 7471	Mercury
Solids	Metals	EPA 7473	Mercury
Solids	Ext Organics	EPA 8015	Diesel range organics (DRO)
Solids	Ext Organics	FL-PRO	Total Petroleum Hydrocarbons (TPH)
Solids	Ext Organics	EPA 8310	Polynuclear Aromatic Hydrocarbons (PAHs)
Solids	Ext Organics	EPA 8315	Formaldehyde
Solids	Ext Organics	EPA 8270	Semi-Volatile (Base-Neutral-Acid) Organics
Solids	Pest-Herb-PCB	EPA 8081	Pesticides
Solids	Pest-Herb-PCB	EPA 8082	Polychlorinated Biphenyls
Solids	Pest-Herb-PCB	EPA 8151	Herbicides
Solids	Vol Organics	EPA 8015	Gasoline range organics (GRO)
Solids	Vol Organics	EPA 8015	Various Nonhalogenated Volatile Compounds
Solids	Vol Organics	EPA 8260	Volatile Organics

Matrix	Category	Method	Description
Air & Emissions			
Air	Vol Organics	EPA TO-14A	Volatile Organics
Air	Vol Organics	EPA TO-15	Volatile Organics

AIHA-LAP, LLC Methods			
Matrix	Category	Method	Description
Air	Ext Organics	N1003	Hydrocarbons, Halogenated
Air	Ext Organics	N1300	Ketones
Air	Ext Organics	N1400	Alcohols I
Air	Ext Organics	N1450	Esters I
Air	Ext Organics	N1457	Ethyl acetate
Air	Ext Organics	N1500	Hydrocarbons, BP 36-126°C
Air	Ext Organics	N1501	Hydrocarbons, Aromatic
Air	Ext Organics	N1550	Naphthas in Air
Air	Ext Organics	N2000	Methanol
Air	Ext Organics	N2500	2-Butanone
Air	Ext Organics	N5506	Polynuclear Aromatic Hydrocarbons by HPLC
Air	Ext Organics	3M3520	Organic Vapors on Passive Monitor
Air	Metals	N7300	Elements by ICP
Air	Metals	N6009	Mercury
Solids	Metals	N7082	Lead in Paint
Solids	Metals	SW3050B/7000B	Total Lead in Solids
Air	Metals	N9102	Lead on Wipes
Air	Asbestos	N7400	PCM
Air	Gen Chem	N0500/0600	Particulates
Air	Microbiology	Fungal Air Direct Exam	MB - 15019, MB - 15022, MB - 15028
Air	Microbiology	Fungal Bulk Direct Exam	MB - 15020
Air	Microbiology	Fungal Surface Direct Exam	MB - 15020

Attachment 5

Quality Assurance Manual Acceptance Agreement

The information in this Quality Assurance Manual including its tables, appendices, figures, and / or attachments may be legally privileged and is confidential information intended for the use of reviewing Analytical Environmental Services Quality System policies and procedures. You are hereby notified that any dissemination, distribution, or copy of this manual or information therein including tables, appendices, figures, and / or attachments is strictly prohibited without written permission from a representative of Analytical Environmental Services Customer Service Department. If you have received this manual in error, please notify Analytical Environmental Services Customer Service by telephone at (770) 457-8177 for instructions on returning the document. If an electronic copy has been received in error by email, contact info@aesatlanta.com and delete the message. Thank you.

SOP No. QA-01000

Date Revised	Revision No.
February 20, 2019	24

I have read, understood and agree to comply with the above statement.

_____ _____
Signature Date

_____
Printed Name

_____
Company

_____
Phone Number with extension

APPENDIX X - Training Form 1

New Employee Initial Quality Assurance Manual Training

TRAINING: Initial Training on AES SOP No. QA-01000,
"SOP for the Quality Assurance Manual"

My signature confirms that I attended the initial training of the company's Quality Assurance Manual, which includes a discussion of the various sections contained within as well as responsibilities I have while performing my daily duties. I will be reading various sections of that document according to my job function. Upon completion I will sign-off on form 'Appendix VI – Quality Assurance Manual Training Summary'.

Supervisor:
_____

Section/area:
_____

Print Name:
_____

Employee Signature:
_____

Date: _____

APPENDIX X - Training Form 2

Employee SOP / QA Manual Training & Retraining Form

SOP and/or Training Description: _____
_____
_____
_____
_____

My signature confirms that I was explained the reasons for this training/retraining and I have read/reviewed sections of the SOP, where applicable, along with other appropriate information including Interim Change Notices (ICNs), spreadsheets, logbook pages, sections in LIMS, calculations, and other forms as they apply. Further, I understand my responsibilities to follow the items presented in this training/retraining as they pertain to my job.

Supervisor:
_____

Section/area:
_____

Print Name:
_____

Employee Signature:
_____

Date: _____

APPENDIX XI

QUALITY ASSURANCE MANUAL
STANDARD OPERATING PROCEDURE ACKNOWLEDGEMENT

Name (Printed): _____

SOP Title: Quality Assurance Manual

SOP Number: QA-01000 Rev. No. 24

The laboratory analyst signature on this approved SOP signifies the following: The analyst has read the SOP in its entirety and has read the analytical methods referenced in the SOP.

The analyst understands that the SOP is to be followed explicitly. Any deviation from the SOP must be noted in writing. Furthermore, the deviation from the SOP must be approved in writing by the laboratory supervisor and the QA staff prior to the analyst's adoption of the deviation from the SOP.

The controlled electronic of this SOP is located on the portal server at: Documents: Quality Assurance: QA Manuals: QA Manual: 2019_QA_Manual_Rev_24.pdf. If a hard copy is desired, you may request one from the Supervisor.

Do not make a copy or print out the QA Manual yourself. Printed copies are uncontrolled documents.

Print Name: _____ Date: _____

Analyst's Signature: _____ Date: _____

Department Manager Signature: _____ Date: _____

Technical Director's Signature: _____ Date: _____

APPENDIX XII
Outside Reference Documents

1. 2003 NELAC Standards, National Environmental Laboratory Accreditation Conference (NELAC), EPA 600/R-041-003, June 5, 2003, www.nelac-institute.org.

2. 2009 NELAC Standards, National Environmental Laboratory Accreditation Conference (NELAC), EL-V1 through V4-2011, www.nelac-institute.org.

3. *AIHA-LAP, LLC Policy Modules for AIHA Laboratory Accreditation Programs*, current revisions posted to web, www.aiha.org.

4. American National Standard, *General Requirements for the Competence of Testing and Calibration Laboratories*, ANSI/ISO/IEC 17025:2005.

5. North Carolina Administrative Code, Title 15: Department of Environment, Health and Natural Resources; Chapter 2, Environmental Management Division; Subchapter 2H; Procedures for Permits, Approvals; Section .0800; Laboratory Certification, August 1, 2002, Environmental Management Commission, Raleigh, North Carolina, http://deq.nc.gov/about/divisions/water-resources/water-resources-rules/nc-administrative-code-statutes.

6. North Carolina Administrative Code, Title 15: Department of Environment, Health and Natural Resources; Chapter 2, Environmental Management Division; Subchapter 2L; Groundwater Classification and Standards, Environmental Management Commission, Raleigh, North Carolina, http://deq.nc.gov/about/divisions/water-resources/water-resources-rules/nc-administrative-code-statutes.

7. *Analytical Methodology for Groundwater and Soil Assessment Guidelines*, SCDHEC UST Program Guidance document, July 14, 2014, http://www.scdhec.gov/Environment/Guidance/.

8. Quality Assurance Program Plan for the Underground Storage Tank Management Division, Revision 3.1, SCDHEC, February 2016, http://www.scdhec.gov/Environment/LW/UST/ReleaseAssessmentClean-up/QualityAssurance/.

9. Solutions to Analytical Chemistry Problems with Clean Water Act Methods, EPA 821-R-07-002 (revision to the "Pumpkin Document", EPA 821-B-93-001), March 2007, www.epa.gov.

10. *Code of Federal Regulations, Title 40, Part 136*, U. S. Government Printing Office: Washington DC, current revision posted on the web, www.epa.gov.

11. Manual for the Certification of Laboratories Analyzing Drinking Water, Fifth Edition, EPA 815-R-05-004, January 2005, www.epa.gov/safewater/methods/laboratorycertification.html.

12. Supplement 1 to the Fifth Edition of the Manual for the Certification of Laboratories Analyzing Drinking Water, EPA 815-F-08-006, June 2008, www.epa.gov/safewater/methods/laboratorycertification.html.

13. Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-020, Revised March 1983.

14. Methods for the Determination of Metals in Environmental Samples, Supplement I, EPA 600/R-94/111, May 1994.

15. Methods for the Determination of Inorganic Substances in Environmental Samples, EPA 600/R-93/100, August 1993.

16. HACH Procedures Manual, Seventh Edition, *Chemical Oxygen Demand, Method 8000*, HACH Chemical Company: Loveland, CO, 1999.

17. Standard Methods for the Examination of Water and Wastewater, Twentieth Edition, American Public Health Association, Washington, DC, 1998.

18. Standard Methods for the Examination of Water and Wastewater, Twenty First Edition, American Public Health Association, Washington, DC, 2005.

19. Standard Methods for the Examination of Water and Wastewater, Twenty Second Edition, American Public Health Association, Washington, DC, 2012.

20. Methods and Guidance for Analysis of Water, *The Determination of Chlorinated Herbicides in Municipal and Industrial Wastewater, Method 615*, EPA 821-C-99-004, June 1999.

21. EASY DIST Manual of Environmental Methods, Rev. 9/5/1996.

22. Method 1664, Revision B: N-Hexane Extractable Material (HEM; Oil and Grease) and Silica Gel Treated N-Hexane Extractable Material (SGT-HEM; Non-Polar Material) by Extraction and Gravimetry, EPA-821-R-10-001, February 2010, www.epa.gov.

23. *Method for the Determination of Extractable Petroleum Hydrocarbons by GC/FID*, State of Tennessee Department of Environment and Conservation, Division of Underground Storage Tanks, current revision posted to web, http://www.tennessee.gov/environment/topic/ust-suspected-or-confirmed-release.

24. *Method for Determination of Petroleum Range Organics, Method # FL-PRO*, Florida Department of Environmental Protection, Revision 1, November 1, 1995, www.dep.state.fl.us/.

25. Test Methods for Evaluating Solid Waste, Third Edition, SW-846 (including Updates I, II, IIA, IIB, III, IIIA, IIIB, IV, and V), US EPA Office of Solid Waste and Emergency Response: Washington, DC, April 1998, www.epa.gov.

26. Methods of Soil Analysis, No. 5, Part 2, *Section 10-2 Saturation Extract and Other Aqueous Extracts, Chemical and Microbiological Properties, Second Edition*, American Society of Agronomy, Inc., 1982.

27. ASTM Standards, latest editions, www.astm.org.

28. NIOSH Manual of Analytical Methods, Fourth Edition (August 1994) and Fifth Edition (August 2016), US Department of Health and Human Services, Cincinnati, Ohio, www.cdc.gov/niosh/.

29. *Code of Federal Regulations, Title 40, Part 60 Appendix A, Test Method 18, VOC by GC*, U. S. Government Printing Office: Washington DC, current revision posted on the web, www.epa.gov.

30. Laboratory Guide to Common Aspergillus Species and Their Telemorphs, Klich, Maren, and John Pitt, CISRO Food Research Laboratory, 1988.

31. Identifying Filamentous Fungi, A Clinical Laboratory Handbook, St-Germain, Guy, and Richard Summerbell, 1996.

32. Environmental Monitoring Services Recommendations for Identification and Quantification of Airborne Fungal Spores, Hyphae, Skin Fragments, Pollen, Fibrous particulaes, and Arthropod (insect) Fragments, Revision 110402.

33. McCrone Research Institute of Chicago, IL, Recommendations for Identification and Quantification of Airborne Fungal Spores, Hyphae, and Pollen as instructed in Course 1630: Indoor air Quality: Fungal Spore Identification.

34. Environmental Monitoring Services Micro5 Analysis Standard Operating Procedure for Examining 100% of Total Trace, Revision 11/4/02.

35. Standards of Practice for the Assessment of Indoor Environmental Quality, Indoor Environmental Standards Organization, Volume 1, First Edition, April 2002.

36. The Alaska Methods: AK101-GRO (4/8/2002), AK102-DRO (4/8/2002), and AK103-RRO (4/8/2002), Alaska Contaminated Sites Approval, Division of Environmental Health, Environmental Health Laboratory, http://dec.alaska.gov/eh/lab/CS/CSapproval.htm.

APPENDIX XIII

Environmental Microbiology Laboratory Accreditation Program (EMLAP) Specific Requirements

1.0 INTRODUCTION

Analytical Environmental Services, Inc. is dedicated to providing quality analytical services. Analytical Environmental Services, Inc. (AES) specializes in the analysis of microorganisms commonly detected in air (e.g., spore trapping), surface (e.g., tape lifts, swabs, wipes), and bulk (e.g., wallboard, carpet, building materials) samples collected from schools, hospitals, offices, industrial, agricultural, and other work environments. AES has implemented a quality assurance and quality control (QA/QC) program to establish quality control standards necessary for compliance to guidelines by The American Industrial Hygiene Association's Laboratory Accreditation Program (AIHA-LAP, LLC) Environmental Microbiology Laboratory Accreditation Program (EMLAP). In order to consistently maintain high standards of precision and accuracy in analytical testing, AES participates in AIHA-LAP, LLC's Proficiency Analytical Testing (PAT) program.

This quality assurance plan will establish the procedures that will be followed to ensure accuracy, precision, completeness, and representation of data obtained from the analysis of environmental microbiology samples.

2.0 PURPOSE

AES has implemented a quality assurance, quality control program for the purpose of providing a baseline of standards which will allow for a continuous surveillance quality performance for the benefit of AIHA-LAP, LLC EMLAP compliance, client satisfaction, and minimization of liability.

3.0 SCOPE

This QA/QC program provides the necessary guidelines to secure and maintain:

- High level of quality work
- Comprehensive accountability of all activities relevant to laboratory services.
- Continuous compliance with ISO/IEC 17025 and AIHA-LAP, LLC's EMLAP quality requirements.

This QA/QC program includes the following information:

- Comprehensive system of daily, weekly, monthly, and annual record keeping.
- Definition of routine monitoring activities.
- Sampling techniques for air, surface, and bulk collection.
- Sampling Equipment
- Calibration of Sampling Equipment
- Analysis of Air, Surface, and Bulk samples.
- Analytical Equipment
- Calibration of Analytical Equipment
- In-House training of analysts.
- QA/QC activities within lab.

4.0 FACILITIES

The laboratory has adequate facilities for the scope of services and meets the requirements for the most current and relative biosafety guidelines set forth by CDC, WHO, and AIHA-LAP, LLC. The lab has a documented routine monitoring program for the verification of adequate contamination control. The laboratory has the proper facilities for biological and chemical storage and disposal of refuse.

5.0 EQUIPMENT

Microscope/Magnification System

- Microscope/Magnification System consisting of Compound optical microscope with a high magnification (100x) oil immersion objective having a numerical aperture (n.a.) of at least 1.25.
- Alignment of each microscope shall be documented with each day of use.
- Each microscope shall have an ocular micrometer that shall be checked annually with a NIST traceable stage micrometer.
- Field of View Diameter for each objective on the microscope shall be checked annually.

Class II Biological Safety Cabinet

- Performance certified annually according to NSF Standard 49.

Steam Sterilizer/Autoclave

- An autoclave with functioning temperature and pressure gauges for the disposal of potentially viable waste.
- Routine use of indicators to document successful sterilization with each use.
- Routine use of biological indicators to document the sterilization process.

Incubators and Refrigerators

- Temperature settings appropriate for the scope of testing.
- Temperatures recorded twice daily.

6.0 PERSONNEL

The laboratory conforms to the personnel requirements of the AIHA-LAP, LLC EMLAP guidelines. In all cases training records for degreed laboratory staff shall include a copy of transcript or diploma from an accredited college/university.

Technical Manager

- The laboratory shall be under the overall direction of an onsite, qualified person, who for the purposes of this document, is designated as the Technical Manager, and has the responsibility for the function, administration, and day-to-day operation of the laboratory. The Technical Manager or designee shall serve as the approved signatory.
- The Technical Manager shall have an earned microbiology or life science degree, minimally at the baccalaureate level, with the required combination of semester hours in microbiology and/or non-academic work experience as listed below. All non-academic work experience and coursework must be documented in the employee's training and personnel files.
  - **(a)** Microbiology degree and a minimum of two (2) years of full time equivalent documented environmental microbiological work experience (bacteriology and/or mycology).
  - **(b)** Life Science degree and:
    - **i.** Twenty (20) semester hours in Microbiology and a minimum two

(2) years of full time equivalent documented environmental microbiological work experience (bacteriology and/or mycology).

ii. Sixteen (16) semester hours in Microbiology and a minimum three (3) years of full time equivalent documented environmental microbiological work experience (bacteriology and/or mycology).

iii. Twelve (12) semester hours in Microbiology and a minimum four (4) years of full time equivalent documented environmental microbiological work experience (bacteriology and/or mycology).

iv. Eight (8) semester hours in microbiology and a minimum of five (5) years of full time equivalent documented environmental microbiological experience (bacteriology and/or mycology).

(c) Experience must reflect the scope of work of the laboratory.

- The Technical Manager shall be experienced in the selection and the use of bioaerosol, surface, fluid, and raw material sampling methods and in sample processing for the quantification and identification appropriate to the FoTs of mesophilic and thermophilic bacteria, and mesophilic, xerophilic, thermo tolerant fungi (molds and yeasts), and fungi identified by spore trap collection methods.

- Training records for the Technical Manager shall include documentation of ability to identify genus/group of fungi from spore trap analysis and genus/species of fungi that are reported.

Laboratory Analytical Staff
The environmental microbiological program distinguishes two titles for those conducting analytical procedures within the laboratory. An analyst is one who has a bachelor's degree and a technician is one who does not have a degree.

Laboratory Technicians

- These staff members shall have a high school diploma or General Education Development (GED) During this required training period, the trainee shall perform work (and have work reviewed prior to release) under the direct supervision of a qualified technician, analyst and/or the Technical Manager.

- Technicians may function in the same manner as analysts for Air – Direct Examination (spore trap) analysis after completion of six (6) months documented on the job training and demonstrated proficiency. For all other analyses, technicians may function in the same manner as analysts after one (1) year documented on the job training and demonstrated proficiency.

Laboratory Analysts

- These staff members shall have a bachelor's degree in a physical or biological science. Analysts shall have three (3) months of documented training for Air - Direct Examination (spore trap) and six (6) months of documented on-the-job training functioning for all other analyses as an analyst trainee. During the required analyst training period, the trainee shall be under the direct supervision of another qualified analyst and/or the Technical Manager. During this period, the trainee shall have all work reviewed prior to release by another qualified analyst and/or the Technical Manager. Training records for technicians and analysts

shall include documentation of ability to identify genus/species of fungi and genus/group of fungi that are reported. Bacterial identification training records shall document training of relevant diagnostic procedures (e.g., gram stain, oxidase, biochemical reactions).

- All analysts and technicians shall have demonstrated ability to produce reliable results through accurate analysis of certified reference materials (CRMs), proficiency testing samples or in-house quality control samples. This demonstration shall be performed and documented at a minimum of every six (6) months.

Laboratory Quality Assurance Coordinator

- This Quality Assurance Coordinator (QAC) of the laboratory shall possess a bachelor's degree in an applicable basic or applied science and have six (6) months of non-academic relevant and documented microbiological laboratory analysis experience. In lieu of bachelor's degree, four years of non-academic analytical experience is acceptable.

- The QAC shall have documented training in statistics. Additional training may consist of quality control procedures.

7.0 ANALYTICAL METHODS: See SOP's

8.0 QUALITY ASSURANCE/QUALITY CONTROL

- Routine QA/QC procedures shall be an integral part of the laboratory procedures and functions. The laboratory is in compliance with APHA-AWWA-WPCF guidelines in *Standard Methods for the Examination of Water and Wastewater*, 21st Edition, APHA, 2005 for microbiology laboratories.

- Five (5) percent intra-analyst analysis shall be completed by each analyst to assess the precision of the analyst.

- Five (5) percent inter-analyst analysis shall be completed to assess the accuracy of the analysis performed within the laboratory.

- The laboratory shall use control charts or databases to compare intra- and inter-analyst analysis performance to established control charts.

- The laboratory shall ensure the quality control of culture media and analytical reagents per lot number for appropriate sterility, microbial growth, and/or analytical reactions. Records will be maintained and acceptance criteria will be documented.

- Acceptance Criteria on 5% replicate and duplicate analysis, daily reference slide analysis (spore traps) and monthly reference culture analysis will be documented and shall include the following:
  (a) Taxon identification acceptability
  (b) Taxon abundance ranking acceptability
  (c) Count of concentration acceptability determined statistically with use of control charts or databases (Spore Traps only).

- Laboratory will maintain routine records of temperature documentation for refrigerators and incubators. Acceptance criteria will be documented.

- The laboratory maintains a microbial culture collection of common organisms relevant to the methods performed. Cultures will be from recognized sources including EMPAT rounds. The culture collection will include the source and date of acquisition.

- The culture collection will be used monthly to prepare blind cultures to be used as part of the routine QC program to monitor accuracy in culture identification.

- The laboratory has a reference slide collection with various count levels and genera/groups of spores which is maintained and used as part of total spore analysis quality control.

- Each day of analysis, at least one slide from the collection shall be reviewed by each analyst. Slides are viewed on a rotational schedule so a different slide is viewed each day until the entire slide collection is examined. The analysis of these slides is incorporated into the daily QC plan. Acceptance criteria will be documented.

- Statistically derived control charts with control limits are used to assess performance.

- The laboratory participates and has documentation of a round robin slide exchange of real samples consistent with AIHA-LAP, LLC Policy 6A.3.2 *Requirements for Round Robin Programs*.

- Round robins include the participation of three (3) laboratories. Round robin program will consist of at least two (2) rounds per year, with each round completed within a 6-month timeframe.

- Each round will consist of four (4) samples at varying concentrations.

- Each analyst within the laboratory will analyze the samples independently and each of the analyst's results will be reported.

- The round robin analytical data will include raw counts and final concentrations for each fungal structure observed.

- Round Robin acceptance criteria shall include the organism identification, ranking, and quantification.

- A designated laboratory shall be responsible for data collection and distribution. The participating laboratories shall rotate this designation.

- A routine air monitoring program is used to verify adequate contamination control.

(a) Two (2) spore trap samples are collected each month. One (1) inside sample and One (1) outside sample are collected and compared. Acceptance criteria will be documented.

SAFETY, HEALTH, ENVIRONMENTAL AND TRANSPORTATION REGULATIONS
Analytical Environmental Services, Inc. adheres to all applicable federal, state, and local regulations regarding safety, health, environment or transportation. Potentially viable microbial waste shall be collected in properly designated biohazard containers and disposed of properly through autoclaving.

Attachment 6

ANALYTICAL ENVIRONMENTAL SERVICES, INC.
ANNUAL MANAGEMENT REVIEW

REQUIRED PARTICIPANTS:

President	VP Operations
QA Manager	Technical Director
PCM Manager	Metals Lab Manager
Sample Rec. Manager	Semi-Volatile Lab Manager
Micro Bio Lab Manager	Customer Service Manager
HR Manager	Volatiles Lab Manager
IC Manager	Wet Chem Lab Manager
TEM Manager	PLM Manager
IT Manager	

The review will be conducted by the President or Vice President of Operations with the assistance of the Quality Assurance Manager.

AGENDA

1. Follow Up-Actions from previous Management Review meetings.
    a. Changes in Policy and Procedures (QA)
    b. Facility Improvements (President/VP)

2. Quality Assurance Report:
    a. Accreditation Requirements (QA)
    b. Changes in Management Structure (President/VP)
    c. Changes/Expansion of laboratory Services (President/VP)
    d. New/Updates of Procedures/SOP's/Reference Materials (QA)

3. Review of Performance in Quality Areas
    a. Handling of failed QC Data: Each Department Supervisor provide an overall statement of finding these errors and how they are being handled in their department as they relate to the items listed. How the lab control listed affected Quality Control Performance if relative (e.g. Pipettor AES 1234 was received in April. Quarterly checks were noticeably tighter than the +/-2% acceptance criteria listed on the sheet.)
        i. General Quality Assurance (indicate ability of the equipment to meet verification frequency requirements)
            1. Balance Performance:
            2. Pipettor Performance:
            3. Hotblock Temperature Checks:
            4. Thermometer Verifications:
            5. Incubator Temperature Checks:
            6. Annual QC Acceptance Limits Update:
            7. Annual Reporting Limit Verification:
            8. Annual MDL Studies (where applicable):
            9. Other:

ii. Metals:
    1. Balance Performance:
    2. Pipettor Performance:
    3. Annual QC Acceptance Limits Update:
    4. Annual Reporting Limit Verification:
    5. Annual MDL Studies (where applicable):
    6. Linear Calibration Range Studies:
    7. Quarterly Pb Contamination Checks:
    8. New Personnel:
    9. Other (Annual vs. Quarterly IDL Check):

iii. Metals Prep:
    1. Balance Performance:
    2. Pipettor Performance:
    3. Hotblock Temperature Checks:
    4. Annual Reporting Limit Verification:
    5. Annual MDL Studies (where applicable):
    6. New Personnel:
    7. Other:

iv. Wet Chemistry:
    1. Equipment Performance
    2. Hotblock Temperature Checks:
    3. Pipettor Performance:
    4. Balance Performance:
    5. Annual QC Acceptance Limits Update:
    6. Annual Reporting Limit Verification:
    7. Annual MDL Studies (where applicable):
    8. Linear Calibration Range Studies (EPA 180.1):
    9. New Personnel:
    10. Other (e.g. Automated vs. Annual BOD check):

v. IC:
    1. Equipment Performance
    2. Linear Range Calibration Study:
    3. Hotblock Temperature Checks:
    4. Pipettor Performance:
    5. Balance Performance:
    6. Annual QC Acceptance Limits Update (e.g. 365.1_S):
    7. Annual Reporting Limit Verification:
    8. Annual MDL Studies (where applicable):
    9. Linear Calibration Range Studies:
    10. New Personnel:
    11. Other:

vi. Semi-Volatiles/Semi-Prep:

1. Equipment Performance
2. Balance Performance:
3. Annual QC Acceptance Limits Update:
4. Annual Reporting Limit Verification:
5. Annual MDL Studies (where applicable):
6. New Personnel:
7. Other:

vii. Volatiles:

1. Equipment Performance
2. Balance Performance:
3. Annual QC Acceptance Limits Update:
4. Annual Reporting Limit Verification:
5. Annual MDL Studies (where applicable):
6. New Personnel:
7. Other (e.g. Quarterly GRO check):

viii. Asbestos:

1. Microscope Performance
2. Balance Performance:
3. Microscope Alignment Calibration:
4. Monthly Air Contamination Checks:
5. New Personnel:
6. Other:

ix. Microbiology:

1. Microscope Performance
2. Balance Performance:
3. Microscope Alignment Calibration:
4. Monthly Air Contamination Checks:
5. New Personnel:
6. Other:

b. Major PT Failure issues (QA)

c. Repeat and total number of deficiencies per department (Each Dept. Supervisor provide info. on repeat and total number of deficiencies related to a specific analysts or your dept. and how it is being handled, technical reprimands, etc.)
Wet Chemistry:
IC:
Metals:
Metals Prep:
Volatiles:
Semi-Volatiles:
Semi-Prep:
Sample Receiving:
Asbestos:

Microbiology

4. Managerial Reports
    a. Equipment Needs (Each Dept. Supervisor to provide info. on current equip./staff needs)
    Wet Chemistry:
    IC:
    Metals:
    Metals Prep:
    Volatiles:
    Semi-Volatiles:
    Semi-Prep:
    Sample Receiving:
    Asbestos:
    Microbiology:
    b. Equipment Maintenance
        i. Calibration Information (VP)
        ii. Repair and maintenance data (VP)
        iii. Equipment downtime logs/review (Each Dept. Supervisor)
        Wet Chemistry:
        Metals:
        Metals Prep:
        Volatiles:
        Semi-Volatiles:
        Semi-Prep:
        Sample Receiving:
        Asbestos:
        Microbiology:

        iv. Resources
            1. Staffing Needs (Each Dept. Supervisor/VP)
            2. Department Training Needs (Technical Director)
            3. Facility and Equipment Needs (President/VP)

5. Internal Auditing
    a. Audit Results (QA)
    b. Audit Schedule (QA)
    c. Nonconformance by Department (HR)
    d. Results of Inter-Laboratory comparisons or proficiency (QA)
6. Corrective and Preventive Actions
    a. Type and source of issues (Each dept. Supervisor)
    Wet Chemistry:
    IC:

Metals:
Metals Prep:
Volatiles:
Semi-Volatiles:
Semi-Prep:
Sample Receiving:
Asbestos:
Microbiology:

b. Areas most commonly having problems (QA)
c. Trends of root causes (QA)
d. Reoccurring problems (QA)
e. Summary and review of corrective action log (QA)

7. External Audit
    a. Performance Evaluation for Quality System and Technical Aspects (VP)
    b. Evaluation common weak areas from each auditing agency (QA)
8. Quality Planning
    a. Upcoming projects (Customer Service Manager)
    b. Status of ongoing projects (Customer Service Manager)
    c. Significant changes including staff/equipment/required accreditations (VP)
9. Customer Feedback (Customer Service Manager)
    a. Customer complaints
        i. Review of Customer Complaint Corrective Action Logs
            1. Repeated complaints
            2. Related/Unrelated issues
            3. Cause of issues identified and corrective measures followed
            4. Weekly meeting review
    b. Client satisfaction survey
10. Improvements (President/VP)
    a. Review of Quality Policy/Objectives
    b. Review of Quality Systems effectiveness and improvement of system and services

Detail and assign responsible party time line for implementation of task.

ANALYTICAL ENVIRONMENTAL SERVICES, INC.
_____ ANNUAL MANAGEMENT REVIEW

My signature confirms that I participated in the Annual Management Review:

Name	Position	Date

Attachment 7 - Subcontract Laboratories

Analysis to Subcontract	Method Required	Holding Time/ Container/ Preservative	Certification Information (i.e. state specific)	Subcontract Lab Name/Location	Subcontract Lab Phone Number	Subcontract Lab Contact	Price	TAT	Quote Expiration Date	Quote Posted to Portal/CS/ Subcontract Lab
2,3,7,8-TCDD	8280		Most	Pace Minneapolis			300	15		
2,3,7,8-TCDD	8290		Most	Pace Minneapolis			350	15		
2,3,7,8-TCDD	1613 DW		Most	Pace Minneapolis			188	5		
2,3,7,8-TCDD	1613 DW		Most	TA Knoxville	(865) 291-3065	Terry Wasmund	450			
2,3,7,8-TCDD	8290/1631 non DW		Most	TA Knoxville	(865) 291-3065	Terry Wasmund	500			
2,3,7,8-TCDD	8290	amber unp, ice	most	SGS Wilmington	(910) 350-1903	Michael Page	375	21 days		TE 6/29/15
2,3,7,8-TCDD	8290	amber unp, ice	Most	SGS Wilmington	(910) 350-1903	Amber Kornegay	656	10 days TAT		
2,3,7,8-TCDD in Potable Water	EPA 1613B		NELAP, ISO 17025, DoD, most states	Eurofins Lancaster	(717) 945-4521	Jenifer Lewis	203	standrad is 10 business days	12/31/2018	yes
2,3,7,8-TCDD (not-potable water/soil)	EPA 1613B or SW-846 8290A		NELAP, ISO 17025, DoD, most states	Eurofins Lancaster	(717) 945-4521	Jenifer Lewis	276	standrad is 10 business days	12/31/2018	yes
Acrylamide	8316		most	TA Various locations	912-944-7847	Debbie Harbuck	215+25 (samp filt)		4/12/2015	
ASTM Leaching Procedure	D3987-85		most	TA Various locations	912-944-7850	Debbie Harbuck	60		4/15/2015	
Carbamates	8318		most	TA Various locations	912-944-7848	Debbie Harbuck	270		4/13/2015	
Compound Specific Isotope analysis	NA	They need 7-8 VOA HCL vials. Holding time not more than 6 months	NA	Pace/Microseeps	412-826-4483	Robin	varies based on isotopes requested-see quote posted under Pace/Microseeps for details	30-50 days	3/1/2015	yes
17 Dioxins/Furans	EPA 1613B or SW-846 8290A		NELAP, ISO 17025, DoD, most states	Eurofins Lancaster	(717) 945-4521	Jenifer Lewis	428	standrad is 10 business days	12/31/2018	yes
17 Dioxins/Furans w/Nontoxic Totals	EPA 1613B or SW-846 8290A		NELAP, ISO 17025, DoD, most states	Eurofins Lancaster	(717) 945-4521	Jenifer Lewis	513	standrad is 10 business days	12/31/2018	yes
Dioxins 17 isomers	8290	2 1L unpreserved ambers	most	TA Various locations	912-944-7837	Debbie Harbuck	1,080		4/2/2015	
Dioxins 17 isomers	8280	2 1L unpreserved ambers	most	TA Various locations	912-944-7840	Debbie Harbuck	600		4/5/2015	
Dioxins/Furans TCL	1631/8290 A9		Most	TA Knoxville	(865) 291-3065	Terry Wasmund	800			
Dioxins/Furans TCL	1631/8290 Full List		Most	TA Knoxville	(865) 291-3065	Terry Wasmund	950			
Dioxins/Furans TCL 17 isomers	8280 (low resolution)		Most	Pace Minneapolis			375	15		
Dioxins/Furans TCL 17 isomers	8290		Most	Pace Minneapolis			525	15		
EMSL	AHERA TEM			EMSL/Smyrna	770-956-9150		See Portal pricing			deB 8/18/15
EMSL	TEM			EMSL/Smyrna	770-956-9150		See Portal pricing			
EOX	9023		most	TA Various locations	912-944-7849	Debbie Harbuck	100		4/14/2015	
Free CN	A4500	NaOH	NELAP	ALS Env	616-399-6070	Tom Beamish	40		DOES receive on Sat	
Grainsize Distribution	ASTM Method D422-63									
Grainsize Distribution	ASTM Method D1140-92									
Grainsize particle	ASTM Method D1140			United Consulting	770-582-2843	Mahvand Saleki	115			
Grainsize with hydrometer	ASTM D6913			Timeley Eng	770-938-8233	Lev Buchko	100			
Grainsize with hydrometer	ASTM D6913			United Consulting	770-582-2843	Mahvand Saleki	75			
Grainsize without hydrometer	ASTM D422			Timeley Eng	772-938-8233	Lev Buchko	125			
Grainsize without hydrometer	ASTM D422			United Consulting	770-582-2843	Mahvand Saleki	140			
Herbicides	8321	2 1L unpreserved ambers	most	TA Various locations	912-944-7838	Debbie Harbuck	240		4/3/2015	JF 1/7/16
Hex Chrome	7199		most	TA Various locations	912-944-7843	Debbie Harbuck	100		4/8/2015	JF 1/7/21
Hex Cr in Air	N7600			MAS Labs (Suwanee, GA)	770-866-3200		90			

Appendix G

Corrective Action Flow Chart

CORRECTIVE ACTION PROCESS