March 23, 2020

Mr. Christos Tsiamis
Senior Project Manager
New York Remedial Branch
United States Environmental Protection Agency Region 2
290 Broadway
New York, New York 10007

Re: Amendment to the Remedial Action Work Plan for PCB Cleanup
BRT Powerhouse Site BCP #C224099/ EPA Consent Order #CERCLA-02-2017-2021
Gowanus Village I, LLC (BRT Powerhouse Site)
322 3rd Avenue, Brooklyn, New York

Dear Mr. Tsiamis:

On behalf of Gemini Arts Initiative, Inc and BRT Powerhouse LLC (GAII), Roux Environmental Engineering and Geology, D.P.C. (Roux) has prepared the attached work plan amendment ("RAWP Amendment") to detail the proposed remediation of remaining polychlorinated biphenyl (PCB) impacts associated with former Site operations at 322 3rd Avenue, Brooklyn, New York, also known as the Powerhouse (Site).

This RAWP Amendment discusses changes to the proposed remediation for the onsite buildings' materials associated with the turbine hall included in the Remedial Action Work Plan, dated April 9, 2019 (USEPA RAWP). The boiler house mat slab investigation and lateral discharge tunnel remediation is also summarized as pertinent background information in this RAWP Amendment. No additional remediation associated with the boiler house structures is proposed. Additionally, observations and analytical results from monitoring well installation and soil sample collection as requested by the USEPA in the comments to the USEPA BRT Powerhouse Sampling Plan, dated July 19, 2017 is summarized herein.

The following outlines the proposed amended remediation for the onsite buildings' materials. The remediation below is all encompassing and no additional remediation to the buildings' materials are proposed:

1. Turbine Hall Sump Structures
    a. Grout each sump structure with a minimum of 2 foot thick concrete plug with a standard concrete mix of a minimum of 3,000 psi strength. No additional removal of material from the sump other than groundwater that is displaced during the grouting process is proposed;
    b. All displaced groundwater will be removed via drum vacuum for proper offsite disposal;
    c. Concrete plug filling the sump will not a have a structural purpose, therefore, the top 18-inches of each sump will be completed with a reinforced structural concrete slab that will be tied into the existing mat slab as required by the final structural design and;
    d. Samples of the concrete plug mix will be collected each day of grouting to evaluate unconfined compressive strength and verify curing of the concrete to meet designed specs over a 7-day period.

2. Turbine Hall Mat Slab
    a. No scarification or concrete removal is proposed;

2705.0001Y276/LR

b. Mat slab remediation will consist of a TSCA-compliant cap as outlined below, which meets capping requirements of 40 CFR §761.61 (a)(4)(7). Additionally, the Site will have a deed restriction, in accordance with 40 CFR §761.61 (a)(4)(8). The deed restriction will limit the use of the cellar to parking and utility equipment rooms only.

   i. 1 to 2 feet of clean imported soil and RCA to act as a leveling course;

   ii. additional 1.5 to 2 feet of clean imported soil to reach the required grade for the lower level of the building;

   iii. 3-inch mud slab;

   iv. water proofing/vapor barrier membrane (i.e. Grace Preprufe 300R Membrane);

   v. 6-inch reinforced concrete slab.

As discussed in the attached RAWP Amendment, PCB concentrations from all brick samples collected from the turbine hall cellar walls were well below the USEPA Low Occupancy Area Cleanup Level of 25 ppm established in the USEPA RAWP and, therefore, no further remediation or engineering controls, such as surface scarification or wall-encapsulation will be implemented.

Specific details concerning analytical data, and proposed procedures are provided for your review in the attached RAWP Amendment and previously provided in USEPA RAWP. Following your review and approval of the RAWP Amendment, a detailed schedule outlining specific tasks and approximate durations will be provided. All remediation efforts will be properly documented and reported in accordance with the June 2017 Administrative Settlement Agreement and Order on Consent for a Removal Action entered among the USEPA and GAII.

Should you have any questions concerning the Work Plan or would like to discuss further, please do not hesitate to contact the undersigned.

Sincerely,

ROUX ENVIRONMENTAL ENGINEERING AND GEOLOGY, D.P.C.

Frank Cherena, P.G.
Principal Geologist

Charles J. McGuckin, P.E.
Principal Engineer

Attachments

cc: Katie Dixon, Powerhouse Environmental Arts Foundation
Paul Parkhill, Gemini Arts Initiative, Inc.
Larry Schnapf, Schnapf, LLC

Amendment to the Remedial Action Work Plan for PCB Cleanup

BRT Powerhouse
322 3rd Avenue
(a.k.a. 153 2nd Street)
Brooklyn, New York

March 23, 2020

Prepared for:

Gemini Arts Initiative, Inc.
540 President Street, #2K
Brooklyn, New York 11215

Prepared by:

Roux Environmental Engineering and Geology, D.P.C.
209 Shafter Street
Islandia, New York 11749

2705.0001Y2276/CV

Environmental Consulting
& Management
+1.800.322.ROUX
rouxinc.com

Table of Contents

1. Introduction 1
   1.1 Property Location and Site Description 1
   1.2 Proposed Redevelopment Plan and Applicable Building Materials Standards 1
2. USEPA Soil Boring Investigation and Monitoring Well Installation 3
   2.1 Previously Completed Lateral Discharge Tunnel Soil Borings 3
   2.2 Newly Installed Monitoring Wells and Soil Borings 4
3. Previous Building Materials Investigations and Remediation 6
   3.1 Turbine Hall Interior Investigations and Remediation 6
      3.1.1 Turbine Hall Interior Brick Walls 6
      3.1.2 Turbine Hall Mat Slab 7
      3.1.3 Turbine Hall Subsurface Structure Investigation 7
   3.2 Boiler House Investigations and Remediation 8
      3.2.1 Boiler House Mat Slab 8
      3.2.2 Boiler House Subsurface Structure Investigation and Remediation 9
4. Proposed Remedial Action 11
   4.1 Turbine Hall Sump Structures 11
   4.2 Turbine Hall Mat Slab 11
   4.3 Soil Vapor Assessment 12
   4.4 Institutional Controls 12
   4.5 Schedule 12
   4.6 Reporting 12

Tables

1. Summary of Volatile Organic Compounds in Soil
2. Summary of Semivolatile Organic Compounds in Soil
3. Summary of Metals in Soil
4. Summary of Polychlorinated Biphenyls in Soil
5. Summary of Pesticides and Herbicides in Soil
6. Summary of Polychlorinated Biphenyls in Boiler House and Turbine Hall Building Materials

Figures

1. Site Location Map
2. USEPA Soil Boring and Monitoring Well Locations
3. 2019-2020 Completed EPA Soil Boring Exceedances
4. Boiler House and Turbine Hall Building Materials Sampling Results

Appendices

A. USEPA Remedial Action Work Plan for PCB Cleanup, dated April 9, 2019
B. Turbine Hall Investigation and Remediation Photo Log

Table of Contents (Continued)

C. Historical Site Drawings

D. Turbine Hall Slab Construction Detail

1. Introduction

On behalf of Gemini Arts Initiative, Inc and BRT Powerhouse, LLC (GAII), Roux Environmental Engineering and Geology, D.P.C. (Roux) has prepared this Amendment to the Remedial Action Work Plan for PCB Cleanup (Amendment) for remaining polychlorinated biphenyl (PCB) contamination at 322 3rd Avenue, Brooklyn, New York (Site). This Amendment was prepared in accordance with the June 2017 Administrative Settlement Agreement and Order on Consent for a Removal Action entered among the USEPA and GAII (Order) and the New York State Department of Environmental Conservation (NYSDEC)-approved Site Management Plan (SMP), dated December 2017. As required by the Order, the proposed bulkhead design was submitted to USEPA in April 2019 and approved in August 2019.

This Amendment will discuss the onsite investigation and remediation work that has been completed to-date in accordance with and since the submittal of the USEPA Remedial Action Work Plan for PCB Cleanup (USEPA RAWP), dated April 8, 2019. All work complete to date has been in accordance with the Draft United States Environmental Protection Agency (USEPA) Sampling Plan, dated June 2017. All onsite investigation and remediation work completed prior to April 2019 has been previously reported to USEPA via work plan and progress report submittals.

The Brownfields Cleanup Program (BCP) Remedial Action (RA) was implemented in accordance with the NYSDEC-approved Remedial Action Work Plan (RAWP), dated June 2014 and the Decision Document, dated February 2014. The certificate of completion (COC) from the NYSDEC was issued on December 30, 2017. Since obtaining the COC, redevelopment activities and additional remediation at the Site has been implemented in accordance with the SMP, the Order, and USEPA RAWP. Pertinent background information and the proposed scope of work for additional investigation and remediation is discussed in the following sections.

1.1 Property Location and Site Description

The Site is located at 322 3rd Avenue in Brooklyn, New York, adjacent to the Gowanus Canal. The Site location is shown on Figure 1. An alternative address for the Site is 153 2nd Street. The Site is designated as Tax Block 967, Lot 1 on the Kings County Tax Map and is bordered to the north by the historical 1st Street Basin, a filled-in former turning basin (Lateral Canal); 2nd Street to the south; the Gowanus Canal to the west; and 3rd Avenue to the east. The Site is approximately 2.5 acres. Currently, an 80-foot tall building covering approximately 24,000 square feet is located on the eastern portion of the Site and the remainder of the Site is currently being redeveloped.

1.2 Proposed Redevelopment Plan and Applicable Building Materials Standards

Site redevelopment began in the Spring of 2018 and includes the renovation of an existing onsite building with a footprint of 24,000 square foot (SF) (turbine hall) and the construction of an adjacent new building with a footprint of 9,000 SF (boiler house). The construction of the boiler house building will be atop the historical mat slab that remains in place. The Site will be used as an industrial center for art, including manufacturing facilities for metal, wood, printmaking, ceramics, and textiles. The lowest level for both buildings will be used for parking and utility equipment rooms. Additionally, a new small one-story utility and security building will be constructed near the north Site entrance. The western portion of the Site redevelopment will include a loading area and paved materials storage yard.

As defined in 40 CFR §761.61, the majority of the upper floors of the proposed redevelopment will be classified as High Occupancy areas (i.e., building occupants in the building areas for 6.7 hours per week or more), meaning occupancy of any individual for more than 6.7 hours. The cleanup level for PCBs in porous materials in High Occupancy areas is ≤1 ppm without further conditions. Concentrations of all interior brick samples and concrete floor samples collected on the first floor through the fourth floor were below the USEPA High Occupancy Area Cleanup Level of 1 ppm for PCBs. High Occupancy areas porous materials that remain at concentrations >1 ppm and ≤10 ppm shall be covered with a cap meeting the requirements of 40 CFR §761.61 (a)(4)(7).

In accordance with USEPA PCB Site Revitalization Guidance, under the Toxic Substance Control Act (TSCA), dated November 2005[1] (USEPA PCB Guidance), the parking and utility equipment rooms on the lowest level of the turbine hall and boiler house will be classified as Low Occupancy Area (i.e., building occupants in the building areas less than 6.7 hours per week). The cleanup level for porous materials in Low Occupancy Area is ≤25 ppm unless covered with a cap. Elevated concentrations of PCBs will remain in a limited area below the mat slab and in the sumps; these concentrations will be addressed with a TSCA-compliant cap meeting the requirements of 40 CFR §761.61 (a)(4)(7) that will prevent contact and isolate the contaminated soils rendering the building suitable for its' intended use.

Based on previous investigations at the Site, all interior brick samples and concrete floor samples collected on the first floor through the fourth floor were below the USEPA High Occupancy Area Cleanup Level of 1 ppm for PCBs. This Amendment will focus all investigation and remediation activities on the lowest (cellar) level of the turbine hall and boiler house materials to meet the USEPA Low Occupancy Area Cleanup Levels. Additionally, this Work Plan will also focus on the soil analytical results of the previously completed soil borings, as requested by USEPA. Results of the previous investigations and remedial efforts are discussed in detail below.

[1] The TSCA Guidance Document provides examples of cleanup site scenarios. Example #6 (page 20) identifies a parking garage as a Low Occupancy Area.

2. USEPA Soil Boring Investigation and Monitoring Well Installation

During the redevelopment activities at the Site, additional soil borings and monitoring wells were installed as required in the NYSDEC-approved SMP and as requested by the USEPA in the comments to the USEPA BRT Powerhouse Sampling Plan, dated July 19, 2017. Soil boring and monitoring well locations are shown on Plates 2 and 3. Details regarding the installation of the two soil borings (MW-16 and MW-17) that align with the boiler house former lateral discharge tunnels and the associated soil delineation sampling has been provided to USEPA in the August through December 2018 Progress Report, and is summarized below.

2.1 Previously Completed Lateral Discharge Tunnel Soil Borings

In July 2018, two (2) soil borings (MW-16 and MW-17) were completed along the northern border of the Site, as requested by the USEPA. Locations of the borings were selected to align with the boiler house's former lateral discharge tunnels. To correlate with the Gowanus Canal final dredging elevation, the two borings were advanced to El.-17.5 feet (ft) North American Vertical Datum of 1988 (NAVD 88) (35 feet below land surface [ft bls]) using a CRS-XL Max Sonic drill rig. These soil borings were later converted to monitoring wells MW-16 and MW-17.

Three (3) soil samples were collected from each boring for laboratory analysis. One sample was collected from the 2 ft interval directly above the water table; the second sample was collected from El. -16 to El. -18, as requested by the USEPA; and the third sample was collected from the 2 ft interval with the greatest evidence of impacts (if any). The table below outlines the soil samples collected and provides the associated depths and elevations.

Monitoring Well / Soil Boring ID	Sample Interval (ft bls)	Sample Elevation (ft NAVD 88)
MW-16	13 to 15	+3 to +1
	25 to 27	-9 to -11
	32 to 34	-16 to -18
MW-17	11 to 13	+5 to +3
	17 to 19	0 to -2
	32 to 34	-16 to -18

Analytical results from July 20, 2018 indicated a PCB concentration in soil above TSCA levels of 50 ppm at MW-16 at 25 to 27 ft bls (El. -9 to El. -11 ft). During drilling for MW-16 well installation, a suspected wooden structural pile, immediately underlying fill materials, was observed from 15 to 20 ft bls (El. +1 to El. -4 ft), and suspected wooden structural pile segments were observed in a soil sample collected from 20 to 30 ft bls (El. -4 to El. -14 ft). It is believed these suspected wooden piles are relic features associated with former structures, potentially including wooden bulkhead cribbing at the Site. Due to the wooden structures observed from 15 to 30 ft bls (El. +1 to El. -14 ft) at MW-16, the concentrations indicated at the soil sample recorded as 25-27 ft bls may be attributable to preferential pathways for downward migrations through piles or cribbing.

Additional soil borings were completed on November 2, 2018 to further investigate elevated concentrations of PCBs identified in soils located at 25-27 ft bls at MW-16. The presence of support of excavation (SOE)

piles and lagging for the boiler house redevelopment excavation work limited access in the areas east, north, and south of MW-16. Therefore, three (3) additional borings were completed in a line located immediately 11 feet to the south of MW-16 at the elevation of the boiler house slab, approximately 10 to 11 ft below the starting elevation of MW-16 (El. +16 ft). Lithology at the additional investigation borings was consistent with MW-16, as fill materials and suspected wooden piles were observed at similar elevation intervals in the additional investigation borings. Multiple attempts were required at each boring in order to clear the obstructions, which included suspected wooden piles, timbers, and the edge of the boiler house mat slab. Two soil samples were collected for laboratory analysis from each of the delineation borings MW-16S, MW-16E, and MW-16W. Soil samples from each boring were collected at elevations that directly correlate with the elevated PCB concentration observed at MW-16 and where Roux believes the PCB concentrations at MW-16 originated from, as discussed above. Two additional soil samples were collected at MW-16S based on field observations of contamination (odor, staining, etc.). Soil sample elevations and PCB concentrations for soil borings MW-16, MW-16S, MW-16E, MW-16W, and MW-17 are shown in the Table below.

Elevation Range	Soil Sample PCB Concentration (ppm)				
	MW-16	MW-16S	MW-16E	MW-16W	MW-17
El. +6 to +1	1.9	NS	NS	NS	7.9
El. +1 to -4 ft	NS	650	0.19	0.19	22
El. -4 to -9 ft	NS	40	NS	NS	NS
El. -9 to -14 ft	1200	270	0.46	ND	NS
El. -13 to -15	NS	NS	NS	NS	NS
El. -14 to -19 ft	1.8	160	NS	NS	ND

The analytical results of the soil samples completed at MW-16 and MW-17 and associated delineation borings are included as Tables 1 through 5 and summarized in Plate 2.

Based on the delineation sampling completed, there appears to be a limited area of impact in the vicinity of MW-16, as shown on Figure 2. The overall volume of impacted soil is estimated to be no greater than 170 cubic yards (CY). Furthermore, the exceedances of TSCA-regulated levels at the MW-16 and associated delineation borings range from El. +1 to -14 ft NAVD 88 or approximately 16.5 to 31.5 ft below the proposed redevelopment grade in that area. Excavation to that depth in that portion of the Site is not feasible. Excavation to that depth for soil removal would surpass the depth and undermine the bottom of the mat slab foundation and potentially conflict with the existing SOE systems at the Site as well as jeopardize the building's integrity. In terms of Site logistics, there is not enough space to feasibly mobilize the proper excavation equipment between the boiler house building and the north property line, temporarily store soil for disposal, or mobilize the dewatering equipment that would be necessary to facilitate excavation to the required depths. In addition, the source of this contaminated soil was removed during the boiler house lateral discharge tunnel remediation, which also sealed the tunnels, and is discussed in Section 3.2.2.

2.2 Newly Installed Monitoring Wells and Soil Borings

Three additional monitoring wells and one soil boring (MW-12, MW-13, MW-14, and EPA-SB-1) were installed from December 2019 through February 2020. Locations of the additional monitoring wells and soil boring are shown in Figure 3. Soil samples were collected to correlate with the proposed Gowanus Canal

dredging elevation of El. -23 ft NAVD 88 (MW-12 and MW-13) and the proposed former lateral canal dredging elevation of El. -17.5 ft NAVD 88 (MW-14 and EPA-SB-1) using a CRS-XL Max Sonic drill rig.

Soil samples were collected during the installation of these monitoring wells to further investigate soil quality at the proposed dredging depths, as requested by the USEPA. At each location, two to three soil samples were collected from the 2-foot interval above the observed water table; the 2-foot interval that contained the greatest evidence of impacts (if any); and the 2-foot interval that aligns with the proposed dredging elevation, as outlined below:

Monitoring Well / Soil Boring ID	Sample Interval (ft bls)	Sample Elevation (ft NAVD 88)
MW-12	3.5 to 5.5	+10 to 8
	34.5 to 36.5	-21 to -23
MW-13	14 to 16	+2.5 to +0.5
	38 to 40	-21.5 to -23.5
MW-14	10 to 12	+7.5 to +5.5
	17 to 19	+0.5 to -1.5
	33 to 35	-15.5 to -17.5
EPA-SB-1	10 to 12	+6.5 to +4.5
	16 to 18	+0.5 to -1.5
	32 to 34	-15.5 to -17.5

The results of the soil samples completed at the aforementioned borings and monitoring wells are included as Tables 1 through 5 and summarized in Plate 3.

All soil samples collected from EPA-SB-1, MW-12, MW-13, and MW-14 yielded non-detect results for PCBs, with the exception of one sample. MW-12 (3.5-5.5 ft bls) yielded a PCB concentration of 2 ppm for PCBs, which is below the NYSDEC-approved Site-Specific Site Cleanup Objective (SCO) of 10 ppm for PCBs and was collected from below the Site cover system. Total SVOC concentrations in MW-12, MW-13, MW-14, and EPA-SB-1 were all well below 200 ppm and ranged from 0.0 ppm to 94.15 ppm.

3. Previous Building Materials Investigations and Remediation

Previous investigations of PCB contents of building materials were conducted by Leggette, Brashears, and Graham Inc. (LBG) and Roux, from 2014 through 2019. These investigations indicate PCB contamination was only identified on building materials in the cellar level of the turbine hall. The remainder of the samples collected on the upper floors yielded concentrations below 1 ppm, which is the applicable USEPA High Occupancy Area Standard. The investigations focused on the following building components:

1. Turbine Hall Cellar Interior Brick Walls;
2. Turbine Hall Cellar Building Materials Sampling;
3. Turbine Hall Subsurface Structure Investigation;
4. Boiler House Mat Slab; and
5. Boiler House Subsurface Structure Investigation.

The implementation and findings of the previous investigations completed by LBG and Roux, from 2014 through April 2019 were reported in the USEPA RAWP, included as Appendix A. The following is a summary of investigation and remediation work completed following submittal and in compliance with the USEPA RAWP.

3.1 Turbine Hall Interior Investigations and Remediation

3.1.1 Turbine Hall Interior Brick Walls

As discussed in the USEPA RAWP, demolition of the two aboveground vaults and topping slab and excavation of the former sand leveling course exposed sections of the turbine hall's brick walls that were previously inaccessible and therefore not sampled. To supplement data previously collected by LBG, on June 6, 2019, eighteen brick wall samples were collected using a rotary hammer drill to identify any potential residual PCB contamination on the brick walls. Twelve (12) of the brick wall samples were completed along the newly exposed walls that were originally obstructed by the aboveground vaults. Six (6) wall samples were collected from the lower two feet of the brick walls that were previously covered by the former sand leveling course and topping slab. All samples were biased towards areas exhibiting visual contamination. All samples were collected in accordance with the USEPA RAWP and the USEPA Standard Operating Procedure for Sampling Porous Surfaces for PCBs (SOP), dated May 2011. The one variation from the SOP was the collection of samples from 2-3" below the surface as previously requested by the USEPA, varying from the 0-0.5" referenced in the SOP. All samples were analyzed for PCBs via USEPA SW-846 Methods. As previously approved by USEPA, the modified cellar brick wall surface characterization sampling protocol consisted of collecting one brick wall sample representing 100 square feet (9 square meters). The rotary hammer drill used for sample collection was decontaminated between each sampling location.

PCBs were detected in six (6) of the 18 samples collected from the previously inaccessible areas of the turbine hall cellar walls. PCB detections ranged from 0.053 ppm (estimated) to 2.3 ppm. PCB detection in previous wall samples collected by LBG in the turbine hall cellar during the RA ranged from non-detect to 3.7 ppm. These detections are well below the USEPA Low Occupancy Area Cleanup Level of 25 ppm established in the USEPA RAWP and, therefore, no further remediation or engineering controls, such as surface scarification or wall-encapsulation will be implemented. No additional sampling of the turbine hall

interior brick walls is proposed. A figure detailing the locations and results of the turbine hall interior wall samples is attached as Figure 4. A summary of the analytical results of the sampling is attached as Table 6. A photo log providing photos of representative sample locations is included in Appendix B.

3.1.2 Turbine Hall Mat Slab

A total of eighteen samples were collected from 2-3" below the surface of the turbine hall mat slab. As previously approved by USEPA, the modified cellar concrete floor surface characterization sampling protocol consisted of collecting one concrete sample to represent approximately 800 SF. All samples were analyzed for PCBs via USEPA SW-846 Methods. The rotary hammer drill was decontaminated between each sampling location.

PCBs were detected in all 18 of the samples collected from the turbine hall mat slab, ranging from 0.061 ppm (estimated) to one sample of 460 ppm. All sample detections were below the threshold of 100 ppm established in the USEPA RAWP, with the exception of one sample, TH-SLAB-8, which had a concentration of 460 ppm. On November 7, 2019, four additional concrete samples were collected around TH-SLAB-8 to delineate the area exceeding the 100 ppm threshold. Samples were collected 10 feet to the north, south, east, and west of the original location. The PCB concentrations of the north, south, and east delineation samples ranged from 1 to 2.2 ppm. The PCB concentration of the west delineation sample was 720 ppm, exceeding the threshold of 100 ppm. The total delineated area is approximately 800 SF and represents a limited portion of the overall turbine hall mat slab area.

Due to the fact that 17 of the 18 sampled grids (representing approximately 96% of the surface of the turbine hall mat slab) yielded analytical results well below the USEPA Low Occupancy Area Cleanup Level of 100 ppm, no further sampling or removal is proposed. On order to mitigate this limited area, the turbine hall mat slab will be capped as part of the Site's redevelopment. A figure detailing the locations and results of the turbine hall mat slab samples is attached as Figure 4. A summary of the analytical results of the sampling is attached as Table 6. A photo log providing photos of representative sample locations is included in Appendix B. Further details regarding the final cap installation of turbine hall mat slab is discussed in Section 4.2.

3.1.3 Turbine Hall Subsurface Structure Investigation

During remediation and redevelopment activities inside the turbine hall cellar, eight sump structures and two smaller auxiliary sump structures were uncovered. Upon review of historical documents, these sumps and tunnel structures appear to have been part of the engine condensing system during the turbine hall's operations. On December 7, 2018, investigation and sampling of the turbine hall subsurface structures was completed. The observations and analytical results from the turbine hall subsurface structure investigation are included in the USEPA RAWP (Appendix A).

The initial remediation of the turbine hall sumps was completed in January 2019. Approximately 7,150 gallons of oil/water recovered from the sumps were disposed offsite via drums to Spring Grove Resource Recovery Inc., located in Cincinnati, Ohio. The discovery of the ten large sumps in the turbine hall mat slab provided a migration pathway and means of recovery for the LNAPL that had been previously trapped under the mat slab. Sediment, soil, and debris was removed from the drainage trenches of the sump structures via hand tools and all solid material was removed from the sump structures to the extent feasible using a small excavator. All solid material removed from the drainage trenches was disposed of offsite via drums. Additional details regarding the turbine hall sump remediation is included in the USEPA

RAWP. All ten sumps were temporarily covered with a steel plate and sealed off with an oil resistant gasket to keep the structures watertight in preparation for the turbine hall mat slab load test. A photo log providing photos of the turbine hall following former leveling course removal and sump remediation is included in Appendix B. Currently, the sump structures remain covered. The final remediation and sealing of the turbine hall sumps will be completed prior to final capping of the turbine hall mat slab. Details regarding permanent turbine hall sump closure are discussed in Section 4.1.

Based on historical drawings, included as Appendix C, two intake tunnels extend below the turbine hall mat slab. These tunnels have been inaccessible during the RA and redevelopment activities since the tunnels are located up to 13 feet below the top of the turbine hall mat slab and are approximately 7 feet below the water table, which are inaccessible due to depth. However, under the RAWP, LBG cut off the hydraulic connection between the potential turbine hall intake tunnels and the Gowanus Canal via hydraulic plug. During the RA, the gate well structures that connected the intake tunnels to the exterior of the building were uncovered and closed. These gate well structures contained a significant quantity of LNAPL, which likely represented the primary source of migration to the exterior of the building. Approximately 4,400 gallons of LNAPL/water were reported removed by LBG via vacuum extraction during the RA. Additional details regarding the turbine hall intake tunnels and gate well structures are included in the Draft BRT Powerhouse Sampling Plan dated June 23, 2017.

Additionally, in November 2017, Roux installed two monitoring wells, MW-5 (associated with the south tunnel) and MW-6 (associated with the north tunnel) within the footprint of each of the two turbine hall intake tunnels. MW-5 and MW-6 were gauged on a monthly basis before they were destroyed in May 2018. LNAPL was never detected in MW-5. LNAPL was detected in MW-6 at thicknesses ranging from 0.74 feet to trace from January through April 2018, and never detected in May 2018.

In order to assess groundwater quality downgradient of the turbine hall intake tunnels and former locations of the gate wells, Roux installed two exterior monitoring wells, MW-8 (associated with the south tunnel) and MW-9 (associated with the north tunnel), downgradient of each of the intake tunnels in November 2017. LNAPL was never observed in MW-8 or MW-9. The locations of monitoring wells associated with the turbine hall intake tunnels is shown on Plate 3.

Based on the previous LNAPL removal activities, lack of LNAPL observed in downgradient monitoring wells and the in accessibility of the intake tunnels, Roux does not propose any additional investigation or remediation associated with these subsurface features, with the exception of sealing the sumps from the surface.

3.2 Boiler House Investigations and Remediation

3.2.1 Boiler House Mat Slab

On June 5, 2019, a total of 15 samples were collected using a rotary hammer drill from 2-3” below the surface of the boiler house mat slab. As previously approved by USEPA, the modified cellar concrete floor surface characterization sampling protocol consisted of collecting one concrete sample to represent approximately 800 SF. All samples were analyzed for PCBs via USEPA SW-846 Methods. The rotary hammer drill was decontaminated between each sampling location.

PCBs were detected in three of the fifteen samples collected from the boiler house mat slab, ranging from 0.059 ppm (estimated) to 0.42 ppm. These detections are well below the threshold of 100 ppm established in the USEPA RAWP, and therefore, no further remediation is proposed. Additionally, an approximately

2-foot thick layer of clean soil was added to the surface of the boiler house mat slab to reach the required grade for the lower level of the building. An overlying slab was then constructed that consists of a 3-inch non-structural rat slab, a layer of waterproofing and vapor barrier, and a 6-inch reinforced topping slab. The 2-foot thick layer of clean soil overlain by the new slab surface completely isolates the boiler house mat slab from the redeveloped area.

3.2.2 Boiler House Subsurface Structure Investigation and Remediation

As part of the on-going redevelopment activities at the Site, the soil/debris on top of the existing boiler house mat slab was excavated and disposed of offsite. Following removal of the soil overlying the boiler house slab, Roux observed six openings in the boiler house mat slab in the vicinity of the former lateral discharge tunnels. The openings appeared to be 1 ft wide by 2 ft long and were partially filled with soil and debris.

On December 7, 2018, investigation and sampling of the boiler house subsurface structures was completed. The observations and analytical results from the boiler house subsurface structure investigation are included in the USEPA RAWP (Appendix A).

The remediation of the boiler house lateral discharge tunnels took place from August 19, 2019 through October 2, 2019. Brookside Environmental, Inc. (Brookside) opened access holes at the north and south ends of the west tunnel and the south end of the east tunnel in order to access the boiler house lateral discharge tunnels and begin remediation. Brookside utilized an excavator with a hydraulic hammer attachment to break the concrete slab above the tunnels. Brookside pumped the oil and water from the tunnels to drums. Brookside utilized an excavator bucket and hand tools to remove contaminated concrete, soil, sludge, and other debris from the interior of the tunnels at the three openings and loaded the material into drums. Clean Harbors Environmental (Clean Harbors), mobilized to the Site to complete the removal of contaminated materials with assistance from Brookside. Brookside opened approximately ten additional access holes at each of the tunnels, one hole every 10 feet. Clean Harbors and Brookside laborers manually removed large debris (concrete, wood, etc.) from the access holes. Once the large debris had been cleared, Clean Harbors used a Cusco vacuum trailer at each of access holes to vacuum out the remaining soil, sludge, smaller debris, and oil. Hand tools were also utilized when necessary to clear material from the tunnels. Oil and water were pumped to a storage tank as necessary during the scope of the remediation. After the storage tank was no longer required, the oil and water as pumped to the groundwater treatment system to be treated with the rest of the groundwater from the geotechnical test pit dewatering scope. Brookside poured high-pressure concrete at the north and south end of the west tunnel and the south end of the east tunnel to form high pressure concrete plugs to seal the tunnels at both ends. A plug was not poured at the north end of the east tunnel because a concrete plug had been previously poured, on November 10, 2017, as part of the remediation to obtain the NYSDEC COC.

When Clean Harbors and Brookside completed removing material from the interior of the tunnels, Roux personnel completed a thorough inspection to ensure that all debris had been removed to the extent feasible. When it was determined that the tunnel had been thoroughly cleared of all oil, water, sludge, and debris, Brookside used a low pressure flowable fill concrete mix to grout both tunnels. The entirety of both tunnels were completely filled with the flowable fill.

The waste generated during the boiler house lateral discharge tunnel remediation was characterized and disposed offsite as hazardous/TSCA-regulated waste. Five Cusco vacuum trailers of material were disposed of to Clean Harbors of Braintree, Braintree, Massachusetts, totaling approximately 31 tons of waste. Approximately 131 drums of solid debris were generated during the remediation. Drums contained

PCB-contaminated large concrete chunks, wood debris, personal protective equipment (PPE), poly-sheeting, absorbents, tools, and any other materials that came into contact with the tunnel waste during the remediation process.

Prior to remediation and plugging of the lateral discharge tunnels, throughout the 2018 and 2019 groundwater gauging events, thin layers or trace amounts of LNAPL were observed periodically in monitoring wells MW-16 and MW-17, which were installed just north of the boiler house lateral discharge tunnels. Since the tunnels were cleaned, grouted, and plugged, LNAPL was not observed in either MW-16 or MW-17 during the last two quarterly sampling rounds. By removing the impacted material and completely grouting the tunnels, effectively immobilizing any residual contaminated material, nearby groundwater and soil will not be further impacted by the lateral discharge tunnels.

4. Proposed Remedial Action

Based on the previously completed remediation and investigation work discussed in the USEPA RAWP and Sections 2 and 3 of this report, the onsite areas that warrant additional remediation are limited to the turbine hall sump structures and mat slab. The proposed remediation plan is outlined below.

As previously discussed, the parking and utility equipment rooms on the lowest level of the turbine hall will be classified as Low Occupancy Area (i.e., building occupants in the building areas less than 6.7 hours per week). All remediation of building materials at the cellar level of the turbine hall will be performed to meet the USEPA Low Occupancy Area requirements. Elevated concentrations of PCBs will remain below the mat slab and in the sumps; these concentrations will be addressed with a TSCA-compliant cap that will prevent contact and isolate the contaminated materials rendering the building suitable for its' intended use.

4.1 Turbine Hall Sump Structures

As discussed above, all recoverable LNAPL and readily accessible material inside the sumps was removed prior to temporarily covering the sumps with steel plates and sealing them off to keep the structures watertight in preparation for the turbine hall mat slab load test.

The sump structures will be uncovered for final remediation. Based on the turbine hall sump investigation completed in December 2018, the bottom of the sumps are estimated to be 6 to 8 feet below the top of the current mat slab. Roux proposes to first backfill the sumps with self-compacting clean ¾-inch gravel to an approximate depth of 3 to 4 feet below top of slab. The use of self-compacting stone will allow for backfilling even with standing water in the sumps. The gravel will fill any potential voids or unforeseen anomalies in the sump structures and provide a level base to accept the concrete plug. All ten sumps will be sealed with a concrete plug with a standard concrete mix of a minimum of 3,000 psi strength. When the sumps are being grouted, a dry concrete mix will be used to maximize the absorption of standing water within the sump spaces. Concrete will be placed into each sump starting uniformly working from bottom to top. Any remaining groundwater displaced by the grout will be captured via drum vacuum and disposed of offsite. There will be no additional removal of materials from the sumps other than what is displaced during the grouting process. The concrete plug at each sump structure will be a minimum of 2 feet thick. Since the concrete used to fill the turbine hall sumps will not have a structural purpose, the top 18-inches of the sump will be completed to the top of the mat slab with a reinforced structural concrete slab that will be tied into the existing mat slab as required by the final structural design.

Samples of the concrete plug mix will be collected each day of grouting to evaluate the unconfined compressive strength and verify curing of the concrete to meet designed specs over a 7-day period. If any settling is observed within the sump structure it will be addressed through modification of the structural slab thickness.

All observations, material removed, and residual contamination remaining in place will be properly documented.

4.2 Turbine Hall Mat Slab

The residual PCB contamination on the turbine hall mat slab has been delineated to a limited area and the sump structure remediation will eliminate any potential pathways for further impact to the turbine hall mat slab.

The proposed remediation for the turbine hall mat slab is the installation of a TSCA-compliant cap following the remediation of the turbine hall sump structures. The cap will consists of 1 to 2 feet of clean imported

soil and RCA to act as a leveling course, an additional 1.5 to 2 feet of clean imported soil, a 3-inch mud slab, a water proofing/vapor barrier membrane (i.e. Grace Preprufe 300R Membrane), and a 6-inch reinforced concrete slab, meeting the capping requirements of 40 CFR §761.61 (a)(4)(7). In addition, the Site will have a deed restriction, in accordance with 40 CFR §761.61 (a)(4)(8), as discussed below. Cross-sections detailing the turbine hall final slab installation details are included Appendix D.

The likely sources of volatile organic compounds (VOCs) in the turbine hall were identified as the LNAPL, dissolved VOCs in groundwater, and impacted soils associated with the former sand leveling course. Sampling of VOCs has not been completed for the turbine hall mat slab concrete itself as this has not been determined as a contaminant of concern in concrete for the Site. The LNAPL and former sand leveling course potential sources of VOCs have been removed as summarized above. Based on groundwater analytical data collected during the RA, groundwater is the most likely remaining source of VOCs in the turbine hall. Because the turbine hall sumps are believed to be indirectly connected to groundwater, the grouting of the turbine hall sumps followed by the vapor barrier and cap installation as discussed above will seal all potential pathways for VOCs to affect future occupants of the building.

4.3 Soil Vapor Assessment

As discussed in Section 4.2, groundwater is the likely remaining source of VOCs in the turbine hall and will be addressed as part of the turbine hall sump remediation. Any potential residual vapors will be address via the turbine hall mat slab cap installation. The cap will include 1 to 2 feet of clean imported soil and RCA to act as a leveling course, 1.5 to 2 feet of clean imported soil, 3-inch mud slab, Grace Preprufe 300R Membrane as the waterproofing/vapor barrier, and a 6-inch reinforced concrete slab. Additionally, the cellar level of the proposed turbine hall's redevelopment plan will be used as a parking area, which will include mechanical ventilation with air exchange rates in accordance with the requirements of the New York City Department of Buildings and will provide additional vapor mitigation.

Prior to the construction of any enclosed structures or reoccupation of the existing turbine hall building, a soil vapor intrusion (SVI) evaluation will be performed to determine whether any additional mitigation measures are necessary to eliminate potential exposure to vapors in the proposed or existing structure.

4.4 Institutional Controls

Since remaining contamination exists at the Site, institutional controls (ICs) are required to protect human health and the environment. The ICs will be used to prevent future exposure to remaining contamination and limit the use and development of the Site to Restricted Residential, Commercial, and/or Industrial uses only. In addition to the Environmental Easement and SMP requirements, a deed restriction will be implemented for all Low Occupancy Area in accordance with 40 CFR §761.61 (a)(4)(8). The deed restriction will limit the use of the cellar to parking and utility equipment rooms only.

4.5 Schedule

Following approval, a detailed schedule outlining specific tasks and approximate durations will be provided to the USEPA.

4.6 Reporting

All investigation and remediation efforts will be properly documented and reported in accordance with the June 2017 Administrative Settlement Agreement and Order on Consent for a Removal Action entered among the USEPA and GAII.

TABLES

1. Summary of Volatile Organic Compounds in Soil
2. Summary of Semivolatile Organic Compounds in Soil
3. Summary of Metals in Soil
4. Summary of Polychlorinated Biphenyls in Soil
5. Summary of Pesticides and Herbicides in Soil
6. Summary of Polychlorinated Biphenyls in Boiler House and Turbine Hall Building Materials

Notes Utilized Throughout Tables	
Soil Tables	
J -	Estimated value
U -	Indicates that the compound was analyzed for but not detected
T -	Indicates that a quality control parameter has exceeded laboratory limits
mg/kg -	Milligrams per kilogram
NYSDEC -	New York State Department of Environmental Conservation
SCO -	Soil Cleanup Objectives
--	No SCO available
Bold data indicates that parameter was detected above the NYSDEC Part 375 Restricted Residential SCO	
Shaded data indicates that parameter was detected above the NYSDEC Part 375 Commercial SCO	

Table 1. Summary of Volatile Organic Compounds in Soil, 322 3rd Avenue, Brooklyn, New York

			Sample Designation:	EPA-SB-1	EPA-SB-1	EPA-SB-1	MW-12	MW-12
			Sample Date:	02/20/2020	02/20/2020	02/20/2020	12/18/2019	12/18/2019
			Sample Depth (ft bls):	10 - 12	16 - 18	32 - 34	3.5 - 5.5	34.5 - 36.5
Parameter	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Commercial SCO	Unit					
1,1,1-Trichloroethane (TCA)	100	500	MG/KG	0.0022 U	0.0033 U	0.0011 U	0.0013 U	0.12 U
1,1,2,2-Tetrachloroethane	--	--	MG/KG	NA	NA	NA	NA	NA
1,1,2-Trichloro-1,2,2-Trifluoroethane	--	--	MG/KG	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	--	--	MG/KG	NA	NA	NA	NA	NA
1,1-Dichloroethane	26	240	MG/KG	0.0022 U	0.0033 U	0.0011 U	0.0013 U	0.12 U
1,1-Dichloroethene	100	500	MG/KG	0.0022 U	0.0033 U	0.0011 U	0.0013 U	0.12 U
1,2,3-Trichlorobenzene	--	--	MG/KG	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	--	--	MG/KG	NA	NA	NA	NA	NA
1,2,4-Trimethylbenzene	52	190	MG/KG	0.0029	0.0033 U	0.0011 U	0.0013 U	25
1,2-Dibromo-3-Chloropropane	--	--	MG/KG	NA	NA	NA	NA	NA
1,2-Dibromoethane (Ethylene Dibromide)	--	--	MG/KG	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	100	500	MG/KG	0.0022 U	0.0033 U	0.0011 U	0.0013 U	0.13
1,2-Dichloroethane	3.1	30	MG/KG	0.0022 U	0.0033 U	0.0011 U	0.0013 U	0.12 U
1,2-Dichloropropane	--	--	MG/KG	NA	NA	NA	NA	NA
1,3,5-Trimethylbenzene (Mesitylene)	52	190	MG/KG	0.0013 J	0.0033 U	0.0011 U	0.0013 U	11
1,3-Dichlorobenzene	**49**	280	MG/KG	0.0022 U	0.0033 U	0.0011 U	0.0013 U	0.12 U
1,4-Dichlorobenzene	**13**	130	MG/KG	0.0022 U	0.0033 U	0.0011 U	0.0013 U	0.12 U
1,4-Dioxane (P-Dioxane)	13	130	MG/KG	NA	NA	NA	NA	NA
2-Hexanone	--	--	MG/KG	NA	NA	NA	NA	NA
Acetone	100	500	MG/KG	0.094	0.12	0.0068 U	0.017	0.79
Benzene	4.8	44	MG/KG	0.0022 U	0.0033 U	0.0011 U	0.0013 U	0.12 U
Bromochloromethane	--	--	MG/KG	NA	NA	NA	NA	NA
Bromodichloromethane	--	--	MG/KG	NA	NA	NA	NA	NA
Bromoform	--	--	MG/KG	NA	NA	NA	NA	NA
Bromomethane	--	--	MG/KG	NA	NA	NA	NA	NA
Carbon Disulfide	--	--	MG/KG	NA	NA	NA	NA	NA
Carbon Tetrachloride	2.4	22	MG/KG	0.0022 U	0.0033 U	0.0011 U	0.0013 U	0.12 UT
Chlorobenzene	100	500	MG/KG	0.0022 U	0.0033 U	0.0011 U	0.0013 U	0.12 U
Chloroethane	--	--	MG/KG	NA	NA	NA	NA	NA
Chloroform	49	350	MG/KG	0.0022 U	0.0033 U	0.0011 U	0.0013 U	0.12 U
Chloromethane	--	--	MG/KG	NA	NA	NA	NA	NA
Cis-1,2-Dichloroethylene	100	500	MG/KG	0.0022 U	0.0033 U	0.00043 J	0.0013 U	0.12 U

Table 1. Summary of Volatile Organic Compounds in Soil, 322 3rd Avenue, Brooklyn, New York

			Sample Designation:	EPA-SB-1	EPA-SB-1	EPA-SB-1	MW-12	MW-12
			Sample Date:	02/20/2020	02/20/2020	02/20/2020	12/18/2019	12/18/2019
			Sample Depth (ft bls):	10 - 12	16 - 18	32 - 34	3.5 - 5.5	34.5 - 36.5
Parameter	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Commercial SCO	Unit					
Cis-1,3-Dichloropropene	--	--	MG/KG	NA	NA	NA	NA	NA
Cyclohexane	--	--	MG/KG	NA	NA	NA	NA	NA
Dibromochloromethane	--	--	MG/KG	NA	NA	NA	NA	NA
Dichlorodifluoromethane	--	--	MG/KG	NA	NA	NA	NA	NA
Ethylbenzene	41	390	MG/KG	0.0022 U	0.0033 U	0.0011 U	0.0013 U	2.6
Isopropylbenzene (Cumene)	--	--	MG/KG	NA	NA	NA	NA	NA
m,p-Xylene	--	--	MG/KG	NA	NA	NA	NA	NA
Methyl Acetate	--	--	MG/KG	NA	NA	NA	NA	NA
Methyl Ethyl Ketone (2-Butanone)	100	500	MG/KG	0.011 UT	0.024	0.0057 U	0.012	0.58 U
Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	--	--	MG/KG	NA	NA	NA	NA	NA
Methylcyclohexane	--	--	MG/KG	NA	NA	NA	NA	NA
Methylene Chloride	100	500	MG/KG	0.0022 U	0.0033 U	0.0006 J	0.00067 J	0.12 U
N-Butylbenzene	100	500	MG/KG	0.0022 U	0.0033 U	0.0011 U	0.0013 U	0.12 U
N-Propylbenzene	100	500	MG/KG	0.0022 U	0.0033 U	0.0011 U	0.0013 U	7.2
O-Xylene (1,2-Dimethylbenzene)	--	--	MG/KG	NA	NA	NA	NA	NA
Sec-Butylbenzene	100	500	MG/KG	0.0012 J	0.0033 U	0.0011 U	0.0013 U	0.59
Styrene	--	--	MG/KG	NA	NA	NA	NA	NA
T-Butylbenzene	100	500	MG/KG	0.0022 U	0.0033 U	0.0011 U	0.0013 U	0.12 U
Tert-Butyl Methyl Ether	100	500	MG/KG	0.0022 U	0.0067	0.00026 J	0.0013 U	0.12 U
Tetrachloroethylene (PCE)	19	150	MG/KG	0.0022 U	0.0033 U	0.0011 U	0.0003 J	0.12 U
Toluene	100	500	MG/KG	0.0022 U	0.0033 U	0.0011 U	0.0013 U	0.12 U
Trans-1,2-Dichloroethene	100	500	MG/KG	0.0022 U	0.0033 U	0.0011 U	0.0013 U	0.12 U
Trans-1,3-Dichloropropene	--	--	MG/KG	NA	NA	NA	NA	NA
Trichloroethylene (TCE)	21	200	MG/KG	0.0022 U	0.0033 U	0.0011 U	0.0013 U	0.12 U
Trichlorofluoromethane	--	--	MG/KG	NA	NA	NA	NA	NA
Vinyl Chloride	0.9	13	MG/KG	0.0022 U	0.0033 U	0.0011 U	0.0013 U	0.12 U
Xylenes	100	500	MG/KG	0.00076 J	0.0066 U	0.0023 U	0.0026 U	2.6
Xylenes, Total	100	500	MG/KG	NA	NA	NA	NA	NA

Table 1. Summary of Volatile Organic Compounds in Soil, 322 3rd Avenue, Brooklyn, New York

			Sample Designation:	MW-13	MW-13	MW-14	MW-14	MW-14
			Sample Date:	02/21/2020	02/21/2020	02/20/2020	02/20/2020	02/20/2020
			Sample Depth (ft bls):	14 - 16	38 - 40	10 - 12	17 - 19	33 - 35
Parameter	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Commercial SCO	Unit					
1,1,1-Trichloroethane (TCA)	100	500	MG/KG	0.16 U	0.0012 U	0.0017 U	0.0019 U	0.0012 U
1,1,2,2-Tetrachloroethane	--	--	MG/KG	NA	NA	NA	NA	NA
1,1,2-Trichloro-1,2,2-Trifluoroethane	--	--	MG/KG	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	--	--	MG/KG	NA	NA	NA	NA	NA
1,1-Dichloroethane	26	240	MG/KG	0.16 U	0.0012 U	0.0017 U	0.0019 U	0.0012 U
1,1-Dichloroethene	100	500	MG/KG	0.16 U	0.0012 U	0.0017 U	0.0019 U	0.0012 U
1,2,3-Trichlorobenzene	--	--	MG/KG	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	--	--	MG/KG	NA	NA	NA	NA	NA
1,2,4-Trimethylbenzene	52	190	MG/KG	0.064 J	0.0012 U	0.0017 U	0.0019 U	0.0012 U
1,2-Dibromo-3-Chloropropane	--	--	MG/KG	NA	NA	NA	NA	NA
1,2-Dibromoethane (Ethylene Dibromide)	--	--	MG/KG	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	100	500	MG/KG	0.16 U	0.00019 J	0.0017 U	0.0019 U	0.0012 U
1,2-Dichloroethane	3.1	30	MG/KG	0.16 U	0.0012 U	0.0017 U	0.0019 U	0.0012 U
1,2-Dichloropropane	--	--	MG/KG	NA	NA	NA	NA	NA
1,3,5-Trimethylbenzene (Mesitylene)	52	190	MG/KG	0.16 U	0.0012 U	0.0017 U	0.0019 U	0.0012 U
1,3-Dichlorobenzene	**49**	280	MG/KG	0.16 U	0.0012 U	0.0017 U	0.0019 U	0.0012 U
1,4-Dichlorobenzene	**13**	130	MG/KG	0.16 U	0.0012 U	0.0017 U	0.0019 U	0.0012 U
1,4-Dioxane (P-Dioxane)	13	130	MG/KG	NA	NA	NA	NA	NA
2-Hexanone	--	--	MG/KG	NA	NA	NA	NA	NA
Acetone	100	500	MG/KG	0.79 U	0.0074 U	0.021	0.028	0.0072 U
Benzene	4.8	44	MG/KG	0.16 U	0.0012 U	0.0017 U	0.0019 U	0.0012 U
Bromochloromethane	--	--	MG/KG	NA	NA	NA	NA	NA
Bromodichloromethane	--	--	MG/KG	NA	NA	NA	NA	NA
Bromoform	--	--	MG/KG	NA	NA	NA	NA	NA
Bromomethane	--	--	MG/KG	NA	NA	NA	NA	NA
Carbon Disulfide	--	--	MG/KG	NA	NA	NA	NA	NA
Carbon Tetrachloride	2.4	22	MG/KG	0.16 U	0.0012 U	0.0017 U	0.0019 U	0.0012 U
Chlorobenzene	100	500	MG/KG	0.16 U	0.0012 U	0.0017 U	0.0019 U	0.0012 U
Chloroethane	--	--	MG/KG	NA	NA	NA	NA	NA
Chloroform	49	350	MG/KG	0.16 U	0.0012 U	0.0017 U	0.0019 U	0.0012 U
Chloromethane	--	--	MG/KG	NA	NA	NA	NA	NA
Cis-1,2-Dichloroethylene	100	500	MG/KG	0.16 U	0.0012 U	0.0017 U	0.0019 U	0.0003 J

Table 1. Summary of Volatile Organic Compounds in Soil, 322 3rd Avenue, Brooklyn, New York

			Sample Designation:	MW-13	MW-13	MW-14	MW-14	MW-14
			Sample Date:	02/21/2020	02/21/2020	02/20/2020	02/20/2020	02/20/2020
			Sample Depth (ft bls):	14 - 16	38 - 40	10 - 12	17 - 19	33 - 35
Parameter	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Commercial SCO	Unit					
Cis-1,3-Dichloropropene	--	--	MG/KG	NA	NA	NA	NA	NA
Cyclohexane	--	--	MG/KG	NA	NA	NA	NA	NA
Dibromochloromethane	--	--	MG/KG	NA	NA	NA	NA	NA
Dichlorodifluoromethane	--	--	MG/KG	NA	NA	NA	NA	NA
Ethylbenzene	41	390	MG/KG	0.067 J	0.0012 U	0.0017 U	0.0019 U	0.0012 U
Isopropylbenzene (Cumene)	--	--	MG/KG	NA	NA	NA	NA	NA
m,p-Xylene	--	--	MG/KG	NA	NA	NA	NA	NA
Methyl Acetate	--	--	MG/KG	NA	NA	NA	NA	NA
Methyl Ethyl Ketone (2-Butanone)	100	500	MG/KG	0.79 U	0.0061 U	0.0087 U	0.0093 UT	0.006 UT
Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	--	--	MG/KG	NA	NA	NA	NA	NA
Methylcyclohexane	--	--	MG/KG	NA	NA	NA	NA	NA
Methylene Chloride	100	500	MG/KG	0.16 U	0.0012 U	0.0017 U	0.0019 U	0.0012 U
N-Butylbenzene	100	500	MG/KG	0.22	0.0012 U	0.0017 U	0.0019 U	0.0012 U
N-Propylbenzene	100	500	MG/KG	0.16 U	0.0012 U	0.0017 U	0.0019 U	0.0012 U
O-Xylene (1,2-Dimethylbenzene)	--	--	MG/KG	NA	NA	NA	NA	NA
Sec-Butylbenzene	100	500	MG/KG	0.34	0.0012 U	0.00024 J	0.0019 U	0.0012 U
Styrene	--	--	MG/KG	NA	NA	NA	NA	NA
T-Butylbenzene	100	500	MG/KG	0.1 J	0.0012 U	0.0017 U	0.0019 U	0.0012 U
Tert-Butyl Methyl Ether	100	500	MG/KG	0.16 U	0.0012 U	0.0017 U	0.0019 U	0.0012 U
Tetrachloroethylene (PCE)	19	150	MG/KG	0.16 U	0.0012 U	0.0017 U	0.0028	0.0012 U
Toluene	100	500	MG/KG	0.16 U	0.0012 U	0.0017 U	0.0019 U	0.0012 U
Trans-1,2-Dichloroethene	100	500	MG/KG	0.16 U	0.0012 U	0.0017 U	0.0019 U	0.0012 U
Trans-1,3-Dichloropropene	--	--	MG/KG	NA	NA	NA	NA	NA
Trichloroethylene (TCE)	21	200	MG/KG	0.16 U	0.0012 U	0.0017 U	0.0019 U	0.0012 U
Trichlorofluoromethane	--	--	MG/KG	NA	NA	NA	NA	NA
Vinyl Chloride	0.9	13	MG/KG	0.16 U	0.0012 U	0.0017 U	0.0019 U	0.0012 U
Xylenes	100	500	MG/KG	0.32 U	0.0025 U	0.0035 U	0.0037 U	0.0024 U
Xylenes, Total	100	500	MG/KG	NA	NA	NA	NA	NA

Table 1. Summary of Volatile Organic Compounds in Soil, 322 3rd Avenue, Brooklyn, New York

			Sample Designation:	MW-16	MW-16	MW-16	MW-16E	MW-16E
			Sample Date:	07/20/2018	07/20/2018	07/20/2018	11/02/2018	11/02/2018
			Sample Depth (ft bls):	13 - 15	25 - 27	32 - 34	7 - 9	14 - 15
Parameter	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Commercial SCO	Unit					
1,1,1-Trichloroethane (TCA)	100	500	MG/KG	0.0011 U	3.3 U	0.00093 U	0.001 U	0.00091 U
1,1,2,2-Tetrachloroethane	--	--	MG/KG	NA	NA	NA	0.001 U	0.00091 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	--	--	MG/KG	NA	NA	NA	0.001 U	0.00091 U
1,1,2-Trichloroethane	--	--	MG/KG	NA	NA	NA	0.001 U	0.00091 U
1,1-Dichloroethane	26	240	MG/KG	0.0011 U	3.3 U	0.00093 U	0.001 U	0.00091 U
1,1-Dichloroethene	100	500	MG/KG	0.0011 U	3.3 U	0.00093 U	0.001 U	0.00091 U
1,2,3-Trichlorobenzene	--	--	MG/KG	NA	NA	NA	0.001 U	0.00091 U
1,2,4-Trichlorobenzene	--	--	MG/KG	NA	NA	NA	0.00019 J	0.00087 J
1,2,4-Trimethylbenzene	52	190	MG/KG	0.0011 U	3.3 U	0.00093 U	NA	NA
1,2-Dibromo-3-Chloropropane	--	--	MG/KG	NA	NA	NA	0.001 U	0.00091 U
1,2-Dibromoethane (Ethylene Dibromide)	--	--	MG/KG	NA	NA	NA	0.001 U	0.00091 U
1,2-Dichlorobenzene	100	500	MG/KG	0.0011 U	1.9 J	0.00015 J	0.001 U	0.00091 U
1,2-Dichloroethane	3.1	30	MG/KG	0.0011 U	3.3 U	0.00093 U	0.001 U	0.00091 U
1,2-Dichloropropane	--	--	MG/KG	NA	NA	NA	0.001 U	0.00091 U
1,3,5-Trimethylbenzene (Mesitylene)	52	190	MG/KG	0.0011 U	3.3 U	0.00093 U	NA	NA
1,3-Dichlorobenzene	**49**	280	MG/KG	0.0011 U	**79**	0.0037	0.00026 J	0.00052 J
1,4-Dichlorobenzene	**13**	130	MG/KG	0.0011 U	**800**	0.029	0.00064 J	0.0016
1,4-Dioxane (P-Dioxane)	13	130	MG/KG	0.022 U	160 U	0.019 U	0.02 U	0.018 U
2-Hexanone	--	--	MG/KG	NA	NA	NA	0.0051 U	0.0045 U
Acetone	100	500	MG/KG	0.016	16 U	0.0051	0.064	0.007
Benzene	4.8	44	MG/KG	0.0011 U	3.3 U	0.00093 U	0.00037 J	0.00091 U
Bromochloromethane	--	--	MG/KG	NA	NA	NA	0.001 U	0.00091 U
Bromodichloromethane	--	--	MG/KG	NA	NA	NA	0.001 U	0.00091 U
Bromoform	--	--	MG/KG	NA	NA	NA	0.001 U	0.00091 U
Bromomethane	--	--	MG/KG	NA	NA	NA	0.001 U	0.00091 U
Carbon Disulfide	--	--	MG/KG	NA	NA	NA	0.0035	0.003
Carbon Tetrachloride	2.4	22	MG/KG	0.0011 U	3.3 U	0.00093 U	0.001 U	0.00091 U
Chlorobenzene	100	500	MG/KG	0.0011 U	100	0.0013	0.0044	0.0017
Chloroethane	--	--	MG/KG	NA	NA	NA	0.001 U	0.00091 U
Chloroform	49	350	MG/KG	0.0011 U	3.3 U	0.00093 U	0.001 U	0.00091 U
Chloromethane	--	--	MG/KG	NA	NA	NA	0.001 U	0.00091 U
Cis-1,2-Dichloroethylene	100	500	MG/KG	0.0011 U	3.3 U	0.00041 J	0.001 U	0.00091 U

Table 1. Summary of Volatile Organic Compounds in Soil, 322 3rd Avenue, Brooklyn, New York

			Sample Designation:	MW-16	MW-16	MW-16	MW-16E	MW-16E
			Sample Date:	07/20/2018	07/20/2018	07/20/2018	11/02/2018	11/02/2018
			Sample Depth (ft bls):	13 - 15	25 - 27	32 - 34	7 - 9	14 - 15
Parameter	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Commercial SCO	Unit					
Cis-1,3-Dichloropropene	--	--	MG/KG	NA	NA	NA	0.001 U	0.00091 U
Cyclohexane	--	--	MG/KG	NA	NA	NA	0.001 U	0.00091 U
Dibromochloromethane	--	--	MG/KG	NA	NA	NA	0.001 U	0.00091 U
Dichlorodifluoromethane	--	--	MG/KG	NA	NA	NA	0.001 UT	0.00091 UT
Ethylbenzene	41	390	MG/KG	0.0011 U	3.3 U	0.00093 U	0.001 U	0.00091 U
Isopropylbenzene (Cumene)	--	--	MG/KG	NA	NA	NA	0.001 U	0.00091 U
m,p-Xylene	--	--	MG/KG	NA	NA	NA	0.001 U	0.00091 U
Methyl Acetate	--	--	MG/KG	NA	NA	NA	0.0051 U	0.0045 U
Methyl Ethyl Ketone (2-Butanone)	100	500	MG/KG	0.0035 J	16 U	0.0046 U	0.0065	0.0045 U
Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	--	--	MG/KG	NA	NA	NA	0.0051 U	0.0045 U
Methylcyclohexane	--	--	MG/KG	NA	NA	NA	0.001 U	0.00091 U
Methylene Chloride	100	500	MG/KG	0.0011 U	3.3 U	0.00018 J	0.00046 J	0.00091 U
N-Butylbenzene	100	500	MG/KG	0.0011 U	3.3 U	0.00093 U	NA	NA
N-Propylbenzene	100	500	MG/KG	0.0011 U	3.3 U	0.00093 U	NA	NA
O-Xylene (1,2-Dimethylbenzene)	--	--	MG/KG	NA	NA	NA	0.00022 J	0.00091 U
Sec-Butylbenzene	100	500	MG/KG	0.0011 U	3.3 U	0.00093 U	NA	NA
Styrene	--	--	MG/KG	NA	NA	NA	0.00026 J	0.00016 J
T-Butylbenzene	100	500	MG/KG	0.0011 U	3.3 U	0.00093 U	NA	NA
Tert-Butyl Methyl Ether	100	500	MG/KG	0.0011 U	3.3 U	0.0021	0.00019 J	0.00078 J
Tetrachloroethylene (PCE)	19	150	MG/KG	0.00055 J	3.3 U	0.00093 U	0.001 U	0.00091 U
Toluene	100	500	MG/KG	0.0011 U	3.3 U	0.00093 U	0.0011	0.001
Trans-1,2-Dichloroethene	100	500	MG/KG	0.0011 U	3.3 U	0.00093 U	0.001 U	0.00091 U
Trans-1,3-Dichloropropene	--	--	MG/KG	NA	NA	NA	0.001 U	0.00091 U
Trichloroethylene (TCE)	21	200	MG/KG	0.00019 J	3.3 U	0.00093 U	0.001 U	0.00091 U
Trichlorofluoromethane	--	--	MG/KG	NA	NA	NA	0.001 U	0.00091 U
Vinyl Chloride	0.9	13	MG/KG	0.0011 U	3.3 U	0.00093 U	0.001 U	0.00091 U
Xylenes	100	500	MG/KG	NA	NA	NA	NA	NA
Xylenes, Total	100	500	MG/KG	0.0022 U	6.5 U	0.0019 U	NA	NA

Table 1. Summary of Volatile Organic Compounds in Soil, 322 3rd Avenue, Brooklyn, New York

			Sample Designation:	MW-16S	MW-16S	MW-16S	MW-16S	MW-16W
			Sample Date:	11/02/2018	11/02/2018	11/02/2018	11/02/2018	11/02/2018
			Sample Depth (ft bls):	5 - 10	13 - 15	17 - 19	21 - 23	8 - 10
Parameter	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Commercial SCO	Unit					
1,1,1-Trichloroethane (TCA)	100	500	MG/KG	0.6 U	0.47 U	0.26 U	0.12 U	0.00091 U
1,1,2,2-Tetrachloroethane	--	--	MG/KG	0.6 U	0.47 U	0.26 U	0.12 U	0.00091 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	--	--	MG/KG	0.6 U	0.47 U	0.26 U	0.12 U	0.00091 U
1,1,2-Trichloroethane	--	--	MG/KG	0.6 U	0.47 U	0.26 U	0.12 U	0.00091 U
1,1-Dichloroethane	26	240	MG/KG	0.6 U	0.47 U	0.26 U	0.12 U	0.00091 U
1,1-Dichloroethene	100	500	MG/KG	0.6 U	0.47 U	0.26 U	0.12 UT	0.00091 U
1,2,3-Trichlorobenzene	--	--	MG/KG	2.1	35	9.4	9	0.00091 U
1,2,4-Trichlorobenzene	--	--	MG/KG	1.3	130	31	30	0.00091 U
1,2,4-Trimethylbenzene	52	190	MG/KG	NA	NA	NA	NA	NA
1,2-Dibromo-3-Chloropropane	--	--	MG/KG	0.6 U	0.47 U	0.26 U	0.12 U	0.00091 U
1,2-Dibromoethane (Ethylene Dibromide)	--	--	MG/KG	0.6 U	0.47 U	0.26 U	0.12 U	0.00091 U
1,2-Dichlorobenzene	100	500	MG/KG	0.55 J	4.3	1.1	0.99	0.00091 U
1,2-Dichloroethane	3.1	30	MG/KG	0.6 U	0.47 U	0.26 U	0.12 U	0.00091 U
1,2-Dichloropropane	--	--	MG/KG	0.6 U	0.47 U	0.26 U	0.12 U	0.00091 U
1,3,5-Trimethylbenzene (Mesitylene)	52	190	MG/KG	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	**49**	280	MG/KG	35	9.5	3.5	3.2	0.00029 J
1,4-Dichlorobenzene	**13**	130	MG/KG	**150**	**45**	**18**	**15**	0.00054 J
1,4-Dioxane (P-Dioxane)	13	130	MG/KG	30 U	24 U	13 U	5.9 U	0.018 U
2-Hexanone	--	--	MG/KG	3 U	2.4 U	1.3 U	0.59 U	0.0046 U
Acetone	100	500	MG/KG	3 U	2.4 U	1.3 U	0.59 U	0.023
Benzene	4.8	44	MG/KG	0.6 U	0.47 U	0.26 U	0.12 U	0.00091 U
Bromochloromethane	--	--	MG/KG	0.6 U	0.47 U	0.26 U	0.12 U	0.00091 U
Bromodichloromethane	--	--	MG/KG	0.6 U	0.47 U	0.26 U	0.12 U	0.00091 U
Bromoform	--	--	MG/KG	0.6 U	0.47 U	0.26 U	0.12 U	0.00091 U
Bromomethane	--	--	MG/KG	0.6 U	0.47 U	0.26 U	0.12 U	0.00091 U
Carbon Disulfide	--	--	MG/KG	0.6 U	0.47 U	0.26 U	0.12 UT	0.0057
Carbon Tetrachloride	2.4	22	MG/KG	0.6 U	0.47 U	0.26 U	0.12 U	0.00091 U
Chlorobenzene	100	500	MG/KG	8.1	1.5	0.59	0.48	0.00091 U
Chloroethane	--	--	MG/KG	0.6 U	0.47 U	0.26 U	0.12 U	0.00091 U
Chloroform	49	350	MG/KG	0.6 U	0.47 U	0.26 U	0.12 U	0.00091 U
Chloromethane	--	--	MG/KG	0.6 U	0.47 U	0.26 U	0.12 U	0.00091 U
Cis-1,2-Dichloroethylene	100	500	MG/KG	0.6 U	0.47 U	0.26 U	0.12 U	0.00091 U

Table 1. Summary of Volatile Organic Compounds in Soil, 322 3rd Avenue, Brooklyn, New York

			Sample Designation:	MW-16S	MW-16S	MW-16S	MW-16S	MW-16W
			Sample Date:	11/02/2018	11/02/2018	11/02/2018	11/02/2018	11/02/2018
			Sample Depth (ft bls):	5 - 10	13 - 15	17 - 19	21 - 23	8 - 10
Parameter	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Commercial SCO	Unit					
Cis-1,3-Dichloropropene	--	--	MG/KG	0.6 U	0.47 U	0.26 U	0.12 U	0.00091 U
Cyclohexane	--	--	MG/KG	0.6 U	0.47 U	0.26 U	0.12 UT	0.00091 U
Dibromochloromethane	--	--	MG/KG	0.6 U	0.47 U	0.26 U	0.12 U	0.00091 U
Dichlorodifluoromethane	--	--	MG/KG	0.6 U	0.47 U	0.26 U	0.12 U	0.00091 UT
Ethylbenzene	41	390	MG/KG	0.6 U	0.47 U	0.26 U	0.12 U	0.00091 U
Isopropylbenzene (Cumene)	--	--	MG/KG	0.6 U	0.47 U	0.26 U	0.12 U	0.00091 U
m,p-Xylene	--	--	MG/KG	0.6 U	0.47 U	0.26 U	0.12 U	0.00091 U
Methyl Acetate	--	--	MG/KG	1.1 J	2.4 U	1.3 U	0.59 U	0.0046 U
Methyl Ethyl Ketone (2-Butanone)	100	500	MG/KG	3 U	2.4 U	1.3 U	0.59 U	0.0038 J
Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	--	--	MG/KG	3 U	2.4 U	1.3 U	0.59 U	0.0046 U
Methylcyclohexane	--	--	MG/KG	0.6 U	0.47 U	0.26 U	0.12 U	0.00091 U
Methylene Chloride	100	500	MG/KG	0.6 U	0.47 U	0.26 U	0.12 U	0.00046 J
N-Butylbenzene	100	500	MG/KG	NA	NA	NA	NA	NA
N-Propylbenzene	100	500	MG/KG	NA	NA	NA	NA	NA
O-Xylene (1,2-Dimethylbenzene)	--	--	MG/KG	0.6 U	0.47 U	0.26 U	0.12 U	0.00091 U
Sec-Butylbenzene	100	500	MG/KG	NA	NA	NA	NA	NA
Styrene	--	--	MG/KG	0.6 U	0.47 U	0.26 U	0.12 U	0.00091 U
T-Butylbenzene	100	500	MG/KG	NA	NA	NA	NA	NA
Tert-Butyl Methyl Ether	100	500	MG/KG	0.6 U	0.47 U	0.26 U	0.12 U	0.00025 J
Tetrachloroethylene (PCE)	19	150	MG/KG	0.6 U	0.47 U	0.26 U	0.12 U	0.00091 U
Toluene	100	500	MG/KG	0.6 U	0.47 U	0.26 U	0.12 U	0.00091 U
Trans-1,2-Dichloroethene	100	500	MG/KG	0.6 U	0.47 U	0.26 U	0.12 U	0.00091 U
Trans-1,3-Dichloropropene	--	--	MG/KG	0.6 U	0.47 U	0.26 U	0.12 U	0.00091 U
Trichloroethylene (TCE)	21	200	MG/KG	0.6 U	0.47 U	0.26 U	0.12 U	0.00091 U
Trichlorofluoromethane	--	--	MG/KG	0.6 U	0.47 U	0.26 U	0.12 U	0.00091 U
Vinyl Chloride	0.9	13	MG/KG	0.6 U	0.47 U	0.26 U	0.12 U	0.00091 U
Xylenes	100	500	MG/KG	NA	NA	NA	NA	NA
Xylenes, Total	100	500	MG/KG	NA	NA	NA	NA	NA

Table 1. Summary of Volatile Organic Compounds in Soil, 322 3rd Avenue, Brooklyn, New York

			Sample Designation:	MW-16W	MW-17	MW-17	MW-17
			Sample Date:	11/02/2018	07/20/2018	07/20/2018	07/20/2018
			Sample Depth (ft bls):	14 - 16	11 - 13	17 - 19	32 - 34
Parameter	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Commercial SCO	Unit				
1,1,1-Trichloroethane (TCA)	100	500	MG/KG	0.00098 U	0.00098 U	0.23 U	0.00089 U
1,1,2,2-Tetrachloroethane	--	--	MG/KG	0.00098 U	NA	NA	NA
1,1,2-Trichloro-1,2,2-Trifluoroethane	--	--	MG/KG	0.00098 U	NA	NA	NA
1,1,2-Trichloroethane	--	--	MG/KG	0.00098 U	NA	NA	NA
1,1-Dichloroethane	26	240	MG/KG	0.00098 U	0.00098 U	0.23 U	0.00089 U
1,1-Dichloroethene	100	500	MG/KG	0.00098 U	0.00098 U	0.23 U	0.00089 U
1,2,3-Trichlorobenzene	--	--	MG/KG	0.00098 U	NA	NA	NA
1,2,4-Trichlorobenzene	--	--	MG/KG	0.00098 U	NA	NA	NA
1,2,4-Trimethylbenzene	52	190	MG/KG	NA	0.00098 U	0.42	0.00016 J
1,2-Dibromo-3-Chloropropane	--	--	MG/KG	0.00098 U	NA	NA	NA
1,2-Dibromoethane (Ethylene Dibromide)	--	--	MG/KG	0.00098 U	NA	NA	NA
1,2-Dichlorobenzene	100	500	MG/KG	0.00098 U	0.00098 U	1.3	0.00089 U
1,2-Dichloroethane	3.1	30	MG/KG	0.00098 U	0.00098 U	0.23 U	0.00089 U
1,2-Dichloropropane	--	--	MG/KG	0.00098 U	NA	NA	NA
1,3,5-Trimethylbenzene (Mesitylene)	52	190	MG/KG	NA	0.00098 U	0.13 J	0.00089 U
1,3-Dichlorobenzene	**49**	280	MG/KG	0.00098 U	0.00098 U	8.8	0.00089 U
1,4-Dichlorobenzene	**13**	130	MG/KG	0.00098 U	0.00025 J	**35**	0.00089 U
1,4-Dioxane (P-Dioxane)	13	130	MG/KG	0.02 U	0.02 U	11 U	0.018 U
2-Hexanone	--	--	MG/KG	0.0049 U	NA	NA	NA
Acetone	100	500	MG/KG	0.015	0.032	1.1 U	0.0056
Benzene	4.8	44	MG/KG	0.00098 U	0.00098 U	0.57	0.00089 U
Bromochloromethane	--	--	MG/KG	0.00098 U	NA	NA	NA
Bromodichloromethane	--	--	MG/KG	0.00098 U	NA	NA	NA
Bromoform	--	--	MG/KG	0.00098 U	NA	NA	NA
Bromomethane	--	--	MG/KG	0.00098 U	NA	NA	NA
Carbon Disulfide	--	--	MG/KG	0.00033 J	NA	NA	NA
Carbon Tetrachloride	2.4	22	MG/KG	0.00098 U	0.00098 U	0.23 U	0.00089 U
Chlorobenzene	100	500	MG/KG	0.00098 U	0.00098 U	2.2	0.00089 U
Chloroethane	--	--	MG/KG	0.00098 U	NA	NA	NA
Chloroform	49	350	MG/KG	0.00098 U	0.00098 U	0.23 U	0.00089 U
Chloromethane	--	--	MG/KG	0.00098 U	NA	NA	NA
Cis-1,2-Dichloroethylene	100	500	MG/KG	0.00098 U	0.00098 U	1	0.00089 U

Table 1. Summary of Volatile Organic Compounds in Soil, 322 3rd Avenue, Brooklyn, New York

			Sample Designation:	MW-16W	MW-17	MW-17	MW-17
			Sample Date:	11/02/2018	07/20/2018	07/20/2018	07/20/2018
			Sample Depth (ft bls):	14 - 16	11 - 13	17 - 19	32 - 34
Parameter	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Commercial SCO	Unit				
Cis-1,3-Dichloropropene	--	--	MG/KG	0.00098 U	NA	NA	NA
Cyclohexane	--	--	MG/KG	0.00098 U	NA	NA	NA
Dibromochloromethane	--	--	MG/KG	0.00098 U	NA	NA	NA
Dichlorodifluoromethane	--	--	MG/KG	0.00098 UT	NA	NA	NA
Ethylbenzene	41	390	MG/KG	0.00098 U	0.00098 U	0.67	0.00089 U
Isopropylbenzene (Cumene)	--	--	MG/KG	0.00098 U	NA	NA	NA
m,p-Xylene	--	--	MG/KG	0.00098 U	NA	NA	NA
Methyl Acetate	--	--	MG/KG	0.0049 U	NA	NA	NA
Methyl Ethyl Ketone (2-Butanone)	100	500	MG/KG	0.0049 U	0.0057	1.1 U	0.0045 U
Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	--	--	MG/KG	0.0049 U	NA	NA	NA
Methylcyclohexane	--	--	MG/KG	0.00098 U	NA	NA	NA
Methylene Chloride	100	500	MG/KG	0.00042 J	0.00017 J	0.23 U	0.00089 U
N-Butylbenzene	100	500	MG/KG	NA	0.00098 U	0.54	0.00089 U
N-Propylbenzene	100	500	MG/KG	NA	0.00098 U	0.35	0.00089 U
O-Xylene (1,2-Dimethylbenzene)	--	--	MG/KG	0.00098 U	NA	NA	NA
Sec-Butylbenzene	100	500	MG/KG	NA	0.00098 U	0.33	0.00089 U
Styrene	--	--	MG/KG	0.00012 J	NA	NA	NA
T-Butylbenzene	100	500	MG/KG	NA	0.00098 U	0.23 U	0.00089 U
Tert-Butyl Methyl Ether	100	500	MG/KG	0.00055 J	0.00098 U	0.23 U	0.00089 U
Tetrachloroethylene (PCE)	19	150	MG/KG	0.00098 U	0.00037 J	0.23 U	0.00089 U
Toluene	100	500	MG/KG	0.00098 U	0.00098 U	0.57	0.00089 U
Trans-1,2-Dichloroethene	100	500	MG/KG	0.00098 U	0.00098 U	0.082 J	0.00089 U
Trans-1,3-Dichloropropene	--	--	MG/KG	0.00098 U	NA	NA	NA
Trichloroethylene (TCE)	21	200	MG/KG	0.00098 U	0.00039 J	0.38	0.00089 U
Trichlorofluoromethane	--	--	MG/KG	0.00098 U	NA	NA	NA
Vinyl Chloride	0.9	13	MG/KG	0.00098 U	0.00098 U	0.28	0.00089 U
Xylenes	100	500	MG/KG	NA	NA	NA	NA
Xylenes, Total	100	500	MG/KG	NA	0.002 U	0.85	0.0018 U

Table 2. Summary of Semivolatile Organic Compounds in Soil, 322 3rd Avenue, Brooklyn, New York

			Sample Designation:	EPA-SB-1	EPA-SB-1	EPA-SB-1	MW-12	MW-12	MW-13
			Sample Date:	02/20/2020	02/20/2020	02/20/2020	12/18/2019	12/18/2019	02/21/2020
			Sample Depth (ft bls):	10 - 12	16 - 18	32 - 34	3.5 - 5.5	34.5 - 36.5	14 - 16
Parameter	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Commercial SCO	Units						
1,2,4,5-Tetrachlorobenzene	--	--	MG/KG	NA	NA	NA	NA	NA	NA
1,4-Dioxane (P-Dioxane)	13	130	MG/KG	0.11 U	0.18 UT	0.12 U	0.12 U	0.62 U	0.14 U
2,3,4,6-Tetrachlorophenol	--	--	MG/KG	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	--	--	MG/KG	NA	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	--	--	MG/KG	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	--	--	MG/KG	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol	--	--	MG/KG	NA	NA	NA	NA	NA	NA
2,4-Dinitrophenol	--	--	MG/KG	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	--	--	MG/KG	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	--	--	MG/KG	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	--	--	MG/KG	NA	NA	NA	NA	NA	NA
2-Chlorophenol	--	--	MG/KG	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	--	--	MG/KG	NA	NA	NA	NA	NA	NA
2-Methylphenol (O-Cresol)	100	500	MG/KG	0.38 U	0.6 UT	0.39 U	0.41 U	2 U	0.46 U
2-Nitroaniline	--	--	MG/KG	NA	NA	NA	NA	NA	NA
2-Nitrophenol	--	--	MG/KG	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	--	--	MG/KG	NA	NA	NA	NA	NA	NA
3-Nitroaniline	--	--	MG/KG	NA	NA	NA	NA	NA	NA
4,6-Dinitro-2-Methylphenol	--	--	MG/KG	NA	NA	NA	NA	NA	NA
4-Bromophenyl Phenyl Ether	--	--	MG/KG	NA	NA	NA	NA	NA	NA
4-Chloro-3-Methylphenol	--	--	MG/KG	NA	NA	NA	NA	NA	NA
4-Chloroaniline	--	--	MG/KG	NA	NA	NA	NA	NA	NA
4-Chlorophenyl Phenyl Ether	--	--	MG/KG	NA	NA	NA	NA	NA	NA
4-Methylphenol (P-Cresol)	100	500	MG/KG	NA	NA	NA	NA	NA	NA
4-Nitroaniline	--	--	MG/KG	NA	NA	NA	NA	NA	NA
4-Nitrophenol	--	--	MG/KG	NA	NA	NA	NA	NA	NA
Acenaphthene	100	500	MG/KG	0.034 J	0.6 UT	0.39 U	0.44	4	1
Acenaphthylene	100	500	MG/KG	0.033 J	0.6 UT	0.39 U	0.27 J	5.2	0.46 U
Acetophenone	--	--	MG/KG	NA	NA	NA	NA	NA	NA
Anthracene	100	500	MG/KG	0.039 J	0.069 JT	0.39 U	1.1	7.2	0.63
Atrazine	--	--	MG/KG	NA	NA	NA	NA	NA	NA
Benzaldehyde	--	--	MG/KG	NA	NA	NA	NA	NA	NA
Benzo(A)Anthracene	**1**	5.6	MG/KG	0.13	0.096 T	0.039 U	**2.3**	**5**	0.4

Table 2. Summary of Semivolatile Organic Compounds in Soil, 322 3rd Avenue, Brooklyn, New York

			Sample Designation:	EPA-SB-1	EPA-SB-1	EPA-SB-1	MW-12	MW-12	MW-13
			Sample Date:	02/20/2020	02/20/2020	02/20/2020	12/18/2019	12/18/2019	02/21/2020
			Sample Depth (ft bls):	10 - 12	16 - 18	32 - 34	3.5 - 5.5	34.5 - 36.5	14 - 16
Parameter	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Commercial SCO	Units						
Benzo(A)Pyrene	**1**	1	MG/KG	0.078	0.06 UT	0.039 U	**1.8**	**3.6**	0.31
Benzo(B)Fluoranthene	**1**	5.6	MG/KG	0.16	0.06 UT	0.039 U	**2.4**	**2.8**	0.4
Benzo(G,H,I)Perylene	100	500	MG/KG	0.064 J	0.6 UT	0.39 U	0.88	1 J	0.15 J
Benzo(K)Fluoranthene	**3.9**	56	MG/KG	0.054	0.06 UT	0.039 U	0.99	1.1	0.13
Benzyl Butyl Phthalate	--	--	MG/KG	NA	NA	NA	NA	NA	NA
Biphenyl (Diphenyl)	--	--	MG/KG	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethoxy) Methane	--	--	MG/KG	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether)	--	--	MG/KG	NA	NA	NA	NA	NA	NA
Bis(2-Chloroisopropyl) Ether	--	--	MG/KG	NA	NA	NA	NA	NA	NA
Bis(2-Ethylhexyl) Phthalate	--	--	MG/KG	NA	NA	NA	NA	NA	NA
Caprolactam	--	--	MG/KG	NA	NA	NA	NA	NA	NA
Carbazole	--	--	MG/KG	NA	NA	NA	NA	NA	NA
Chrysene	**3.9**	56	MG/KG	0.24 J	0.085 JT	0.39 U	2.2	**5**	0.57
Cresols, M & P	100	500	MG/KG	0.38 U	0.6 UT	0.39 U	0.41 U	2 U	0.46 U
Dibenz(A,H)Anthracene	**0.33**	0.56	MG/KG	0.038 U	0.06 UT	0.039 U	0.2	**0.39**	0.037 J
Dibenzofuran	59	350	MG/KG	0.093 J	0.6 UT	0.39 U	0.34 J	0.66 J	0.46 U
Diethyl Phthalate	--	--	MG/KG	NA	NA	NA	NA	NA	NA
Dimethyl Phthalate	--	--	MG/KG	NA	NA	NA	NA	NA	NA
Di-N-Butyl Phthalate	--	--	MG/KG	NA	NA	NA	NA	NA	NA
Di-N-Octylphthalate	--	--	MG/KG	NA	NA	NA	NA	NA	NA
Fluoranthene	100	500	MG/KG	0.17 J	0.13 JT	0.39 U	4.8	8.3	0.73
Fluorene	100	500	MG/KG	0.089 J	0.6 UT	0.39 U	0.45	7.8	0.46 U
Hexachlorobenzene	1.2	6	MG/KG	0.038 U	0.06 UT	0.039 U	0.041 U	0.2 U	0.046 U
Hexachlorobutadiene	--	--	MG/KG	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	--	--	MG/KG	NA	NA	NA	NA	NA	NA
Hexachloroethane	--	--	MG/KG	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-C,D)Pyrene	**0.5**	5.6	MG/KG	0.082	0.06 UT	0.039 U	**1**	**1.1**	0.15
Isophorone	--	--	MG/KG	NA	NA	NA	NA	NA	NA
Naphthalene	100	500	MG/KG	0.41	0.6 UT	0.39 U	0.44	2 U	0.46 U
Nitrobenzene	--	--	MG/KG	NA	NA	NA	NA	NA	NA
N-Nitrosodi-N-Propylamine	--	--	MG/KG	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	--	--	MG/KG	NA	NA	NA	NA	NA	NA
Pentachlorophenol	6.7	6.7	MG/KG	0.31 U	0.48 UT	0.31 U	0.33 U	1.6 U	0.37 U
Phenanthrene	100	500	MG/KG	0.29 J	0.12 JT	0.39 U	4.2	27	1.1
Phenol	100	500	MG/KG	0.38 U	0.6 UT	0.39 U	0.41 U	2 U	0.46 U
Pyrene	100	500	MG/KG	0.24 J	0.15 JT	0.39 U	4	14	2.2

Table 2. Summary of Semivolatile Organic Compounds in Soil, 322 3rd Avenue, Brooklyn, New York

			Sample Designation:	MW-13	MW-14	MW-14	MW-14	MW-16	MW-16
			Sample Date:	02/21/2020	02/20/2020	02/20/2020	02/20/2020	07/20/2018	07/20/2018
			Sample Depth (ft bls):	38 - 40	10 - 12	17 - 19	33 - 35	13 - 15	25 - 27
Parameter	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Commercial SCO	Units						
1,2,4,5-Tetrachlorobenzene	--	--	MG/KG	NA	NA	NA	NA	NA	NA
1,4-Dioxane (P-Dioxane)	13	130	MG/KG	0.13 U	0.12 U	0.14 U	0.12 UT	NA	NA
2,3,4,6-Tetrachlorophenol	--	--	MG/KG	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	--	--	MG/KG	NA	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	--	--	MG/KG	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	--	--	MG/KG	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol	--	--	MG/KG	NA	NA	NA	NA	NA	NA
2,4-Dinitrophenol	--	--	MG/KG	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	--	--	MG/KG	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	--	--	MG/KG	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	--	--	MG/KG	NA	NA	NA	NA	NA	NA
2-Chlorophenol	--	--	MG/KG	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	--	--	MG/KG	NA	NA	NA	NA	NA	NA
2-Methylphenol (O-Cresol)	100	500	MG/KG	0.42 U	0.38 U	0.46 U	0.4 UT	0.46 U	3.6 U
2-Nitroaniline	--	--	MG/KG	NA	NA	NA	NA	NA	NA
2-Nitrophenol	--	--	MG/KG	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	--	--	MG/KG	NA	NA	NA	NA	NA	NA
3-Nitroaniline	--	--	MG/KG	NA	NA	NA	NA	NA	NA
4,6-Dinitro-2-Methylphenol	--	--	MG/KG	NA	NA	NA	NA	NA	NA
4-Bromophenyl Phenyl Ether	--	--	MG/KG	NA	NA	NA	NA	NA	NA
4-Chloro-3-Methylphenol	--	--	MG/KG	NA	NA	NA	NA	NA	NA
4-Chloroaniline	--	--	MG/KG	NA	NA	NA	NA	NA	NA
4-Chlorophenyl Phenyl Ether	--	--	MG/KG	NA	NA	NA	NA	NA	NA
4-Methylphenol (P-Cresol)	100	500	MG/KG	NA	NA	NA	NA	NA	NA
4-Nitroaniline	--	--	MG/KG	NA	NA	NA	NA	NA	NA
4-Nitrophenol	--	--	MG/KG	NA	NA	NA	NA	NA	NA
Acenaphthene	100	500	MG/KG	0.42 U	0.14 J	0.07 J	0.4 U	0.034 J	3.6
Acenaphthylene	100	500	MG/KG	0.42 U	0.069 J	0.044 J	0.4 U	0.25 J	1.8 J
Acetophenone	--	--	MG/KG	NA	NA	NA	NA	NA	NA
Anthracene	100	500	MG/KG	0.42 U	0.17 J	0.27 J	0.4 U	0.19 J	7.3
Atrazine	--	--	MG/KG	NA	NA	NA	NA	NA	NA
Benzaldehyde	--	--	MG/KG	NA	NA	NA	NA	NA	NA
Benzo(A)Anthracene	**1**	5.6	MG/KG	0.042 U	0.55	0.83	0.04 UT	0.62	**6.8**

Table 2. Summary of Semivolatile Organic Compounds in Soil, 322 3rd Avenue, Brooklyn, New York

			Sample Designation:	MW-13	MW-14	MW-14	MW-14	MW-16	MW-16
			Sample Date:	02/21/2020	02/20/2020	02/20/2020	02/20/2020	07/20/2018	07/20/2018
			Sample Depth (ft bls):	38 - 40	10 - 12	17 - 19	33 - 35	13 - 15	25 - 27
Parameter	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Commercial SCO	Units						
Benzo(A)Pyrene	**1**	1	MG/KG	0.042 U	0.44	0.69	0.04 UT	0.67	**5.7**
Benzo(B)Fluoranthene	**1**	5.6	MG/KG	0.042 U	0.69	0.97	0.04 UT	0.88	**4.9**
Benzo(G,H,I)Perylene	100	500	MG/KG	0.42 U	0.28 J	0.42 J	0.4 UT	0.55	2.5 J
Benzo(K)Fluoranthene	**3.9**	56	MG/KG	0.042 U	0.23	0.4	0.04 UT	0.35	2.3
Benzyl Butyl Phthalate	--	--	MG/KG	NA	NA	NA	NA	NA	NA
Biphenyl (Diphenyl)	--	--	MG/KG	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethoxy) Methane	--	--	MG/KG	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether)	--	--	MG/KG	NA	NA	NA	NA	NA	NA
Bis(2-Chloroisopropyl) Ether	--	--	MG/KG	NA	NA	NA	NA	NA	NA
Bis(2-Ethylhexyl) Phthalate	--	--	MG/KG	NA	NA	NA	NA	NA	NA
Caprolactam	--	--	MG/KG	NA	NA	NA	NA	NA	NA
Carbazole	--	--	MG/KG	NA	NA	NA	NA	NA	NA
Chrysene	**3.9**	56	MG/KG	0.42 U	0.7	0.84	0.4 UT	0.65	**7.4**
Cresols, M & P	100	500	MG/KG	0.42 U	0.38 U	0.46 U	0.4 UT	0.46 U	3.6 U
Dibenz(A,H)Anthracene	**0.33**	0.56	MG/KG	0.042 U	0.098	0.13	0.04 UT	0.12	**0.8**
Dibenzofuran	59	350	MG/KG	0.42 U	0.19 J	0.083 J	0.4 U	0.035 J	0.48 J
Diethyl Phthalate	--	--	MG/KG	NA	NA	NA	NA	NA	NA
Dimethyl Phthalate	--	--	MG/KG	NA	NA	NA	NA	NA	NA
Di-N-Butyl Phthalate	--	--	MG/KG	NA	NA	NA	NA	NA	NA
Di-N-Octylphthalate	--	--	MG/KG	NA	NA	NA	NA	NA	NA
Fluoranthene	100	500	MG/KG	0.42 U	1.1	1.3	0.4 U	0.93	12
Fluorene	100	500	MG/KG	0.42 U	0.29 J	0.085 J	0.4 U	0.048 J	0.83 J
Hexachlorobenzene	1.2	6	MG/KG	0.042 U	0.038 U	0.046 U	0.04 U	0.046 U	0.36 U
Hexachlorobutadiene	--	--	MG/KG	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	--	--	MG/KG	NA	NA	NA	NA	NA	NA
Hexachloroethane	--	--	MG/KG	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-C,D)Pyrene	**0.5**	5.6	MG/KG	0.042 U	0.31	0.5	0.04 UT	0.45	**3**
Isophorone	--	--	MG/KG	NA	NA	NA	NA	NA	NA
Naphthalene	100	500	MG/KG	0.42 U	0.48	0.059 J	0.4 U	0.089 J	0.91 J
Nitrobenzene	--	--	MG/KG	NA	NA	NA	NA	NA	NA
N-Nitrosodi-N-Propylamine	--	--	MG/KG	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	--	--	MG/KG	NA	NA	NA	NA	NA	NA
Pentachlorophenol	6.7	6.7	MG/KG	0.34 U	0.31 U	0.37 U	0.32 U	0.37 U	2.9 U
Phenanthrene	100	500	MG/KG	0.42 U	1.1	1	0.4 U	0.48	9.1
Phenol	100	500	MG/KG	0.42 U	0.38 U	0.46 U	0.4 UT	0.015 J	3.6 U
Pyrene	100	500	MG/KG	0.42 U	0.85	1.3	0.4 UT	1.1	20

Table 2. Summary of Semivolatile Organic Compounds in Soil, 322 3rd Avenue, Brooklyn, New York

			Sample Designation:	MW-16	MW-16E	MW-16E	MW-16S	MW-16S	MW-16W
			Sample Date:	07/20/2018	11/02/2018	11/02/2018	11/02/2018	11/02/2018	11/02/2018
			Sample Depth (ft bls):	32 - 34	7 - 9	14 - 15	5 - 10	13 - 15	8 - 10
Parameter	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Commercial SCO	Units						
1,2,4,5-Tetrachlorobenzene	--	--	MG/KG	NA	0.41 U	0.38 U	0.39 U	0.3 J	0.38 U
1,4-Dioxane (P-Dioxane)	13	130	MG/KG	NA	NA	NA	NA	NA	NA
2,3,4,6-Tetrachlorophenol	--	--	MG/KG	NA	0.41 U	0.38 U	0.39 U	0.39 U	0.38 U
2,4,5-Trichlorophenol	--	--	MG/KG	NA	0.41 U	0.38 U	0.39 U	0.39 U	0.38 U
2,4,6-Trichlorophenol	--	--	MG/KG	NA	0.17 U	0.15 U	0.16 U	0.16 U	0.15 U
2,4-Dichlorophenol	--	--	MG/KG	NA	0.17 U	0.15 U	0.16 U	0.026 J	0.15 U
2,4-Dimethylphenol	--	--	MG/KG	NA	0.41 U	0.38 U	0.39 U	0.39 U	0.38 U
2,4-Dinitrophenol	--	--	MG/KG	NA	0.33 U	0.3 U	0.31 U	0.31 U	0.31 U
2,4-Dinitrotoluene	--	--	MG/KG	NA	0.084 U	0.077 U	0.079 U	0.078 U	0.078 U
2,6-Dinitrotoluene	--	--	MG/KG	NA	0.084 U	0.077 U	0.079 U	0.078 U	0.078 U
2-Chloronaphthalene	--	--	MG/KG	NA	0.41 U	0.38 U	0.39 U	0.39 U	0.38 U
2-Chlorophenol	--	--	MG/KG	NA	0.41 UT	0.38 UT	0.39 UT	0.39 UT	0.38 UT
2-Methylnaphthalene	--	--	MG/KG	NA	0.41 U	0.38 U	0.17 J	0.39 U	0.038 J
2-Methylphenol (O-Cresol)	100	500	MG/KG	0.4 U	0.41 U	0.38 U	0.39 U	0.39 U	0.38 U
2-Nitroaniline	--	--	MG/KG	NA	0.41 U	0.38 U	0.39 U	0.39 U	0.38 U
2-Nitrophenol	--	--	MG/KG	NA	0.41 U	0.38 U	0.39 U	0.39 U	0.38 U
3,3'-Dichlorobenzidine	--	--	MG/KG	NA	0.17 U	0.15 U	0.16 U	0.16 U	0.15 U
3-Nitroaniline	--	--	MG/KG	NA	0.41 U	0.38 U	0.39 U	0.39 U	0.38 U
4,6-Dinitro-2-Methylphenol	--	--	MG/KG	NA	0.33 U	0.3 U	0.31 U	0.31 U	0.31 U
4-Bromophenyl Phenyl Ether	--	--	MG/KG	NA	0.41 U	0.38 U	0.39 U	0.39 U	0.38 U
4-Chloro-3-Methylphenol	--	--	MG/KG	NA	0.41 U	0.38 U	0.39 U	0.39 U	0.38 U
4-Chloroaniline	--	--	MG/KG	NA	0.41 U	0.38 U	0.39 U	0.39 U	0.38 U
4-Chlorophenyl Phenyl Ether	--	--	MG/KG	NA	0.41 U	0.38 U	0.39 U	0.39 U	0.38 U
4-Methylphenol (P-Cresol)	100	500	MG/KG	NA	0.41 U	0.38 U	0.025 J	0.39 U	0.38 U
4-Nitroaniline	--	--	MG/KG	NA	0.41 U	0.38 U	0.39 U	0.39 U	0.38 U
4-Nitrophenol	--	--	MG/KG	NA	0.84 U	0.77 U	0.79 U	0.78 U	0.78 U
Acenaphthene	100	500	MG/KG	0.4 U	0.41 U	0.38 U	0.15 J	0.39 U	0.38 U
Acenaphthylene	100	500	MG/KG	0.4 U	0.016 J	0.38 U	0.72	0.044 J	0.0066 J
Acetophenone	--	--	MG/KG	NA	0.41 U	0.38 U	0.038 J	0.39 U	0.38 U
Anthracene	100	500	MG/KG	0.0063 J	0.017 J	0.38 U	0.96	0.037 J	0.0066 J
Atrazine	--	--	MG/KG	NA	0.17 U	0.15 U	0.16 U	0.16 U	0.15 U
Benzaldehyde	--	--	MG/KG	NA	0.41 U	0.38 U	0.39 U	0.39 U	0.38 U
Benzo(A)Anthracene	**1**	5.6	MG/KG	0.04 U	0.062	0.017 J	**2.9**	0.18	0.018 J

Table 2. Summary of Semivolatile Organic Compounds in Soil, 322 3rd Avenue, Brooklyn, New York

			Sample Designation:	MW-16	MW-16E	MW-16E	MW-16S	MW-16S	MW-16W
			Sample Date:	07/20/2018	11/02/2018	11/02/2018	11/02/2018	11/02/2018	11/02/2018
			Sample Depth (ft bls):	32 - 34	7 - 9	14 - 15	5 - 10	13 - 15	8 - 10
Parameter	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Commercial SCO	Units						
Benzo(A)Pyrene	**1**	1	MG/KG	0.04 U	0.064	0.012 J	**2.8**	0.15	0.011 J
Benzo(B)Fluoranthene	**1**	5.6	MG/KG	0.04 U	0.068	0.012 J	**2.7**	0.13	0.038 U
Benzo(G,H,I)Perylene	100	500	MG/KG	0.4 U	0.041 J	0.38 U	1.5	0.084 J	0.38 U
Benzo(K)Fluoranthene	**3.9**	56	MG/KG	0.04 U	0.029 J	0.038 U	0.89	0.042	0.038 U
Benzyl Butyl Phthalate	--	--	MG/KG	NA	0.41 U	0.38 U	0.46	0.39 U	0.38 U
Biphenyl (Diphenyl)	--	--	MG/KG	NA	0.41 U	0.38 U	0.065 J	0.39 U	0.38 U
Bis(2-Chloroethoxy) Methane	--	--	MG/KG	NA	0.41 U	0.38 U	0.39 U	0.39 U	0.38 U
Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether)	--	--	MG/KG	NA	0.041 U	0.038 U	0.039 U	0.039 U	0.038 U
Bis(2-Chloroisopropyl) Ether	--	--	MG/KG	NA	0.41 U	0.38 U	0.39 U	0.39 U	0.38 U
Bis(2-Ethylhexyl) Phthalate	--	--	MG/KG	NA	0.41 U	0.38 U	0.68	0.073 J	0.38 U
Caprolactam	--	--	MG/KG	NA	0.41 U	0.38 U	0.39 U	0.39 U	0.38 U
Carbazole	--	--	MG/KG	NA	0.41 U	0.38 U	0.095 J	0.39 U	0.38 U
Chrysene	**3.9**	56	MG/KG	0.01 J	0.065 J	0.011 J	3.1	0.17 J	0.01 J
Cresols, M & P	100	500	MG/KG	0.4 U	NA	NA	NA	NA	NA
Dibenz(A,H)Anthracene	**0.33**	0.56	MG/KG	0.04 U	0.041 U	0.038 U	**0.46**	0.017 J	0.038 U
Dibenzofuran	59	350	MG/KG	0.4 U	0.41 U	0.38 U	0.39 U	0.39 U	0.38 U
Diethyl Phthalate	--	--	MG/KG	NA	0.41 U	0.38 U	0.39 U	0.39 U	0.38 U
Dimethyl Phthalate	--	--	MG/KG	NA	0.41 U	0.38 U	0.39 U	0.39 U	0.38 U
Di-N-Butyl Phthalate	--	--	MG/KG	NA	0.41 U	0.38 U	0.39 U	0.39 U	0.38 U
Di-N-Octylphthalate	--	--	MG/KG	NA	0.41 U	0.38 U	0.39 U	0.39 U	0.38 U
Fluoranthene	100	500	MG/KG	0.4 U	0.095 J	0.018 J	5	0.27 J	0.018 J
Fluorene	100	500	MG/KG	0.4 U	0.41 U	0.38 U	0.39 U	0.39 U	0.38 U
Hexachlorobenzene	1.2	6	MG/KG	0.04 U	0.041 U	0.038 U	0.039 U	0.039 U	0.038 U
Hexachlorobutadiene	--	--	MG/KG	NA	0.084 U	0.077 U	0.079 U	0.078 U	0.078 U
Hexachlorocyclopentadiene	--	--	MG/KG	NA	0.41 U	0.38 U	0.39 U	0.39 U	0.38 U
Hexachloroethane	--	--	MG/KG	NA	0.041 U	0.038 U	0.039 U	0.039 U	0.038 U
Indeno(1,2,3-C,D)Pyrene	**0.5**	5.6	MG/KG	0.04 U	0.037 J	0.038 U	**1.4**	0.071	0.038 U
Isophorone	--	--	MG/KG	NA	0.17 U	0.15 U	0.16 U	0.16 U	0.15 U
Naphthalene	100	500	MG/KG	0.4 U	0.017 J	0.38 U	0.3 J	0.013 J	0.13 J
Nitrobenzene	--	--	MG/KG	NA	0.041 U	0.038 U	0.039 U	0.039 U	0.038 U
N-Nitrosodi-N-Propylamine	--	--	MG/KG	NA	0.041 U	0.038 U	0.039 U	0.039 U	0.038 U
N-Nitrosodiphenylamine	--	--	MG/KG	NA	0.41 U	0.38 U	0.39 U	0.39 U	0.38 U
Pentachlorophenol	6.7	6.7	MG/KG	0.32 U	0.33 U	0.3 U	0.31 U	0.31 U	0.31 U
Phenanthrene	100	500	MG/KG	0.4 U	0.041 J	0.0093 J	1.1	0.04 J	0.017 J
Phenol	100	500	MG/KG	0.4 U	0.41 UT	0.38 UT	0.39 UT	0.39 UT	0.38 UT
Pyrene	100	500	MG/KG	0.023 J	0.19 J	0.023 J	6.8	0.41	0.029 J

Table 2. Summary of Semivolatile Organic Compounds in Soil, 322 3rd Avenue, Brooklyn, New York

			Sample Designation:	MW-16W	MW-17	MW-17	MW-17
			Sample Date:	11/02/2018	07/20/2018	07/20/2018	07/20/2018
			Sample Depth (ft bls):	14 - 16	11 - 13	17 - 19	32 - 34
Parameter	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Commercial SCO	Units				
1,2,4,5-Tetrachlorobenzene	--	--	MG/KG	0.39 U	NA	NA	NA
1,4-Dioxane (P-Dioxane)	13	130	MG/KG	NA	NA	NA	NA
2,3,4,6-Tetrachlorophenol	--	--	MG/KG	0.39 U	NA	NA	NA
2,4,5-Trichlorophenol	--	--	MG/KG	0.39 U	NA	NA	NA
2,4,6-Trichlorophenol	--	--	MG/KG	0.16 U	NA	NA	NA
2,4-Dichlorophenol	--	--	MG/KG	0.16 U	NA	NA	NA
2,4-Dimethylphenol	--	--	MG/KG	0.39 U	NA	NA	NA
2,4-Dinitrophenol	--	--	MG/KG	0.31 U	NA	NA	NA
2,4-Dinitrotoluene	--	--	MG/KG	0.079 U	NA	NA	NA
2,6-Dinitrotoluene	--	--	MG/KG	0.079 U	NA	NA	NA
2-Chloronaphthalene	--	--	MG/KG	0.39 U	NA	NA	NA
2-Chlorophenol	--	--	MG/KG	0.39 UT	NA	NA	NA
2-Methylnaphthalene	--	--	MG/KG	0.39 U	NA	NA	NA
2-Methylphenol (O-Cresol)	100	500	MG/KG	0.39 U	0.37 U	27 U	0.39 U
2-Nitroaniline	--	--	MG/KG	0.39 U	NA	NA	NA
2-Nitrophenol	--	--	MG/KG	0.39 U	NA	NA	NA
3,3'-Dichlorobenzidine	--	--	MG/KG	0.16 U	NA	NA	NA
3-Nitroaniline	--	--	MG/KG	0.39 U	NA	NA	NA
4,6-Dinitro-2-Methylphenol	--	--	MG/KG	0.31 U	NA	NA	NA
4-Bromophenyl Phenyl Ether	--	--	MG/KG	0.39 U	NA	NA	NA
4-Chloro-3-Methylphenol	--	--	MG/KG	0.39 U	NA	NA	NA
4-Chloroaniline	--	--	MG/KG	0.39 U	NA	NA	NA
4-Chlorophenyl Phenyl Ether	--	--	MG/KG	0.39 U	NA	NA	NA
4-Methylphenol (P-Cresol)	100	500	MG/KG	0.39 U	NA	NA	NA
4-Nitroaniline	--	--	MG/KG	0.39 U	NA	NA	NA
4-Nitrophenol	--	--	MG/KG	0.79 U	NA	NA	NA
Acenaphthene	100	500	MG/KG	0.39 U	0.05 J	13 J	0.39 U
Acenaphthylene	100	500	MG/KG	0.39 U	0.037 J	12 J	0.39 U
Acetophenone	--	--	MG/KG	0.39 U	NA	NA	NA
Anthracene	100	500	MG/KG	0.39 U	0.16 J	23 J	0.39 U
Atrazine	--	--	MG/KG	0.16 U	NA	NA	NA
Benzaldehyde	--	--	MG/KG	0.39 U	NA	NA	NA
Benzo(A)Anthracene	**1**	5.6	MG/KG	0.039 U	0.4	**30**	0.039 U

Table 2. Summary of Semivolatile Organic Compounds in Soil, 322 3rd Avenue, Brooklyn, New York

			Sample Designation:	MW-16W	MW-17	MW-17	MW-17
			Sample Date:	11/02/2018	07/20/2018	07/20/2018	07/20/2018
			Sample Depth (ft bls):	14 - 16	11 - 13	17 - 19	32 - 34
Parameter	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Commercial SCO	Units				
Benzo(A)Pyrene	**1**	1	MG/KG	0.039 U	0.39	**17**	0.039 U
Benzo(B)Fluoranthene	**1**	5.6	MG/KG	0.039 U	0.49	**38**	0.039 U
Benzo(G,H,I)Perylene	100	500	MG/KG	0.39 U	0.29 J	15 J	0.39 U
Benzo(K)Fluoranthene	**3.9**	56	MG/KG	0.039 U	0.18	**5.1**	0.039 U
Benzyl Butyl Phthalate	--	--	MG/KG	0.39 U	NA	NA	NA
Biphenyl (Diphenyl)	--	--	MG/KG	0.39 U	NA	NA	NA
Bis(2-Chloroethoxy) Methane	--	--	MG/KG	0.39 U	NA	NA	NA
Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether)	--	--	MG/KG	0.039 U	NA	NA	NA
Bis(2-Chloroisopropyl) Ether	--	--	MG/KG	0.39 U	NA	NA	NA
Bis(2-Ethylhexyl) Phthalate	--	--	MG/KG	0.39 U	NA	NA	NA
Caprolactam	--	--	MG/KG	0.39 U	NA	NA	NA
Carbazole	--	--	MG/KG	0.39 U	NA	NA	NA
Chrysene	**3.9**	56	MG/KG	0.39 U	0.43	**39**	0.39 U
Cresols, M & P	100	500	MG/KG	NA	0.37 U	1.8 J	0.39 U
Dibenz(A,H)Anthracene	**0.33**	0.56	MG/KG	0.039 U	0.072	**3.5**	0.039 U
Dibenzofuran	59	350	MG/KG	0.39 U	0.039 J	6.6 J	0.39 U
Diethyl Phthalate	--	--	MG/KG	0.39 U	NA	NA	NA
Dimethyl Phthalate	--	--	MG/KG	0.39 U	NA	NA	NA
Di-N-Butyl Phthalate	--	--	MG/KG	0.39 U	NA	NA	NA
Di-N-Octylphthalate	--	--	MG/KG	0.39 U	NA	NA	NA
Fluoranthene	100	500	MG/KG	0.39 U	0.85	55	0.016 J
Fluorene	100	500	MG/KG	0.39 U	0.064 J	6.6 J	0.39 U
Hexachlorobenzene	1.2	6	MG/KG	0.039 U	0.037 U	2.7 U	0.039 U
Hexachlorobutadiene	--	--	MG/KG	0.079 U	NA	NA	NA
Hexachlorocyclopentadiene	--	--	MG/KG	0.39 U	NA	NA	NA
Hexachloroethane	--	--	MG/KG	0.039 U	NA	NA	NA
Indeno(1,2,3-C,D)Pyrene	**0.5**	5.6	MG/KG	0.039 U	0.28	**14**	0.039 U
Isophorone	--	--	MG/KG	0.16 U	NA	NA	NA
Naphthalene	100	500	MG/KG	0.012 J	0.042 J	7 J	0.39 U
Nitrobenzene	--	--	MG/KG	0.039 U	NA	NA	NA
N-Nitrosodi-N-Propylamine	--	--	MG/KG	0.039 U	NA	NA	NA
N-Nitrosodiphenylamine	--	--	MG/KG	0.39 U	NA	NA	NA
Pentachlorophenol	6.7	6.7	MG/KG	0.31 U	0.3 U	22 U	0.31 U
Phenanthrene	100	500	MG/KG	0.39 U	0.69	57	0.009 J
Phenol	100	500	MG/KG	0.39 UT	0.0092 J	0.99 J	0.39 U
Pyrene	100	500	MG/KG	0.39 U	0.9	70	0.023 J

Table 3. Summary of Metals in Soil, 322 3rd Avenue, Brooklyn, New York

			Sample Designation:	EPA-SB-1	EPA-SB-1	EPA-SB-1	MW-12	MW-12	MW-13	MW-13	MW-14
			Sample Date:	02/20/2020	02/20/2020	02/20/2020	12/18/2019	12/18/2019	02/21/2020	02/21/2020	02/20/2020
			Sample Depth (ft bls):	10 - 12	16 - 18	32 - 34	3.5 - 5.5	34.5 - 36.5	14 - 16	38 - 40	10 - 12
Parameter	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Commercial SCO	Units								
Aluminum	--	--	MG/KG	NA	NA	NA	NA	NA	NA	NA	NA
Antimony	--	--	MG/KG	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	**16**	16	MG/KG	12.5	9.1	1.5	13.1	3.3	**83.7**	3.5	**33.5**
Barium	**400**	400	MG/KG	86.5	59.4	20	379	34.2	48.7	22.4	275
Beryllium	72	590	MG/KG	0.32 J	0.54 J	0.27 J	0.47 J	0.21 J	0.39 J	0.4 J	0.39 J
Cadmium	**4.3**	9.3	MG/KG	0.5 J	1.7 U	1.1 U	**7.7**	1.1 U	1.3 U	1.2 U	2.3
Calcium	--	--	MG/KG	NA	NA	NA	NA	NA	NA	NA	NA
Chromium III	180	1500	MG/KG	16.4	23.1	10.6	60.8	10.8	16.3	9.1	18.1
Chromium, Hexavalent	110	400	MG/KG	0.47 J	7.4 U	0.76 J	2.5 U	2.5 U	2.8 U	2.5 U	0.43 J
Chromium, Total	180	1500	MG/KG	17	23.1	11.5	60.8	10.8	16.3	9.1	18.7
Cobalt	--	--	MG/KG	NA	NA	NA	NA	NA	NA	NA	NA
Copper	**270**	270	MG/KG	260	41	9.2	**299**	9.8	84.9	11.6	218
Cyanide	27	27	MG/KG	0.21 J	0.2 J	0.28 U	0.28 U	0.29 U	0.31 U	0.27 U	0.37
Iron	--	--	MG/KG	NA	NA	NA	NA	NA	NA	NA	NA
Lead	**400**	1000	MG/KG	284	140	2.8	**917**	5.5	157	3.8	**1050**
Magnesium	--	--	MG/KG	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	2000	10000	MG/KG	160	151	249	573	111	391	87	606
Mercury	**0.81**	2.8	MG/KG	**3.8**	**2**	0.02 U	0.28	0.019 U	**0.9**	0.021 U	0.52
Nickel	310	310	MG/KG	23.9	26.1	14.7	99.4	14	29	18	27.5
Potassium	--	--	MG/KG	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	180	1500	MG/KG	1.1 J	1.9 J	5.6 U	0.65 J	5.7 U	4.5 J	6.1 U	2.5 J
Silver	180	1500	MG/KG	1.1 U	1.7 U	1.1 U	3.2	1.1 U	1.3 U	1.2 U	1 U
Sodium	--	--	MG/KG	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	--	--	MG/KG	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	--	--	MG/KG	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	10000	10000	MG/KG	263	56.8	16.4	1560	22.7	136	19.5	800

Table 3. Summary of Metals in Soil, 322 3rd Avenue, Brooklyn, New York

			Sample Designation:	MW-14	MW-14	MW-16	MW-16	MW-16	MW-16E
			Sample Date:	02/20/2020	02/20/2020	07/20/2018	07/20/2018	07/20/2018	11/02/2018
			Sample Depth (ft bls):	17 - 19	33 - 35	13 - 15	25 - 27	32 - 34	7 - 9
Parameter	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Commercial SCO	Units						
Aluminum	--	--	MG/KG	NA	NA	NA	NA	NA	9130
Antimony	--	--	MG/KG	NA	NA	NA	NA	NA	5 U
Arsenic	**16**	16	MG/KG	**29.2**	**17**	10.6	11.9	1 J	8.4
Barium	**400**	400	MG/KG	**578**	24.2	170	124	42.7	27.4 J
Beryllium	72	590	MG/KG	0.72	0.33 J	0.57	0.35 J	0.4	0.94
Cadmium	**4.3**	9.3	MG/KG	1.4 U	1.1 U	1	1.9	0.74 U	1 U
Calcium	--	--	MG/KG	NA	NA	NA	NA	NA	32000
Chromium III	180	1500	MG/KG	46.9	13.1	38.9	42.2	12	NA
Chromium, Hexavalent	110	400	MG/KG	2.8 U	0.65 J	2.8 U	4.3 U	2.5 U	NA
Chromium, Total	180	1500	MG/KG	47.5	13.9	38.9	42.2	12	14.5
Cobalt	--	--	MG/KG	NA	NA	NA	NA	NA	13.4
Copper	**270**	270	MG/KG	184	7.3	160	137	10	26.8
Cyanide	27	27	MG/KG	0.32	0.28 U	0.75	0.45 J	0.11 J	NA
Iron	--	--	MG/KG	NA	NA	NA	NA	NA	13200
Lead	**400**	1000	MG/KG	344	3.6	384	258	6.6	13.1
Magnesium	--	--	MG/KG	NA	NA	NA	NA	NA	10600
Manganese	2000	10000	MG/KG	268	188	518	278	133	131
Mercury	**0.81**	2.8	MG/KG	**6.9**	0.019 U	**1.1**	**1.7**	0.019 U	0.23
Nickel	310	310	MG/KG	28	16.7	33.9	26	15.4	34.6
Potassium	--	--	MG/KG	NA	NA	NA	NA	NA	936 J
Selenium	180	1500	MG/KG	1.7 J	0.32 J	4.4 U	6.8 U	3.7 U	5 U
Silver	180	1500	MG/KG	1.4 U	1.1 U	0.42 J	0.79 J	1.9 U	2.5 U
Sodium	--	--	MG/KG	NA	NA	NA	NA	NA	291 J
Thallium	--	--	MG/KG	NA	NA	NA	NA	NA	5 U
Vanadium	--	--	MG/KG	NA	NA	NA	NA	NA	17.8
Zinc	10000	10000	MG/KG	159	21	407	339	20.3	211

Table 3. Summary of Metals in Soil, 322 3rd Avenue, Brooklyn, New York

			Sample Designation:	MW-16E	MW-16S	MW-16S	MW-16W	MW-16W	MW-17	MW-17	MW-17
			Sample Date:	11/02/2018	11/02/2018	11/02/2018	11/02/2018	11/02/2018	07/20/2018	07/20/2018	07/20/2018
			Sample Depth (ft bls):	14 - 15	5 - 10	13 - 15	8 - 10	14 - 16	11 - 13	17 - 19	32 - 34
Parameter	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Commercial SCO	Units								
Aluminum	--	--	MG/KG	6330	5870	9860	7580	6810	NA	NA	NA
Antimony	--	--	MG/KG	4.2 U	4 U	4.4 U	3.8 U	4.6 U	NA	NA	NA
Arsenic	**16**	16	MG/KG	2.4 J	11.5	3 J	3.1	1.4 J	4.2	**40.6**	1.5 J
Barium	**400**	400	MG/KG	27.9 J	142	74.2	46	43 J	131	213 J	40
Beryllium	72	590	MG/KG	0.31 J	0.31 J	0.53	0.42	0.36 J	0.57	2.6 U	0.48
Cadmium	**4.3**	9.3	MG/KG	0.85 U	1.1	0.88 U	0.76 U	0.92 U	0.27 J	3.1 J	0.72 U
Calcium	--	--	MG/KG	1620	51700	580 J	651 J	652 J	NA	NA	NA
Chromium III	180	1500	MG/KG	NA	NA	NA	NA	NA	21.8	95.9	14.9
Chromium, Hexavalent	110	400	MG/KG	NA	NA	NA	NA	NA	2.2 U	3.3 U	2.4 U
Chromium, Total	180	1500	MG/KG	15.4	39	23.7	17	15.9	21.8	95.9	14.9
Cobalt	--	--	MG/KG	3.4 J	5.3 J	6 J	4.8 J	5.4 J	NA	NA	NA
Copper	**270**	270	MG/KG	9.4	131	16.3	12.5	11.5	34.1	**295**	11.9
Cyanide	27	27	MG/KG	NA	NA	NA	NA	NA	1.2	0.45 J	0.25 U
Iron	--	--	MG/KG	12200	19400	18600	15500	12300	NA	NA	NA
Lead	**400**	1000	MG/KG	6.1	269	9	8.7	5.2	120	**972**	3.9
Magnesium	--	--	MG/KG	2880	6860	4820	3210	3000	NA	NA	NA
Manganese	2000	10000	MG/KG	96.6	276	141	129	405	323	975	156
Mercury	**0.81**	2.8	MG/KG	0.031	**0.88**	0.067	0.56	0.028	0.15	0.25	0.018 U
Nickel	310	310	MG/KG	14.4	23.1	20.5	17.5	18.2	16.8	70	20.5
Potassium	--	--	MG/KG	1210	743 J	2600	1990	1800	NA	NA	NA
Selenium	180	1500	MG/KG	4.2 U	4 U	4.4 U	3.8 U	4.6 U	3.5 U	26.4 U	3.6 U
Silver	180	1500	MG/KG	2.1 U	0.23 J	2.2 U	1.9 U	2.3 U	1.8 U	5.4 J	1.8 U
Sodium	--	--	MG/KG	146 J	1160	165 J	157 J	132 J	NA	NA	NA
Thallium	--	--	MG/KG	4.2 U	0.66 J	4.4 U	3.8 U	4.6 U	NA	NA	NA
Vanadium	--	--	MG/KG	13.8	17.3	21.4	17.1	17.2	NA	NA	NA
Zinc	10000	10000	MG/KG	22.4	474	38.9	29.6	24.5	210	752	20.3

Table 4. Summary of Polychlorinated Biphenyls in Soil, 322 3rd Avenue, Brooklyn, New York

			Sample Designation:	EPA-SB-1	EPA-SB-1	EPA-SB-1	MW-12	MW-12	MW-13
			Sample Date:	02/20/2020	02/20/2020	02/20/2020	12/18/2019	12/18/2019	02/21/2020
			Sample Depth (ft bls):	10 - 12	16 - 18	32 - 34	3.5 - 5.5	34.5 - 36.5	14 - 16
Parameter	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Commercial SCO	Units						
PCB-1016 (Aroclor 1016)	--	--	MG/KG	0.077 U	0.12 U	0.079 U	0.083 U	0.083 U	0.093 U
PCB-1221 (Aroclor 1221)	--	--	MG/KG	0.077 U	0.12 U	0.079 U	0.083 U	0.083 U	0.093 U
PCB-1232 (Aroclor 1232)	--	--	MG/KG	0.077 U	0.12 U	0.079 U	0.083 U	0.083 U	0.093 U
PCB-1242 (Aroclor 1242)	--	--	MG/KG	0.077 U	0.12 U	0.079 U	0.083 U	0.083 U	0.093 U
PCB-1248 (Aroclor 1248)	--	--	MG/KG	0.077 U	0.12 U	0.079 U	0.083 U	0.083 U	0.093 U
PCB-1254 (Aroclor 1254)	--	--	MG/KG	0.077 U	0.12 U	0.079 U	0.083 U	0.083 U	0.093 U
PCB-1260 (Aroclor 1260)	--	--	MG/KG	0.055 J	0.12 U	0.079 U	2	0.083 U	0.093 U
PCB-1262 (Aroclor 1262)	--	--	MG/KG	0.077 U	0.12 U	0.079 U	0.083 U	0.083 U	0.093 U
PCB-1268 (Aroclor 1268)	--	--	MG/KG	0.077 U	0.12 U	0.079 U	0.083 U	0.083 U	0.093 U
Polychlorinated Biphenyl (PCBs)	**1**	1	MG/KG	0.055 J	0.12 U	0.079 U	**2**	0.083 U	0.093 U

Table 4. Summary of Polychlorinated Biphenyls in Soil, 322 3rd Avenue, Brooklyn, New York

			Sample Designation:	MW-13	MW-14	MW-14	MW-14	MW-16	MW-16
			Sample Date:	02/21/2020	02/20/2020	02/20/2020	02/20/2020	07/20/2018	07/20/2018
			Sample Depth (ft bls):	38 - 40	10 - 12	17 - 19	33 - 35	13 - 15	25 - 27
Parameter	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Commercial SCO	Units						
PCB-1016 (Aroclor 1016)	--	--	MG/KG	0.085 U	0.078 U	0.094 U	0.081 U	0.093 U	74 U
PCB-1221 (Aroclor 1221)	--	--	MG/KG	0.085 U	0.078 U	0.094 U	0.081 U	0.093 U	74 U
PCB-1232 (Aroclor 1232)	--	--	MG/KG	0.085 U	0.078 U	0.094 U	0.081 U	0.093 U	74 U
PCB-1242 (Aroclor 1242)	--	--	MG/KG	0.085 U	0.078 U	0.094 U	0.081 U	0.093 U	74 U
PCB-1248 (Aroclor 1248)	--	--	MG/KG	0.085 U	0.078 U	0.094 U	0.081 U	0.093 U	74 U
PCB-1254 (Aroclor 1254)	--	--	MG/KG	0.085 U	0.078 U	0.094 U	0.081 U	0.093 U	74 U
PCB-1260 (Aroclor 1260)	--	--	MG/KG	0.085 U	0.078 U	0.094 U	0.081 U	1.9	1200
PCB-1262 (Aroclor 1262)	--	--	MG/KG	0.085 U	0.078 U	0.094 U	0.081 U	0.093 U	74 U
PCB-1268 (Aroclor 1268)	--	--	MG/KG	0.085 U	0.078 U	0.094 U	0.081 U	0.093 U	74 U
Polychlorinated Biphenyl (PCBs)	**1**	1	MG/KG	0.085 U	0.078 U	0.094 U	0.081 U	**1.9**	**1200**

Table 4. Summary of Polychlorinated Biphenyls in Soil, 322 3rd Avenue, Brooklyn, New York

			Sample Designation:	MW-16	MW-16E	MW-16E	MW-16S	MW-16S	MW-16S
			Sample Date:	07/20/2018	11/02/2018	11/02/2018	11/02/2018	11/02/2018	11/02/2018
			Sample Depth (ft bls):	32 - 34	7 - 9	14 - 15	5 - 10	13 - 15	17 - 19
Parameter	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Commercial SCO	Units						
PCB-1016 (Aroclor 1016)	--	--	MG/KG	0.081 U	0.084 U	0.077 U	40 U	3.1 U	16 U
PCB-1221 (Aroclor 1221)	--	--	MG/KG	0.081 U	0.084 U	0.077 U	40 U	3.1 U	16 U
PCB-1232 (Aroclor 1232)	--	--	MG/KG	0.081 U	0.084 U	0.077 U	40 U	3.1 U	16 U
PCB-1242 (Aroclor 1242)	--	--	MG/KG	0.081 U	0.084 U	0.077 U	40 U	3.1 U	16 U
PCB-1248 (Aroclor 1248)	--	--	MG/KG	0.081 U	0.084 U	0.077 U	40 U	3.1 U	16 U
PCB-1254 (Aroclor 1254)	--	--	MG/KG	0.081 U	0.084 U	0.077 U	40 U	3.1 U	16 U
PCB-1260 (Aroclor 1260)	--	--	MG/KG	1.8	0.19	0.46	650	40	270
PCB-1262 (Aroclor 1262)	--	--	MG/KG	0.081 U	0.084 U	0.077 U	40 U	3.1 U	16 U
PCB-1268 (Aroclor 1268)	--	--	MG/KG	0.081 U	0.084 U	0.077 U	40 U	3.1 U	16 U
Polychlorinated Biphenyl (PCBs)	**1**	1	MG/KG	**1.8**	0.19	0.46	**650**	**40**	**270**

Table 4. Summary of Polychlorinated Biphenyls in Soil, 322 3rd Avenue, Brooklyn, New York

			Sample Designation:	MW-16S	MW-16W	MW-16W	MW-17	MW-17	MW-17
			Sample Date:	11/02/2018	11/02/2018	11/02/2018	07/20/2018	07/20/2018	07/20/2018
			Sample Depth (ft bls):	21 - 23	8 - 10	14 - 16	11 - 13	17 - 19	32 - 34
Parameter	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Commercial SCO	Units						
PCB-1016 (Aroclor 1016)	--	--	MG/KG	9 U	0.077 U	0.079 U	0.75 U	1.1 U	0.079 U
PCB-1221 (Aroclor 1221)	--	--	MG/KG	9 U	0.077 U	0.079 U	0.75 U	1.1 U	0.079 U
PCB-1232 (Aroclor 1232)	--	--	MG/KG	9 U	0.077 U	0.079 U	0.75 U	1.1 U	0.079 U
PCB-1242 (Aroclor 1242)	--	--	MG/KG	9 U	0.077 U	0.079 U	0.75 U	1.1 U	0.079 U
PCB-1248 (Aroclor 1248)	--	--	MG/KG	9 U	0.077 U	0.079 U	0.75 U	1.1 U	0.079 U
PCB-1254 (Aroclor 1254)	--	--	MG/KG	9 U	0.077 U	0.079 U	0.75 U	1.1 U	0.079 U
PCB-1260 (Aroclor 1260)	--	--	MG/KG	160	0.19	0.079 U	7.9	22	0.079 U
PCB-1262 (Aroclor 1262)	--	--	MG/KG	9 U	0.077 U	0.079 U	0.75 U	1.1 U	0.079 U
PCB-1268 (Aroclor 1268)	--	--	MG/KG	9 U	0.077 U	0.079 U	0.75 U	1.1 U	0.079 U
Polychlorinated Biphenyl (PCBs)	**1**	1	MG/KG	**160**	0.19	0.079 U	**7.9**	**22**	0.079 U

Table 5. Summary of Pesticides and Herbicides in Soil, 322 3rd Avenue, Brooklyn, New York

			Sample Designation:	EPA-SB-1	EPA-SB-1	EPA-SB-1	MW-12	MW-12
			Sample Date:	02/20/2020	02/20/2020	02/20/2020	12/18/2019	12/18/2019
			Sample Depth (ft bls):	10 - 12	16 - 18	32 - 34	3.5 - 5.5	34.5 - 36.5
Parameter	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Commercial SCO	Unit					
Aldrin	0.097	0.68	MG/KG	0.0077 U	0.012 U	0.0079 U	0.0083 U	0.0083 U
Alpha Bhc (Alpha Hexachlorocyclohexane)	0.48	3.4	MG/KG	0.0023 U	0.0036 U	0.0023 U	0.0025 U	0.0025 U
Alpha Endosulfan	24	200	MG/KG	0.0077 U	0.012 U	0.0079 U	0.0083 U	0.0083 U
Beta Bhc (Beta Hexachlorocyclohexane)	0.36	3	MG/KG	0.0023 U	0.0036 U	0.0023 U	0.0025 U	0.0025 U
Beta Endosulfan	24	200	MG/KG	0.0077 U	0.012 U	0.0079 U	0.0083 U	0.0083 U
Chlordane	--	--	MG/KG	0.14	NA	NA	NA	NA
cis-Chlordane	4.2	24	MG/KG	0.016	0.012 U	0.0079 U	0.0083 U	0.0083 U
Delta BHC (Delta Hexachlorocyclohexane)	100	500	MG/KG	0.0023 U	0.0036 U	0.0023 U	0.0025 U	0.0025 U
Dieldrin	0.2	1.4	MG/KG	0.0023 U	0.0036 U	0.0023 U	0.0025 U	0.0025 U
Endosulfan Sulfate	24	200	MG/KG	0.0077 U	0.012 U	0.0079 U	0.0083 U	0.0083 U
Endrin	11	89	MG/KG	0.0077 U	0.012 U	0.0079 U	0.0083 U	0.0083 U
Endrin Aldehyde	--	--	MG/KG	0.013	0.012 U	0.0079 U	0.0083 U	0.0083 U
Endrin Ketone	--	--	MG/KG	0.0077 U	0.012 U	0.0079 U	0.0083 U	0.0083 U
Gamma Bhc (Lindane)	1.3	9.2	MG/KG	0.0023 U	0.0036 U	0.0023 U	0.0025 U	0.0025 U
Heptachlor	2.1	15	MG/KG	0.0077 U	0.012 U	0.0079 U	0.0083 U	0.0083 U
Heptachlor Epoxide	--	--	MG/KG	0.0077 U	0.012 U	0.0079 U	0.0083 U	0.0083 U
Methoxychlor	--	--	MG/KG	0.0077 U	0.012 U	0.0079 U	0.0083 U	0.0083 U
P,P'-DDD	**13**	92	MG/KG	0.014	0.012 U	0.0079 U	0.0083 U	0.0083 U
P,P'-DDE	**8.9**	62	MG/KG	0.0067 J	0.012 U	0.0079 U	0.0083 U	0.0083 U
P,P'-DDT	7.9	47	MG/KG	0.0083	0.012 U	0.0079 U	0.0083 U	0.0083 U
Silvex (2,4,5-TP)	100	500	MG/KG	0.038 U	0.06 U	0.039 U	0.041 U	0.041 U
Toxaphene	--	--	MG/KG	0.077 U	0.12 U	0.079 U	0.083 U	0.083 U

Table 5. Summary of Pesticides and Herbicides in Soil, 322 3rd Avenue, Brooklyn, New York

			Sample Designation:	MW-13	MW-13	MW-14	MW-14	MW-14	MW-16	MW-16
			Sample Date:	02/21/2020	02/21/2020	02/20/2020	02/20/2020	02/20/2020	07/20/2018	07/20/2018
			Sample Depth (ft bls):	14 - 16	38 - 40	10 - 12	17 - 19	33 - 35	13 - 15	25 - 27
Parameter	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Commercial SCO	Unit							
Aldrin	0.097	0.68	MG/KG	0.0093 U	0.0085 U	0.0078 U	0.0094 U	0.0081 U	0.46 U	0.29 U
Alpha Bhc (Alpha Hexachlorocyclohexane)	0.48	3.4	MG/KG	0.0028 U	0.0025 U	0.0023 U	0.0028 U	0.0024 U	0.14 U	0.088 U
Alpha Endosulfan	24	200	MG/KG	0.0093 U	0.0085 U	0.0078 U	0.0094 U	0.0081 U	0.46 U	0.29 U
Beta Bhc (Beta Hexachlorocyclohexane)	0.36	3	MG/KG	0.0028 U	0.0025 U	0.0023 U	0.0028 U	0.0024 U	0.14 U	0.088 U
Beta Endosulfan	24	200	MG/KG	0.0093 U	0.0085 U	0.0078 U	0.0094 U	0.0081 U	0.46 U	0.29 U
Chlordane	--	--	MG/KG	NA	NA	NA	NA	NA	4.6 U	2.9 U
cis-Chlordane	4.2	24	MG/KG	0.0093 U	0.0085 U	0.0078 U	0.0094 U	0.0081 U	0.46 U	0.29 U
Delta BHC (Delta Hexachlorocyclohexane)	100	500	MG/KG	0.0028 U	0.0025 U	0.0023 U	0.0028 U	0.0024 U	0.14 U	0.088 U
Dieldrin	0.2	1.4	MG/KG	0.0028 U	0.0025 U	0.0023 U	0.0028 U	0.0024 U	0.14 U	0.088 U
Endosulfan Sulfate	24	200	MG/KG	0.0093 U	0.0085 U	0.0078 U	0.0094 U	0.0081 U	0.46 U	0.29 U
Endrin	11	89	MG/KG	0.0093 U	0.0085 U	0.0078 U	0.0094 U	0.0081 U	0.46 U	0.29 U
Endrin Aldehyde	--	--	MG/KG	0.0093 U	0.0085 U	0.0078 U	0.0094 U	0.0081 U	0.46 U	0.29 U
Endrin Ketone	--	--	MG/KG	0.0093 U	0.0085 U	0.0078 U	0.0094 U	0.0081 U	0.46 U	0.29 U
Gamma Bhc (Lindane)	1.3	9.2	MG/KG	0.0028 U	0.0025 U	0.0023 U	0.0028 U	0.0024 U	0.14 U	0.088 U
Heptachlor	2.1	15	MG/KG	0.0093 U	0.0085 U	0.0078 U	0.0094 U	0.0081 U	0.46 U	0.29 U
Heptachlor Epoxide	--	--	MG/KG	0.0093 U	0.0085 U	0.0078 U	0.0094 U	0.0081 U	0.46 U	0.29 U
Methoxychlor	--	--	MG/KG	0.0093 U	0.0085 U	0.0078 U	0.0094 U	0.0081 U	0.46 U	0.29 U
P,P'-DDD	**13**	92	MG/KG	0.0093 U	0.0085 U	0.015	0.0094 U	0.0081 U	3.3	0.29 U
P,P'-DDE	**8.9**	62	MG/KG	0.0093 U	0.0085 U	0.014	0.0094 U	0.0081 U	5.9	0.29 U
P,P'-DDT	7.9	47	MG/KG	0.0093 U	0.0085 U	0.0076 J	0.0094 U	0.0081 U	1.9	0.29 U
Silvex (2,4,5-TP)	100	500	MG/KG	0.046 U	0.042 U	0.039 U	0.047 U	0.04 U	0.046 U	0.073 U
Toxaphene	--	--	MG/KG	0.093 U	0.085 U	0.078 U	0.094 U	0.081 U	4.6 U	2.9 U

Table 5. Summary of Pesticides and Herbicides in Soil, 322 3rd Avenue, Brooklyn, New York

			Sample Designation:	MW-16	MW-16E	MW-16E	MW-16S	MW-16S	MW-16W	MW-16W
			Sample Date:	07/20/2018	11/02/2018	11/02/2018	11/02/2018	11/02/2018	11/02/2018	11/02/2018
			Sample Depth (ft bls):	32 - 34	7 - 9	14 - 15	5 - 10	13 - 15	8 - 10	14 - 16
Parameter	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Commercial SCO	Unit							
Aldrin	0.097	0.68	MG/KG	0.0081 U	0.0084 U	0.0077 U	4 U	0.31 U	0.0077 U	0.0079 U
Alpha Bhc (Alpha Hexachlorocyclohexane)	0.48	3.4	MG/KG	0.0024 U	0.0025 U	0.0023 U	1.2 U	0.094 U	0.0023 U	0.0024 U
Alpha Endosulfan	24	200	MG/KG	0.0081 U	0.0084 U	0.0077 U	4 U	0.31 U	0.0077 U	0.0079 U
Beta Bhc (Beta Hexachlorocyclohexane)	0.36	3	MG/KG	0.0024 U	0.0025 U	0.0023 U	1.2 U	0.094 U	0.0023 U	0.0024 U
Beta Endosulfan	24	200	MG/KG	0.0081 U	0.0084 U	0.0077 U	4 U	0.31 U	0.0077 U	0.0079 U
Chlordane	--	--	MG/KG	0.081 U	0.084 U	0.077 U	40 U	3.1 U	0.077 U	0.079 U
cis-Chlordane	4.2	24	MG/KG	0.0081 U	NA	NA	NA	NA	NA	NA
Delta BHC (Delta Hexachlorocyclohexane)	100	500	MG/KG	0.0024 U	0.0025 U	0.0023 U	1.2 U	0.094 U	0.0023 U	0.0024 U
Dieldrin	0.2	1.4	MG/KG	0.0024 U	0.0025 U	0.0023 U	1.2 U	0.094 U	0.0023 U	0.0024 U
Endosulfan Sulfate	24	200	MG/KG	0.0081 U	0.0084 U	0.0077 U	4 U	0.31 U	0.0077 U	0.0079 U
Endrin	11	89	MG/KG	0.0081 U	0.0084 U	0.0077 U	4 U	0.31 U	0.0077 U	0.0079 U
Endrin Aldehyde	--	--	MG/KG	0.0081 U	0.0084 U	0.0077 U	4 U	0.31 U	0.0077 U	0.0079 U
Endrin Ketone	--	--	MG/KG	0.0081 U	0.0084 U	0.0077 U	4 U	0.31 U	0.0077 U	0.0079 U
Gamma Bhc (Lindane)	1.3	9.2	MG/KG	0.0024 U	0.0025 U	0.0023 U	1.2 U	0.094 U	0.0023 U	0.0024 U
Heptachlor	2.1	15	MG/KG	0.0081 U	0.0084 U	0.0077 U	4 U	0.31 U	0.0077 U	0.0079 U
Heptachlor Epoxide	--	--	MG/KG	0.0081 U	0.0084 U	0.0077 U	4 U	0.31 U	0.0077 U	0.0079 U
Methoxychlor	--	--	MG/KG	0.0081 U	0.0084 U	0.0077 U	4 U	0.31 U	0.0077 U	0.0079 U
P,P'-DDD	**13**	92	MG/KG	0.0081 U	0.0084 U	0.0077 U	4 U	0.31 U	0.0077 U	0.0079 U
P,P'-DDE	**8.9**	62	MG/KG	0.0081 U	0.0084 U	0.0077 U	4 U	0.31 U	0.0077 U	0.0079 U
P,P'-DDT	7.9	47	MG/KG	0.0081 U	0.0084 U	0.0077 U	4 U	0.31 U	0.0077 U	0.0079 U
Silvex (2,4,5-TP)	100	500	MG/KG	0.04 U	NA	NA	NA	NA	NA	NA
Toxaphene	--	--	MG/KG	0.081 U	0.084 U	0.077 U	40 U	3.1 U	0.077 U	0.079 U

Table 5. Summary of Pesticides and Herbicides in Soil, 322 3rd Avenue, Brooklyn, New York

			Sample Designation:	MW-17	MW-17	MW-17
			Sample Date:	07/20/2018	07/20/2018	07/20/2018
			Sample Depth (ft bls):	11 - 13	17 - 19	32 - 34
Parameter	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Commercial SCO	Unit			
Aldrin	0.097	0.68	MG/KG	0.0075 U	1.1 U	0.0079 U
Alpha Bhc (Alpha Hexachlorocyclohexane)	0.48	3.4	MG/KG	0.0022 U	0.33 U	0.0024 U
Alpha Endosulfan	24	200	MG/KG	0.0075 U	1.1 U	0.0079 U
Beta Bhc (Beta Hexachlorocyclohexane)	0.36	3	MG/KG	0.0022 U	0.33 U	0.0024 U
Beta Endosulfan	24	200	MG/KG	0.0075 U	1.1 U	0.0079 U
Chlordane	--	--	MG/KG	0.075 U	11 U	0.079 U
cis-Chlordane	4.2	24	MG/KG	0.0075 U	1.1 U	0.0079 U
Delta BHC (Delta Hexachlorocyclohexane)	100	500	MG/KG	0.0022 U	0.33 U	0.0024 U
Dieldrin	0.2	1.4	MG/KG	0.0022 U	0.33 U	0.0024 U
Endosulfan Sulfate	24	200	MG/KG	0.0075 U	1.1 U	0.0079 U
Endrin	11	89	MG/KG	0.0075 U	1.1 U	0.0079 U
Endrin Aldehyde	--	--	MG/KG	0.0075 U	1.1 U	0.0079 U
Endrin Ketone	--	--	MG/KG	0.0075 U	1.1 U	0.0079 U
Gamma Bhc (Lindane)	1.3	9.2	MG/KG	0.0022 U	0.33 U	0.0024 U
Heptachlor	2.1	15	MG/KG	0.0075 U	1.1 U	0.0079 U
Heptachlor Epoxide	--	--	MG/KG	0.0075 U	1.1 U	0.0079 U
Methoxychlor	--	--	MG/KG	0.0075 U	1.1 U	0.0079 U
P,P'-DDD	**13**	92	MG/KG	0.0075 U	**16**	0.0079 U
P,P'-DDE	**8.9**	62	MG/KG	0.0075 U	**15**	0.0079 U
P,P'-DDT	7.9	47	MG/KG	0.0075 U	1.1 U	0.0079 U
Silvex (2,4,5-TP)	100	500	MG/KG	0.037 U	0.054 U	0.039 U
Toxaphene	--	--	MG/KG	0.075 U	11 U	0.079 U

Notes Utilized Throughout Tables	
Building Materials Table	
J -	Estimated value
U -	Indicates that the compound was analyzed for but not detected
ft bls -	Feet below land surface
mg/kg -	Milligrams per kilogram
USEPA -	United States Environmental Protection Agency
--	No Standards available
Bold data indicates that parameter was detected above the USEPA Low Occupancy Cleanup Level	

Table 6. Summary of Polychlorinated Biphenyls in Boiler House and Turbine Hall Building Materials, 322 3rd Avenue, Brooklyn, New York

			Sample Designation:	BH-SLAB-1	BH-SLAB-2	BH-SLAB-3	BH-SLAB-4
			Sample Date:	06/05/2019	06/05/2019	06/05/2019	06/05/2019
Parameter	USEPA Low Occupancy Cleanup Level		Units				
PCB-1016 (Aroclor 1016)	--	--	MG/KG	0.074 U	0.074 U	0.072 U	0.071 U
PCB-1221 (Aroclor 1221)	--	--	MG/KG	0.074 U	0.074 U	0.072 U	0.071 U
PCB-1232 (Aroclor 1232)	--	--	MG/KG	0.074 U	0.074 U	0.072 U	0.071 U
PCB-1242 (Aroclor 1242)	--	--	MG/KG	0.074 U	0.074 U	0.072 U	0.071 U
PCB-1248 (Aroclor 1248)	--	--	MG/KG	0.074 U	0.074 U	0.072 U	0.071 U
PCB-1254 (Aroclor 1254)	--	--	MG/KG	0.074 U	0.074 U	0.072 U	0.071 U
PCB-1260 (Aroclor 1260)	--	--	MG/KG	0.074 U	0.074 U	0.072 U	0.059 J
PCB-1262 (Aroclor 1262)	--	--	MG/KG	0.074 U	0.074 U	0.072 U	0.071 U
PCB-1268 (Aroclor 1268)	--	--	MG/KG	0.074 U	0.074 U	0.072 U	0.071 U
Polychlorinated Biphenyl (PCBs)	**25**	**100**	MG/KG	0.074 U	0.074 U	0.072 U	0.059 J

Table 6. Summary of Polychlorinated Biphenyls in Boiler House and Turbine Hall Building Materials, 322 3rd Avenue, Brooklyn, New York

			Sample Designation:	BH-SLAB-5	BH-SLAB-6	BH-SLAB-7	BH-SLAB-8
			Sample Date:	06/05/2019	06/05/2019	06/05/2019	06/05/2019
Parameter	USEPA Low Occupancy Cleanup Level		Units				
PCB-1016 (Aroclor 1016)	--	--	MG/KG	0.071 U	0.072 U	0.071 U	0.075 U
PCB-1221 (Aroclor 1221)	--	--	MG/KG	0.071 U	0.072 U	0.071 U	0.075 U
PCB-1232 (Aroclor 1232)	--	--	MG/KG	0.071 U	0.072 U	0.071 U	0.075 U
PCB-1242 (Aroclor 1242)	--	--	MG/KG	0.071 U	0.072 U	0.071 U	0.075 U
PCB-1248 (Aroclor 1248)	--	--	MG/KG	0.071 U	0.072 U	0.071 U	0.075 U
PCB-1254 (Aroclor 1254)	--	--	MG/KG	0.071 U	0.072 U	0.071 U	0.075 U
PCB-1260 (Aroclor 1260)	--	--	MG/KG	0.071 U	0.072 U	0.42	0.075 U
PCB-1262 (Aroclor 1262)	--	--	MG/KG	0.071 U	0.072 U	0.071 U	0.075 U
PCB-1268 (Aroclor 1268)	--	--	MG/KG	0.071 U	0.072 U	0.071 U	0.075 U
Polychlorinated Biphenyl (PCBs)	**25**	**100**	MG/KG	0.071 U	0.072 U	0.42	0.075 U

Table 6. Summary of Polychlorinated Biphenyls in Boiler House and Turbine Hall Building Materials, 322 3rd Avenue, Brooklyn, New York

			Sample Designation:	BH-SLAB-9	BH-SLAB-10	BH-SLAB-11	BH-SLAB-12
			Sample Date:	06/05/2019	06/05/2019	06/05/2019	06/05/2019
Parameter	USEPA Low Occupancy Cleanup Level		Units				
PCB-1016 (Aroclor 1016)	--	--	MG/KG	0.071 U	0.073 U	0.073 U	0.073 U
PCB-1221 (Aroclor 1221)	--	--	MG/KG	0.071 U	0.073 U	0.073 U	0.073 U
PCB-1232 (Aroclor 1232)	--	--	MG/KG	0.071 U	0.073 U	0.073 U	0.073 U
PCB-1242 (Aroclor 1242)	--	--	MG/KG	0.071 U	0.073 U	0.073 U	0.073 U
PCB-1248 (Aroclor 1248)	--	--	MG/KG	0.071 U	0.073 U	0.073 U	0.073 U
PCB-1254 (Aroclor 1254)	--	--	MG/KG	0.071 U	0.073 U	0.073 U	0.073 U
PCB-1260 (Aroclor 1260)	--	--	MG/KG	0.071 U	0.073 U	0.073 U	0.073 U
PCB-1262 (Aroclor 1262)	--	--	MG/KG	0.071 U	0.073 U	0.073 U	0.073 U
PCB-1268 (Aroclor 1268)	--	--	MG/KG	0.071 U	0.073 U	0.073 U	0.073 U
Polychlorinated Biphenyl (PCBs)	**25**	**100**	MG/KG	0.071 U	0.073 U	0.073 U	0.073 U

Table 6. Summary of Polychlorinated Biphenyls in Boiler House and Turbine Hall Building Materials, 322 3rd Avenue, Brooklyn, New York

			Sample Designation:	BH-SLAB-13	BH-SLAB-14	BH-SLAB-15	TH-SLAB-1
			Sample Date:	06/05/2019	06/05/2019	06/05/2019	10/21/2019
Parameter	USEPA Low Occupancy Cleanup Level		Units				
PCB-1016 (Aroclor 1016)	--	--	MG/KG	0.073 U	0.069 U	0.074 U	1.8 U
PCB-1221 (Aroclor 1221)	--	--	MG/KG	0.073 U	0.069 U	0.074 U	1.8 U
PCB-1232 (Aroclor 1232)	--	--	MG/KG	0.073 U	0.069 U	0.074 U	1.8 U
PCB-1242 (Aroclor 1242)	--	--	MG/KG	0.073 U	0.069 U	0.074 U	1.8 U
PCB-1248 (Aroclor 1248)	--	--	MG/KG	0.073 U	0.069 U	0.074 U	1.8 U
PCB-1254 (Aroclor 1254)	--	--	MG/KG	0.073 U	0.069 U	0.074 U	1.8 U
PCB-1260 (Aroclor 1260)	--	--	MG/KG	0.073 U	0.1	0.074 U	19
PCB-1262 (Aroclor 1262)	--	--	MG/KG	0.073 U	0.069 U	0.074 U	1.8 U
PCB-1268 (Aroclor 1268)	--	--	MG/KG	0.073 U	0.069 U	0.074 U	1.8 U
Polychlorinated Biphenyl (PCBs)	**25**	**100**	MG/KG	0.073 U	0.1	0.074 U	19

Table 6. Summary of Polychlorinated Biphenyls in Boiler House and Turbine Hall Building Materials, 322 3rd Avenue, Brooklyn, New York

			Sample Designation:	TH-SLAB-2	TH-SLAB-3	TH-SLAB-4	TH-SLAB-5
			Sample Date:	10/21/2019	10/21/2019	10/21/2019	10/22/2019
Parameter	USEPA Low Occupancy Cleanup Level		Units				
PCB-1016 (Aroclor 1016)	--	--	MG/KG	0.07 U	0.15 U	0.072 U	0.074 U
PCB-1221 (Aroclor 1221)	--	--	MG/KG	0.07 U	0.15 U	0.072 U	0.074 U
PCB-1232 (Aroclor 1232)	--	--	MG/KG	0.07 U	0.15 U	0.072 U	0.074 U
PCB-1242 (Aroclor 1242)	--	--	MG/KG	0.07 U	0.15 U	0.072 U	0.074 U
PCB-1248 (Aroclor 1248)	--	--	MG/KG	0.07 U	0.76	0.072 U	0.074 U
PCB-1254 (Aroclor 1254)	--	--	MG/KG	0.07 U	0.15 U	0.072 U	0.074 U
PCB-1260 (Aroclor 1260)	--	--	MG/KG	0.8	2.3	0.24	0.061 J
PCB-1262 (Aroclor 1262)	--	--	MG/KG	0.07 U	0.15 U	0.072 U	0.074 U
PCB-1268 (Aroclor 1268)	--	--	MG/KG	0.07 U	0.15 U	0.072 U	0.074 U
Polychlorinated Biphenyl (PCBs)	**25**	**100**	MG/KG	0.8	3.1	0.24	0.061 J

Table 6. Summary of Polychlorinated Biphenyls in Boiler House and Turbine Hall Building Materials, 322 3rd Avenue, Brooklyn, New York

			Sample Designation:	TH-SLAB-6	TH-SLAB-7	TH-SLAB-8	TH-SLAB-8E
			Sample Date:	10/22/2019	10/21/2019	10/21/2019	11/7/2019
Parameter	USEPA Low Occupancy Cleanup Level		Units				
PCB-1016 (Aroclor 1016)	--	--	MG/KG	0.073 U	0.069 U	35 U	0.14 U
PCB-1221 (Aroclor 1221)	--	--	MG/KG	0.073 U	0.069 U	35 U	0.14 U
PCB-1232 (Aroclor 1232)	--	--	MG/KG	0.073 U	0.069 U	35 U	0.14 U
PCB-1242 (Aroclor 1242)	--	--	MG/KG	0.073 U	0.069 U	35 U	0.14 U
PCB-1248 (Aroclor 1248)	--	--	MG/KG	0.2	0.069 U	35 U	0.14 U
PCB-1254 (Aroclor 1254)	--	--	MG/KG	0.073 U	0.069 U	35 U	0.14 U
PCB-1260 (Aroclor 1260)	--	--	MG/KG	0.65	0.69	**460**	2.2
PCB-1262 (Aroclor 1262)	--	--	MG/KG	0.073 U	0.069 U	35 U	0.14 U
PCB-1268 (Aroclor 1268)	--	--	MG/KG	0.073 U	0.069 U	35 U	0.14 U
Polychlorinated Biphenyl (PCBs)	**25**	**100**	MG/KG	0.85	0.69	**460**	2.2

Table 6. Summary of Polychlorinated Biphenyls in Boiler House and Turbine Hall Building Materials, 322 3rd Avenue, Brooklyn, New York

			Sample Designation:	TH-SLAB-8N	TH-SLAB-8S	TH-SLAB-8W	TH-SLAB-9
			Sample Date:	11/7/2019	11/7/2019	11/7/2019	10/21/2019
Parameter	USEPA Low Occupancy Cleanup Level		Units				
PCB-1016 (Aroclor 1016)	--	--	MG/KG	0.072 U	0.073 U	35 U	1.8 U
PCB-1221 (Aroclor 1221)	--	--	MG/KG	0.072 U	0.073 U	35 U	1.8 U
PCB-1232 (Aroclor 1232)	--	--	MG/KG	0.072 U	0.073 U	35 U	1.8 U
PCB-1242 (Aroclor 1242)	--	--	MG/KG	0.072 U	0.073 U	35 U	1.8 U
PCB-1248 (Aroclor 1248)	--	--	MG/KG	0.072 U	0.073 U	35 U	1.8 U
PCB-1254 (Aroclor 1254)	--	--	MG/KG	0.072 U	0.073 U	35 U	1.8 U
PCB-1260 (Aroclor 1260)	--	--	MG/KG	1.1	1	720	24
PCB-1262 (Aroclor 1262)	--	--	MG/KG	0.072 U	0.073 U	35 U	1.8 U
PCB-1268 (Aroclor 1268)	--	--	MG/KG	0.072 U	0.073 U	35 U	1.8 U
Polychlorinated Biphenyl (PCBs)	**25**	**100**	MG/KG	1.1	1	**720**	24

Table 6. Summary of Polychlorinated Biphenyls in Boiler House and Turbine Hall Building Materials, 322 3rd Avenue, Brooklyn, New York

			Sample Designation:	TH-SLAB-10	TH-SLAB-11	TH-SLAB-12	TH-SLAB-13
			Sample Date:	10/22/2019	10/22/2019	10/22/2019	10/22/2019
Parameter	USEPA Low Occupancy Cleanup Level		Units				
PCB-1016 (Aroclor 1016)	--	--	MG/KG	0.15 U	0.071 U	0.071 U	0.36 U
PCB-1221 (Aroclor 1221)	--	--	MG/KG	0.15 U	0.071 U	0.071 U	0.36 U
PCB-1232 (Aroclor 1232)	--	--	MG/KG	0.15 U	0.071 U	0.071 U	0.36 U
PCB-1242 (Aroclor 1242)	--	--	MG/KG	0.15 U	0.071 U	0.071 U	0.36 U
PCB-1248 (Aroclor 1248)	--	--	MG/KG	0.15 U	0.071 U	0.27	0.64
PCB-1254 (Aroclor 1254)	--	--	MG/KG	0.15 U	0.071 U	0.071 U	0.36 U
PCB-1260 (Aroclor 1260)	--	--	MG/KG	1.8	0.073	0.44	3.7
PCB-1262 (Aroclor 1262)	--	--	MG/KG	0.15 U	0.071 U	0.071 U	0.36 U
PCB-1268 (Aroclor 1268)	--	--	MG/KG	0.15 U	0.071 U	0.071 U	0.36 U
Polychlorinated Biphenyl (PCBs)	**25**	**100**	MG/KG	1.8	0.073	0.71	4.3

Table 6. Summary of Polychlorinated Biphenyls in Boiler House and Turbine Hall Building Materials, 322 3rd Avenue, Brooklyn, New York

			Sample Designation:	TH-SLAB-14	TH-SLAB-15	TH-SLAB-16	TH-SLAB-17
			Sample Date:	10/22/2019	10/22/2019	10/21/2019	10/21/2019
Parameter	USEPA Low Occupancy Cleanup Level		Units				
PCB-1016 (Aroclor 1016)	--	--	MG/KG	0.072 U	0.7 U	0.69 U	0.068 U
PCB-1221 (Aroclor 1221)	--	--	MG/KG	0.072 U	0.7 U	0.69 U	0.068 U
PCB-1232 (Aroclor 1232)	--	--	MG/KG	0.072 U	0.7 U	0.69 U	0.068 U
PCB-1242 (Aroclor 1242)	--	--	MG/KG	0.072 U	0.7 U	0.69 U	0.068 U
PCB-1248 (Aroclor 1248)	--	--	MG/KG	0.12	2.2	2.3	0.21
PCB-1254 (Aroclor 1254)	--	--	MG/KG	0.072 U	0.7 U	0.69 U	0.068 U
PCB-1260 (Aroclor 1260)	--	--	MG/KG	0.75	11	11	0.79
PCB-1262 (Aroclor 1262)	--	--	MG/KG	0.072 U	0.7 U	0.69 U	0.068 U
PCB-1268 (Aroclor 1268)	--	--	MG/KG	0.072 U	0.7 U	0.69 U	0.068 U
Polychlorinated Biphenyl (PCBs)	**25**	**100**	MG/KG	0.87	13	13	1

Table 6. Summary of Polychlorinated Biphenyls in Boiler House and Turbine Hall Building Materials, 322 3rd Avenue, Brooklyn, New York

			Sample Designation:	TH-SLAB-18	TH-WALL-1	TH-WALL-2	TH-WALL-3
			Sample Date:	10/21/2019	06/06/2019	06/06/2019	06/06/2019
Parameter	USEPA Low Occupancy Cleanup Level		Units				
PCB-1016 (Aroclor 1016)	--	--	MG/KG	0.07 U	0.083 U	0.16 U	0.078 U
PCB-1221 (Aroclor 1221)	--	--	MG/KG	0.07 U	0.083 U	0.16 U	0.078 U
PCB-1232 (Aroclor 1232)	--	--	MG/KG	0.07 U	0.083 U	0.16 U	0.078 U
PCB-1242 (Aroclor 1242)	--	--	MG/KG	0.07 U	0.083 U	0.16 U	0.078 U
PCB-1248 (Aroclor 1248)	--	--	MG/KG	0.07 U	0.083 U	0.16 U	0.078 U
PCB-1254 (Aroclor 1254)	--	--	MG/KG	0.07 U	0.083 U	0.16 U	0.078 U
PCB-1260 (Aroclor 1260)	--	--	MG/KG	0.11	0.083 U	2.3	0.082
PCB-1262 (Aroclor 1262)	--	--	MG/KG	0.07 U	0.083 U	0.16 U	0.078 U
PCB-1268 (Aroclor 1268)	--	--	MG/KG	0.07 U	0.083 U	0.16 U	0.078 U
Polychlorinated Biphenyl (PCBs)	**25**	**100**	MG/KG	0.11	0.083 U	2.3	0.082

Table 6. Summary of Polychlorinated Biphenyls in Boiler House and Turbine Hall Building Materials, 322 3rd Avenue, Brooklyn, New York

			Sample Designation:	TH-WALL-4	TH-WALL-5	TH-WALL-6	TH-WALL-7
			Sample Date:	06/06/2019	06/06/2019	06/06/2019	06/06/2019
Parameter	USEPA Low Occupancy Cleanup Level		Units				
PCB-1016 (Aroclor 1016)	--	--	MG/KG	0.08 U	0.081 U	0.075 U	0.068 U
PCB-1221 (Aroclor 1221)	--	--	MG/KG	0.08 U	0.081 U	0.075 U	0.068 U
PCB-1232 (Aroclor 1232)	--	--	MG/KG	0.08 U	0.081 U	0.075 U	0.068 U
PCB-1242 (Aroclor 1242)	--	--	MG/KG	0.08 U	0.081 U	0.075 U	0.068 U
PCB-1248 (Aroclor 1248)	--	--	MG/KG	0.08 U	0.081 U	0.075 U	0.068 U
PCB-1254 (Aroclor 1254)	--	--	MG/KG	0.08 U	0.081 U	0.075 U	0.068 U
PCB-1260 (Aroclor 1260)	--	--	MG/KG	0.08 U	0.081 U	0.075 U	0.068 U
PCB-1262 (Aroclor 1262)	--	--	MG/KG	0.08 U	0.081 U	0.075 U	0.068 U
PCB-1268 (Aroclor 1268)	--	--	MG/KG	0.08 U	0.081 U	0.075 U	0.068 U
Polychlorinated Biphenyl (PCBs)	**25**	**100**	MG/KG	0.08 U	0.081 U	0.075 U	0.068 U

Table 6. Summary of Polychlorinated Biphenyls in Boiler House and Turbine Hall Building Materials, 322 3rd Avenue, Brooklyn, New York

			Sample Designation:	TH-WALL-8	TH-WALL-9	TH-WALL-10	TH-WALL-11
			Sample Date:	06/06/2019	06/06/2019	06/06/2019	06/06/2019
Parameter	USEPA Low Occupancy Cleanup Level		Units				
PCB-1016 (Aroclor 1016)	--	--	MG/KG	0.067 U	0.067 U	0.067 U	0.067 U
PCB-1221 (Aroclor 1221)	--	--	MG/KG	0.067 U	0.067 U	0.067 U	0.067 U
PCB-1232 (Aroclor 1232)	--	--	MG/KG	0.067 U	0.067 U	0.067 U	0.067 U
PCB-1242 (Aroclor 1242)	--	--	MG/KG	0.067 U	0.067 U	0.067 U	0.067 U
PCB-1248 (Aroclor 1248)	--	--	MG/KG	0.067 U	0.067 U	0.067 U	0.067 U
PCB-1254 (Aroclor 1254)	--	--	MG/KG	0.067 U	0.067 U	0.067 U	0.067 U
PCB-1260 (Aroclor 1260)	--	--	MG/KG	0.067 U	0.053 J	0.24	0.067 U
PCB-1262 (Aroclor 1262)	--	--	MG/KG	0.067 U	0.067 U	0.067 U	0.067 U
PCB-1268 (Aroclor 1268)	--	--	MG/KG	0.067 U	0.067 U	0.067 U	0.067 U
Polychlorinated Biphenyl (PCBs)	**25**	**100**	MG/KG	0.067 U	0.053 J	0.24	0.067 U

Table 6. Summary of Polychlorinated Biphenyls in Boiler House and Turbine Hall Building Materials, 322 3rd Avenue, Brooklyn, New York

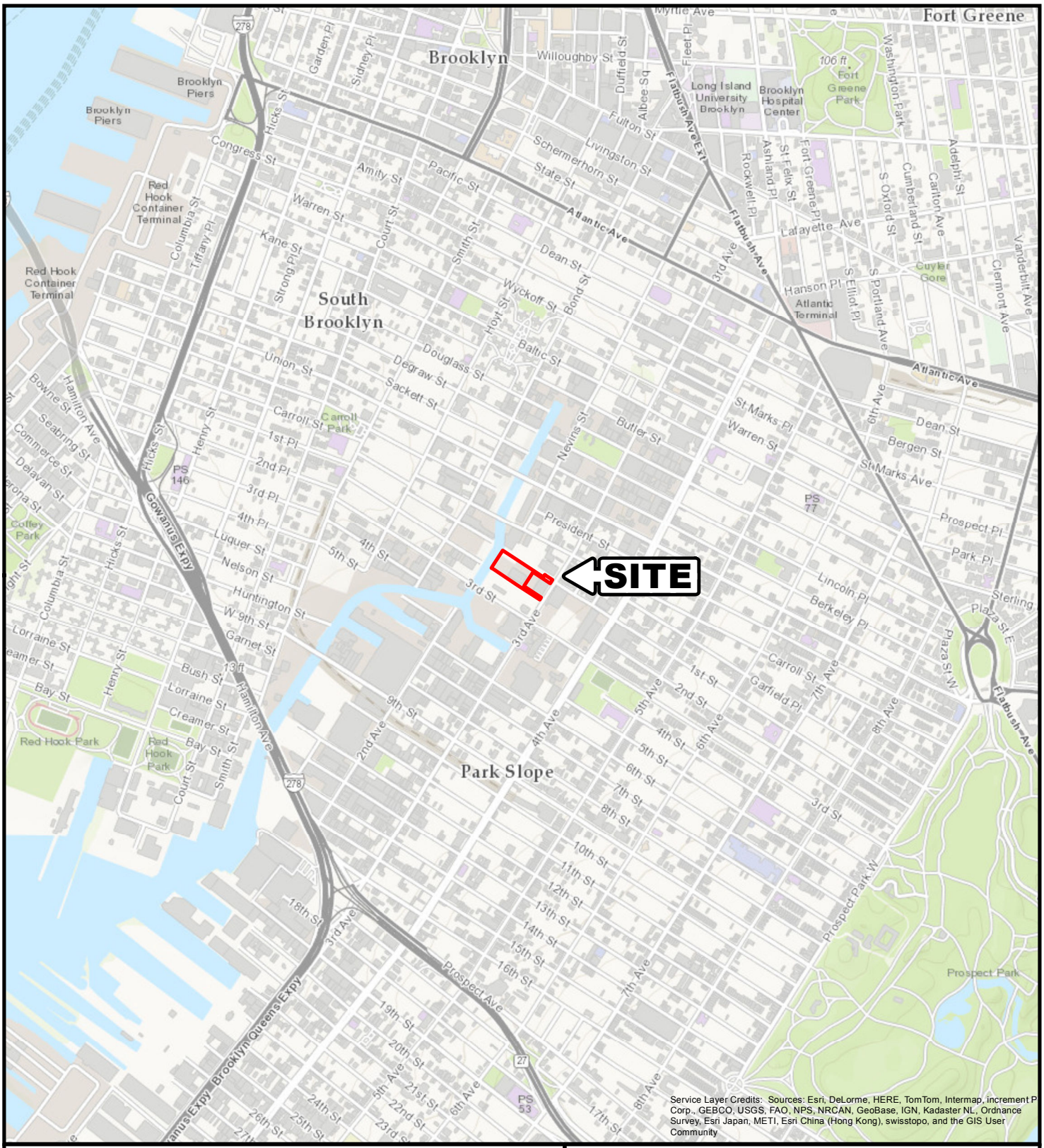
			Sample Designation:	TH-WALL-12	TH-WALL-13	TH-WALL-14	TH-WALL-15
			Sample Date:	06/06/2019	06/06/2019	06/06/2019	06/06/2019
Parameter	USEPA Low Occupancy Cleanup Level		Units				
PCB-1016 (Aroclor 1016)	--	--	MG/KG	0.068 U	0.077 U	0.076 U	0.079 U
PCB-1221 (Aroclor 1221)	--	--	MG/KG	0.068 U	0.077 U	0.076 U	0.079 U
PCB-1232 (Aroclor 1232)	--	--	MG/KG	0.068 U	0.077 U	0.076 U	0.079 U
PCB-1242 (Aroclor 1242)	--	--	MG/KG	0.068 U	0.077 U	0.076 U	0.079 U
PCB-1248 (Aroclor 1248)	--	--	MG/KG	0.068 U	0.077 U	0.076 U	0.079 U
PCB-1254 (Aroclor 1254)	--	--	MG/KG	0.068 U	0.077 U	0.076 U	0.079 U
PCB-1260 (Aroclor 1260)	--	--	MG/KG	0.068 U	0.28	0.076 U	0.079 U
PCB-1262 (Aroclor 1262)	--	--	MG/KG	0.068 U	0.077 U	0.076 U	0.079 U
PCB-1268 (Aroclor 1268)	--	--	MG/KG	0.068 U	0.077 U	0.076 U	0.079 U
Polychlorinated Biphenyl (PCBs)	**25**	**100**	MG/KG	0.068 U	0.28	0.076 U	0.079 U

Table 6. Summary of Polychlorinated Biphenyls in Boiler House and Turbine Hall Building Materials, 322 3rd Avenue, Brooklyn, New York

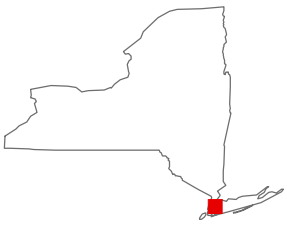
			Sample Designation:	TH-WALL-16	TH-WALL-17	TH-WALL-18
			Sample Date:	06/06/2019	06/06/2019	06/06/2019
Parameter	USEPA Low Occupancy Cleanup Level		Units			
PCB-1016 (Aroclor 1016)	--	--	MG/KG	0.078 U	0.069 U	0.08 U
PCB-1221 (Aroclor 1221)	--	--	MG/KG	0.078 U	0.069 U	0.08 U
PCB-1232 (Aroclor 1232)	--	--	MG/KG	0.078 U	0.069 U	0.08 U
PCB-1242 (Aroclor 1242)	--	--	MG/KG	0.078 U	0.069 U	0.08 U
PCB-1248 (Aroclor 1248)	--	--	MG/KG	0.078 U	0.069 U	0.08 U
PCB-1254 (Aroclor 1254)	--	--	MG/KG	0.078 U	0.069 U	0.08 U
PCB-1260 (Aroclor 1260)	--	--	MG/KG	0.078 U	0.069 U	0.12
PCB-1262 (Aroclor 1262)	--	--	MG/KG	0.078 U	0.069 U	0.08 U
PCB-1268 (Aroclor 1268)	--	--	MG/KG	0.078 U	0.069 U	0.08 U
Polychlorinated Biphenyl (PCBs)	**25**	**100**	MG/KG	0.078 U	0.069 U	0.12

FIGURES

1. Site Location Map
2. Lateral Discharge Tunnel EPA Soil Boring Exceedances
3. 2019-2020 Completed EPA Soil Boring Exceedances
4. Boiler House and Turbine Hall Building Materials Sampling Results



QUADRANGLE LOCATION



N

750 0 750 1,500 Feet

Title:

SITE LOCATION MAP

GOWANUS VILLAGE 1, LLC
BROOKLYN, NEW YORK

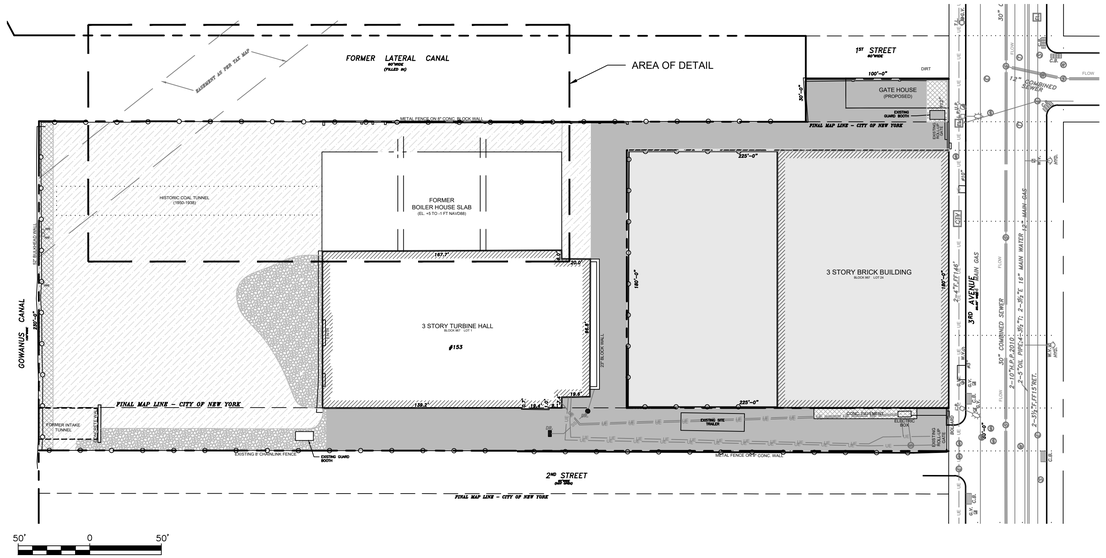
Prepared For:

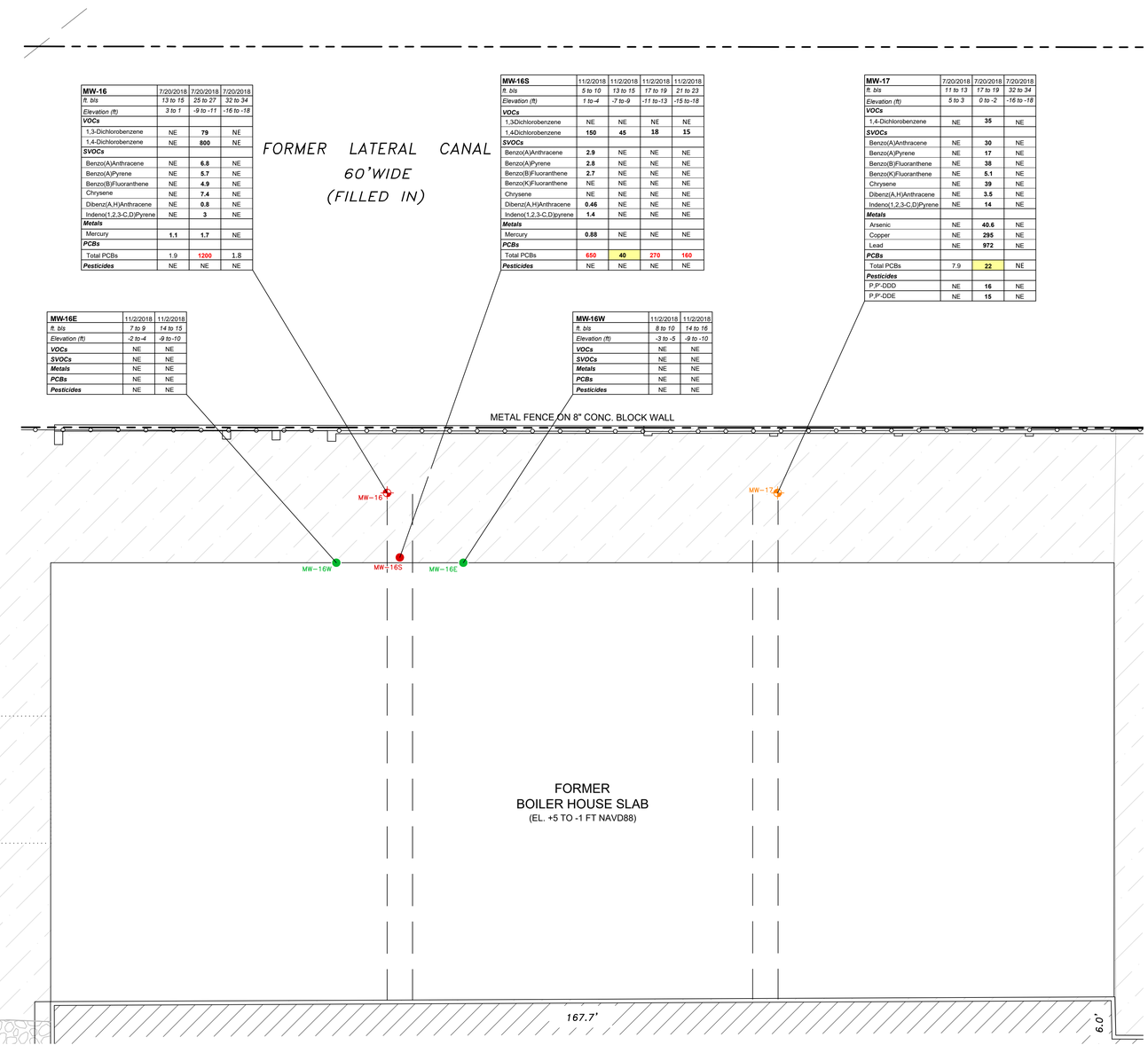
BRT POWERHOUSE LLC

ROUX
ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: L.D.	Date: 20JUL17	FIGURE
Prepared by: M.R.	Scale: AS SHOWN	1
Project Mgr: M.A.	Project: 2705.0001Y000	
File: 2705.0001Y181.2.mxd		

V:\GIS\Projects\2705Y\0001Y\181\2705.0001Y181.2.mxd





MW-16	7/20/2018	7/20/2018	7/20/2018
ft. bls	*13 to 15*	*25 to 27*	*32 to 34*
Elevation (ft)	*3 to 1*	*-9 to -11*	*-16 to -18*
VOCs			
1,3-Dichlorobenzene	NE	**79**	NE
1,4-Dichlorobenzene	NE	**800**	NE
SVOCs			
Benzo(A)Anthracene	NE	**6.8**	NE
Benzo(A)Pyrene	NE	**5.7**	NE
Benzo(B)Fluoranthene	NE	**4.9**	NE
Chrysene	NE	**7.4**	NE
Dibenz(A,H)Anthracene	NE	**0.8**	NE
Indeno(1,2,3-C,D)Pyrene	NE	**3**	NE
Metals			
Mercury	**1.1**	**1.7**	NE
PCBs			
Total PCBs	1.9	**1200**	1..8
Pesticides	NE	NE	NE

MW-16S	11/2/2018	11/2/2018	11/2/2018	11/2/2018
ft. bls	*5 to 10*	*13 to 15*	*17 to 19*	*21 to 23*
Elevation (ft)	*1 to -4*	*-7 to -9*	*-11 to -13*	*-15 to -18*
VOCs				
1,3Dichlorobenzene	NE	NE	NE	NE
1,4-Dichlorobenzene	**150**	**45**	**18**	**15**
SVOCs				
Benzo(A)Anthracene	**2.9**	NE	NE	NE
Benzo(A)Pyrene	**2.8**	NE	NE	NE
Benzo(B)Fluoranthene	**2.7**	NE	NE	NE
Benzo(K)Fluoranthene	NE	NE	NE	NE
Chrysene	NE	NE	NE	NE
Dibenz(A,H)Anthracene	**0.46**	NE	NE	NE
Indeno(1,2,3-C,D)pyrene	**1.4**	NE	NE	NE
Metals				
Mercury	**0.88**	NE	NE	NE
PCBs				
Total PCBs	**650**	**40**	**270**	**160**
Pesticides	NE	NE	NE	NE

MW-17	7/20/2018	7/20/2018	7/20/2018
ft. bls	*11 to 13*	*17 to 19*	*32 to 34*
Elevation (ft)	*5 to 3*	*0 to -2*	*-16 to -18*
VOCs			
1,4-Dichlorobenzene	NE	**35**	NE
SVOCs			
Benzo(A)Anthracene	NE	**30**	NE
Benzo(A)Pyrene	NE	**17**	NE
Benzo(B)Fluoranthene	NE	**38**	NE
Benzo(K)Fluoranthene	NE	**5.1**	NE
Chrysene	NE	**39**	NE
Dibenz(A,H)Anthracene	NE	**3.5**	NE
Indeno(1,2,3-C,D)Pyrene	NE	**14**	NE
Metals			
Arsenic	NE	**40.6**	NE
Copper	NE	**295**	NE
Lead	NE	**972**	NE
PCBs			
Total PCBs	7.9	**22**	NE
Pesticides			
P,P'-DDD	NE	**16**	NE
P,P'-DDE	NE	**15**	NE

MW-16E	11/2/2018	11/2/2018
ft. bls	*7 to 9*	*14 to 15*
Elevation (ft)	*-2 to -4*	*-9 to -10*
VOCs	NE	NE
SVOCs	NE	NE
Metals	NE	NE
PCBs	NE	NE
Pesticides	NE	NE

MW-16W	11/2/2018	11/2/2018
ft. bls	*8 to 10*	*14 to 16*
Elevation (ft)	*-3 to -5*	*-9 to -10*
VOCs	NE	NE
SVOCs	NE	NE
Metals	NE	NE
PCBs	NE	NE
Pesticides	NE	NE

LEGEND

- EXISTING BUILDING OR STRUCTURE
- PROPERTY LINE
- FENCE LINE
- EXISTING UNDERGROUND ELECTRIC
- EXISTING STORM WATER SEWER
- EXISTING MANHOLE
- EXISTING STORM WATER DRYWELL
- APPROXIMATE LOCATION OF FORMER LATERAL DISCHARGE TUNNELS
- MW-16 LOCATION AND DESIGNATION OF MONITORING WELL (PCBs GREATER THAN 50 PPM)
- MW-17 LOCATION AND DESIGNATION OF MONITORING WELL (PCBS GREATER THAN 10 PPM)
- MW-16S LOCATION AND DESIGNATION OF SOIL BORING (PCBS GREATER THAN 50 PPM)
- MW-16E LOCATION AND DESIGNATION OF SOIL BORING (PCBS LESS THAN 10 PPM)
- ASPHALT CAP
- CLEAN STONE
- EXISTING CONCRETE SLAB
- RECYCLED CONCRETE AGGREGATE

NOTE

BASE MAP PREPARED FROM SURVEY PERFORMED BY PERFECT POINT LAND SURVEYING, RT, JANUARY 2017.

DATA BOX KEY

SAMPLE DESIGNATION — SAMPLE DATE

MW-17	7/20/2018
Elevation (ft)	*-16 to -18*
VOCs	NE
SVOCs	NE
Metals	NE
Total PCBs	NE
Pesticides	NE

PARAMETER — CONCENTRATION

Parameter (mg/kg)	NYSDEC Part 375 Restricted Residential Standards
VOCs	
1,3-Dichlorobenzene	**49**
1,4-Dichlorobenzene	**13**
SVOCs	
Benzo(A)Anthracene	**1**
Benzo(A)Pyrene	**1**
Benzo(K)Fluoranthene	**3.9**
Benzo(B)Fluoranthene	**1**
Chrysene	**3.9**
Dibenz(A,H)Anthracene	**0.33**
Indeno(1,2,3-C,D)Pyrene	**0.5**
Metals	
Arsenic	**16**
Copper	**270**
Lead	**400**
Mercury	**0.81**
Pesticides	
P,P'-DDD	**13**
P,P'-DDE	**8.9**

CONCENTRATIONS IN mg/kg

Parameter (Concentrations in mg/kg)	NYSDEC RAWP Cleanup Levels (mg/kg)	TSCA Hazardous Levels (mg/kg)
PCBs, Total	**10**	**50**

mg/kg – MILLIGRAMS PER KILOGRAM
VOCs – VOLATILE ORGANIC COMPOUNDS
SVOCs – SEMIVOLATILE ORGANIC COMPOUNDS
PCBs – POLYCHLORINATED BIPHENYLS
ft bls – FEET BELOW LAND SURFACE

N

10' 0 10'

NO.	DATE	REVISION DESCRIPTION	INT.

UNAUTHORIZED ALTERATION OR ADDITION TO THIS DOCUMENT IS A VIOLATION OF STATE LAW.

THESE DOCUMENTS (OR COPIES OF ANY THEREOF) PREPARED BY OR BEARING THE SEAL OF THE ENGINEER, SHALL NOT BE REUSED FOR ANY EXTENSIONS OF THE PROJECT OR ANY OTHER PROJECT WITHOUT THE WRITTEN CONSENT OF THE ENGINEER.

PROJ. ENGINEER: C.M.	DRAWN BY: G.M.
DESIGNED BY: J.K.	CHECKED BY: C.P.
DRAWING SCALE: AS SHOWN	PLOT SCALE: 1:1
DRAWING DATE: 13MAR20	PRINT TYPE: COLOR
OFFICE: NY	PAPER SIZE: ARCH D
PROJECT NO.: 2705.0001Y000	
DRAWING FILE: 2705.0001Y276.01.DWG	

ROUX
Roux Environmental Engineering & Geology, D.P.C.
209 SHAFTER STREET, ISLANDIA, NEW YORK 11746
(631) 232-2600

PROJECT NAME:
AMENDMENT TO USEPA RAWP
GOWANUS VILLAGE I, LLC - BROOKLYN, NEW YORK

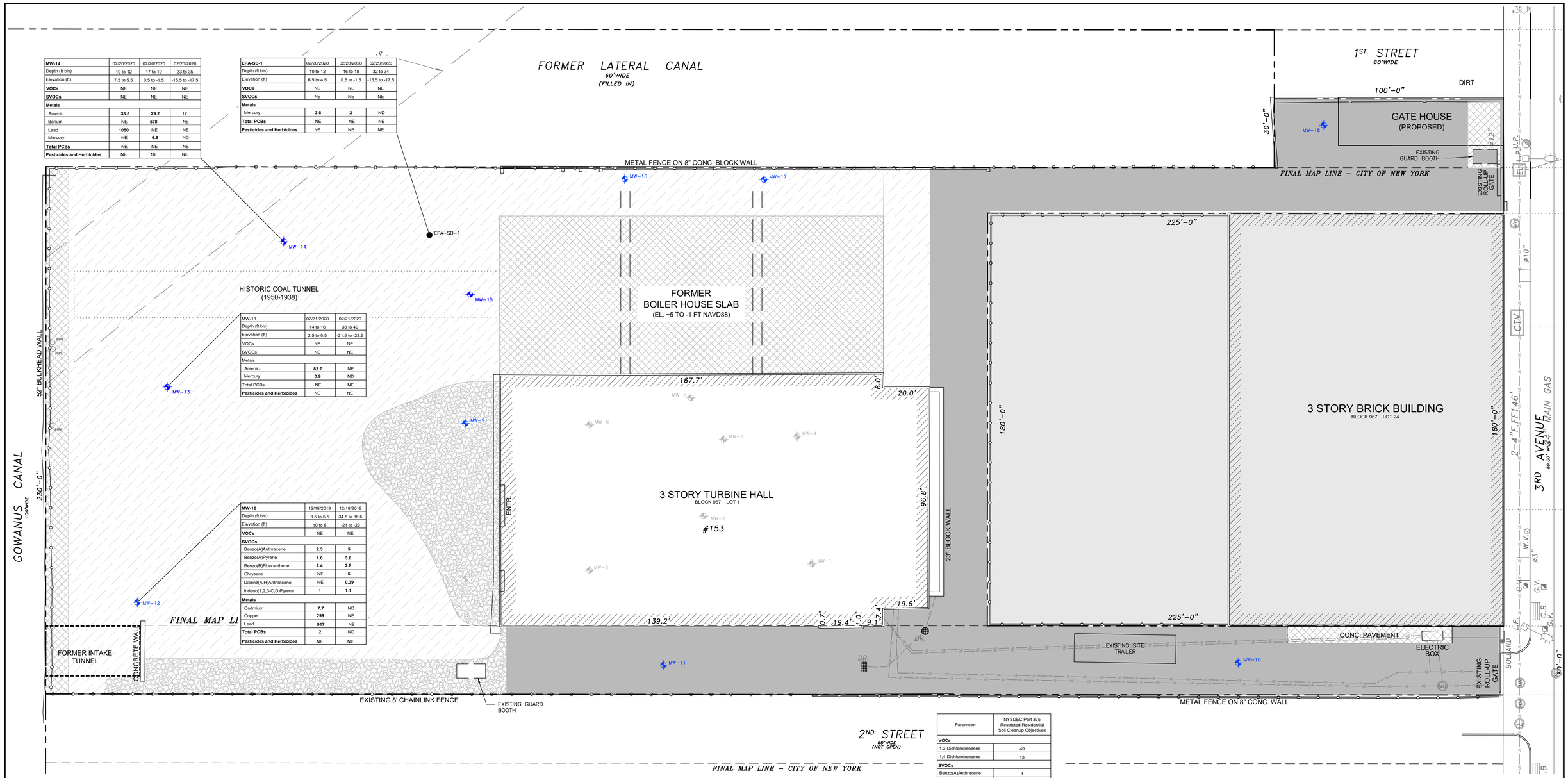
PROJECT FOR:
BRT POWERHOUSE LLC

TITLE:
LATERAL DISCHARGE TUNNEL
EPA SOIL BORING
EXCEEDANCES

FIGURE
2

FIGURE 2 OF 4

V:\CAD\PROJECTS\2705\Y\0001Y\276\2705.0001Y276.01.DWG



MW-14	02/20/2020	02/20/2020	02/20/2020
Depth (ft bls)	10 to 12	17 to 19	33 to 35
Elevation (ft)	7.5 to 5.5	0.5 to -1.5	-15.5 to -17.5
VOCs	NE	NE	NE
SVOCs	NE	NE	NE
Metals			
Arsenic	**33.5**	**29.2**	17
Barium	NE	**578**	NE
Lead	**1050**	NE	NE
Mercury	NE	**6.9**	ND
Total PCBs	NE	NE	NE
Pesticides and Herbicides	NE	NE	NE

EPA-SB-1	02/20/2020	02/20/2020	02/20/2020
Depth (ft bls)	10 to 12	16 to 18	32 to 34
Elevation (ft)	6.5 to 4.5	0.5 to -1.5	-15.5 to -17.5
VOCs	NE	NE	NE
SVOCs	NE	NE	NE
Metals			
Mercury	**3.8**	**2**	ND
Total PCBs	NE	NE	NE
Pesticides and Herbicides	NE	NE	NE

MW-13	02/21/2020	02/21/2020
Depth (ft bls)	14 to 16	38 to 40
Elevation (ft)	2.5 to 0.5	-21.5 to -23.5
VOCs	NE	NE
SVOCs	NE	NE
Metals		
Arsenic	**83.7**	NE
Mercury	**0.9**	ND
Total PCBs	NE	NE
Pesticides and Herbicides	NE	NE

MW-12	12/18/2019	12/18/2019
Depth (ft bls)	3.5 to 5.5	34.5 to 36.5
Elevation (ft)	10 to 8	-21 to -23
VOCs	NE	NE
SVOCs		
Benzo(A)Anthracene	**2.3**	**5**
Benzo(A)Pyrene	**1.8**	**3.6**
Benzo(B)Fluoranthene	**2.4**	**2.8**
Chrysene	NE	**5**
Dibenz(A,H)Anthracene	NE	**0.39**
Indeno(1,2,3-C,D)Pyrene	**1**	**1.1**
Metals		
Cadmium	**7.7**	ND
Copper	**299**	NE
Lead	**917**	NE
Total PCBs	**2**	ND
Pesticides and Herbicides	NE	NE

Parameter	NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives
VOCs	
1,3-Dichlorobenzene	49
1,4-Dichlorobenzene	13
SVOCs	
Benzo(A)Anthracene	1
Benzo(A)Pyrene	1
Benzo(B)Fluoranthene	1
Benzo(K)Fluoranthene	4
Chrysene	4
Dibenz(A,H)Anthracene	0
Indeno(1,2,3-C,D)Pyrene	1
Metals	
Arsenic	16
Barium	400
Cadmium	4
Copper	270
Lead	400
Mercury	1
Polychlorinated Biphenyl (PCBs)	1
Metals	
P,P'-DDD	13
P,P'-DDE	9

CONCENTRATIONS IN mg/kg

LEGEND

- EXISTING BUILDING OR STRUCTURE
- PROPERTY LINE
- FENCE LINE
- UE — EXISTING UNDERGROUND ELECTRIC
- SS — EXISTING STORM WATER SEWER
- MH — EXISTING MANHOLE
- DR. — EXISTING STORM WATER DRYWELL
- APPROXIMATE LOCATION OF FORMER LATERAL DISCHARGE TUNNELS
- MW-10 — LOCATION AND DESIGNATION OF MONITORING WELL
- MW-1 — LOCATION AND DESIGNATION OF DESTROYED MONITORING WELL
- EPA-SB-1 — LOCATION AND DESIGNATION OF SOIL BORING
- ASPHALT CAP
- CLEAN STONE
- EXISTING CONCRETE SLAB
- RECYCLED CONCRETE AGGREGATE

NOTES

1. BASE MAP PREPARED FROM SURVEY PERFORMED BY PERFECT POINT LAND SURVEYING, RT, JANUARY 2017.
2. LOCATIONS OF MONITORING WELLS MW-12, MW-13, MW-14 AND EPA-SB-1 ARE APPROXIMATE AND WILL BE FINALIZED AFTER A SURVEY.

DATA BOX KEY

SAMPLE DESIGNATION → MW-13; SAMPLE DATE → 02/21/2020 / 02/21/2020

MW-13	02/21/2020	02/21/2020
Depth (ft bls)	14 to 16	38 to 40
Elevation (ft)	2.5 to 0.5	-21.5 to -23.5
VOCs	NE	NE
SVOCs	NE	NE
Metals		
Arsenic	**83.7**	NE
Mercury	**0.9**	ND
Total PCBs	NE	NE
Pesticides and Herbicides	NE	NE

PARAMETER → Arsenic; CONCENTRATION → 83.7 / NE

mg/kg – MILLIGRAMS PER KILOGRAM
NYSDEC – NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
– – NO NYSDEC PART 375 SOIL CLEANUP OBJECTIVES AVAILABLE
J – ESTIMATED VALUE
VOCS – VOLATILE ORGANIC COMPOUNDS
SVOCS – SEMIVOLATILE ORGANIC COMPOUNDS
PCBS – POLYCHLORINATED BIPHENYLS
NE – NO EXCEEDANCE
NA – NOT ANALYZED FOR BY LABORATORY
FT BLS – FEET BELOW LAND SURFACE

N

20' 0 20'

NO.	DATE	REVISION DESCRIPTION	INT.

UNAUTHORIZED ALTERATION OR ADDITION TO THIS DOCUMENT IS A VIOLATION OF STATE LAW.

THESE DOCUMENTS (OR COPIES OF ANY THEREOF) PREPARED BY OR BEARING THE SEAL OF THE ENGINEER, SHALL NOT BE REUSED FOR ANY EXTENSIONS OF THE PROJECT OR ANY OTHER PROJECT WITHOUT THE WRITTEN CONSENT OF THE ENGINEER.

PROJ. ENGINEER: C.M.	DRAWN BY: G.M.
DESIGNED BY: L.D.	CHECKED BY: C.P.
DRAWING SCALE: AS SHOWN	PLOT SCALE: 1:1
DRAWING DATE: 13MAR20	PRINT TYPE: COLOR
OFFICE: NY	PAPER SIZE: ARCH D
PROJECT NO.: 2705.0001Y000	
DRAWING FILE: 2705.0001Y276.02.DWG	

ROUX
Roux Environmental Engineering & Geology, D.P.C.
209 SHAFTER STREET, ISLANDIA, NEW YORK 11746
(631) 232-2600

PROJECT NAME:
AMENDMENT TO USEPA RAWP
GOWANUS VILLAGE I, LLC - BROOKLYN, NEW YORK

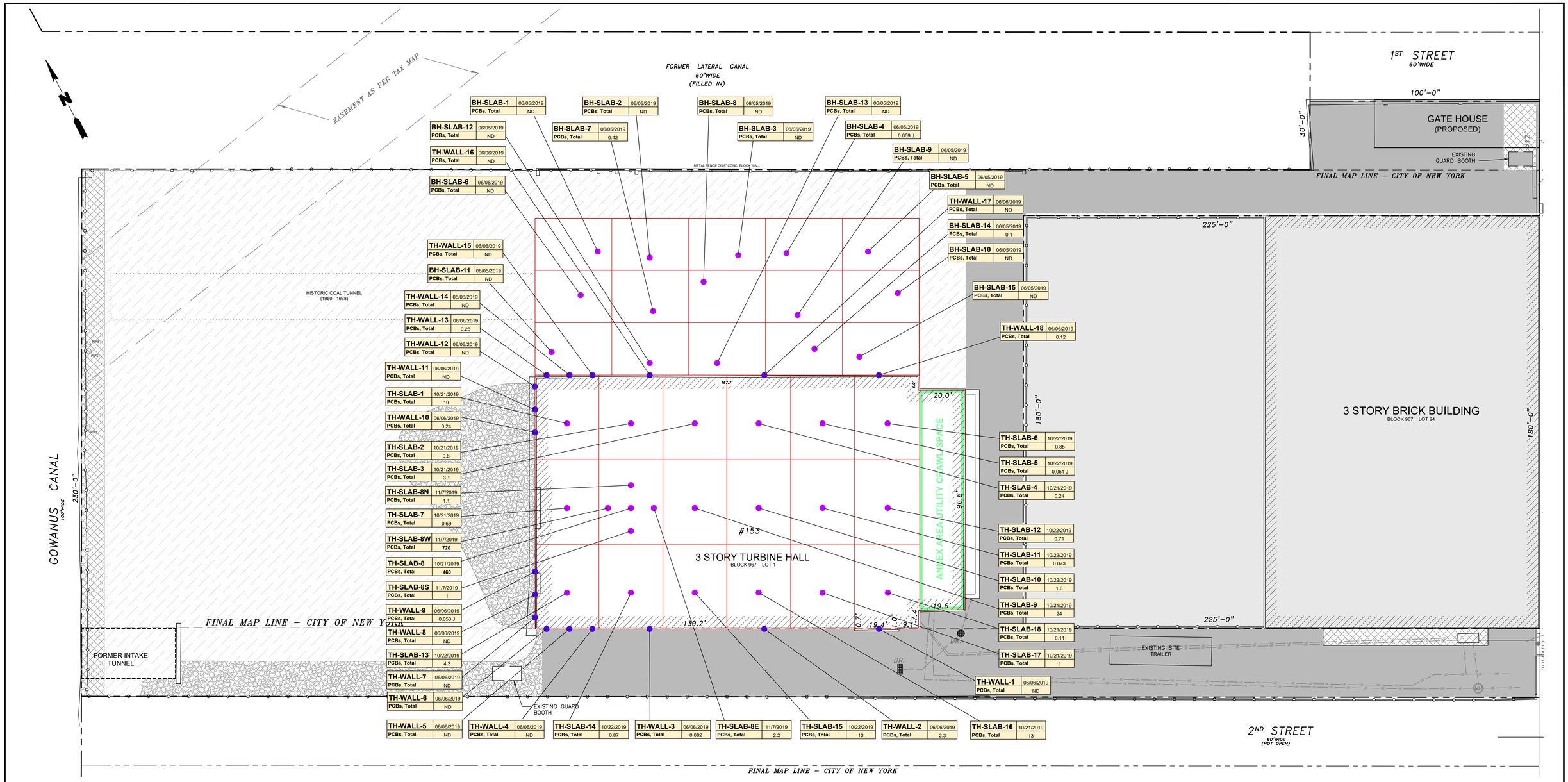
PROJECT FOR:
BRT POWERHOUSE LLC

TITLE:
2019-2020 COMPLETED EPA EPA SOIL BORING EXCEEDANCES

FIGURE
3

FIGURE 3 OF 4

V:\CAD\PROJECTS\2705\Y\0001Y\276\2705.0001Y276.02.DWG



LEGEND

- EXISTING BUILDING OR STRUCTURE
- PROPERTY LINE
- FENCE LINE
- EXISTING UNDERGROUND ELECTRIC
- EXISTING STORM WATER SEWER
- EXISTING MANHOLE
- EXISTING STORM WATER DRYWELL
- ASPHALT CAP
- CLEAN STONE
- EXISTING CONCRETE SLAB
- RECYCLED CONCRETE AGGREGATE
- APPROXIMATE LOCATION OF MAT SLAB SAMPLE GRID
- APPROXIMATE LOCATION OF WALL SAMPLE
- APPROXIMATE LOCATION OF SLAB SAMPLE

TYPICAL DATA BOX INFORMATION

SAMPLE ID# → TH-WALL-9 06/06/2019 ← SAMPLE DATE
ANALYTE → PCBs, Total 0.053 J ← CONCENTRATION (mg/kg)

Parameter	USEPA Low Occupancy Cleanup Level	
PCBs, Total	25	100

CONCENTRATIONS IN mg/kg

mg/kg – MICROGRAMS PER KILOGRAM
USEPA – UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
-- – NO NYSDEC PART 375 SOIL CLEANUP OBJECTIVES AVAILABLE
J – ESTIMATED VALUE
ND – NO DETECTION

NOTES

1. BASEMAP PREPARED FROM SURVEY PERFORMED BY PERFECT POINT LAND SURVEYING, RT, JANUARY 2017.
2. HORIZONTAL LOCATIONS AND COORDINATES ARE IN U.S. FEET RELATIVE TO THE NEW YORK STATE PLANE COORDINATE SYSTEM, NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
3. APPROXIMATE LOCATIONS OF FORMER LATERAL CONDENSATE TUNNELS BASED ON HISTORICAL DRAWINGS FROM NEW YORK TRANSIT MUSEUM.
4. ALL TURBINE HALL WELL SAMPLES WERE COLLECTED FROM APPROXIMATELY SEVEN FEET ABOVE THE TURBINE HALL MAT SLAB, WITH THE EXCEPTION OF SAMPLES TH-WALL-1, TH-WALL-2, TH-WALL-3, TH-WALL-16, TH-WALL-17, AND TH-WALL-18, WHICH WERE COLLECTED FROM APPROXIMATELY TWO FEET ABOVE THE TURBINE MAT SLAB.

20' 0 20'

NO.	DATE	REVISION DESCRIPTION	INT.

UNAUTHORIZED ALTERATION OR ADDITION TO THIS DOCUMENT IS A VIOLATION OF STATE LAW.

THESE DOCUMENTS (OR COPIES OF ANY THEREOF) PREPARED BY OR BEARING THE SEAL OF THE ENGINEER, SHALL NOT BE REUSED FOR ANY EXTENSIONS OF THE PROJECT OR ANY OTHER PROJECT WITHOUT THE WRITTEN CONSENT OF THE ENGINEER.

PROJ. ENGINEER:	DRAWN BY: B.H.C.
DESIGNED BY:	CHECKED BY:
DRAWING SCALE: AS SHOWN	PLOT SCALE: 1:1
DRAWING DATE: 13MAR20	PRINT TYPE: COLOR
OFFICE: NY	PAPER SIZE: ARCH D
PROJECT NO.: 2705.0001Y000	
DRAWING FILE: 2705.0001Y276.03.DWG	

ROUX
Roux Environmental Engineering & Geology, D.P.C.
209 SHAFTER STREET, ISLANDIA, NEW YORK 11746
(631) 232-2600

PROJECT NAME:
AMENDMENT TO USEPA RAWP
GOWANUS VILLAGE I, LLC - BROOKLYN, NEW YORK

PROJECT FOR:
BRT POWERHOUSE LLC

TITLE:
BOILER HOUSE AND TURBINE HALL BUILDING MATERIALS SAMPLING RESULTS

FIGURE
4
FIGURE 4 OF 4

V:\CAD\PROJECTS\2705\0001\276\2705.0001Y276.03.DWG

APPENDICES

A. USEPA Remedial Action Work Plan for PCB Cleanup, dated April 9, 2019

B. Turbine Hall Investigation and Remediation Photo Log

C. Historical Site Drawings

D. Turbine Hall Slab Construction Detail

APPENDIX A

USEPA Remedial Action Work Plan for PCB Cleanup,
dated April 9, 2019

April 9, 2019

Mr. Christos Tsiamis
Senior Project Manager
New York Remedial Branch
United States Environmental Protection Agency Region 2
290 Broadway
New York, New York 10007

Re: USEPA Building Materials PCB Cleanup Plan
BRT Powerhouse Site BCP #C224099/ EPA Consent Order #CERCLA-02-2017-2021
Gowanus Village I, LLC (BRT Powerhouse Site)
322 3rd Avenue, Brooklyn, New York

Dear Mr. Tsiamis:

On behalf of BRT Powerhouse, Roux Environmental Engineering and Geology, D.P.C. (Roux) has prepared the attached work plan to remediate remaining polychlorinated biphenyl (PCB) contamination in building materials associated with former Site operations at 322 3rd Avenue Brooklyn, New York, also known as the Powerhouse (Site). The proposed bulkhead design for the Site will be submitted under a separate cover. In addition, the Site soil boring investigation will be completed once access is made available and provided under a separate cover.

Through the course of historical document review and investigation, it appears the PCB contamination is limited to the basement levels of both the Turbine Hall and Boiler House. In order to confirm safe occupancy of the buildings, and in accordance with 40 CFR §761.3, the lowest level of the building will be used only for parking and utilities space and, therefore, will be cleaned up to comply with the applicable TSCA low-occupancy standards. The remaining contamination within the lowest level of the buildings will require remediation, installation of engineering controls, and imposition of a deed notice restricting usage and requiring continued use of engineering controls. Based on our current understanding, Roux has identified the following five (5) remaining areas of concern associated with the building.

1. Turbine Hall Mat Slab
    a. Collect 18 Concrete Samples for PCB analysis.
    b. Delineate/Scarify/Remove concrete from areas indicated to contain over 100 ppm of PCBs.
    c. Cover entire mat slab with vapor barrier and 6” thick reinforced concrete slab.
2. Turbine Hall Interior Brick Walls
    a. Majority of walls comply with standard.
    b. Areas of walls covered by former structures will be tested.
    c. Scarify/Remove concrete from areas indicated to contain over 25 ppm of PCBs.
3. Turbine Hall Sump Structures
    a. Remove remaining oil, sediment, and debris from sump structures.

2705.0001Y245/LP

b. Fill structures with grout to grade.

4. Boiler House Mat Slab
   a. Collect 15 Concrete Samples for PCB analysis.
   b. Delineate/Scarify/Remove concrete from areas indicated to contain over 100 ppm of PCBs.
   c. Cover entire mat slab with vapor barrier and 6" thick reinforced concrete slab.
5. Boiler House Lateral Discharge Tunnels
   a. Remove remaining oil, sediment, and debris from the tunnels and sump structures.
   b. Fill tunnels and sump structures with grout to grade.

Specific details concerning analytical data, and proposed procedures are provided for your review in the attached Work Plan. Following your review and approval of the Work Plan, a detailed schedule outlining specific tasks and approximate durations will be provided. All investigation and remediation efforts will be properly documented and reported in accordance with the June 2017 Administrative Settlement Agreement and Order on Consent for a Removal Action entered among the USEPA and GAII.

Should you have any questions concerning the Work Plan or would like to discuss further, please do not hesitate to contact the undersigned.

Sincerely,

ROUX ENVIRONMENTAL ENGINEERING AND GEOLOGY, D.P.C.

Christina Prete, P.E.
Senior Engineer

Frank Cherena, P.G.
Principal Geologist

Charles J. McGuckin, P.E.
Principal Engineer

Attachments

cc: Katie Dixon, Powerhouse Environmental Arts Foundation
Paul Parkhill, Gemini Arts Initiative, Inc.
Larry Schnapf, Schnapf, LLC

Remedial Action Work Plan for PCB Cleanup

322 3rd Avenue
Brooklyn, NY

April 9, 2019

Prepared for:

Gemini Arts Initiative, Inc.
98 4th Street, Suite 406
Brooklyn, NY 11231

Prepared by:

Roux Environmental Engineering and Geology, D.P.C.
209 Shafter Street
Islandia, New York 11749

2705.0001Y002.245/CV

Environmental Consulting
& Management
+1.800.322.ROUX
rouxinc.com

Table of Contents

1. Introduction 1
   1.1 Property Location and Site Description 1
   1.2 Proposed Redevelopment Plan and Applicable Standards 1
   1.3 Previous Investigations 2
      1.3.1 Turbine Hall Interior Brick Walls 2
      1.3.2 Turbine Hall Basement Topping Slab, Leveling Course, and Mat Slab 3
      1.3.3 Turbine Hall Subsurface Structure Investigation 4
      1.3.4 Boiler House Mat Slab 5
      1.3.5 Boiler House Subsurface Structure Investigation 7

2. Remedial Action 8
   2.1 Remedial Approach and Applicable Occupancy Standards 8
      2.1.1 Turbine Hall Mat Slab 8
      2.1.2 Turbine Hall Interior Brick Walls 9
      2.1.3 Turbine Hall Sump Structures 10
      2.1.4 Boiler House Mat Slab 10
      2.1.5 Boiler House Lateral Discharge Tunnels 11
   2.2 Soil Vapor Assessment 11
   2.3 Institutional Controls 11
   2.4 Schedule 11
   2.5 Reporting 11

Tables

1. Summary of Volatile Organic Compounds in Soil
2. Summary of Semivolatile Organic Compounds in Soil
3. Summary of Metals in Soil
4. Summary of Polychlorinated Biphenyls in Soil
5. Summary of Polychlorinated Biphenyls in Groundwater

Figures

1. Site Location Map

Appendices

A. LBG Site-Wide PCB Cleanup Status Summary Update, October 2015
B. Quality Assurance Protection Plan

Plates

1. Historical Subsurface Features Site Plan
2. PCB Results in Historical Subsurface Features
3. Proposed Interior Sampling

1. Introduction

On behalf of Gemini Arts Initiative, Inc and BRT Powerhouse LLC (GAII), Roux Environmental Engineering & Geology, D.P.C. (Roux), has prepared this PCB Cleanup Work Plan (Work Plan) for residual polychlorinated biphenyl (PCB) contamination at 322 3rd Avenue, Brooklyn, New York (Site). This Work Plan, focusing on contamination associated with the existing building structure, was prepared in accordance with the Draft United States Environmental Protection Agency (USEPA) Sampling Plan, dated June 2017, which was attached to the June 2017 Administrative Settlement Agreement and Order on Consent for a Removal Action entered among the USEPA and GAII (Order) and the New York State Department of Environmental Conservation (NYSDEC) approved Site Management Plan (SMP), dated December 2017. The proposed bulkhead design for the Site will be submitted under a separate cover. In addition, the remaining soil borings from the previously proposed EPA Soil Boring Investigation will be completed once access is made available to the western portion of the Site and a comprehensive report will provided under a separate cover.

The Brownfields Cleanup Program (BCP) remedy was implemented in accordance with the Remedial Action Work Plan (RAWP), dated June 2014 and the Decision Document, dated February 2014. The certificate of completion (COC) from the NYSDEC was issued on December 30, 2017. Since obtaining the COC, additional remediation at the Site, as part of redevelopment activities, has been implemented in accordance with the SMP. In addition to the requirements of the NYSDEC SMP, the USEPA approval of the cleanup is required pursuant to the Order. Pertinent background information and the proposed scope of work for additional investigation and remediation is discussed in the following sections.

1.1 Property Location and Site Description

The Site is located at 322 3rd Avenue in Brooklyn, New York, adjacent to the Gowanus Canal. The Site location is shown on Figure 1. An alternative address for the Site is 153 2nd Street. The Site is designated as Tax Block 967, Lot 1 on the Kings County Tax Map and is bordered to the north by the historical 1st Street Basin, a filled-in former turning basin, (Lateral Canal), 2nd Street to the south, the Gowanus Canal to the west, and 3rd Avenue to the east. The Site is approximately 2.5 acres. Currently, an 80-foot tall building covering approximately 24,200 square feet is located on the eastern portion of the Site; the remainder of the Site is undeveloped.

1.2 Proposed Redevelopment Plan and Applicable Standards

The current redevelopment plan for the Site is to renovate the existing on-Site building and construct an adjacent 9,000 square foot building. The Site will be used as an industrial center for art, including manufacturing facilities for metal, wood, printmaking, ceramics, and textiles. The lowest level for both buildings will be used for parking and utility equipment rooms. Additionally, a new small one-story utility and security building will be constructed near the Site entrance. The western portion of the Site redevelopment will include a loading area and paved materials storage yard.

As defined in 40 CFR §761.61, the majority of the upper floors of the proposed redevelopment will be classified as high occupancy areas (i.e., building occupants in the building areas for 6.7 hours per week or more), meaning occupancy of any individual for more than 6.7 hours. The cleanup level for porous materials in high occupancy areas is ≤1 ppm without further conditions. High occupancy areas porous materials that

remain at concentrations >1 ppm and ≤10 ppm shall be covered with a cap meeting the requirements of 40 CFR §761.61 (a)(4)(7).

In accordance with USEPA PCB Site Revitalization Guidance Under the Toxic Substance Control Act (TSCA), dated November 2005[1] (USEPA PCB Guidance) the parking and utility equipment rooms on the lowest level of the turbine hall and boiler house will be classified as low occupancy areas (i.e., building occupants in the building areas less than 6.7 hours per week). The cleanup level for porous materials in low occupancy areas is ≤25 ppm. As defined in 40 CFR §761.61 porous materials wastes may remain at a cleanup site at concentrations >25 ppm and ≤100 ppm if the Site is covered with a cap meeting the requirements of 40 CFR §761.61 (a)(4)(7).

Based on previous investigations at the Site, all interior brick samples and concrete floor samples collected on the first floor through the fourth floor were below the USEPA High Occupancy Cleanup Level of 1 ppm. This Work Plan will focus all investigation and remediation activities on the lowest (basement) level of the turbine hall and boiler house materials to meet the USEPA Low Occupancy Cleanup Levels. Results of the previous investigations and remedial efforts are discussed in detail below.

1.3 Previous Investigations

Previous investigations of PCB contents of building materials were conducted by Leggette, Brashears, and Graham Inc. (LBG) and Roux. These investigations indicate PCB contamination was only identified on building materials in the basement level of the Turbine Hall. The investigations focused on the following building components:

1. Turbine Hall Basement Interior Brick Walls
2. Turbine Hall Basement Concrete Floor, Leveling Course, and Mat Slab
3. Turbine Hall Subsurface Structure Investigation
4. Boiler House Mat Slab
5. Boiler House Subsurface Structure Investigation

1.3.1 Turbine Hall Interior Brick Walls

Turbine hall interior brick wall PCB sampling activities were performed by LBG in March 2014 and June 2015. A total of 97 interior brick wall core composite samples were collected from the building interior. PCB concentrations for all interior brick samples collected on the first floor through the fourth floor were below the USEPA High Occupancy Cleanup Level of 1 ppm.

As stated above, the proposed use of the basement of the turbine hall, including parking and utility rooms, is classified as low occupancy (i.e. building occupants will be in the garage space for less than 6.7 hours per week). PCB concentrations at two (2) interior brick sample locations (BWC-4 and BWC-6) along the south basement wall exceeded the USEPA High Occupancy Cleanup Level of 1 ppm (2.7 and 3.7 ppm, respectively); however, the PCB concentrations were below the USEPA Low Occupancy Cleanup Level of 25 ppm. Results of the turbine hall interior brick wall investigation are provided in Appendix A.

[1] The TSCA Guidance Document provides examples of cleanup site scenarios. Example #6 (page 20) identifies a parking garage as a low occupancy area.

Therefore, no further actions are proposed for the interior brick walls on the basement level with exception of a walls along the interior basement wall, as discussed below.

During the initial turbine hall interior brick wall investigation, the interior western basement wall was never investigated due to the presence of two large aboveground equipment vault structures. In 2018, demolition of the two aboveground vaults was completed, exposing the western brick wall. The western basement wall areas will be investigated as part of the turbine hall interior brick PCB sampling plan to determine potential PCB contamination, discussed below. The basement walls will remain exposed during future occupancy; therefore, any walls that have exceedances of the low occupancy standard will require remediation prior to occupancy.

1.3.2 Turbine Hall Basement Topping Slab, Leveling Course, and Mat Slab

In 2015, LBG completed sampling of the concrete floor surfaces in the turbine hall. Concrete samples were collected from the concrete floor in the basement (referred to as the Topping Slab), the 1st floor, mezzanine, 2nd floor, 3rd floor, and 4th floor, in accordance with USEPA SOP for Sampling Porous Surfaces for PCBs. In 2015, the USEPA approved a modified interior surface sampling procedure for characterizing the basement concrete floor. The modified basement concrete floor surface characterization sampling protocol consisted of collecting samples representing approximately 800 sf (75 square meters) areas. The basement concrete floor sampling grid is shown in Appendix A. Samples of the concrete floor were collected for PCB laboratory analysis via USEPA Method SW-846 using a concrete hammer drill.

The concrete floor characterization analytical results for samples collected from all of the floor levels (above the basement level) indicate that all PCB concentrations are below the USEPA High Occupancy Cleanup Level of 1 ppm. Laboratory analytical results indicated three of the concrete samples in the basement had PCB concentrations ranging from 1.4 to 2.1 ppm, slightly exceeding the USEPA High Occupancy Cleanup Level of 1 ppm. None of these areas exceeded the USEPA Low Occupancy Cleanup Level of 25 ppm. A total of five (5) supplemental concrete samples from the basement concrete floor surface were collected by Roux in 2016, per the request of USEPA, to a depth of 3 inches below the slab. All samples were analyzed for PCBs via USEPA Method SW-846. PCB concentrations at four (4) of the five (5) concrete samples were below detection levels and one (1) concrete sample had a PCB concentration of 0.26 ppm, well below the USEPA Low Occupancy Cleanup Level of 25 ppm. Based on the results, it was determined that PCB contaminants did not penetrate deeper into the exposed concrete slab than the 0.5 in. previously delineated by the shallow (0.5 in.) samples. A geotechnical investigation conducted from September 27 through November 1, 2016, showed that these exceedances were in the topping slab, which has since been removed and disposed off-Site, as previously reported. The existing mat slab has not been investigated to date.

A layer of soil approximately 18 to 24 inches thick was uncovered following topping slab removal. This layer of soil was likely installed on top of the underlying mat slab to act as a levelling course for the topping slab. A summary of topping slab and leveling course disposal is shown in the table below. Weights are approximate as final weight tickets are still being received from the disposal facilities.

Grid ID	Disposal Facility	Characterization	Approximate Weight (Tons)
LC-1/LC-5/LC-4/Topping Slab	Chemical Waste Management, Inc.	TSCA-Regulated	670
LC-1/LC-5/LC-4/Topping Slab	Wayne Disposal	TSCA-Regulated	575

Grid ID	Disposal Facility	Characterization	Approximate Weight (Tons)
LC-4	Chemical Waste Management, Inc.	TSCA-Regulated/RCRA Hazardous	215
LC-2/LC-3	Sunny Farms Landfill	Non-hazardous PCB Impacted	600

During leveling course excavation inside the turbine hall basement, a series of raised concrete areas was uncovered. These structures, which likely served as foundations for the historic turbine hall equipment, extend approximately 1-2 ft above the mat slab and appear to have been poured as part of the mat slab. Following the removal of the leveling course, the turbine hall mat slab was examined for visual evidence of contamination. LNAPL staining was observed on the mat slab. The stained areas have been documented and will be further investigated as part of the mat slab PCB sampling plan, discussed below.

Following the removal of the leveling course and inspection of the turbine hall mat slab, a layer of clean soil was placed on a portion of the mat slab to help facilitate redevelopment activities, including equipment access and creating a working surface.

In preparation for the turbine hall mat slab load test, a ground improvement program was designed by the geotechnical engineer in order to ensure safe reuse of the existing mat slab. The ground improvement program included a probing investigation beneath the mat slab to examine the extent of voids beneath the mat slab. In areas where significant voids were identified, a chemical foam grout was injected beneath the slab within the probe holes. During the probing and injection events, all impacted groundwater and LNAPL that was displaced and expelled through nearby probe holes was recovered via drum vacuums and absorbents. All material was containerized on-Site in labeled 55-gallon steel drums for proper off-Site disposal. Thirty (30) drums containing absorbents and PPE and twelve (12) drums containing hardened polymer, from ground improvement injections, were sent as TSCA-regulated material to Clean Harbors Deer Park, LLC, in La Porte, Texas for incineration. Thirty-four (34) drums containing an LNAPL/water mixture was sent as TSCA-regulated material to Spring Grove Resource Recovery, Inc, in Cincinnati, Ohio for disposal. Twenty-seven (27) drums containing LNAPL, absorbents, and PPE remain on-Site awaiting disposal.

1.3.3 Turbine Hall Subsurface Structure Investigation

During leveling course excavation inside the turbine hall basement, eight (8) sump structures and two (2) smaller auxiliary sump structures were uncovered in the slab. Upon review of historical documents, these sumps appear to have been part of the engine condensing system during the turbine hall's operations. On December 7, 2018, investigation and sampling of the turbine hall subsurface structures was completed. This investigation included sampling and recording observations of the content in the sumps and to collect additional samples for waste characterization purposes. Analytical results for the sump and tunnel investigation are included in Tables 1 through 5. The turbine hall sumps are approximately 5 feet in diameter, each with a metal collar at the slab surface when initially uncovered. At the two (2) eastern most sumps (TH Sump-1 and TH-Sump-5), there are smaller 2-foot auxiliary circular sumps in the slab located approximately 3 feet away from TH-Sump-1 and TH-Sump-5. During the investigation, four (4) sumps (TH Sump-1, 2, 3, and 5) contained LNAPL and water. An excavator was used to determine depth to bottom of sumps containing LNAPL and water. A hard bottom located approximately 6 to 8 ft below top of the mat slab was determined using the excavator at each sump. One water sample was collected from each of the sumps and analyzed for PCBs. Four (4) sumps (TH-Sump-4, 6, 7, 8) contained stained soil

and debris. Both soil and water analytical results indicated TSCA-regulated levels of PCBs in all turbine hall sumps. In addition, the sumps all appeared to be connected by a network of concrete lined channels (or trench drains) located within the surface of the mat slab. The trench drains appeared to have facilitated drainage from mat slab surfaces to the sumps. Soil and debris from the trench drains (which were approximately 6-inches wide by 12-inches deep) were cleaned out with hand tools and placed in drums for off-Site disposal, and the trench drains were backfilled with ¾-inch stone. All recoverable LNAPL was removed from the sump structures via drum vacuum and absorbent material, to the extent feasible. Following removal of the LNAPL, any residual LNAPL recharge has been removed using absorbent material throughout this reporting period. All waste generated during this initial sump remediation was containerized on-Site in labeled 55-gallon steel drums. Six (6) drums containing absorbents and personal protective equipment (PPE) were sent as TSCA-regulated material to Clean Harbors Deer Park, LLC, La Porte, Texas for incineration. Thirty-three (33) drums containing LNAPL and/or an LNAPL/water mixture were sent as TSCA-regulated material to Spring Grove Resource Recovery, Inc, Cincinnati, Ohio for disposal. LNAPL recovery within the sumps will continue in the turbine hall, as needed, until the sumps are remediated and closed. Sump remediation is discussed further below.

All ten (10) sumps have been temporarily covered with a steel plate and sealed off with an oil resistant gasket to keep the structures watertight in preparation for the turbine hall mat slab load test. Sediment was removed from the sumps in preparation to temporarily seal them off. Approximately 30 CY of sediment generated during this initial sump remediation was disposed as TSCA-regulated waste at Chemical Waste Management, Inc. of Emelle, Alabama

During excavation of the leveling course, two openings in the slab against the northern turbine hall wall were uncovered. Based on field observations and measurements, it is believed these openings are connected to the southern extent of the lateral discharge tunnels that run northerly beneath the boiler house slab. The tunnels do not appear to continue further south into the turbine hall slab. Further investigation of these openings is discussed below. See Plates 1 and 2 showing the locations and designations of subsurface features at the Site and PCB concentrations.

1.3.4 Boiler House Mat Slab

As part of the redevelopment, the boiler house load test requires exposing the mat slab foundation and imparting a series of known loads on the foundation in accordance with a New York City Department of Buildings (NYCDOB) approved testing plan. In preparation for the load test, soil and debris overlying the boiler house slab was divided into ten grids of approximately 500 cubic yards for proper characterization. A composite sample was collected from each grid, and was submitted for laboratory analysis for the following parameters to determine potential for on-Site reuse during the load test:

- Target Compound List (TCL) VOCs (only analyzed as a grab sample);
- TCL Semi-Volatile Organic Compounds (SVOCs);
- Polychlorinated biphenyls (PCBs);
- Total Analyte List (TAL) Metals;
- Toxicity Characteristic Leachate Procedure (TCLP) Metals;
- TCLP Mercury;
- TCLP VOCs;

- TCLP SVOCs;
- Herbicides;
- TCL Pesticides;
- Resource Conservation and Recovery Act (RCRA) Characteristics including Reactivity, Ignitability, and Corrosivity;
- Total Cyanide;
- pH;
- Percent Moisture;
- Reactive Cyanide and Sulfide; and
- Paint Filter.

The laboratory results were compared to the soil reuse requirements, as discussed in the NYSDEC Decision Document (DD) dated February 2014:

"On-site soils which do not exceed the commercial use SCOs for VOCs and/or metals, and have less than 500 ppm of total SVOCs may be consolidated on-site, utilized for backfilling excavations or re-grading of low elevation areas of the site (above the water table) and will be covered (see Paragraph 3, below); for contaminants with groundwater concentrations above standards, this criteria or the Protection of Groundwater SCOs (whichever is lower) will be used to determine if soils may be reused on-site."

Based on the criteria outlined in the DD, nine of the ten grids were eligible for reuse on-Site. One of the grids exceeded commercial use SCO for lead and exceeded 500 ppm for total SVOCs and was therefore not considered for reuse at the Site. As a further precaution, two (2) additional grids were not considered for reuse due to PCB concentrations greater than 1 ppm. Analytical results from laboratory analysis of the soil samples were compared to NYSDEC Part 375 Unrestricted Use, Restricted Residential, and Commercial SCOs.

In accordance with the NYSDEC Site Management Plan. a request to reuse of this soil was submitted to the NYSDEC via email on July 3, 2018. Soil from the seven (7) approved grids was excavated and screened to remove any deleterious materials and large debris including wood, trash, metal, and tires prior to reuse. Approximately 3,890 tons of removed debris was disposed of off-Site (approximately 3,820 tons were sent to Bayshore Recycling and approximately 70 tons were sent to Republic Services Conestoga Landfill). Approximately 2,910 tons of soil and debris from the three (3) grids that were not used for reuse were sent to Bayshore Recycling as non-TSCA regulated material based on the soil characterization data.

Prior to the start of the load test, the ground improvement program was implemented to examine the extent of voids beneath the boiler house mat slab, similar to the ground improvement program described above in Section 1.3.2. In areas where significant voids were identified, a chemical foam grout was injected beneath the slab within the probe holes. During the probing and injection events, all impacted groundwater and LNAPL that was displaced and expelled through nearby probe holes was recovered via drum vacuums and absorbents. All material was containerized on-Site in labeled 55-gallon steel drums for proper off-Site disposal. Twenty (20) drums containing absorbents and personal protective equipment (PPE) were sent as TSCA-regulated material to Clean Harbors Deer Park, LLC, La Porte, Texas for incineration. Twenty (20) drums containing LNAPL and/or an LNAPL/water mixture were sent as TSCA-regulated material to

Spring Grove Resource Recovery, Inc, in Cincinnati, Ohio for disposal. Ten (10) drums of LNAPL, absorbents, and PPE remain on-Site awaiting disposal.

Following the ground improvement program, the boiler house load test began by covering the slab with the reuse soil and imported soil meeting either NYSDEC unrestricted use or restricted residential SCOs. Following the removal of the load test soil, the boiler house mat slab will be examined and further investigated for contamination as part of the mat slab PCB sampling plan, discussed below.

Once the boiler house load test is complete, the soil will be placed on the turbine hall slab for the turbine hall mat slab load test. Following all load testing activities, reused soil will be placed and compacted in low lying areas of the backyard bringing the Site up to grade. In accordance with the SMP, only soil meeting the NYSDEC Part 375 Restricted Residential Use will be used as backfill within in the upper 2-feet of the Site or within landscaping berms.

1.3.5 Boiler House Subsurface Structure Investigation

Following removal of the soil overlying the boiler house slab, Roux observed six (6) openings in the boiler house mat slab in the vicinity of the former discharge tunnels. The openings appear to be 1 ft wide by 2 ft long and are partially filled with soil and debris. Based on field observations and measurements, these openings closely align with sump structures associated with the former discharge tunnels shown on historical boiler house drawings; however, it is unclear whether these opening are part of the sump structures or openings directly to the lateral discharge tunnels. In addition, these openings closely aligned with the lateral tunnel openings uncovered in the turbine hall, as discussed above. It is believed the openings in the turbine hall are connected to the southern extent of the lateral discharge tunnels that run northerly beneath the boiler house slab.

The boiler house lateral tunnel openings inside the turbine hall are filled with soil and debris and appear to have a few inches of water and sediment at the northern end. Soil at the bottom of these openings appeared to exhibit staining and odor. The boiler house sumps are irregularly shaped openings in the slab, without a collar or manhole cover associated with them. The openings are filled with soil and debris at the openings. These openings appear to extend into the lateral discharge tunnels. Further inspection into these tunnels suggest the tunnels are not completely filled and only contain a few inches of water and sediment. During the investigation, one grab sample was collected from the two tunnel openings in the turbine hall and each of the sump openings, from the material sitting on the bottom of the tunnels. An odor and sheen were observed on the material recovered from the bottom of the tunnels. Each grab sample was collected for laboratory analysis of PCBs. All analytical results from the soil samples collected PCBs above 50 ppm. See Plates 1 and 2 showing the locations and designations of subsurface features at the Site and PCB concentrations.

2. Remedial Action

The following remedial action has been developed for the Site based on the results of the previous Site investigations. The results of the previous investigation activities indicate that there are potentially five (5) areas associated with the existing building structure where PCB contamination (if unmitigated) remains above applicable occupancy standards. These areas include:

1. Turbine Hall Mat Slab
2. Turbine Hall Interior Brick Walls
3. Turbine Hall Sump Structures
4. Boiler House Mat Slab
5. Boiler House Lateral Discharge Tunnels

2.1 Remedial Approach and Applicable Occupancy Standards

As previously discussed, the parking and utility equipment rooms on the lowest level of the turbine hall and boiler house will be classified as low occupancy areas (i.e. building occupants in the building areas less than 6.7 hours per week), in accordance with the USEPA PCB Guidance the cleanup level for porous materials in low occupancy areas is ≤25 ppm. As defined in 40 CFR §761.61, porous materials may remain at a cleanup site at concentrations >25 ppm and ≤100 ppm if the site is covered with a cap meeting the requirements of 40 CFR §761.61 (a)(4)(7).

All investigation and remediation of building materials at the basement level of the turbine hall and boiler house will be performed to meet the USEPA Low Occupancy Cleanup Levels associated with the intended use.

2.1.1 Turbine Hall Mat Slab

Eighteen (18) turbine hall mat slab concrete samples are proposed to identify any potential residual PCB contamination (see Plate 3). As previously approved by the USEPA, a modified basement concrete floor surface characterization sampling protocol will consist of collecting one (1) concrete sample, representing approximately 800 SF (75 square meters). To collect the mat slab concrete samples, a 2-foot by 2-foot area of the clean soil leveling course will be removed above the area anticipated to be sampled to expose the underlying mat slab. The eighteen (18) concrete PCB samples will be positioned so that one (1) sample will be collected from each grid from an area exhibiting visual contamination, if any. An impact hammer drill with a carbide drill bit will be used to collect a concrete sample from 2-3 inches into mat slab, as previously requested by the USEPA. Core sampling will help to determine the extent to which the PCBs may have migrated through the concrete floor. All samples will be collected in accordance with the USEPA Standard Operating Procedure for Sampling Porous Surfaces for PCBs, dated May 2011 and will be analyzed for PCBs via USEPA SW-846 Methods. Standard operating procedures for sampling are described in the Quality Assurance Protection Plan (QAPP) (Appendix B).

As discussed above, areas of the turbine hall mat slab exceeding 100 ppm for PCBs will be removed using mechanical means (i.e., scarification). Following the impacted concrete removal, additional concrete samples will be collected to confirm PCB concentrations above 100 ppm have been removed. Concrete removal will be conducted based on the laboratory results generated from the proposed mat slab investigation. Post-scarification verification sampling will be conducted in accordance with

40 CFR §761.61 (a)(6) and Subpart O and the modified sampling protocol, as previously approved by the USEPA. The leveling course will be sampled for PCBs prior to being placed back on the mat slab following removal of all PCB concentrations greater than 100 ppm. All samples will be analyzed for PCBs using USEPA SW-846 Methods. Any soil with PCB concentrations exceeding the TSCA hazardous waste regulatory limit of 100 ppm will be disposed of at a USEPA permitted hazardous waste landfill. All soil with PCB concentrations at or below the TSCA hazardous waste regulatory limit will remain on-Site. All material removed will be disposed of off-Site. All observations, material removed, and residual contamination remaining in place will be properly documented.

Following remediation, the mat slab and leveling course will be covered with a 6-inch gravel layer, a water proofing/vapor barrier membrane (i.e. Grace Preprufe 300R) and a 6-inch reinforced concrete slab, meeting the capping requirements of 40 CFR §761.61 (a)(4)(7). In addition, the Site will have a deed restriction, in accordance with 40 CFR §761.61 (a)(4)(8), as discussed below.

All samples will be submitted to a New York State Department of Health ELAP certified laboratory and analyzed for PCBs via USEPA SW-846 Methods. Standard operating procedures for sampling are described in the QAPP (Appendix B).

2.1.2 Turbine Hall Interior Brick Walls

As discussed above, demolition of the two aboveground vaults was completed, exposing the western brick wall. In addition, following the removal of the topping slab and leveling course, the lower two feet of the basement walls was exposed. The western basement walls and lower wall areas will be investigated as part of the turbine hall interior brick PCB sampling plan to determine potential PCB contamination.

Eighteen (18) turbine hall basement brick wall samples are proposed to identify any potential residual PCB contamination (see Plate 3). Each sample will represent approximately 100 SF (9 square meters). Twelve (12) of the turbine hall basement brick wall samples will be located along the newly exposed walls that were originally obstructed by the aboveground vaults. The remaining six (6) wall samples will be collected within the lower 2 feet of the brick walls that was previously covered by the leveling course and topping slab. The eighteen (18) PCB samples will be positioned so that one (1) sample will be collected from each grid from an area exhibiting visual contamination, if any. An impact hammer drill with a carbide drill bit will be used to collect the brick sample from 2-3 inches deep into the wall, as previously requested by the USEPA. All samples will be collected in accordance with the USEPA Standard Operating Procedure for Sampling Porous Surfaces for PCBs, dated May 2011 and will be analyzed for PCBs via USEPA SW-846 Methods. Standard operating procedures for sampling are described in the QAPP (Appendix B).

All grids exceeding the USEPA Low Occupancy Cleanup Level of 25 ppm will be remediated using abrasive blasting methods, to the extent feasible. Following removal, additional wall samples will be collected to confirm PCB concentrations above 25 ppm have been removed. Removal will be conducted based on the laboratory results generated from the proposed brick wall investigation. Verification sampling will be conducted in accordance with 40 CFR §761.61 (a)(6) and Subpart O. All samples will be analyzed for PCBs using USEPA SW-846 Methods. All material removed from will be disposed of off-Site. All observations, material removed, and residual contamination remaining in place will be properly documented.

In the event meeting the USEPA Low Occupancy Cleanup Level of 25 ppm is not feasible, any remaining PCB concentrations in the brick wall between 25 ppm and 100 ppm will be capped in accordance with

40 CFR §761.61 (a)(4)(7) to prevent human exposure. Examples of a cap include two applications of a paint or epoxy coating of contrasting colors or a barrier (i.e. concrete) over accessible areas, as outlined in the USEPA PCB Guidance. In addition, the Site will have a deed restriction, in accordance with 40 CFR §761.61 (a)(4)(8), as discussed below.

2.1.3 Turbine Hall Sump Structures

As discussed above, all recoverable LNAPL and readily accessible dry material inside the sumps was removed prior to temporarily covering the sumps with steel plates and sealing them off to keep the structures watertight in preparation for the turbine hall mat slab load test.

Following the turbine hall mat slab load test, the sump structures will be uncovered for final remediation. Remediation for the sump structures will include removal of remaining sediment and debris from all sumps via excavator, to the extent feasible. A small excavator bucket designed to drain out water will be used to facilitate the removal of any sediments within the sump structures below the groundwater table. Following excavation, all recoverable LNAPL will be removed from the sumps via drum vacuum and/or absorbent materials. All material removed from the sumps will be disposed of off-Site. All observations, material removed, and residual contamination remaining in place will be properly documented.

Following removal of sediment and debris, all ten (10) sumps will then be filled with grout to grade. If any interior connections are encountered, a temporary plug (e.g., plywood board) will be used to seal off access to any interior connections to contain the grout within the sumps. Grout will be placed into each sump starting at the bottom of the structure using a tremie. Any groundwater displaced by the grout will be captured via drum vacuum and disposed of off-Site.

2.1.4 Boiler House Mat Slab

Fifteen (15) boiler house mat slab concrete samples are proposed to identify any potential residual PCB contamination (see Plate 3). Each sample will represent approximately 800 SF. The mat slab will be examined for contamination (i.e., staining) and documented prior to sampling. The fifteen (15) concrete PCB samples will be positioned so that one (1) sample will be collected from each grid from an area exhibiting visual contamination, if any. An impact hammer drill with a carbide drill bit will be used to collect a concrete sample from 2-3 inches into mat slab, as previously requested by the USEPA. Core sampling will help to determine the extent to which the PCBs may have migrated through the concrete floor. All samples will be collected in accordance with the USEPA Standard Operating Procedure for Sampling Porous Surfaces for PCBs, dated May 2011 and will be analyzed for PCBs via USEPA SW-846 Methods. Standard operating procedures for sampling are described in the QAPP (Appendix B).

Following the same approach as the Turbine Hall mat slab, areas of the boiler house mat slab exceeding 100 ppm for PCBs will be removed using mechanical means (i.e., scarification). Concrete removal will be conducted based on the laboratory results generated from the proposed mat slab investigation. Following concrete removal, additional PCB samples will be collected to confirm all elevated PCB concentrations above 100 ppm have been removed. Post-scarification verification sampling will be conducted in accordance with 40 CFR §761.61 (a)(6) and Subpart O and the modified sampling protocol, as previously approved by the USEPA.

Following remediation, the mat slab will be covered with a 20-inch gravel layer, a water proofing/vapor barrier membrane (i.e. Grace Preprufe 300R) and a 6-inch reinforced concrete slab, meeting the capping

requirements of 40 CFR §761.61 (a)(4)(7). In addition, the Site will have a deed restriction, in accordance with 40 CFR §761.61 (a)(4)(8), as discussed below.

2.1.5 Boiler House Lateral Discharge Tunnels

In order to remediate the former discharge tunnels and associated sump structures and eliminate the potential for contamination migration, all material will be removed from the former discharge tunnels via the existing sump structures using vacuum extraction methods, to the extent feasible. All material removed from the tunnels will be tested and properly disposed of off-Site. All observations, material removed, and residual contamination remaining in place will be properly documented.

Following removal of the contaminated material, the tunnels will be filled with grout to seal off access to the tunnels and remove the potential for further contamination migration. The grout will be poured into place using a tremie pipe. In addition, all sump openings in the slab will be filled with grout.

2.2 Soil Vapor Assessment

Prior to the construction of any enclosed structures or reoccupation of the existing turbine hall building, a soil vapor intrusion (SVI) evaluation will be performed to determine whether any additional mitigation measures are necessary to eliminate potential exposure to vapors in the proposed or existing structure.

Due to the thickness of the turbine hall and boiler house reinforced-concrete mat slab, which extends into the groundwater table, a sub-slab depressurization (SSDS) is not feasible at the Site. While it is expected that the thickness of the reinforced-concrete mat slab and grouting of all openings will provide a barrier to prevent SVI, a vapor barrier capable of preventing SVI of VOCs will be installed within the subsurface portions of the building prior to occupancy to ensure the protection of indoor air quality. The potential for soil vapor intrusion in any new development structures will be evaluated with the collection and analysis of a single round of indoor air sampling prior to occupation.

2.3 Institutional Controls

Since remaining contamination exists at the Site, institutional controls (ICs) are required to protect human health and the environment. The ICs will be used to prevent future exposure to remaining contamination and limit the use and development of the Site to Restricted Residential, Commercial, and/or Industrial uses only. In addition to the Environmental Easement and SMP requirements, a deed restriction will be implemented for all low occupancy areas in accordance with 40 CFR §761.61 (a)(4)(8). The deed restriction will limit the use of the basement to parking and utility equipment rooms only.

2.4 Schedule

Following approval, a detailed schedule outlining specific tasks and approximate durations will be provided to the USEPA.

2.5 Reporting

All investigation and remediation efforts will be properly documented and reported in accordance with the June 2017 Administrative Settlement Agreement and Order on Consent for a Removal Action entered among the USEPA and GAII.

TABLES

1. Summary of Volatile Organic Compounds in Soil
2. Summary of Semivolatile Organic Compounds in Soil
3. Summary of Metals in Soil
4. Summary of Polychlorinated Biphenyls in Soil
5. Summary of Polychlorinated Biphenyls in Groundwater

Notes Utilized Throughout Tables	
Soil Tables	
J -	Estimated value
U -	Indicates that the compound was analyzed for but not detected
T -	Indicates that a quality control parameter has exceeded laboratory limits
mg/kg -	Milligrams per kilogram
NYSDEC -	New York State Department of Environmental Conservation
SCO -	Soil Cleanup Objectives
USEPA -	United States Environmental Protection Agency
TSCA -	Toxic Substances Control Act
--	No SCO available
Bold data indicates that parameter was detected above the NYSDEC Part 375 Restricted Residential SCO	
Bold data indicates that parameter was detected above the NYSDEC RAWP Cleanup Levels	
Shaded data indicates that parameter was detected above the Site Specific USEPA TSCA Hazardous Levels	
Groundwater Tables	
NYSDEC -	New York State Department of Environmental Conservation
AWQSGVs -	Ambient Water-Quality Standards and Guidance Values
µg/L -	Micrograms per liter
J -	Estimated Value
U -	Compound was analyzed for but not detected
--	No NYSDEC AWQSGV available
Bold data indicates that parameter was detected above the NYSDEC AWQSGVs	

Table 1. Summary of Volatile Organic Compounds in Soil, 322 3rd Avenue, Brooklyn, New York

		Sample Designation:	BH-SUMP-4	TH-Sump-4	TH-Sump-6	TH-Sump-7	TH-Sump-8
		Sample Date:	12/14/2018	12/07/2018	12/07/2018	12/07/2018	12/07/2018
Parameter	NYSDEC Part 375 Restricted Residential SCO	Units					
1,1,1-Trichloroethane (TCA)	100	MG/KG	0.0012 UT	0.18 U	0.0017 U	0.15 U	0.14 U
1,1,2,2-Tetrachloroethane	--	MG/KG	0.0012 U	0.18 U	0.0017 U	0.15 U	0.14 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	--	MG/KG	0.0012 U	0.18 U	0.0017 U	0.15 U	0.14 U
1,1,2-Trichloroethane	--	MG/KG	0.0012 U	0.18 U	0.0017 U	0.15 U	0.14 U
1,1-Dichloroethane	26	MG/KG	0.0012 UT	0.18 UT	0.0017 U	0.15 UT	0.14 UT
1,1-Dichloroethene	100	MG/KG	0.0012 U	0.18 U	0.0017 U	0.15 U	0.14 U
1,2,3-Trichlorobenzene	--	MG/KG	0.0012 U	0.84	0.0017 U	0.12 J	0.59
1,2,4-Trichlorobenzene	--	MG/KG	0.0012 U	3.7	0.0017 U	0.11 J	3.8
1,2-Dibromo-3-Chloropropane	--	MG/KG	0.0012 U	0.18 U	0.0017 U	0.15 U	0.14 U
1,2-Dibromoethane (Ethylene Dibromide)	--	MG/KG	0.0012 UT	0.18 U	0.0017 U	0.15 U	0.14 U
1,2-Dichlorobenzene	100	MG/KG	0.017	1.8	0.0034	0.085 J	0.19
1,2-Dichloroethane	3.1	MG/KG	0.0012 U	0.18 U	0.0017 U	0.15 U	0.14 U
1,2-Dichloropropane	--	MG/KG	0.0012 U	0.18 U	0.0017 U	0.15 U	0.14 U
1,3-Dichlorobenzene	49	MG/KG	0.14	14	0.15	1.2	9.3
1,4-Dichlorobenzene	**13**	MG/KG	0.029	**28**	0.055	2.3	12
1,4-Dioxane (P-Dioxane)	13	MG/KG	0.023 U	9 U	0.034 U	7.3 U	6.9 U
2-Hexanone	--	MG/KG	0.0058 UT	0.9 U	0.0084 U	0.73 U	0.69 U
Acetone	100	MG/KG	0.0072 T	0.9 U	0.013 B	0.73 U	0.69 U
Benzene	4.8	MG/KG	0.0012 U	0.18 U	0.0017 U	0.11 J	0.14 U
Bromochloromethane	--	MG/KG	0.0012 UT	0.18 U	0.0017 U	0.15 U	0.14 U
Bromodichloromethane	--	MG/KG	0.0012 UT	0.18 U	0.0017 U	0.15 U	0.14 U
Bromoform	--	MG/KG	0.0012 U	0.18 U	0.0017 U	0.15 U	0.14 U
Bromomethane	--	MG/KG	0.0012 U	0.18 U	0.0017 U	0.15 U	0.14 U
Carbon Disulfide	--	MG/KG	0.0012 U	0.18 U	0.0017 U	0.15 U	0.14 U
Carbon Tetrachloride	2.4	MG/KG	0.0012 UT	0.18 U	0.0017 U	0.15 U	0.14 U
Chlorobenzene	100	MG/KG	0.001 J	42	0.1	18	21
Chloroethane	--	MG/KG	0.0012 U	0.18 U	0.0017 U	0.15 U	0.14 U
Chloroform	49	MG/KG	0.0012 UT	0.18 U	0.0017 U	0.15 U	0.14 U
Chloromethane	--	MG/KG	0.0012 U	0.18 U	0.0017 U	0.15 U	0.14 U
Cis-1,2-Dichloroethylene	100	MG/KG	0.0012 U	0.18 U	0.0017 U	0.15 U	0.14 U
Cis-1,3-Dichloropropene	--	MG/KG	0.0012 UT	0.18 U	0.0017 U	0.15 U	0.14 U
Cyclohexane	--	MG/KG	0.0012 U	0.12 J	0.00073 J	0.16	0.14 U
Dibromochloromethane	--	MG/KG	0.0012 U	0.18 U	0.0017 U	0.15 U	0.14 U
Dichlorodifluoromethane	--	MG/KG	0.0012 U	0.18 U	0.0017 U	0.15 U	0.14 U
Ethylbenzene	41	MG/KG	0.0012 U	0.39	0.00079 J	0.076 J	0.092 J

Table 1. Summary of Volatile Organic Compounds in Soil, 322 3rd Avenue, Brooklyn, New York

		Sample Designation:	BH-SUMP-4	TH-Sump-4	TH-Sump-6	TH-Sump-7	TH-Sump-8
		Sample Date:	12/14/2018	12/07/2018	12/07/2018	12/07/2018	12/07/2018
Parameter	NYSDEC Part 375 Restricted Residential SCO	Units					
Isopropylbenzene (Cumene)	--	MG/KG	0.0012 U	0.29	0.0013 J	0.48	0.14 U
m,p-Xylene	--	MG/KG	0.0012 U	1.6	0.00083 J	0.081 J	0.1 J
Methyl Acetate	--	MG/KG	0.0058 U	0.3 J	0.0084 U	0.12 J	0.21 J
Methyl Ethyl Ketone (2-Butanone)	100	MG/KG	0.0021 J	0.9 U	0.0025 J	0.73 U	0.69 U
Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	--	MG/KG	0.0058 U	0.9 U	0.0084 U	0.73 U	0.69 U
Methylcyclohexane	--	MG/KG	0.0012 U	0.72	0.0037	0.74	0.11 J
Methylene Chloride	100	MG/KG	0.0012 U	0.18 U	0.0017 U	0.15 U	0.14 U
O-Xylene (1,2-Dimethylbenzene)	--	MG/KG	0.00018 J	0.87	0.0015 J	0.078 J	0.1 J
Styrene	--	MG/KG	0.0012 U	0.18 U	0.0017 U	0.15 U	0.14 U
Tert-Butyl Methyl Ether	100	MG/KG	0.0012 UT	0.18 U	0.0017 U	0.15 U	0.14 U
Tetrachloroethylene (PCE)	19	MG/KG	0.00018 J	0.18 U	0.00057 J	0.15 U	0.33
Toluene	100	MG/KG	0.0012 U	0.3	0.0017 U	0.15 U	0.14 U
Trans-1,2-Dichloroethene	100	MG/KG	0.0012 U	0.18 U	0.0017 U	0.15 U	0.14 U
Trans-1,3-Dichloropropene	--	MG/KG	0.0012 U	0.18 U	0.0017 U	0.15 U	0.14 U
Trichloroethylene (TCE)	21	MG/KG	0.0012 UT	0.18 U	0.0017 U	0.15 U	0.14 U
Trichlorofluoromethane	--	MG/KG	0.0012 U	0.18 U	0.0017 U	0.15 U	0.14 U
Vinyl Chloride	0.9	MG/KG	0.0012 U	0.18 U	0.0017 U	0.15 U	0.14 U

Table 2. Summary of Semivolatile Organic Compounds in Soil, 322 3rd Avenue, Brooklyn, New York

		Sample Designation:	TH-Sump-4	TH-Sump-6	TH-Sump-7	TH-Sump-8
		Sample Date:	12/07/2018	12/07/2018	12/07/2018	12/07/2018
Parameter	NYSDEC Part 375 Restricted Residential SCO	Units				
1,2,4,5-Tetrachlorobenzene	--	MG/KG	5.2 U	4.3 U	4.6 U	4.3 U
2,3,4,6-Tetrachlorophenol	--	MG/KG	5.2 U	4.3 U	4.6 U	4.3 U
2,4,5-Trichlorophenol	--	MG/KG	5.2 U	4.3 U	4.6 U	4.3 U
2,4,6-Trichlorophenol	--	MG/KG	2.1 U	1.7 U	1.8 U	1.7 U
2,4-Dichlorophenol	--	MG/KG	2.1 U	1.7 U	1.8 U	1.7 U
2,4-Dimethylphenol	--	MG/KG	5.2 U	4.3 U	4.6 U	4.3 U
2,4-Dinitrophenol	--	MG/KG	4.2 U	3.5 U	3.7 U	3.4 U
2,4-Dinitrotoluene	--	MG/KG	1.1 U	0.88 U	0.93 U	0.87 U
2,6-Dinitrotoluene	--	MG/KG	1.1 U	0.88 U	0.93 U	0.87 U
2-Chloronaphthalene	--	MG/KG	5.2 U	4.3 U	4.6 U	4.3 U
2-Chlorophenol	--	MG/KG	5.2 U	4.3 U	4.6 U	4.3 U
2-Methylnaphthalene	--	MG/KG	1.4 J	0.87 J	2.7 J	2 J
2-Methylphenol (O-Cresol)	100	MG/KG	0.31 J	4.3 U	4.6 U	4.3 U
2-Nitroaniline	--	MG/KG	5.2 U	4.3 U	4.6 U	4.3 U
2-Nitrophenol	--	MG/KG	5.2 U	4.3 U	4.6 U	4.3 U
3,3'-Dichlorobenzidine	--	MG/KG	2.1 U	1.7 U	1.8 U	1.7 U
3-Nitroaniline	--	MG/KG	5.2 UT	4.3 UT	4.6 UT	4.3 UT
4,6-Dinitro-2-Methylphenol	--	MG/KG	4.2 U	3.5 U	3.7 U	3.4 U
4-Bromophenyl Phenyl Ether	--	MG/KG	5.2 U	4.3 U	4.6 U	4.3 U
4-Chloro-3-Methylphenol	--	MG/KG	5.2 U	4.3 U	4.6 U	4.3 U
4-Chloroaniline	--	MG/KG	5.2 UT	4.3 UT	4.6 UT	4.3 UT
4-Chlorophenyl Phenyl Ether	--	MG/KG	5.2 U	4.3 U	4.6 U	4.3 U
4-Methylphenol (P-Cresol)	100	MG/KG	0.74 J	0.42 J	4.6 U	4.3 U
4-Nitroaniline	--	MG/KG	5.2 U	4.3 U	4.6 U	4.3 U
4-Nitrophenol	--	MG/KG	11 U	8.8 U	9.3 U	8.7 U
Acenaphthene	100	MG/KG	4 J	0.7 J	0.84 J	0.89 J
Acenaphthylene	100	MG/KG	1.4 J	0.69 J	4.6 U	0.77 J
Acetophenone	--	MG/KG	5.2 U	0.8 J	4.6 U	0.47 J
Anthracene	100	MG/KG	3.8 J	0.71 J	4.6 U	0.91 J
Atrazine	--	MG/KG	2.1 U	1.7 U	1.8 U	1.7 U
Benzaldehyde	--	MG/KG	2.1 J	4.3 U	0.47 J	4.3 U
Benzo(A)Anthracene	**1**	MG/KG	**12**	**2.2**	**1.6**	**2.7**
Benzo(A)Pyrene	**1**	MG/KG	**9.2**	**1.7**	**1.2**	**2.6**
Benzo(B)Fluoranthene	**1**	MG/KG	**12**	**2.2**	**1.6**	**2.9**
Benzo(G,H,I)Perylene	100	MG/KG	5.7	1 J	0.82 J	1.6 J

Table 2. Summary of Semivolatile Organic Compounds in Soil, 322 3rd Avenue, Brooklyn, New York

		Sample Designation:	TH-Sump-4	TH-Sump-6	TH-Sump-7	TH-Sump-8
		Sample Date:	12/07/2018	12/07/2018	12/07/2018	12/07/2018
Parameter	NYSDEC Part 375 Restricted Residential SCO	Units				
Benzo(K)Fluoranthene	**3.9**	MG/KG	**5.2**	0.43 U	0.46 U	1.1
Benzyl Butyl Phthalate	--	MG/KG	8.2	4.3 U	4.6 U	4.3 U
Biphenyl (Diphenyl)	--	MG/KG	5.2 U	4.3 U	4.6 U	4.3 U
Bis(2-Chloroethoxy) Methane	--	MG/KG	5.2 U	4.3 U	4.6 U	4.3 U
Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether)	--	MG/KG	0.52 U	0.43 U	0.46 U	0.43 U
Bis(2-Chloroisopropyl) Ether	--	MG/KG	5.2 U	4.3 U	4.6 U	4.3 U
Bis(2-Ethylhexyl) Phthalate	--	MG/KG	4.6 J	4.8	5.7	1.5 J
Caprolactam	--	MG/KG	5.2 U	4.3 U	4.6 U	4.3 U
Carbazole	--	MG/KG	1.5 J	4.3 U	4.6 U	4.3 U
Chrysene	**3.9**	MG/KG	**12**	3.4 J	2 J	3.9 J
Dibenz(A,H)Anthracene	**0.33**	MG/KG	**1.8**	**0.38 J**	0.24 J	**0.43**
Dibenzofuran	59	MG/KG	1.4 J	4.3 U	4.6 U	4.3 U
Diethyl Phthalate	--	MG/KG	5.2 U	4.3 U	4.6 U	4.3 U
Dimethyl Phthalate	--	MG/KG	5.2 U	4.3 U	4.6 U	4.3 U
Di-N-Butyl Phthalate	--	MG/KG	5.2 U	4.3 U	4.6 U	4.3 U
Di-N-Octylphthalate	--	MG/KG	5.2 U	4.3 U	4.6 U	4.3 U
Fluoranthene	100	MG/KG	20	3.6 J	3.2 J	5.1
Fluorene	100	MG/KG	2.3 J	0.66 J	2.9 J	1.5 J
Hexachlorobenzene	1.2	MG/KG	0.52 U	0.43 U	0.46 U	0.43 U
Hexachlorobutadiene	--	MG/KG	1.1 U	0.88 U	0.93 U	0.87 U
Hexachlorocyclopentadiene	--	MG/KG	5.2 U	4.3 U	4.6 U	4.3 U
Hexachloroethane	--	MG/KG	0.52 U	0.43 U	0.46 U	0.43 U
Indeno(1,2,3-C,D)Pyrene	**0.5**	MG/KG	**6.1**	**1**	**0.79**	**1.6**
Isophorone	--	MG/KG	2.1 U	1.7 U	1.8 U	1.7 U
Naphthalene	100	MG/KG	2.1 J	1.7 J	1.6 J	0.97 J
Nitrobenzene	--	MG/KG	0.52 U	0.43 U	0.46 U	0.43 U
N-Nitrosodi-N-Propylamine	--	MG/KG	0.52 U	0.43 U	0.46 U	0.43 U
N-Nitrosodiphenylamine	--	MG/KG	5.2 U	4.3 U	4.6 U	4.3 U
Pentachlorophenol	6.7	MG/KG	4.2 U	3.5 U	3.7 U	3.4 U
Phenanthrene	100	MG/KG	13	2.3 J	4.9	4.2 J
Phenol	100	MG/KG	0.77 J	0.3 J	4.6 U	4.3 U
Pyrene	100	MG/KG	23	5.2	3.3 J	7.3

Table 3. Summary of Metals in Soil, 322 3rd Avenue, Brooklyn, New York

		Sample Designation:	TH-Sump-4	TH-Sump-6	TH-Sump-7	TH-Sump-8
		Sample Date:	12/07/2018	12/07/2018	12/07/2018	12/07/2018
Parameter	NYSDEC Part 375 Restricted Residential SCO	Units				
Aluminum	--	MG/KG	6980	7090	7460	4580
Antimony	--	MG/KG	1.8 J	2.1 J	3.7 J	4.9 U
Arsenic	**16**	MG/KG	**32.5**	11	8.7	**21.9**
Barium	**400**	MG/KG	**4510**	**600**	**684**	**641**
Beryllium	72	MG/KG	0.44 J	0.54	0.58	0.34 J
Cadmium	**4.3**	MG/KG	3.6	**5.4**	2.9	2.5
Calcium	--	MG/KG	78500	47800	24000	28500
Chromium III	180	MG/KG	96.7	60.7	47.2	121
Chromium, Hexavalent	110	MG/KG	3.1 U	2.6 U	2.8 U	2.6 U
Chromium, Total	180	MG/KG	96.7	60.7	47.2	121
Cobalt	--	MG/KG	4.2 J	6.6 J	7.9 J	4 J
Copper	**270**	MG/KG	128	**431**	248	147
Iron	--	MG/KG	32900	29000	33200	26600
Lead	**400**	MG/KG	**1560**	**1750**	**2150**	**1270**
Magnesium	--	MG/KG	24700	3760	3420	2600
Manganese	2000	MG/KG	315	326	326	209
Mercury	**0.81**	MG/KG	**1.7**	**1.2**	**3.7**	**1.1**
Nickel	310	MG/KG	26.3	34.8	27.6	22.2
Potassium	--	MG/KG	1020 J	1300	1070 J	828 J
Selenium	180	MG/KG	6.1 U	4.9 U	5.1 U	4.9 U
Silver	180	MG/KG	21.7	4.8	2.7	3.5
Sodium	--	MG/KG	292 J	836 J	200 J	369 J
Thallium	--	MG/KG	6.1 U	4.9 U	5.1 U	4.9 U
Vanadium	--	MG/KG	31	25.1	29.8	27
Zinc	10000	MG/KG	1110	1340	1160	919

Table 4. Summary of Polychlorinated Biphenyls in Soil, 322 3rd Avenue, Brooklyn, New York

			Sample Designation:	BH-Sump-1	BH-Sump-2	BH-Sump-3	BH-Sump-4	BH-Sump-5	BH-Sump-6
			Sample Date:	12/07/2018	12/07/2018	12/07/2018	12/07/2018	12/07/2018	12/07/2018
Parameter	NYSDEC RAWP Cleanup	TSCA Hazardous Levels	Units						
PCB-1016 (Aroclor 1016)	--	--	MG/KG	4 U	47 U	42 U	87 U	9.1 U	21 U
PCB-1221 (Aroclor 1221)	--	--	MG/KG	4 U	47 U	42 U	87 U	9.1 U	21 U
PCB-1232 (Aroclor 1232)	--	--	MG/KG	4 U	47 U	42 U	87 U	9.1 U	21 U
PCB-1242 (Aroclor 1242)	--	--	MG/KG	4 U	47 U	42 U	87 U	9.1 U	21 U
PCB-1248 (Aroclor 1248)	--	--	MG/KG	4 U	47 U	42 U	87 U	9.1 U	21 U
PCB-1254 (Aroclor 1254)	--	--	MG/KG	4 U	47 U	42 U	87 U	9.1 U	21 U
PCB-1260 (Aroclor 1260)	--	--	MG/KG	79	480	420	1300	180	320
PCB-1262 (Aroclor 1262)	--	--	MG/KG	4 U	47 U	42 U	87 U	9.1 U	21 U
PCB-1268 (Aroclor 1268)	--	--	MG/KG	4 U	47 U	42 U	87 U	9.1 U	21 U
Polychlorinated Biphenyl (PCBs)	**10**	50	MG/KG	**79**	**480**	**420**	**1300**	**180**	**320**

Table 4. Summary of Polychlorinated Biphenyls in Soil, 322 3rd Avenue, Brooklyn, New York

			Sample Designation:	LDT-E	LDT-W	TH-Sump-4	TH-Sump-5	TH-Sump-6	TH-Sump-7
			Sample Date:	12/07/2018	12/07/2018	12/07/2018	12/07/2018	12/07/2018	12/07/2018
Parameter	NYSDEC RAWP Cleanup	TSCA Hazardous Levels	Units						
PCB-1016 (Aroclor 1016)	--	--	MG/KG	51 U	70 U	110 U	500 U	22 U	9.3 U
PCB-1221 (Aroclor 1221)	--	--	MG/KG	51 U	70 U	110 U	500 U	22 U	9.3 U
PCB-1232 (Aroclor 1232)	--	--	MG/KG	51 U	70 U	110 U	500 U	22 U	9.3 U
PCB-1242 (Aroclor 1242)	--	--	MG/KG	51 U	70 U	110 U	500 U	22 U	9.3 U
PCB-1248 (Aroclor 1248)	--	--	MG/KG	51 U	70 U	110 U	500 U	22 U	9.3 U
PCB-1254 (Aroclor 1254)	--	--	MG/KG	51 U	70 U	110 U	500 U	22 U	9.3 U
PCB-1260 (Aroclor 1260)	--	--	MG/KG	490	850	1700	4800	180	89
PCB-1262 (Aroclor 1262)	--	--	MG/KG	51 U	70 U	110 U	500 U	22 U	9.3 U
PCB-1268 (Aroclor 1268)	--	--	MG/KG	51 U	70 U	110 U	500 U	22 U	9.3 U
Polychlorinated Biphenyl (PCBs)	**10**	50	MG/KG	**490**	**850**	**1700**	**4800**	**180**	**89**

Table 4. Summary of Polychlorinated Biphenyls in Soil, 322 3rd Avenue, Brooklyn, New York

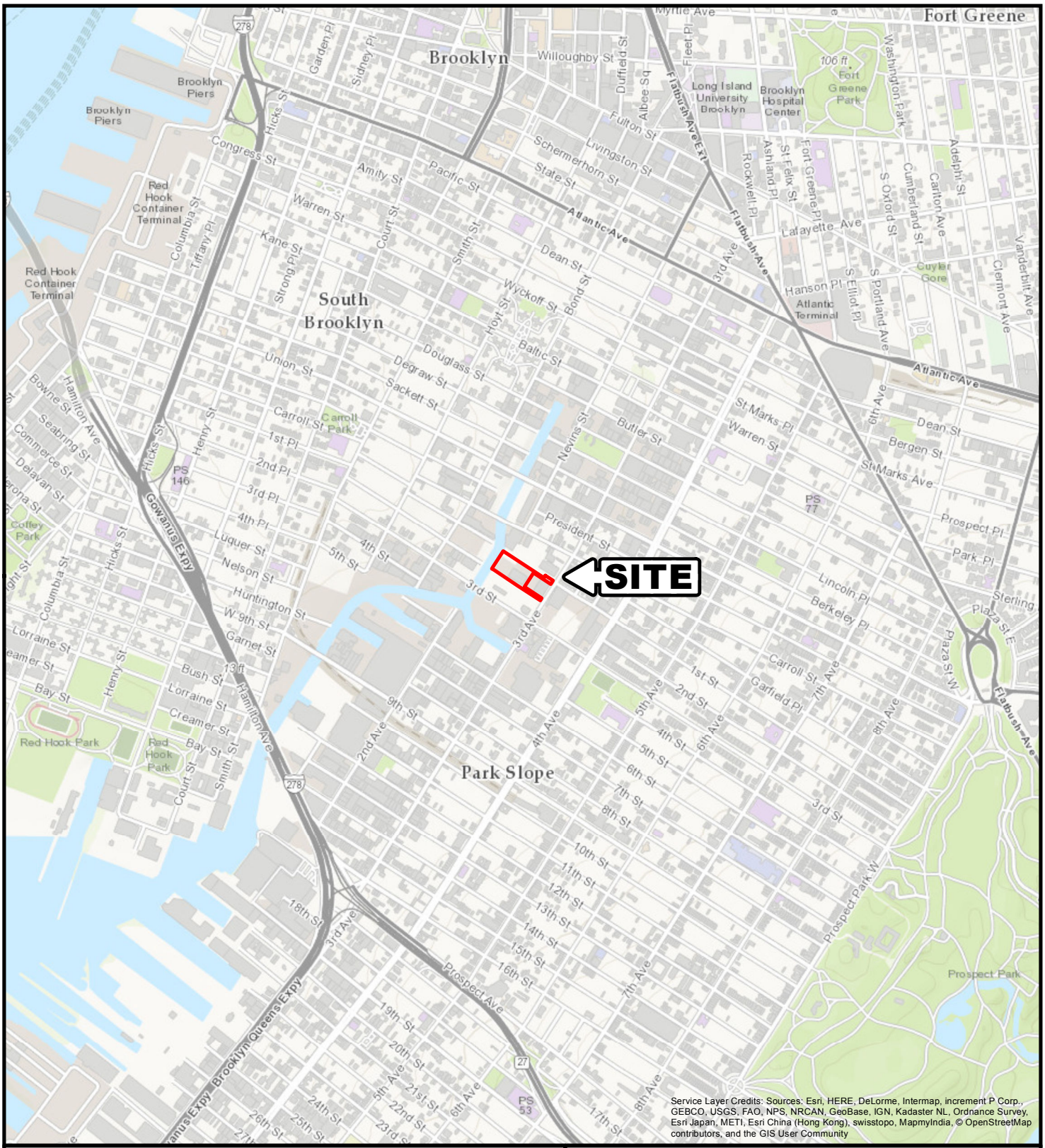
			Sample Designation:	TH-Sump-8
			Sample Date:	12/07/2018
Parameter	NYSDEC RAWP Cleanup	TSCA Hazardous Levels	Units	
PCB-1016 (Aroclor 1016)	--	--	MG/KG	87 U
PCB-1221 (Aroclor 1221)	--	--	MG/KG	87 U
PCB-1232 (Aroclor 1232)	--	--	MG/KG	87 U
PCB-1242 (Aroclor 1242)	--	--	MG/KG	87 U
PCB-1248 (Aroclor 1248)	--	--	MG/KG	87 U
PCB-1254 (Aroclor 1254)	--	--	MG/KG	87 U
PCB-1260 (Aroclor 1260)	--	--	MG/KG	590
PCB-1262 (Aroclor 1262)	--	--	MG/KG	87 U
PCB-1268 (Aroclor 1268)	--	--	MG/KG	87 U
Polychlorinated Biphenyl (PCBs)	**10**	50	MG/KG	**590**

Table 5. Summary of Polychlorinated Biphenyls in Groundwater, 322 3rd Avenue, Brooklyn, New York

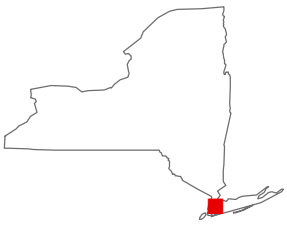
		Sample Designation:	TH-SUMP-1	TH-SUMP-2	TH-SUMP-3
		Sample Date:	12/07/2018	12/07/2018	12/07/2018
Parameter	NYSDEC Ambient Water-Quality Standards	Units			
PCB-1016 (Aroclor 1016)	--	UG/L	400 U	4 U	200 U
PCB-1221 (Aroclor 1221)	--	UG/L	400 U	4 U	200 U
PCB-1232 (Aroclor 1232)	--	UG/L	400 U	4 U	200 U
PCB-1242 (Aroclor 1242)	--	UG/L	400 U	4 U	200 U
PCB-1248 (Aroclor 1248)	--	UG/L	400 U	4 U	200 U
PCB-1254 (Aroclor 1254)	--	UG/L	400 U	4 U	200 U
PCB-1260 (Aroclor 1260)	--	UG/L	4200	86	2600
PCB-1262 (Aroclor 1262)	--	UG/L	400 U	4 U	200 U
PCB-1268 (Aroclor 1268)	--	UG/L	400 U	4 U	200 U
Polychlorinated Biphenyl (PCBs)	**0.09**	UG/L	**4200**	**86**	**2600**

FIGURES

Site Location Map



QUADRANGLE LOCATION



N

750 0 750 1,500 Feet

Title:

SITE LOCATION MAP

153 2ND ST, BROOKLYN, NEW YORK

Prepared For:

GEMINI ARTS INITIATIVE, INC.

ROUX
ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: L.D.	Date: 19APR17	FIGURE
Prepared by: M.R.	Scale: AS SHOWN	1
Project Mgr: M.A.	Project: 2705.0001Y000	
File: 2705.0001Y171.1.mxd		

V:\GIS\Projects\2705Y\0001Y\171\2705.0001Y171.1.mxd

APPENDICES

A. LBG Site-Wide PCB Cleanup Status Summary Update, October 2015

B. Quality Assurance Protection Plan

APPENDIX A

LBG Site-Wide PCB Cleanup Status Summary Update,
October 2015

LEGGETTE, BRASHEARS & GRAHAM, INC.

PROFESSIONAL GROUNDWATER AND ENVIRONMENTAL ENGINEERING SERVICES

4 WESTCHESTER PARK DRIVE, SUITE 175
WHITE PLAINS, NY 10604
914-694-5711
FAX 914-694-5744
www.lbgweb.com

October 29, 2015

Via e-mail: *Tsiamis.Christos@epa.gov*

Mr. Christos Tsiamis
USEPA Region 2
New York Remediation Branch
290 Broadway, 20th Floor
New York, NY 10007

RE: Site-Wide PCB Cleanup
Status Summary Update
Gowanus Village I, LLC
153 2nd Street, Brooklyn, New York
NYS BCA Site No. C224099

Dear Mr. Tsiamis:

Leggette, Brashears & Graham, Inc. (LBG), on behalf of BRT Powerhouse, LLC (BRT) and Gemini Arts Initiative, Inc. (GAII), is submitting this Site-Wide PCB Cleanup status update summary letter regarding the remedial activities at the above-referenced Site. All PCB cleanup work activities have been performed in accordance with the Site-Wide PCB Cleanup Work Plan (Work Plan) to address the historic PCB contamination identified at the above referenced Site. The final version of the Work Plan was forwarded to your attention on July 25, 2015. The following sections present the current remedial status of the Site as well as the proposed schedule for future remedial activities.

Should you have any questions regarding the remedial action field activities completed at the Site and/or the future work scheduled to be implemented, please do not hesitate to contact me at (914) 694-5711.

Very truly yours,

LEGGETTE, BRASHEARS & GRAHAM, INC.

Sean Groszkowski, CPG
Associate Vice President

SCG:dmd
Attachment
cc: Brian Davidson – NYSDEC (brian.davidson@dec.ny.gov)
Katie Dixon – Powerhouse Arts / Gemini Arts Initiative, Inc. (katie@powerhousearts.org)
Brian Carr - USEPA *(carr.brian@epa.gov)*
Larry Schnapf – Schnapf LLC (larry@schnapflaw.com)
f:\reports\sive paget\gowanus\phase 4 - remedial action\usepa documents\project status summary letter and future scope\epa cleanup - remedial action status summary.docx

SITE-WIDE PCB CLEANUP
STATUS SUMMARY UPDATE
GOWANUS VILLAGE I, LLC
153 2ND STREET, BROOKLYN, NEW YORK
NYS BCA SITE NO. C224099

Prepared For

Gemini Arts Initiative, Inc.
98 4th Street, Suite 406
Brooklyn, NY 11231

October 2015

Prepared By

LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Groundwater and Environmental Engineering Services
4 Westchester Park Drive, Suite 175
White Plains, NY 10604
(914) 694-5711
www.lbgweb.com

TABLE OF CONTENTS

Page

EXECUTIVE SUMMARY 1

INTRODUCTION 6

FINALIZATION OF THE SITE-WIDE PCB CLEANUP WORK PLAN 6

RE-COMMENCEMENT OF REMEDIAL ACTIVITIES AT THE SITE 7

NON-HAZARDOUS CONTAMINATION EXCAVATION ACTIVITIES 8

HAZARDOUS CONTAMINATION EXCAVATION ACTIVITIES 9
- Soil-Excavation Activities 9
- Former Condensate Intake Tunnel Excavation Activities 11
- Excavation Endpoint Confirmation Soil Sampling Activities 13

BUILDING INTERIOR SURFACE CHARACTERIZATION 15
- Initial Building Interior Basement Brick Wall Surface Sampling 15
- Supplemental Building Interior Brick Wall Surface-Sampling 16
- Building Interior Concrete Floor Surface Sampling 18

AIR QUALITY ASSESSMENT 20

REMEDIAL WASTE GENERATION SUMMARY 22

PLANNED SCOPE OF WORK FOR CONTINUED RAWP ACTIVITIES 22
- Supplemental Site Characterization Activities 22
- Continuation of Soil Excavation and Endpoint Confirmation Sampling 23
- Former Condensate Intake Tunnel Excavation Activities 23
- Basement Interior Surface Demolition and Decontamination Activities 25
- Basement Soil Vapor Barrier and Concrete Slab Installation 26
- Determination of USEPA Approved Cap Specifications 26

PLANNED PROJECT COMPLETION DETAILS 26

LIST OF TABLES
(at end of report)

Table

1 Summary of Polychlorinated Biphenyls, Gate Well Source Area – Post-Excavation Endpoint Soil Samples

2 Summary of Polychlorinated Biphenyls, Southern Property Boundary – Post-Excavation Endpoint Soil Samples; North of Intake Tunnel – Post-Excavation Endpoint Soil Samples

3 Building Interior Wall Surface – Bulk Wall Core Sampling for PCBs

4 Basement Building Interior Surfaces – Bulk Wall Core Sampling for PCBs

5 Ground Floor Building Interior Surfaces – Bulk Wall Core Sampling for PCBs

6 1st Floor Building Interior Surfaces – Bulk Wall Core Sampling for PCBs

7 Mezzanine Building Interior Surfaces – Bulk Wall Core Sampling for PCBs

8 2nd Floor Building Interior Surfaces – Bulk Wall Core Sampling for PCBs

9 3rd Floor Building Interior Surfaces – Bulk Wall Core Sampling for PCBs

10 4th Floor Building Interior Surfaces – Bulk Wall Core Sampling for PCBs

11 PCB Air Sampling – PUF Cartridges

LIST OF FIGURES
(at end of report)

Figure

1	Site Conditions – August 12, 2015
2	Extent of Excavation Activities
3	Endpoint Confirmation Soil Sample Results – Total PCBs
4	Building Interior Wall Core Sampling (2014)
5	Interior Surface Sample Locations: Walls, Basement/Ground Floor – June 23, 2015
6	Interior Surface Sample Locations: Walls, First Floor – June 18 and 19, 2015
7	Interior Surface Sample Locations: Walls, Mezzanine – June 18 and 22, 2015
8	Interior Surface Sample Locations: Walls, Second Floor – June 16 and 17, 2015
9	Interior Surface Sample Locations: Walls, Third Floor – June 10, 11 and 12, 2015
10	Interior Surface Sample Locations: Walls, Fourth Floor – June 11, 12 and 16, 2015
11	Interior Surface Sample Locations: Floors, Basement/Ground Floor – June 24, 25 and July 9, 2015
12	Interior Surface Sample Locations: Floors, First Floor – July 8 and 9, 2015
13	Interior Surface Sample Locations: Floors, Mezzanine – July 8, 2015
14	Interior Surface Sample Locations: Floors, Second Floor, July 1, 2015
15	Interior Surface Sample Locations: Floors, Third Floor – July 6, 2015
16	Interior Surface Sample Locations: Floors, Fourth Floor – July 6 and 7, 2015
17	Interior Air Sample Location: Basement/Ground Floor – July 31, 2015

LIST OF FIGURES
(at end of report)
(continued)

Figures

18 Interior Air Sample Location: First Floor – July 30, 2015

19 Interior Air Sample Location: Second Floor – July 30, 2015

20 Interior Air Sample Location: Third Floor – July 29, 2015

21 Interior Air Sample Location: Fourth Floor – July 29, 2015

22 Exterior Air Sample Locations, July 29, 30 and 31, 2015

SITE-WIDE PCB CLEANUP
STATUS SUMMARY UPDATE
GOWANUS VILLAGE I, LLC
153 2ND STREET, BROOKLYN, NEW YORK
NYS BCA SITE NO. C224099

EXECUTIVE SUMMARY

Following the United States Environmental Protection Agency (USEPA) review and approval of the Work Plan, remedial activities including soil excavation, intake demolition, waste disposal, indoor surface sampling, air sampling and excavation endpoint confirmation soil sampling resumed on May 11, 2015. All remedial cleanup activities have been performed in accordance with the approved Work Plan and any approved modifications.

The results of the listed remedial activities are as follows:

- The hazardous polychlorinated biphenyls (PCB) contamination excavation activities have been performed in the following areas: the identified source area adjacent to the west of the building (the former gate well excavation); the area to the south-southeast of the source area; and, the portion of the former condensate system intake tunnel west of the hydraulic plug. The PCB contaminated hazardous soils within and adjacent to these areas have been and continue to be excavated to the extent necessary to meet USEPA regulatory standards.
- The top of the intake tunnel (west of the hydraulic plug) was broken open, exposing the light non-aqueous phase liquid (LNAPL) contained within the top of the tunnel. The LNAPL was extracted from the interior of the tunnel and all impacted concrete was removed and stockpiled with the hazardous soil.
- Endpoint confirmation soil sampling was completed for the source area excavation as well as to the north and south of the exposed intake tunnel in the locations presented on figure 3. The analytical results of the post-excavation endpoint confirmation soil samples (presented on table 1, table 2 and summa-

rized on figure 3) show adequate remediation has been achieved in these areas. As per the laboratory analytical results:

- o PCBs concentrations in all of the excavation endpoint bottom samples are below 50 mg/kg (milligrams per kilogram). Only two bottom samples contained PCBs at concentrations exceeding 1 mg/kg: NGW-4 (2,300 ug/kg [micrograms per kilogram]); and, SGW Bottom 2 (1,300 ug/kg);
- o PCBs concentrations in all of the excavation endpoint samples collected from the southern property boundary (south of the intake tunnel) are below 50 mg/kg. Only five of the endpoint confirmation samples contained PCBs at concentrations exceeding 1 mg/kg: SB-1A (1,700 ug/kg); SB-1B (12,000 ug/kg); SB-2A (3,400 ug/kg); SB-5A (1,100 ug/kg); and SB-8B (1,200 ug/kg);
- o PCBs concentrations in all of the excavation endpoint samples collected from north of the intake tunnel (west of the hydraulic plug) are below 50 mg/kg. Only two of the endpoint confirmation samples contained PCBs at concentrations exceeding 1 mg/kg: NIT-3A (2,800 ug/kg) and NIT-4A (2,500 ug/kg).

Based on the results of the post-excavation sample results, we request USEPA authorization to backfill the completed portion of the source area excavation to current grade. This will also facilitate access into the building basement for performing the drilling program (outlined below).

- 4,389.59 tons of non-hazardous soil was transported for offsite disposal from June 2, 2015 to date. All of the non-hazardous waste soil was transported under manifest by licensed haulers for offsite disposal at the IESI PA Bethlehem Landfill Corporation facility in Bethlehem, Pennsylvania.
- 3,072.74 tons of hazardous PCB contaminated soil was transported for offsite disposal from May 21, 2015 to date. All PCB contaminated hazardous waste soil was transported under hazardous waste manifest by licensed haulers for

offsite disposal at the Wayne Disposal, Inc. facility in Belleville, Michigan, which is a Toxic Substances Control Act (TSCA) certified chemical waste landfill approved under §761.75 for disposal.

- The building interior surface characterization sampling was performed on all interior walls and floors (excluding inaccessible areas and new-pour concrete floors).
  - The interior brick wall characterization analytical results for all samples collected from the building interior (for all of the floor levels) indicate that all PCB concentrations are below the USEPA "High Occupancy" Cleanup Level of 1,000 ug/kg.
  - The concrete floor characterization analytical results for samples collected from the basement level indicate that all PCB concentrations are below the USEPA "High Occupancy" Cleanup Level of 1,000 ug/kg, with the exception of three locations (B1F-C – 1,400 ug/kg, B1F-L – 2,100 ug/kg and B1F-N –1,700 ug/kg). The concrete in these areas will either be decontaminated of scarified in an effort to meet high occupancy cleanup concentrations. The basement concrete floor characterization sample locations are presented on figure 11. The results of the PCB concentrations for the concrete floor core composite samples for the basement are summarized on table 4.
- Air quality sampling activities and PCB analysis were performed on the building interior (all floors independently) in addition to the outdoor air (work zone and background) and field blank (Quality Assurance/Quality Control [QA/QC]). The laboratory analytical results of the air sampling activities indicate that the PCB concentrations in all of the air samples collected are below the USEPA air exposure level for PCBs. The analytical results for the air samples are summarized on table 11.

Based on the extent of the completed remedial action activities, the planned scope of work for continued remedial action field activities include the following:

- The supplemental soil characterization activities are scheduled to commence on November 2, 2015. Following the completion of the supplemental soil characterization drilling activities and installation of the groundwater monitoring wells, the supplemental groundwater characterization activities will be performed at the Site. The detailed descriptions of these activities are outlined in the Work Plan.
- The onsite excavation and waste disposal activities are scheduled to continue. It is anticipated that the source area "hot spot" excavation activities in the area of the gate wells will be completed in October. As per the Remedial Action Work Plan (RAWP), lateral extraction piping will be installed within the groundwater in the completed source area excavation prior to backfilling. This will facilitate future monitoring of the environmental conditions within this area.
- Following verification that the PCB contamination within delineated areas has been encompassed within the extents of the respective completed excavations, endpoint confirmation sampling will be performed. Following receipt of the analytical results for endpoint confirmation samples, the respective excavations will be backfilled in accordance with the procedures and specifications as outlined in the New York State Department of Environmental Conservation (NYSDEC) approved RAWP.
- Excavation of the remainder of the condensate intake tunnel, recovery of any remaining LNAPL and excavation of any impacted soil, pending the installation of the harbor boom within the Gowanus Canal and removal of the overlying portion of the property perimeter fence.
- Waste generated during all future remedial activities will be characterized and disposed of in accordance with the approved Work Plan.
- Based on the results of the analytical results of the post-excavation soil confirmation samples, the USEPA will evaluate the appropriateness of the pro-

posed soil covers throughout the Site. Following data review and receipt of input from the USEPA, final surface cover specifications will be developed for the Site.

- Due to the PCB concentrations exceeding the USEPA "High Occupancy" Cleanup Level in the basement wall cores (2014 sampling locations BWC-4 and BWC-6) and the basement floor cores (B1F-C, B1F-L and B1F-N), the representative surface areas will be demolished and/or decontaminated. These activities will be performed in accordance with the Work Plan, as described below.
- In addition to the vault demolition and surface decontamination activities that will be performed in the basement, the Remedial Action at the Site will incorporate a soil vapor barrier and new concrete slab in the basement of the building. This will function as an additional protective measure eliminating the exposure pathway to the underlying basement interior surfaces. The detailed descriptions of these activities are outlined in the Work Plan.

INTRODUCTION

As previously indicated, the environmental remediation activities at the Site are being performed pursuant to the New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program (BCP), under which it is listed as BCA Index Number W2-1069-0506, Site No. C224099.

The Site contains surface and subsurface soils impacted with polychlorinated biphenyls (PCBs), including some areas with concentrations exceeding 50 ppm (parts per million), as well as limited PCB contamination in the interior of an existing building at the Site.

The sections that follow present the status of the PCB-related cleanup activities implemented at the Site subsequent to the United States Environmental Protection Agency (USEPA) approval of the Work Plan, as well as to outline the scheduled work that continues at the Site.

FINALIZATION OF THE SITE-WIDE PCB CLEANUP WORK PLAN

The initial version of the Site-Wide PCB Cleanup Work Plan was submitted to the USEPA Toxic Substances Control Act (TSCA) office on March 20, 2015.

On April 20, 2015, the USEPA TSCA office issued a comment sheet outlining aspects of the Site-Wide PCB Cleanup Work Plan of which the USEPA required modification. The comments outlined Work Plan modifications that the USEPA deemed necessary to adequately address perceived data gaps with respect to the characterization of the Site which include: the extent and concentration of PCB soil contamination at the Site; the extent and concentration of PCB groundwater contamination at the Site; expanding the detail for descriptions of building slab conditions; and, modifications to proposed sampling methodologies and analytical limits.

On April 24, 2015, a letter was sent to the USEPA presenting responses to the April 20, 2015 comment sheet and outlining the modifications that will be made to the Work Plan.

On May 8, 2015, the USEPA issued written notification that the response letter satisfactorily addressed the USEPA's concerns regarding the Work Plan, with the exception of the

response to the planned soil cover. The USEPA then granted authorization to resume work at the Site contingent upon assurance that the Work Plan will be revised to incorporate the April 24th responses, and will be resubmitted to the USEPA Region 2, New York Remediation Branch in a timely manner. In addition to approved revisions, the Work Plan modification must state that the decision on the nature of the soil cap has been deferred for a later time when additional soil data collection and review by the USEPA has been completed. Additionally, the authorization stated that the USEPA reserves the right to request additional work following review of the results of the current and future characterization data in relation to any potential impacts from the Site to the Gowanus Canal.

The Work Plan was modified as per the April 24, 2015 response letter and May 8, 2015 notification, and final copies of the Work Plan were forwarded (in hard copy and electronic format) to the USEPA Region 2, New York Remediation Branch.

RE-COMMENCEMENT OF REMEDIAL ACTIVITIES AT THE SITE

In anticipation of the USEPA authorization to resume work, Site preparation activities were performed on May 5-8, 2015. These activities included re-mobilizing construction equipment, performing maintenance on onsite equipment, and performing maintenance on storm-water pollution prevention measures at the Site.

Subsequent to receiving the May 8, 2015 written authorization to resume the remedial work at the Site, the excavation activities resumed on May 11, 2015. The remedial activities that have been performed at the Site from May 11, 2015 to date include:

- source area excavation of hazardous PCB contaminated soil adjacent to the west of the building (the Gate Well Excavations);
- excavation of non-hazardous soil contaminated soil on the southwestern portion of the Site;
- breaking and removing the top of the intake tunnels and extraction of PCB contaminated light non-aqueous phase liquid (LNAPL) that was contained within;

- building interior surface characterization sampling (walls and floors) activities;
- interior and exterior air quality characterization sampling;
- offsite disposal of hazardous PCB contaminated soil; and,
- offsite disposal of non-hazardous contaminated soil.

It should be noted that the drilling activities that will be performed to obtain the additional soil quality characterization data, install the additional groundwater monitoring wells and obtain the additional groundwater quality characterization data is scheduled to commence on November 2, 2015.

The current Site conditions (as of August 12, 2015) are presented on the attached figure 1. The lateral extents of the onsite excavation activities are illustrated on figure 2. Summaries of the completed and ongoing elements of the Work Plan are summarized in the sections that follow.

NON-HAZARDOUS CONTAMINATION EXCAVATION ACTIVITIES

The contaminated soil excavation activities have been and continue to be performed in the western portion of the Site. Additionally, the soil adjacent to the south of the building was excavated to lower the grade to an elevation of 9.73 feet Brooklyn datum (as surveyed adjacent to the southeastern corner of the building).

Non-hazardous contaminated soil excavation activities have been performed to facilitate access to identified source areas (i.e., the intake tunnel and the Gate Well Excavation). The non-hazardous soil was generated from areas of the Site that were not previously characterized as containing hazardous concentrations of PCBs. This includes soil in the southwestern portion of the Site (overlying soil above and to the north and south the unexcavated portion of the intake tunnel) as well as soil directly south of the building (2nd Street). Additionally, independent waste characterization sampling was performed on all non-hazardous soil stockpiles to confirm PCB concentrations did not exceed the TSCA hazardous classification of 50 mg/kg (milligrams per kilogram). After site activities resumed in May, the soil stockpiles that were

generated and which were characterized as non-hazardous include SC-16, SC-19, SC-20, SC-21, SC-22, SC-23, SC-24 and SC-25. Non-hazardous soil excavation and stockpile generation activities continue to be performed.

Outbound shipments of non-hazardous soil stockpiled onsite resumed on June 2, 2015.

From June 2, 2015 until August 7, 2015, a total of 187 truck-loads of non-hazardous soil have been transported offsite for disposal.

- Twenty-one (21) truck-loads for a total of 512.55 tons of non-hazardous soil were transported for offsite disposal in June 2015.
- One hundred sixty-six (166) truck-loads for a total of 3,703.72 tons of non-hazardous soil were transported for offsite disposal in July 2015.
- Eight (8) truck-loads for a total of 173.32 tons of non-hazardous soil were transported for offsite disposal in August 2015.

In total, 4,389.59 tons of non-hazardous soil was transported for offsite disposal for the period from June 2, 2015 to date. All of the non-hazardous waste soil was transported under manifest by licensed haulers for offsite disposal at the following facility:

IESI PA Bethlehem Landfill Corporation
2335 Applebutter Road
Bethlehem, PA 18015
Telephone: (610) 317-3200
WRC502, DEP#707

HAZARDOUS CONTAMINATION EXCAVATION ACTIVITIES

Soil Excavation Activities

The hazardous PCB contamination excavation activities have been performed in the following areas: the identified source area adjacent to the west of the building (the former gate well excavation); the area to the south-southeast of the source area; and, the portion of the former condensate system intake tunnel west of the hydraulic plug. The PCB contaminated

hazardous soils within and adjacent to these areas have been and continue to be excavated to the extent necessary to meet USEPA regulatory standards. The final extents of the soil excavations will be dictated based on the results of the endpoint confirmation soil samples.

In addition to the previously designated hazardous soil excavation areas, two PCB contaminated hazardous soil stockpiles (SC-17 and SC-18) were generated from the southeast of the source area excavation. These two soil stockpiles were generated from an area for which Site characterization data did not identify "as found" PCBs at concentrations exceeding 50 mg/kg. However, the waste characterization PCB analysis (performed as a Quality Assurance/Quality Control [QA/QC] measure for all potential non-hazardous waste stockpiles) resulted in a hazardous classification for these two stockpiles based on the PCB concentrations (SC-17 with PCBs detected at 51 mg/kg, and SC-18 with PCBs detected at 51 mg/kg).

Outbound shipments of PCB contaminated hazardous soil stockpiled onsite resumed on May 21, 2015.

From May 21, 2015 until August 14, 2015, a total of 131 truck-loads of PCB contaminated hazardous soil has been transported offsite for disposal.

- Five (5) truck-loads for a total of 114.02 tons of PCB contaminated hazardous soil was transported for offsite disposal in May 2015.
- Sixty-seven (67) truck-loads for a total of 1,553.68 tons of PCB contaminated hazardous soil was transported for offsite disposal in June 2015.
- Nineteen (19) truck-loads for a total of 459.65 tons of PCB contaminated hazardous soil was transported for offsite disposal in July 2015.
- Forty (40) truck-loads for a total of 945.39 tons of PCB contaminated hazardous soil was transported for offsite disposal in August 2015.

In total, an approximate volume of 3,072.74 tons of PCB contaminated hazardous waste soil for that period from May 21, 2015 to date. Additionally, this disposal volume includes the impacted waste concrete generated during the former condensate system intake tunnel excavation activities in July/August 2015 (outlined below). The PCB contaminated hazardous waste

soil was transported under hazardous waste manifest by licensed haulers for offsite disposal at the following facility:

Wayne Disposal, Inc.
Site #2 Landfill (Hazardous and PCB Waste Landfill)
49350 North I-94 Service Drive
Belleville, Michigan 48111-1854
Telephone: (800) 592-5489
USEPA ID# - MID048090633

As required under §761.50(b)(3), all PCB contaminated soil excavated from these areas has been classified as PCB Remediation Waste containing PCBs at concentrations of greater than or equal to 50 mg/kg and subsequently transported to a TSCA certified chemical waste landfill approved under §761.75 for disposal.

Former Condensate Intake Tunnel Excavation Activities

Following completion of the initial source area excavation surrounding the former gate wells, activities shifted to tracing the intake tunnel (west of the hydraulic plug) towards the Gowanus Canal. The overlying soil was removed and stored in discrete stockpiles for waste characterization sampling and analysis. While the overlying soil was being excavated, it was observed that the timber shoring that was used to install the intake tunnel was still present and was observed to be in good condition. Therefore, all excavation activities performed to complete the tunnel closure were performed within the existing timber shoring.

The top exterior surface of the intake tunnel was encountered at Brooklyn Datum elevations ranging from -1.55' (adjacent to the hydraulic plug) to -1.82' (the western extent of the tunnel approximately 65 feet east of the Gowanus Canal). Additionally, the interior bottom of the tunnel was surveyed at an elevation of -8.05' Brooklyn Datum. This indicates that the interior void of the tunnel has a vertical clearance of approximately 6 feet. Once the overlying soil was removed and the tunnel was exposed, static groundwater table was observed to be present at approximately 0.50' to 1.00' Brooklyn Datum.

After clearing the overlying soil, the concrete top of the intake tunnel was broken to assess the interior condition. Similar to the conditions observed for the eastern portion of the intake tunnel (east of the hydraulic plug), residual LNAPL was contained within the western portion of the tunnel. The residual LNAPL was viscous in nature and required manual removal from the excavation with sorbent boom and bailing containers. Due to the fact that the tunnel is filled with water, coupled with the fact that the LNAPL is less-dense than water, the LNAPL appears to have been contained on the top of the tunnel interior.

In addition to soil excavation, the remedial field activities include breaking the concrete top of the former condensate system intake tunnel along its total length to recover all residual LNAPL. Currently, the concrete top has been broken and the LNAPL has been recovered from the entire length of the intake tunnel with the exception of the westernmost section (approximately 65 feet long) which extends to the property boundary (i.e., the Gowanus Canal).

As a result of the tunnel breaking activities, approximately 100 gallons of LNAPL has been recovered from the interior of the western portion of the intake tunnel. Additionally, the top portion of the tunnel concrete (the portion that was in contact with the LNAPL) was broken, removed and disposed of by being added to the PCB contaminated hazardous waste soil stockpiles. The volumes of these waste materials are included in the hazardous waste soil disposal volumes presented above.

After all impacted concrete was broken and removed, and the interior of the tunnel was cleaned, excavation activities were expanded to include visually impacted soils located adjacent to the southern property boundary (south of the tunnel). Additional excavation activities are planned to the north of the tunnel and to the west of the completed source area excavation.

Following the completion of the soil excavation activities, endpoint confirmation soil samples will be collected to assess the effectiveness of the excavation and dictate whether additional excavation is required. Endpoint confirmation samples that exhibit PCB concentrations of greater than or equal to 50 mg/kg will prompt expansion of the excavation extent(s) within practical limits and the resampling of modified endpoint confirmation sample(s).

Excavation Endpoint Confirmation Soil Sampling Activities

Following the completion of the source area excavation activities performed adjacent to the western side of the building (encompassing the former gate wells and the eastern portion of the intake tunnel) several excavation endpoint confirmation soil samples were collected. The following endpoint samples were collected: NGW Bottom 1, NGW Bottom 2, NGW Bottom 3, NGW-4, SGW Bottom 1, SGW Bottom 2, SGW Bottom 3 and, SGW-4. The locations of the source area gate well excavation bottom samples are illustrated on figure 3. No eastern sidewall samples were collected as the excavation was terminated adjacent to the building foundation and the timber sheeting (assumed to be associated with the condensate tunnel system intake tunnel installation). Due to the fact that the lateral extents of the source area excavation have not yet been determined, the endpoint confirmation soil samples consist solely of bottom samples. All source area gate well excavation bottom samples were collected from elevations between -5.19' to -6.09' Brooklyn datum, which is approximately 7-8 feet below the static groundwater table elevation. A summary of the laboratory analytical results for the source area excavation bottom endpoint confirmation soil samples are presented on table 1. As per the laboratory analysis, PCB concentrations in all of the excavation endpoint bottom samples are below 50 mg/kg. Only two bottom samples contained PCBs at concentrations exceeding 1 mg/kg: NGW-4 (2,300 ug/kg [micrograms per kilogram]); and, SGW Bottom 2 (1,300 ug/kg).

The source excavation will be expanded to the west and north (if required) to ensure it encompasses the extents of the soil contaminated with residual PCBs at concentrations greater than 50 mg/kg. Additional endpoint confirmation samples will be collected as the final extents of the excavation are reached.

Subsequent to regrading in the southwestern portion of the Site the western portion of the intake tunnel was exposed, broken and the residual contamination (LNAPL and impacted concrete) was removed. Endpoint soil samples were then collected from the southern property boundary starting approximately 50 feet east of the Gowanus Canal and continuing to the western extent of the onsite building. These excavation endpoint samples were designated: SB-1A through SB-8A (shallow samples from 0.5 ft bg [feet below grade]); and, SB-1B

through SB-8B (samples just above the water table). The locations of the southern property boundary endpoint confirmation soil samples are illustrated on figure 3. A summary of the laboratory analytical results for the southern property boundary endpoint confirmation soil samples are presented on table 2. As per the laboratory analysis, PCB concentrations in all of the excavation endpoint samples collected from the southern property boundary (south of the intake tunnel) are below 50 mg/kg. Only five of the endpoint confirmation samples contained PCBs at concentrations exceeding 1 mg/kg: SB-1A (1,700 ug/kg); SB-1B (12,000 ug/kg); SB-2A (3,400 ug/kg); SB-5A (1,100 ug/kg); and SB-8B (1,200 ug/kg).

In addition to the southern property boundary area, the regrading activities were performed in the area north of the western portion of the intake tunnel. The regrading activities facilitated access to the intake tunnel for breaking the top of the tunnel, and also permitted recovery of the residual contamination (LNAPL and impacted concrete) within the tunnel. Post-excavation endpoint confirmation soil samples were then collected from this area. These post-excavation endpoint samples were designated: NIT-1A through NIT-5A (shallow samples from 0.5 ft bg); and, NIT-1B through NIT-5B (samples just above the water table). The locations of the southern property boundary endpoint confirmation soil samples are illustrated on figure 3. A summary of the laboratory analytical results for the post-excavation endpoint confirmation soil samples north of the intake tunnel are presented on table 2. As per the laboratory analysis, PCB concentrations in all of the samples are below 50 mg/kg. Only two of the endpoint confirmation samples contained PCBs at concentrations exceeding 1 mg/kg: NIT-3A (2,800 ug/kg) and NIT-4A (2,500 ug/kg).

Future soil excavation extents will be expanded to the west of the source area excavation and north of the intake tunnel to ensure that the excavation boundaries encompass the extents of soil contaminated with residual PCBs at concentrations greater than 50 mg/kg. Additional endpoint confirmation samples will be collected as the final extents of the excavation are reached.

BUILDING INTERIOR SURFACE CHARACTERIZATION

The redevelopment plan for the Site is as an artist development center, and as such the building interior will be classified as a high occupancy area, i.e., building occupants in the building for 6.7 hours per week or more.

40 CFR §761.123 contains the definitions for both high-contact and low-contact residential/commercial surfaces. A high-contact residential/commercial surface means a surface in a residential/commercial area which is repeatedly touched, often for relatively long periods of time. Examples of high-contact residential/commercial surfaces include doors, wall areas below 6 feet in height, uncovered flooring, windowsills, fencing, bannisters, stairs, automobiles, and children's play areas such as outdoor patios and sidewalks. Examples of low-contact residential/commercial surfaces include interior ceilings, interior wall areas above 6 feet in height, roofs, asphalt roadways, concrete roadways, wooden utility poles, unmanned machinery, concrete pads beneath electrical equipment, curbing, exterior structural building components (e.g., aluminum/vinyl siding, cinder block, asphalt tiles), and pipes.

For PCB waste management involving porous structural surfaces, such as floors, walls, or ceilings made of concrete, brick, wood, plaster, plasterboard, etc., "clean" is defined by a bulk PCB concentration, e.g., weight/weight or volume/volume, such as a core sample, and not a surface PCB concentration, such as a wipe sample.

To verify that the interior surfaces of the building comply with the high occupancy PCB concentration, from June 10, 2015 to July 9, 2015 additional surface sampling was performed at the Site. The summary of the sampling methodology as well as the analytical results of the interior surface samples collected are summarized below.

Initial Building Interior Basement Brick Wall Surface Sampling

Based on the results of the initial sampling activities performed in March 2014, PCBs were detected in porous concrete surfaces within the Site building. The March 2014 surface sampling activities were performed in accordance with the USEPA Standard Operating Procedures for Sampling Porous Surfaces for PCBs (May 2011). The locations of the basement wall

core sampling areas (representing approximately 100 square foot sampling areas) are presented on figure 4.

The analytical results indicated that wall core samples collected from select basement wall surface areas (BWC-4 and BWC-6) within the basement are impacted with PCBs exceeding the allowable USEPA "High Occupancy" Cleanup Level of 1,000 ug/kg. However, the PCB concentrations in all of the brick wall core samples were below 10,000 ug/kg which is the USEPA "High Occupancy" Cleanup Level for a self-implemented cleanup with a cap. The results of the interior basement wall surface sampling are presented on table 3.

Samples of surface coatings present on the eastern walls of the concrete basement vaults (located on the western perimeter of the basement) were collected and analyzed for PCBs (figure 4). The results of the laboratory analysis indicated that the coatings contain PCBs at 12,000 ug/kg on the north vault and 2,400 ug/kg on the south vault.

Core samples were subsequently collected from the eastern walls of the basement vaults (beyond the surface coatings). The vault wall core samples contained concentrations of PCB (Aroclor 1260) less than 250 ug/kg for the south vault (BWC-VS), and less than 2,500 ug/kg for the north vault (BWC-VN).

Supplemental Building Interior Brick Wall Surface Sampling

In-situ characterization sampling of the building interior brick wall was performed to assess PCB concentrations throughout the remainder of the building as well as to substantiate the 2014 sampling results.

Interior brick wall sampling was performed pursuing a risk-based cleanup standard. The interior surface characterization activities (sampling scope, frequency and methodology) were performed in accordance with the established USEPA Standard Operating Procedure for Sampling Porous Surfaces for PCBs.

With respect to the building interior surfaces, there are no visible traces of spilled material at the Site. Due to the lack of a known source area, the modified sampling procedures for characterizing the interior brick walls consisting of collecting composite core samples (utilizing a sampling grid applied to the accessible interior walls on each floor of the building).

Upon initial review of the proposed interior surface sampling protocol, the USEPA approved the use of sampling grid nodes with a surface area of 75 square meters (400 square feet). This sampling protocol encompassed the entire wall surface area for each floor, which on some floors extends more than 30 feet vertically. However, based on the definition of high-contact residential/commercial surface presented in §761.123, a request was made to the USEPA that the interior brick wall sampling area extents (and resulting grid node dimensions) be modified, and that the height of the sampling nodes be limited to 8 feet above the floor surface. The USEPA approved the sampling protocol modification request prior to commencement of the sampling activities in June 2015.

Since the interior wall sampling was applied to high-contact surfaces, the area of each wall sampling grid node was reduced to encompass an area of approximately 37 square meters. Therefore the dimensions of the sampling grid nodes measured approximately 2.4 meters (8 feet) vertically and approximately 15.24 meters (50 feet) horizontally. Based on the limited surface area available for certain wall areas, the overall coverage area for select nodes was less than 37 square meters. The lateral dimensions of each interior brick wall surface composite sampling nodes (plan view) for the basement/ground floor, 1st floor, mezzanine, 2nd floor, 3rd floor and 4th floor are shown on figures 5, 6, 7, 8, 9 and 10, respectively.

After the dimensions of the sampling nodes were marked in the field, a 1.2-meter by 1.2-meter (4-foot by 4-foot) grid was overlain onto each characterization sampling node, which resulted in approximately 26 potential sub-sample areas per node. The surface area extents of the interior brick wall surface composite sampling nodes as well as the sub-sample grid areas for the basement/ground floor, 1st floor, mezzanine, 2nd floor, 3rd floor and 4th floor are shown on figures 5, 6, 7, 8, 9 and 10, respectively. The sub-sample areas in which composite sub-sample cores were collected were selected using a digital random number generator (https://www.random.org/). Interior brick wall core samples and sub-sample locations were labeled sequentially in order of completion from where the sample was collected.

A decontaminated hammer drill was used as the primary method for the collection of the brick wall core samples. The interior brick wall core composite samples for each sampling grid node consisted of three (3) core sub-samples collected from sample points located within

each respective sampling grid node. Sufficient brick powder for laboratory analyses required the drilling of multiple cores (per sub-sample) adjacent to each other, all extending approximately 0.5 inch into the surface of the brick wall surface.

Each interior brick wall core composite sample consisted of equal volumes of brick powder from each of the three (3) core sub-samples, which was then transferred to pre-labeled sample containers. The interior brick wall core composite samples were transported under chain of custody procedures to AMRO and analyzed for PCBs by USEPA Method 3540C.

The interior brick wall characterization analytical results for all samples collected from the building interior (for all of the floor levels) indicate that all PCB concentrations are below the USEPA "High Occupancy" Cleanup Level of 1,000 ug/kg. The results of the PCB concentrations for the interior brick wall core composite samples for the basement, ground floor, 1st floor, mezzanine, 2nd floor, 3rd floor and 4th floor are presented on summary tables 4, 5, 6, 7, 8, 9 and 10, respectively.

Building Interior Concrete Floor Surface Sampling

Similar to the interior brick wall sampling activities, in-situ characterization sampling of the building interior concrete floors (a porous surface) was performed to assess PCB concentrations.

Concrete floor characterization sampling was performed pursuing a risk-based cleanup standard. The interior surface characterization activities (sampling scope, frequency and methodology) were performed in accordance with the established USEPA Standard Operating Procedure for Sampling Porous Surfaces for PCBs. Due to the lack of a known source area, the USEPA approved a modified interior surface sampling procedure for characterizing the basement concrete floor.

The modified basement concrete floor surface characterization sampling protocol consisted of collecting composite core samples from sampling grid nodes that cover a surface area of 75 square meters (~800 square feet). This resulted in sampling nodes with approximate dimensions of 8.6-meter by 8.6-meter. The basement concrete floor surface sampling grid is

shown on figure 11. Based on actual building dimensions, the overall coverage area for select nodes was less than 75 square meters.

The concrete floor surface characterization sampling protocol for the ground floor, 1st floor, mezzanine, 2nd floor, 3rd floor and 4th floor consisted of collecting composite core samples from sampling grid nodes that cover a surface area of 37 square meters (400 square feet). Based on the irregular shape of several of the floor areas, the dimensions of composite sample nodes for these levels vary per floor. After the dimensions of the sampling nodes were marked in the field, a 1.2-meter by 1.2-meter (4-foot by 4-foot) grid was overlain onto each characterization sampling node, which resulted in approximately 49 potential sub-sample areas. The surface area extents of the concrete floor surface composite sampling nodes as well as the respective sub-sample grid areas for the ground floor, 1st floor, mezzanine, 2nd floor, 3rd floor and 4th floor are shown on figures 11, 12, 13, 14, 15 and 16, respectively. The sub-sample areas in which composite sub-sample cores were collected were selected using a digital random number generator (https://www.random.org/). Concrete core sample locations were labeled sequentially in order of completion from where the sample was collected.

A decontaminated hammer drill was used as the primary method for the collection of the concrete samples. The concrete core composite samples for each sampling grid interval consisted of three (3) core sub-samples collected from sample points located within each respective sampling grid node. Sufficient concrete powder for laboratory analyses required the drilling of multiple cores (per sub-sample) adjacent to each other, all extending approximately 0.5 inch into the surface of the concrete slab.

Each concrete core composite sample consisted of equal volumes of concrete powder from each of the three (3) core sub-samples, and was then transferred to pre-labeled sample containers. The concrete core composite samples were transported under chain of custody procedures to AMRO and analyzed for PCBs by USEPA Method 3540C.

The concrete floor characterization analytical results for samples collected from all of the floor levels (above the basement level) indicate that all PCB concentrations are below the USEPA "High Occupancy" Cleanup Level of 1,000 ug/kg.

The concrete floor characterization analytical results for samples collected from the basement level indicate that all PCB concentrations are below the USEPA "High Occupancy" Cleanup Level of 1,000 ug/kg, with the exception of three locations (B1F-C – 1,400 ug/kg, B1F-L – 2,100 ug/kg and B1F-N – 1,700 ug/kg). The results of the PCB concentrations for the concrete floor core composite samples for the basement, ground floor, 1st floor, mezzanine, 2nd floor, 3rd floor and 4th floor are summarized on tables 4, 5, 6, 7, 8, 9 and 10, respectively.

AIR QUALITY ASSESSMENT

Due to the fact that PCBs are known to migrate into the indoor air, the USEPA recommended the collection of indoor air samples to characterize the indoor air quality.

From July 29-31, 2015, air sampling was performed at the Site. Indoor air sampling was performed on each floor of the building, and outdoor air sampling was performed within the work zone as well as at an ambient (background) sampling location. The pump operation locations for the air sampling activities are presented on figures 17, 18, 19, 20, 21 and 22.

The sampling method used to analyze the indoor air samples for PCBs was USEPA Method TO-10A - Determination of Pesticides and Polychlorinated Biphenyls in Ambient Air Using Low Volume Polyurethane Foam (PUF) Sampling Followed by Gas Chromatographic/Multi-Detector Detection (GC/MD). The sampling methodology has been formulated to meet the needs of common pesticide and PCB sampling in ambient air.

The air samples were collected using a continuous-flow sampling pump that provides a constant air flow ($\leq^{\pm}5\%$), is quiet and unobtrusive, and has a flow rate of 1 to 5 l/min (liters per minute). The samples were collected using pre-extracted PUF plugs and glass cartridges obtained from SKC, Inc. (SKC). The sample media to be used is SKC Product Number 226-124. All media received from SKC included a certification that states that the media meets the specifications of USEPA and American Society for Testing and Materials (ASTM) sampling methods, and that the media has been cleaned according to SKC proprietary procedures, and have passed a quality control check for background contamination. For each sample location, the air sampler was positioned in an unobstructed area at least 30 meters from

any obstacle to air flow. The PUF cartridge intake was positioned 1 to 2 meters above ground level. Cartridge height above ground was recorded on the Compendium Method TO-10A field test data sheet (FTDS). Copies of the FTDSs are included as an attachment.

After the PUF cartridge was correctly inserted and positioned, the power switch was turned on and the sampling began. The elapsed time meter was activated and the start time was recorded on the FTDS. The pumps were checked during the sampling process to assess if any abnormal conditions were discovered. Ambient temperatures and barometric pressures were measured and recorded periodically during the sampling procedure on the FTDS. The sampling entailed collection of a minimum of 1,000 liters of air. At the end of the sampling period the power was turned off, the PUF cartridge was removed from the sampler, wrapped with the original aluminum foil and placed in a sealed, labeled container for transport under blue ice ($<4^{o}C$), to the laboratory. One field blank was returned to the laboratory with the group of samples. The field blank was treated exactly like a sample except that no air was drawn through the cartridge. The samples were stored at $<4^{o}C$ or below until analyzed in the laboratory. As required extraction occurred within 7 days of sampling and analysis was performed within 40 days of extraction. It should be noted that one of the outdoor air samples (Work Zone 2) reacted in the laboratory during the extraction clean-up step. Therefore, no analytical results were derived from this air sample cartridge.

The air sample cartridges will be shipped under chain of custody to Phoenix Environmental Laboratories, Inc. (Phoenix) for analysis of PCBs by USEPA Method TO-10A. The quantities of PCBs in each sample were initially calculated by the analytical laboratory as micrograms per polyurethane foam (ug/PUF), and then converted to micrograms per cubic meter (ug/m^3) by dividing by the reported air volume to provide ambient concentrations. The laboratory analysis will report the PCB concentration with a minimum detection level of less than or equal to 0.250 ug/m^3. This will ensure that the air quality results can be compared to the USEPA air exposure level for PCBs of 0.450 ug/m^3.

The laboratory analytical results of the air sampling activities indicate that the PCB concentrations in all of the air samples collected are below the USEPA air exposure level for PCBs of 0.450 ug/m^3. The analytical results for the air samples are summarized on table 11.

REMEDIAL WASTE GENERATION SUMMARY

From the commencement of the Remedial Action field activities to date, waste streams generated at the Site consist of non-hazardous waste soil, TSCA hazardous waste soil, TSCA hazardous LNAPL, and decontamination waste.

The total volumes of each waste stream generated from/shipped from June 2014 until February 20, 2015, and transported offsite for disposal are:

1. TSCA Hazardous PCB Contaminated Soil - 4,045.4 tons
2. Non-Hazardous Waste Soil - 4,840.55 tons
3. TSCA Hazardous PCB Contaminated LNAPL – 14, 560 kilograms
   80 drums / ~4,400 gallons

No remedial activities were performed onsite from February 21, 2015 until May 8, 2015; excluding equipment decontamination activities (February and March) and equipment remobilization (May). On May 11, 2015, the active remedial action field activities resumed onsite. The approximate volume of each waste stream generated from/shipped from May 11, 2015 to date, and transported offsite for disposal are:

1. TSCA Hazardous PCB Contaminated Soil – approximately 3,072.74 tons
2. Non-Hazardous Waste Soil - approximately 4,389.59 tons
3. TSCA Hazardous PCB Contaminated LNAPL – None

PLANNED SCOPE OF WORK FOR CONTINUED RAWP ACTIVITIES

Supplemental Site Characterization Activities

The supplemental soil characterization activities are scheduled to commence on November 2, 2015. Following the completion of the supplemental soil characterization drilling activities and installation of the groundwater monitoring wells, the supplemental groundwater characterization activities will be performed at the Site.

The detailed descriptions of these activities are outlined in the Work Plan.

Continuation of Soil Excavation and Endpoint Confirmation Sampling

The onsite excavation and waste disposal activities are scheduled to continue throughout October. It is anticipated that the source area "hot spot" excavation activities in the area of the gate wells will be completed by the end of November. As per the RAWP, lateral extraction piping will be installed within the groundwater in the completed source area excavation prior to backfilling. This will facilitate future monitoring of the environmental conditions within this area.

Following verification that the PCB contamination within delineated areas has been encompassed within the respective completed extents excavations, endpoint confirmation sampling will be performed. Following receipt of the analytical results for endpoint confirmation samples, the respective excavations will be backfilled in accordance with the procedures and specifications as outlined in the NYSDEC approved RAWP.

Former Condensate Intake Tunnel Excavation Activities

Excavation activities associated with the former condensate intake tunnel will be expanded to encompass the remaining portion of the tunnel extending to the Gowanus Canal. This currently encompasses an area from the western extent of the exposed intake tunnel excavation extending approximately 65 feet to the west, terminating at the Gowanus Canal.

In order to minimize any potential risk of LNAPL discharge to the Gowanus Canal, 100 feet of harbor boom (containment boom) will be installed within the Gowanus Canal adjacent to the bulkhead. The harbor boom is manufactured with fully welded PCV. The boom consists of an upper portion (float) constructed with a 6" diameter solid foam flotation within the PCV covering and a weighted skirt which extends approximately 12" beneath the water surface. The boom is designed to contain oil spilled onto surface waters as well as to concentrate the oil so that recovery methods can be implemented more effectively.

This harbor boom will be installed within the Gowanus Canal starting at approximately 25 feet north of the current exposed portion of the intake tunnel, and will extend approximately 80 feet to the south. The 80-foot coverage length will allow for the boom to be positioned with catchment areas on both the northern and southern ends. The boom will serve as a preventa-

tive measure in the event there is an unintended discharge of LNAPL into the Gowanus Canal during the excavation of the remainder of the intake tunnel. This contingency measure will reduce the possibility of polluting the Gowanus Canal as well as surrounding properties located along the Gowanus Canal during the performance of the remaining intake tunnel excavation activities.

To facilitate the excavation of this remaining portion of the intake tunnel, the security fence on the southwestern perimeter of the property (overlying the remainder of the intake tunnel) will be removed to allow the additional excavation activities.

After the harbor boom is installed and the security fence is removed, soil excavation/ regrading activities will be performed to expose the remainder of the condensate intake tunnel. Once the remaining intake tunnel is exposed, the top portion of the concrete tunnel (the portion that is in contact with residual LNAPL) will be broken, removed and stockpiled for offsite disposal. The concrete will be added to the PCB contaminated hazardous waste soil stockpile(s) for disposal.

After all impacted concrete is broken and removed and the interior of the tunnel is cleaned, excavation activities will be expanded to include visually impacted soils located adjacent to the south and north of the tunnel.

Following the completion of the soil excavation activities, endpoint confirmation soil samples will be collected to assess the effectiveness of the excavation and dictate whether additional excavation is required. Endpoint confirmation samples that exhibit PCB concentrations of greater than or equal to 50 mg/kg will prompt expansion of the excavation extent(s) within practical limits and the resampling of modified endpoint confirmation sample(s).

Following verification that the PCB contamination within delineated areas has been effectively remediated within the extents of the respective completed excavations, endpoint confirmation sampling will be performed. After receipt of analytical results showing acceptable post-excavation PCB concentrations in the endpoint confirmation samples, the respective excavations will be backfilled in accordance with the procedures and specifications as outlined in the NYSDEC approved RAWP.

Basement Interior Surface Demolition and Decontamination Activities

Due to the PCB concentrations exceeding the USEPA "High Occupancy" Cleanup Level in the basement wall cores (2014 sampling locations BWC-4 and BWC-6) and the basement floor cores (B1F-C, B1F-L and B1F-N), the representative surface areas will be decontaminated. The surfaces will be sand blasted to remove the contaminated surface layer. Following sufficient decontamination (based on visual assessment of the wall surface), verification samples will be collected to verify its effectiveness. To the maximum extent practical, Engineering Controls (ECs) will be utilized during the performance of interior decontamination activities. This may consist of but not be limited to the use of physical barriers and the use of High Efficiency Particulate Arrestance (HEPA) ventilation equipment. Additionally, to the maximum extent practical, disposable equipment and materials including Personal Protective Equipment (PPE) will be used to reduce the amount of decontamination required. All material generated during the surface decontamination will be contained and will be stored in a dedicated stockpile within the building interior.

Based on the PCB concentrations detected in the surface coatings well as the core samples collected from the eastern walls of the concrete basement vaults, these structures will be removed. The concrete vaults will be demolished with a hydraulic breaker. The concrete demolition debris will be segregated in a designated stockpile within the building interior.

After the decontamination and demolition activities are completed, post-decontamination verification sampling will be performed as per the characterization sampling procedures and as outlined in the Work Plan.

The impacted concrete and brick material generated as a result of the decontamination and demolition activities will be managed as Bulk PCB Remediation Waste. Based on the "as-found" PCB concentrations, the basement brick wall surface decontamination waste (that will be generated during the surface decontamination of the BWC-4 and BWC-6 core sample areas) as well as the basement vault concrete demolition debris is considered non-hazardous for PCBs. Waste characterization samples will be collected from the waste stockpile for generating a waste profile and obtaining a waste disposal facility approval.

Basement Soil Vapor Barrier and Concrete Slab Installation

In addition to the vault demolition and surface decontamination activities that will be performed in the basement, the Remedial Action at the Site will incorporate a soil vapor barrier and new concrete slab in the basement of the building. This will function as an additional protective measure eliminating the exposure pathway to the underlying basement interior surfaces. The detailed descriptions of these activities are outlined in the Work Plan.

Determination of USEPA Approved Cap Specifications

Based on the results of the analytical results of the post-excavation soil confirmation samples, the USEPA will evaluate the appropriateness of the proposed soil covers throughout the Site. Based on input from the USEPA, final surface cover specifications will be developed for the Site.

PLANNED PROJECT COMPLETION DETAILS

The targeted completion date for the onsite remedial activities outlined in the RAWP is December 15, 2015.

Following completion of onsite activities, the Final Engineering Report (FER) and Site Management Plan (SMP) for the Site will be submitted to the NYSDEC for final review.

The FER will be prepared in conformance with DER-10 and will provide:

- documentation that the remedial work required under this RAWP has been completed and has been performed in compliance with the RAWP;
- a comprehensive account of the locations and characteristics of all material removed from the Site and surrounding properties including the surveyed map(s) of all sources;
- as-built drawings for all constructed elements, certifications, manifests, bills of lading as well as the complete SMP;
- a description of the changes in the remedial action from the elements provided in the RAWP and associated design documents;

- a tabular summary of all performance evaluation sampling results and all material characterization results and other sampling and chemical analysis performed as part of the remedial action;
- test results demonstrating that all mitigation and remedial systems are functioning properly;
- written and photographic documentation of all remedial work performed under this remedy;
- an itemized tabular description of actual costs incurred during all aspects of the remedial action;
- a thorough summary of all residual contamination left on the Site after the remedy is complete;
  - table that shows exceedances from 6 NYCRR Part 375 Restricted Use Soil Cleanup Objectives (RUSCOs) for Restricted Residential for all residual contamination (soil/fill) remaining at the Site after the remedial action;
- a map that shows the location and summarizes exceedances from 6 NYCRR Part 375 RUSCOs for Restricted Residential use with respect to all residual contamination (soil/fill) remaining at the Site after the remedial action;
- an explanation for why the residual contamination material was not removed as part of the remedial action; and,
- an accounting of all material removed from the Site, including excavated contaminated soil, historic fill, solid waste, hazardous waste, non-regulated material, fluids, waste manifests and facility approvals for receipt of the material.

After the remedial action scope of work contained within the NYSDEC RAWP and the USEPA Work Plan have been implemented, isolated areas of residual contamination will remain onsite. Under the NYSDEC BCP, an Environmental Easement (EE) is required when residual contamination is left onsite after the remedial action is complete. The EE renders the Site a Controlled Property and will provide an enforceable means of ensuring the continual and

proper management of residual contamination and protection of public health and the environment in perpetuity or until released in writing by NYSDEC. The EE will require that the grantor of the EE and the grantor's successors and assigns adhere to all Engineering Controls (ECs) and Institutional Controls (ICs) placed on this Site by this NYSDEC-approved remedy.

Long-term management of ECs/ICs as well as management of residual contamination will be executed under the Site-specific SMP. The SMP will describe required methods and procedures required to ensure compliance with all ECs and ICs that are necessary under the EE. The SMP is intended to provide a detailed description of the procedures required to manage residual contamination left in place at the Site and surrounding properties following completion of the remedial action in accordance with the BCA with the NYSDEC.

The table below presents estimates for targeted project schedule dates for implementation and completion of the Site remedial work outlined in the RAWP, as well as targeted deliverable submission dates required to achieve the Certificate of Completion for the Site under the NYSDEC BCP.

1	Continued Implementation of RAWP	October-December 2015
2	Finalize Specifications and Installation of USEPA Approved Site Cap	December 30, 2015
3	Complete Implementation of RAWP	February 15, 2016
4	Submission of Draft FER, SMP and EE	March 15, 2016
5	NYSDEC Review of Draft FER, SMP and EE	TBD
6	Submit Final FER, SMP and EE	May 1, 2016
7	NYSDEC Issuance of Certificate of Completion	TBD
8	Long-Term Site Management	TBD

LEGGETTE, BRASHEARS & GRAHAM, INC.

Sean Groszkowski, CPG
Associate Vice President

dmd
October 29, 2015
f:\reports\sive paget\gowanus\phase 4 - remedial action\usepa documents\project status summary letter and future scope\epa cleanup - remedial action status summary.docx

TABLES

TABLE 1

GOWANUS VILLAGE I, LLC
153 2ND STREET
BROOKLYN, KINGS COUNTY, NEW YORK
NYSDEC BCA SITE NO. C224099
INDEX NO. W2-1069-0506

Summary of Polychlorinated Biphenyls (PCBs)

Gate Well Source Area - Post-Excavation Endpoint Soil Samples

Sample ID	Lab Sample ID	Date Collected	Aroclor 1016 (ug/kg)	Aroclor 1221 (ug/kg)	Aroclor 1232 (ug/kg)	Aroclor 1242 (ug/kg)	Aroclor 1248 (ug/kg)	Aroclor 1254 (ug/kg)	Aroclor 1260 (ug/kg)	Total PCB (ug/kg)
Restricted Use Residential, Commercial, Restricted-Residential^			NE	NE	NE	NE	NE	NE	NE	1,000
EPA TSCA Hazardous Waste Classification			NE	NE	NE	NE	NE	NE	NE	50,000
NGW Bottom 1	1502010-01B	2/4/2015	<29	<29	<29	<29	<29	<29	57	**57**
NGW Bottom 2	1502010-02B	2/4/2015	<41	<41	<41	<41	<41	<41	<41	ND
NGW Bottom 3	1502010-03B	2/4/2015	<47	<47	<47	<47	<47	<47	570	570
NGW-4	1506074-01B	6/22/2015	<520	<520	<520	<520	<520	<520	**2,300**	**2,300**
SGW Bottom 1	1501055-01B	1/28/2015	<44	<44	<44	<44	<44	<44	210	210
SGW Bottom 2	1501055-02B	1/28/2015	<430	<430	<430	<430	<430	<430	**1,300**	**1,300**
SGW Bottom 3	1501055-03B	1/28/2015	<49	<49	<49	<49	<49	<49	<49	ND
SGW-4	1506074-02B	06/22/2015	<450	<450	<450	<450	<450	<450	<450	ND

Notes:
Bottom Samples Collected from approximate elevation of -4.00 Brooklyn datum

^	Soil cleanup objective same as EPA 'high occupancy' area cleanup level
ug/kg	micrograms per kilogram
ND	Substance not detected above laboratory reporting limit
NE	Criteria Not Established for Individual PCB Aroclors
Bold	Exceeds Restricted Use Residential, Commercial, Restricted-Residential Criteria
	Exceeds EPA TSCA Hazardous Waste Characterization

TABLE 2

GOWANUS VILLAGE I, LLC
153 2ND STREET
BROOKLYN, KINGS COUNTY, NEW YORK
NYSDEC BCA SITE NO. C224099
INDEX NO. W2-1069-0506

Summary of Polychlorinated Biphenyls (PCBs)

Southern Property Boundary - Post-Excavation Endpoint Soil Samples

Sample ID	Lab Sample ID	Sample Depth (ft bg)	Date Collected	Aroclor 1016 (ug/kg)	Aroclor 1221 (ug/kg)	Aroclor 1232 (ug/kg)	Aroclor 1242 (ug/kg)	Aroclor 1248 (ug/kg)	Aroclor 1254 (ug/kg)	Aroclor 1260 (ug/kg)	Total PCB (ug/kg)
Restricted Use Residential, Commercial, Restricted-Residential^				NE	NE	NE	NE	NE	NE	NE	1,000
EPA TSCA Hazardous Waste Classification				NE	NE	NE	NE	NE	NE	NE	50,000
SB-1A	1508017-01A	0.5	8/10/2015	<300	<300	<300	<300	<300	<300	**1,700**	**1,700**
SB-2A	1508017-03A		8/10/2015	**<3,000**	**<3,000**	**<3,000**	**<3,000**	**<3,000**	**<3,000**	**3,400**	**3,400**
SB-3A	1508017-05A		8/10/2015	<350	<350	<350	<350	<350	<350	760	760
SB-4A	1508017-07A		8/10/2015	<310	<310	<310	<310	<310	<310	<310	ND
SB-5A	1508017-09A		8/10/2015	<300	<300	<300	<300	<300	<300	**1,100**	**1,100**
SB-6A	1508017-11A		8/10/2015	<270	<270	<270	<270	<270	<270	830	830
SB-7A	1508017-13A		8/10/2015	<270	<270	<270	<270	<270	<270	<270	ND
SB-8A	1508017-15A		8/10/2015	<270	<270	<270	<270	<270	<270	<270	ND
SB-1B	1508017-02A	~3.0	8/10/2015	**<2,900**	**<2,900**	**<2,900**	**<2,900**	**<2,900**	**<2,900**	**12,000**	**12,000**
SB-2B	1508017-04A		8/10/2015	<370	<370	<370	<370	<370	<370	<370	ND
SB-3B	1508017-06A		8/10/2015	<390	<390	<390	<390	<390	<390	<390	ND
SB-4B	1508017-08A		8/10/2015	<380	<380	<380	<380	<380	<380	<380	ND
SB-5B	1508017-10A		8/10/2015	<380	<380	<380	<380	<380	<380	<380	ND
SB-6B	1508017-12A		8/10/2015	<290	<290	<290	<290	<290	<290	<290	ND
SB-7B	1508017-14A		8/10/2015	<300	<300	<300	<300	<300	<300	<300	ND
SB-8B	1508017-16A		08/10/2015	<300	<300	<300	<300	<300	<300	**1,200**	**1,200**

North of Intake Tunnel - Post-Excavation Endpoint Soil Samples

Sample ID	Lab Sample ID	Sample Depth (ft bg)	Date Collected	Aroclor 1016 (ug/kg)	Aroclor 1221 (ug/kg)	Aroclor 1232 (ug/kg)	Aroclor 1242 (ug/kg)	Aroclor 1248 (ug/kg)	Aroclor 1254 (ug/kg)	Aroclor 1260 (ug/kg)	Total PCB (ug/kg)
Restricted Use Residential, Commercial, Restricted-Residential^				NE	NE	NE	NE	NE	NE	NE	1,000
EPA TSCA Hazardous Waste Classification				NE	NE	NE	NE	NE	NE	NE	50,000
NIT-1A	1508026-01A	0.5	8/13/2015	<310	<310	<310	<310	<310	<310	<310	ND
NIT-2A	1508026-03A		8/13/2015	<340	<340	<340	<340	<340	<340	<340	ND
NIT-3A	1508026-05A		8/13/2015	<310	<310	<310	<310	<310	<310	**2,800**	**2,800**
NIT-4A	1508026-07A		8/13/2015	<280	<280	<280	<280	<280	<280	**2,500**	**2,500**
NIT-5A	1508026-09A		8/13/2015	<300	<300	<300	<300	<300	<300	<300	ND
NIT-1B	1508026-02A	~3.0	8/13/2015	<330	<330	<330	<330	<330	<330	<330	ND
NIT-2B	1508026-04A		8/13/2015	<270	<270	<270	<270	<270	<270	<270	ND
NIT-3B	1508026-06A		8/13/2015	<360	<360	<360	<360	<360	<360	<360	ND
NIT-4B	1508026-08A		8/13/2015	<310	<310	<310	<310	<310	<310	<310	ND
NIT-5B	1508026-10A		08/13/2015	<330	<330	<330	<330	<330	<330	<330	ND

Notes:

^	Soil cleanup objective same as EPA 'high occupancy' area cleanup level
ug/kg	micrograms per kilogram
ND	Substance not detected above laboratory reporting limit
NE	Criteria Not Established for Individual PCB Aroclors
Bold	Exceeds Restricted Use Residential, Commercial, Restricted-Residential Criteria
	Exceeds EPA TSCA Hazardous Waste Characterization

TABLE 3

GOWANUS VILLAGE I, LLC
153 2ND STREET
BROOKLYN, KINGS COUNTY, NEW YORK
NYSDEC BCA SITE NO. C224099
INDEX NO. W2-1069-0506

Building Interior Wall Surface - Bulk Wall Core Sampling for PCBs

LAB ID	Client Sample ID	Collection Date	Aroclor 1016 (ug/kg)	Aroclor 1221 (ug/kg)	Aroclor 1242 (ug/kg)	Aroclor 1248 (ug/kg)	Aroclor 1254 (ug/kg)	Aroclor 1260 (ug/kg)	Aroclor 1262 (ug/kg)	Aroclor 1268 (ug/kg)	Total PCB (ug/kg)
EPA 'High Occupancy' Cleanup Level (Unconditional)			NE	NE	NE	NE	NE	NE	NE	NE	≤1,000
EPA 'High Occupancy' Cleanup Level (Self-Implemented Cleanup with Cap			NE	NE	NE	NE	NE	NE	NE	NE	≤10,000
1403075-01A	BWC-1	03/26/2014	ND	ND	ND	ND	ND	780	ND	ND	780
1403075-02A	BWC-2	03/26/2014	ND	ND	ND	ND	ND	600	ND	ND	600
1403075-03A	BWC-3	03/26/2014	ND	ND	ND	ND	ND	350	ND	ND	350
1403075-04A	BWC-4	03/26/2014	ND	ND	ND	ND	ND	2,700	ND	ND	**2,700**
1403075-05A	BWC-5	03/26/2014	ND	ND	ND	ND	ND	390	ND	ND	390
1403075-06A	BWC-6	03/26/2014	ND	ND	ND	ND	ND	3,700	ND	ND	**3,700**
1403075-07A	BWC-7	03/26/2014	ND	ND	ND	ND	ND	ND	ND	ND	ND
1403075-08A	BWC-8	03/26/2014	ND	ND	ND	ND	ND	ND	ND	ND	ND
1403075-09A	BWC-9	03/26/2014	ND	ND	ND	ND	ND	ND	ND	ND	ND
1403075-10A	BWC-10	03/26/2014	ND	ND	ND	ND	ND	ND	ND	ND	ND
1403075-11A	BWC-11	03/26/2014	ND	ND	ND	ND	ND	ND	ND	ND	ND
1403075-12A	BWC-12	03/26/2014	ND	ND	ND	ND	ND	ND	ND	ND	ND
1403075-13A	BWC-13	03/27/2014	ND	ND	ND	ND	ND	ND	ND	ND	ND
1403075-14A	BWC-14	03/27/2014	ND	ND	ND	ND	ND	ND	ND	ND	ND
1403075-15A	BWC-15	03/27/2014	ND	ND	ND	ND	ND	ND	ND	ND	ND
1403075-16A	BWC-16	03/27/2014	ND	ND	ND	ND	ND	ND	ND	ND	ND
1403075-17A	BWC-17	03/27/2014	ND	ND	ND	ND	ND	ND	ND	ND	ND
1403075-18A	BWC-18	03/27/2014	ND	ND	ND	ND	ND	ND	ND	ND	ND
1403075-19A	BWC-19	03/27/2014	ND	ND	ND	ND	ND	ND	ND	ND	ND
1403075-20A	BWC-20	03/27/2014	ND	ND	ND	ND	ND	ND	ND	ND	ND
1403075-21A	BWC-21	03/27/2014	ND	ND	ND	ND	ND	ND	ND	ND	ND
1403075-22A	BWC-22	03/27/2014	ND	ND	ND	ND	ND	ND	ND	ND	ND
1403075-23A	BWC-23	03/27/2014	ND	ND	ND	ND	ND	460	ND	ND	460
1403075-24A	BWC-24	03/27/2014	ND	ND	ND	ND	ND	ND	ND	ND	ND
1403075-25A	BWC-25	03/27/2014	ND	ND	ND	ND	ND	ND	ND	ND	ND
1403074-01A	BWC-VN	03/27/2014	ND	ND	ND	ND	ND	ND	ND	ND	ND
1403074-02A	BWC-VS	03/27/2014	ND	ND	ND	ND	ND	ND	ND	ND	ND
1310063-01A - North Wall Characterization (Coating)		10/21/2013	ND	ND	ND	ND	ND	12,000	ND	ND	**12,000**
1310063-02A - South Wall Characterization (Coating)		10/21/2013	ND	ND	ND	ND	ND	2,400	ND	ND	**2,400**

Notes:

^	Soil cleanup objective same as EPA 'high occupancy' area cleanup level
ug/kg	micrograms per kilogram
ND	Substance not detected above laboratory reporting limit
NE	Criteria Not Established for Individual PCB Aroclors
---	Information not available at time of reporting
Bold	Exceeds EPA 'High Occupancy' Cleanup Level (Unconditional)
	Exceeds EPA 'High Occupancy' Cleanup Level (Self-Implemented Cleanup with Cap)

TABLE 4

GOWANUS VILLAGE I, LLC
153 2ND STREET
BROOKLYN, KINGS COUNTY, NEW YORK
NYSDEC BCA SITE NO. C224099
INDEX NO. W2-1069-0506

Basement Building Interior Surfaces - Bulk Wall Core Sampling for PCBs

LAB ID	Concrete Core Sampling Location	Client Sample ID	Collection Date	Aroclor 1016 (ug/kg)	Aroclor 1221 (ug/kg)	Aroclor 1242 (ug/kg)	Aroclor 1248 (ug/kg)	Aroclor 1254 (ug/kg)	Aroclor 1260 (ug/kg)	Aroclor 1262 (ug/kg)	Aroclor 1268 (ug/kg)	Total PCB (ug/kg)
EPA 'High Occupancy' Cleanup Level (Unconditional)				NE	NE	NE	NE	NE	NE	NE	NE	≤1,000
EPA 'High Occupancy' Cleanup Level (Self-Implemented Cleanup with Cap				NE	NE	NE	NE	NE	NE	NE	NE	≤10,000
1506088-01A	Wall Cores	B1-A	06/23/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506088-02A		B1-B	06/23/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506083-01A		B2-A	06/23/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506083-02A		B2-B	06/23/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506083-03A		B2-C	06/23/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506083-04A		B2-D	06/23/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506083-05A		B2-E	06/23/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506083-06A		Field Duplicate	06/23/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506088-03A		B1F-A	06/24/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506088-04A		B1F-B	06/24/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506088-05A		B1F-C	06/24/2015	ND	ND	ND	ND	ND	1,400	ND	ND	**1,400**
1506088-06A		B1F-D	06/24/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506088-07A		B1F-E	06/24/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506088-08A		B1F-F	06/24/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506088-09A		B1F-G	06/25/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506088-10A		B1F-H	06/25/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506088-11A		B1F-I	06/25/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506088-12A		B1F-J	06/25/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506088-13A		B1F-K	06/25/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506088-14A		B1F-L	06/25/2015	ND	ND	ND	ND	ND	2,100	ND	ND	**2,100**
1506088-15A		B1F-M	06/25/2015	ND	ND	ND	ND	ND	470	ND	ND	470
1506088-16A		B1F-N	06/25/2015	ND	ND	ND	ND	ND	1,700	ND	ND	**1,700**
1506088-17A		B1F-O	06/25/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506088-18A		B1F-P	06/25/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506088-19A		B1F-Q	06/25/2015	ND	ND	ND	ND	ND	690	ND	ND	690
1506088-20A		B1F-R	06/25/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506088-21A		Field Duplicate	06/25/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND

Notes:

^	Soil cleanup objective same as EPA 'high occupancy' area cleanup level
ug/kg	micrograms per kilogram
ND	Substance not detected above laboratory reporting limit
NE	Criteria Not Established for Individual PCB Aroclors
---	Information not available at time of reporting
Bold	Exceeds EPA 'High Occupancy' Cleanup Level (Unconditional)
	Exceeds EPA 'High Occupancy' Cleanup Level (Self-Implemented Cleanup with Cap)

TABLE 5

GOWANUS VILLAGE I, LLC
153 2ND STREET
BROOKLYN, KINGS COUNTY, NEW YORK
NYSDEC BCA SITE NO. C224099
INDEX NO. W2-1069-0506

Ground Floor Building Interior Surfaces - Bulk Wall Core Sampling for PCBs

LAB ID	Concrete Core Sampling Location	Client Sample ID	Collection Date	Aroclor 1016 (ug/kg)	Aroclor 1221 (ug/kg)	Aroclor 1242 (ug/kg)	Aroclor 1248 (ug/kg)	Aroclor 1254 (ug/kg)	Aroclor 1260 (ug/kg)	Aroclor 1262 (ug/kg)	Aroclor 1268 (ug/kg)	Total PCB (ug/kg)
EPA 'High Occupancy' Cleanup Level (Unconditional)				NE	NE	NE	NE	NE	NE	NE	NE	≤1,000
EPA 'High Occupancy' Cleanup Level (Self-Implemented Cleanup with Cap				NE	NE	NE	NE	NE	NE	NE	NE	≤10,000
1506088-01A	Wall Core Samples	B1-A	06/23/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506088-02A		B1-B	06/23/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1507033-27A	Floor Core Samples	G1F-A	07/09/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1507033-28A		G1F-B	07/09/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1507033-29A		G1F-C	07/09/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1507033-30A		G1F-D	07/09/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND

Notes:

^	Soil cleanup objective same as EPA 'high occupancy' area cleanup level
ug/kg	micrograms per kilogram
ND	Substance not detected above laboratory reporting limit
NE	Criteria Not Established for Individual PCB Aroclors
---	Information not available at time of reporting
Bold	Exceeds EPA 'High Occupancy' Cleanup Level (Unconditional)
	Exceeds EPA 'High Occupancy' Cleanup Level (Self-Implemented Cleanup with Cap)

TABLE 6

GOWANUS VILLAGE I, LLC
153 2ND STREET
BROOKLYN, KINGS COUNTY, NEW YORK
NYSDEC BCA SITE NO. C224099
INDEX NO. W2-1069-0506

1st Floor Building Interior Surfaces - Bulk Wall Core Sampling for PCBs

LAB ID	Concrete Core Sampling Location	Client Sample ID	Collection Date	Aroclor 1016 (ug/kg)	Aroclor 1221 (ug/kg)	Aroclor 1242 (ug/kg)	Aroclor 1248 (ug/kg)	Aroclor 1254 (ug/kg)	Aroclor 1260 (ug/kg)	Aroclor 1262 (ug/kg)	Aroclor 1268 (ug/kg)	Total PCB (ug/kg)
EPA 'High Occupancy' Cleanup Level (Unconditional)				NE	NE	NE	NE	NE	NE	NE	NE	≤1,000
EPA 'High Occupancy' Cleanup Level (Self-Implemented Cleanup with Cap				NE	NE	NE	NE	NE	NE	NE	NE	≤10,000
1506068-40A	Wall Core Samples	FL1-A	06/18/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506068-41A		FL1-B	06/18/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506068-42A		FL1-C	06/18/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506068-43A		FL1-D	06/18/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506068-44A		FL1-E	06/18/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506075-12A		FL1-F	06/19/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506075-13A		FL1-G	06/19/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506075-14A		FL1-H	06/19/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506075-15A		FL1-I	06/19/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506075-16A		FL1-J	06/19/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506075-17A		FL1-K	06/19/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506075-18A		FL1-L	06/19/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506075-19A		FL1-M	06/19/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506075-20A		FL1-N	06/19/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506075-21A		FL1-O	06/19/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1507033-23A	Floor Core Samples	FL1F-A	07/08/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1507033-24A		FL1F-B	07/08/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1507033-25A		FL1F-C	07/08/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1507033-26A		FL1F-D	07/09/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND

Notes:

^	Soil cleanup objective same as EPA 'high occupancy' area cleanup level
ug/kg	micrograms per kilogram
ND	Substance not detected above laboratory reporting limit
NE	Criteria Not Established for Individual PCB Aroclors
---	Information not available at time of reporting
Bold	Exceeds EPA 'High Occupancy' Cleanup Level (Unconditional)
	Exceeds EPA 'High Occupancy' Cleanup Level (Self-Implemented Cleanup with Cap)

TABLE 7

GOWANUS VILLAGE I, LLC
153 2ND STREET
BROOKLYN, KINGS COUNTY, NEW YORK
NYSDEC BCA SITE NO. C224099
INDEX NO. W2-1069-0506

Mezzanine Building Interior Surfaces - Bulk Wall Core Sampling for PCBs

LAB ID	Concrete Core Sampling Location	Client Sample ID	Collection Date	Aroclor 1016 (ug/kg)	Aroclor 1221 (ug/kg)	Aroclor 1242 (ug/kg)	Aroclor 1248 (ug/kg)	Aroclor 1254 (ug/kg)	Aroclor 1260 (ug/kg)	Aroclor 1262 (ug/kg)	Aroclor 1268 (ug/kg)	Total PCB (ug/kg)
EPA 'High Occupancy' Cleanup Level (Unconditional)				NE	NE	NE	NE	NE	NE	NE	NE	≤1,000
EPA 'High Occupancy' Cleanup Level (Self-Implemented Cleanup with Cap				NE	NE	NE	NE	NE	NE	NE	NE	≤10,000
1506075-01A	Wall Core Samples	MZ1-A	06/18/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506075-02A		MZ1-B	06/22/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506075-03A		MZ1-C	06/22/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506075-04A		MZ1-D	06/22/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506075-05A		MZ1-E	06/22/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506075-06A		MZ1-F	06/22/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506075-07A		MZ1-G	06/22/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506075-08A		MZ1-H	06/22/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506075-09A		MZ1-I	06/22/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506075-10A		MZ1-J	06/18/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506075-11A		MZ1-K	06/22/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1507033-11A	Floor Core Samples	MZ1F-A	07/08/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1507033-12A		MZ1F-B	07/08/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1507033-13A		MZ1F-C	07/08/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1507033-14A		MZ1F-D	07/08/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1507033-15A		MZ1F-E	07/08/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1507033-16A		MZ1F-F	07/08/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1507033-17A		MZ1F-G	07/08/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1507033-18A		MZ1F-H	07/08/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1507033-19A		MZ1F-I	07/08/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1507033-20A		MZ1F-J	07/08/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1507033-21A		MZ1F-K	07/08/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1507033-22A		MZ1F-L	07/08/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND

Notes:

^	Soil cleanup objective same as EPA 'high occupancy' area cleanup level
ug/kg	micrograms per kilogram
ND	Substance not detected above laboratory reporting limit
NE	Criteria Not Established for Individual PCB Aroclors
---	Information not available at time of reporting
Bold	Exceeds EPA 'High Occupancy' Cleanup Level (Unconditional)
	Exceeds EPA 'High Occupancy' Cleanup Level (Self-Implemented Cleanup with Cap)

TABLE 8

GOWANUS VILLAGE I, LLC
153 2ND STREET
BROOKLYN, KINGS COUNTY, NEW YORK
NYSDEC BCA SITE NO. C224099
INDEX NO. W2-1069-0506

2nd Floor Building Interior Surfaces - Bulk Wall Core Sampling for PCBs

LAB ID	Concrete Core Sampling Location	Client Sample ID	Collection Date	Aroclor 1016 (ug/kg)	Aroclor 1221 (ug/kg)	Aroclor 1242 (ug/kg)	Aroclor 1248 (ug/kg)	Aroclor 1254 (ug/kg)	Aroclor 1260 (ug/kg)	Aroclor 1262 (ug/kg)	Aroclor 1268 (ug/kg)	Total PCB (ug/kg)
EPA 'High Occupancy' Cleanup Level (Unconditional)				NE	NE	NE	NE	NE	NE	NE	NE	≤1,000
EPA 'High Occupancy' Cleanup Level (Self-Implemented Cleanup with Cap				NE	NE	NE	NE	NE	NE	NE	NE	≤10,000
1506068-27A	Wall Core Samples	FL2-A	06/16/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506068-28A		FL2-B	06/16/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506068-29A		FL2-C	06/16/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506068-30A		FL2-D	06/16/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506068-31A		FL2-E	06/16/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506068-32A		FL2-F	06/16/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506068-33A		FL2-G	06/16/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506068-34A		FL2-H	06/16/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506068-35A		FL2-I	06/16/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506068-36A		FL2-J	06/17/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506068-37A		FL2-K	06/17/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506068-38A		FL2-L	06/17/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506068-39A		FL2-M	06/17/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1507011-01A	Floor Core Samples	FL2F-A	07/01/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1507011-02A		FL2F-B	07/01/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1507011-03A		FL2F-C	07/01/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1507011-04A		FL2F-D	07/01/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1507011-05A		FL2F-E	07/01/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1507011-06A		FL2F-F	07/01/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1507011-07A		FL2F-G	07/01/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1507011-08A		FL2F-H	07/01/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND

Notes:

^	Soil cleanup objective same as EPA 'high occupancy' area cleanup level
ug/kg	micrograms per kilogram
ND	Substance not detected above laboratory reporting limit
NE	Criteria Not Established for Individual PCB Aroclors
---	Information not available at time of reporting
Bold	Exceeds EPA 'High Occupancy' Cleanup Level (Unconditional)
	Exceeds EPA 'High Occupancy' Cleanup Level (Self-Implemented Cleanup with Cap)

TABLE 9

GOWANUS VILLAGE I, LLC
153 2ND STREET
BROOKLYN, KINGS COUNTY, NEW YORK
NYSDEC BCA SITE NO. C224099
INDEX NO. W2-1069-0506

3rd Floor Building Interior Surfaces - Bulk Wall Core Sampling for PCBs

LAB ID	Concrete Core Sampling Location	Client Sample ID	Collection Date	Aroclor 1016 (ug/kg)	Aroclor 1221 (ug/kg)	Aroclor 1242 (ug/kg)	Aroclor 1248 (ug/kg)	Aroclor 1254 (ug/kg)	Aroclor 1260 (ug/kg)	Aroclor 1262 (ug/kg)	Aroclor 1268 (ug/kg)	Total PCB (ug/kg)
EPA 'High Occupancy' Cleanup Level (Unconditional)				NE	NE	NE	NE	NE	NE	NE	NE	≤1,000
EPA 'High Occupancy' Cleanup Level (Self-Implemented Cleanup with Cap				NE	NE	NE	NE	NE	NE	NE	NE	≤10,000
1506068-10A	Wall Core Samples	FL3-A	06/10/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506068-11A		FL3-B	06/10/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506068-12A		FL3-C	06/11/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506068-13A		FL3-D	06/11/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506068-14A		FL3-E	06/11/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506068-15A		FL3-F	06/11/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506068-16A		FL3-G	06/11/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506068-17A		FL3-H	06/11/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506068-18A		FL3-I	06/12/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506068-19A		FL3-J	06/12/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506068-20A		FL3-K	06/12/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506068-21A		FL3-L	06/12/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506068-22A		FL3-M	06/12/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506068-23A		FL3-N	06/12/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506068-24A		FL3-O	06/12/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506068-25A		FL3-P	06/12/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506068-26A		FL3-Q	06/12/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1507016-01A	Floor Core Samples	FL3F-A	07/06/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1507016-02A		FL3F-B	07/06/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1507016-03A		FL3F-C	07/06/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1507016-04A		FL3F-D	07/06/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1507016-05A		FL3F-E	07/06/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1507016-06A		FL3F-F	07/06/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1507016-07A		FL3F-G	07/06/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND

Notes:

^	Soil cleanup objective same as EPA 'high occupancy' area cleanup level
ug/kg	micrograms per kilogram
ND	Substance not detected above laboratory reporting limit
NE	Criteria Not Established for Individual PCB Aroclors
---	Information not available at time of reporting
Bold	Exceeds EPA 'High Occupancy' Cleanup Level (Unconditional)
	Exceeds EPA 'High Occupancy' Cleanup Level (Self-Implemented Cleanup with Cap)

TABLE 10

GOWANUS VILLAGE I, LLC
153 2ND STREET
BROOKLYN, KINGS COUNTY, NEW YORK
NYSDEC BCA SITE NO. C224099
INDEX NO. W2-1069-0506

4th Floor Building Interior Surfaces - Bulk Wall Core Sampling for PCBs

LAB ID	Concrete Core Sampling Location	Client Sample ID	Collection Date	Aroclor 1016 (ug/kg)	Aroclor 1221 (ug/kg)	Aroclor 1242 (ug/kg)	Aroclor 1248 (ug/kg)	Aroclor 1254 (ug/kg)	Aroclor 1260 (ug/kg)	Aroclor 1262 (ug/kg)	Aroclor 1268 (ug/kg)	Total PCB (ug/kg)
EPA 'High Occupancy' Cleanup Level (Unconditional)				NE	NE	NE	NE	NE	NE	NE	NE	≤1,000
EPA 'High Occupancy' Cleanup Level (Self-Implemented Cleanup with Cap				NE	NE	NE	NE	NE	NE	NE	NE	≤10,000
1506068-01A	Wall Core Samples	FL4-A	06/11/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506068-02A		FL4-B	06/11/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506068-03A		FL4-C	06/12/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506068-04A		FL4-D	06/12/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506068-05A		FL4-E	06/12/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506068-06A		FL4-F	06/12/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506068-07A		FL4-G	06/16/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506068-08A		FL4-H	06/16/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1506068-09A		FL4-I	06/16/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1507016-08A	Floor Core Samples	FL4F-A	07/06/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1507016-09A		FL4F-B	07/06/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1507016-10A		FL4F-C	07/06/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1507033-01A		FL4F-D	07/07/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1507033-02A		FL4F-E	07/07/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1507033-03A		FL4F-F	07/07/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1507033-04A		FL4F-G	07/07/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1507033-05A		FL4F-H	07/07/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1507033-06A		FL4F-I	07/07/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1507033-07A		FL4F-J	07/07/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND
1507033-10A		Field Duplicate	07/07/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND

Notes:

^	Soil cleanup objective same as EPA 'high occupancy' area cleanup level
ug/kg	micrograms per kilogram
ND	Substance not detected above laboratory reporting limit
NE	Criteria Not Established for Individual PCB Aroclors
---	Information not available at time of reporting
Bold	Exceeds EPA 'High Occupancy' Cleanup Level (Unconditional)
	Exceeds EPA 'High Occupancy' Cleanup Level (Self-Implemented Cleanup with Cap)

TABLE 11

GOWANUS VILLAGE I, LLC
153 2ND STREET
BROOKLYN, KINGS COUNTY, NEW YORK
NYSDEC BCA SITE NO. C224099
INDEX NO. W2-1069-0506

PCB Air Sampling - PUF Cartridges

LAB ID	Sampling Location	Client Sample ID	Collection Date	Aroclor 1016 (ug/m^3)	Aroclor 1221 (ug/m^3)	Aroclor 1232 (ug/m^3)	Aroclor 1242 (ug/m^3)	Aroclor 1248 (ug/m^3)	Aroclor 1254 (ug/m^3)	Aroclor 1260 (ug/m^3)	Aroclor 1262 (ug/m^3)	Aroclor 1268 (ug/m^3)	Total PCB (ug/m^3)
USEPA air exposure level for PCBs *				0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
67304	Indoor Air	Basement Air	07/31/2015	< 0.082	< 0.082	< 0.082	< 0.082	< 0.082	0.32	< 0.082	< 0.082	< 0.082	0.320
67305		FL1 Air	07/30/2015	< 0.084	< 0.084	< 0.084	< 0.084	< 0.084	0.19	< 0.084	< 0.084	< 0.084	0.190
67306		FL2 Air	07/30/2015	< 0.081	< 0.081	< 0.081	< 0.081	< 0.081	< 0.081	< 0.081	< 0.081	< 0.081	ND
67307		FL3 Air	07/29/2015	< 0.079	< 0.079	< 0.079	< 0.079	< 0.079	< 0.079	< 0.079	< 0.079	< 0.079	ND
67308		FL4 Air	07/29/2015	< 0.077	< 0.077	< 0.077	< 0.077	< 0.077	< 0.077	< 0.077	< 0.077	< 0.077	ND
67302	Outdoor Air	Work Zone Air 1	07/30/2015	< 0.082	< 0.082	< 0.082	< 0.082	< 0.082	0.092	< 0.082	< 0.082	< 0.082	0.092
67303 **		Work Zone Air 2	07/31/2015	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
67300		Offsite Air 1	07/29/2015	< 0.077	< 0.077	< 0.077	< 0.077	< 0.077	< 0.077	< 0.077	< 0.077	< 0.077	ND
67301		Offsite Air 2	07/31/2015	< 0.082	< 0.082	< 0.082	< 0.082	< 0.082	< 0.082	< 0.082	< 0.082	< 0.082	ND
67309	QA/QC	Field Blank	07/31/2015	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	ND

Notes:

ug/m^3	micrograms per cubic meter
ND	Substance not detected above laboratory reporting limit
NS	No Sampling Data Generated
Bold	Exceeds USEPA air exposure level for PCBs
*	OSHA's PEL is 1,000 µg/m3 for PCB mixtures 42% chlorinated and 500 µg/m3 for compounds 54% chlorinated.
**	During the extraction clean-up step sample with Phoenix Lab ID BJ67303 (Work Zone Air 2) reacted and there is no extract for analyses

FIGURES

LEGEND

PROPERTY BOUNDARY

NOTES:
AERIAL PHOTOGRAPH COLLECTED AUGUST, 2015. GEOREFERENCED USING ARCGIS 10.3,
APPROXIMATE LOCATIONS FOR DISPLAY USE ONLY.
NOT FOR USE AS SITE SURVEY.

0 20
SCALE IN FEET

GOWANUS VILLAGE I, LLC
153 2ND STREET
BROOKLYN, KINGS COUNTY, NEW YORK
NYSDEC BCA SITE NO. C224099
INDEX NO. W2-1069-0506

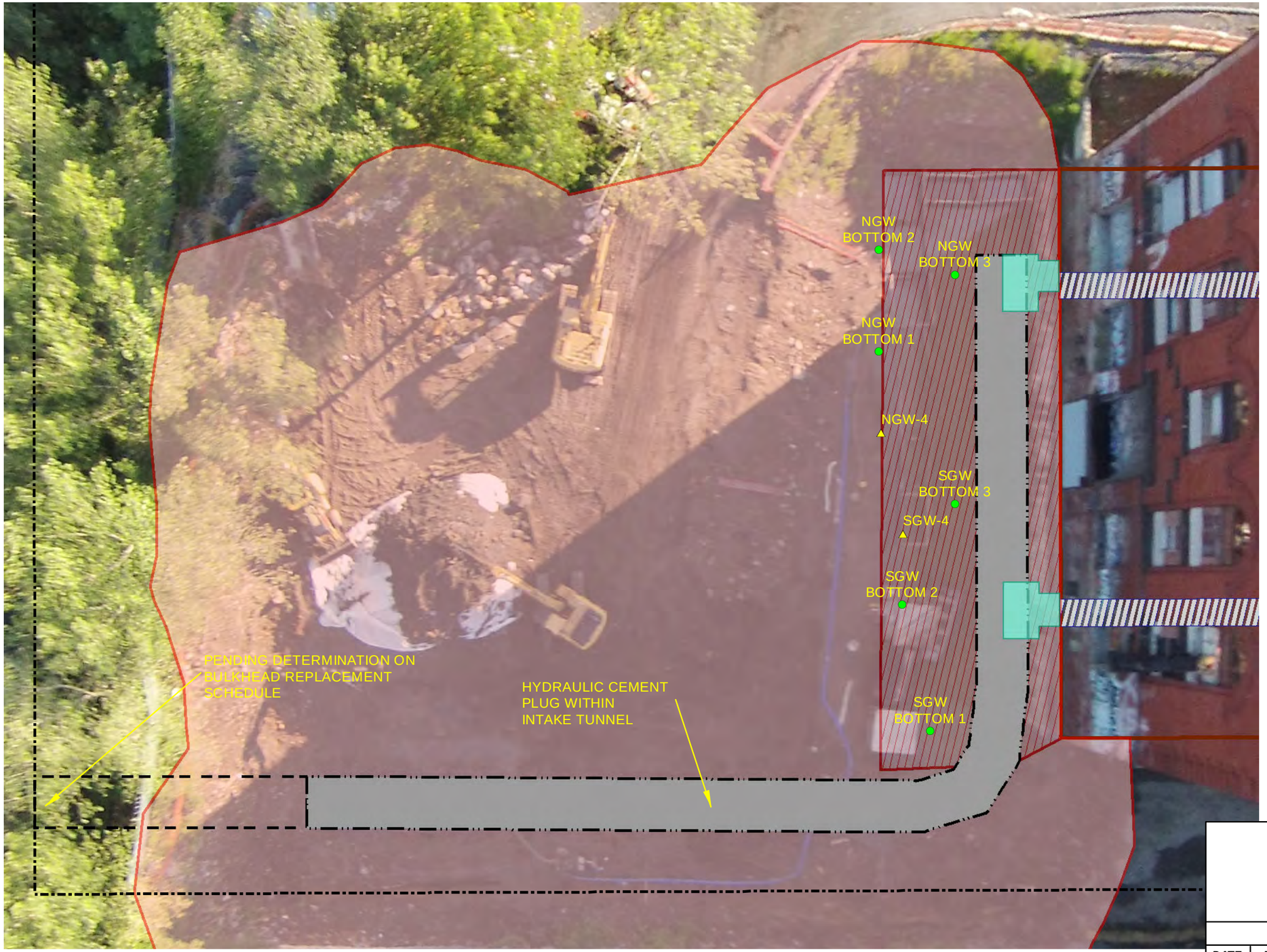
Site Conditions - August 12, 2015

DATE	REVISED

PREPARED BY:
LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Groundwater and Environmental Engineering Services
4 Westchester Park Drive
Suite 175
White Plains, New York 10604
(914) 438-9567

DRAWN: SL | CHECKED: SG | DATE: 8/13/15 | FIGURE: 1

Document Path: C:\Users\slong\Documents\SML_projects\GowanusGIS\Maps_local\Figure 1 - Aerial - 8-12-15.mxd



LEGEND

- BOTTOM CONFIRMATION SOIL SAMPLE
- SIDEWALL CONFIRMATION SOIL SAMPLE
- PROPERTY BOUNDARY
- EXISTING BUILDING FOOTPRINT
- EXCAVATION EXTENTS (AUGUST 2015)
- COMPLETED SOURCE AREA EXCAVATION EXTENT (BELOW WATER-TABLE)
- GATE WELLS (APPROX.)
- EXPOSED INTAKE TUNNEL (SEALED 2014)
- ASSUMED PATH OF INTAKE TUNNEL (NOT EXPOSED)
- CONDENSATE TUNNELS BENEATH BUILDING SLAB (APPROX.)

N E S W

NOTES:
AERIAL PHOTOGRAPH COLLECTED BY LBG, AUGUST, 2015, USING DRONE. GEOREFERENCED USING ARCGIS 10.3, APPROXIMATE LOCATIONS FOR DISPLAY USE ONLY.
NOT FOR USE AS SITE SURVEY.

0 20
SCALE IN FEET

GOWANUS VILLAGE, LLC
153 2ND STREET
BROOKLYN, KINGS COUNTY, NEW YORK
NYSDEC BCA SITE NO. C224099
INDEX NO. W2-1069-0506

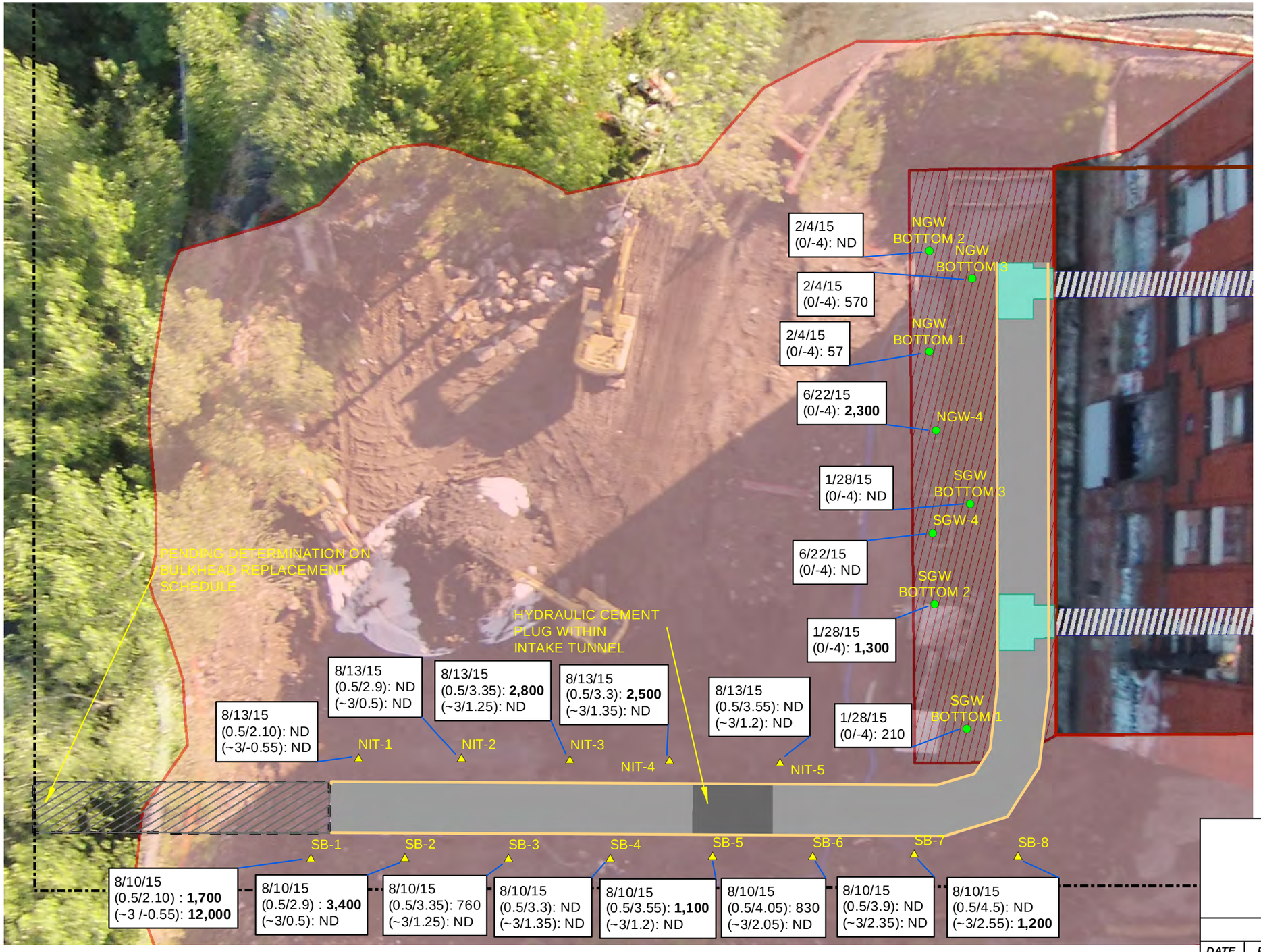
Extent of Excavation Activities

DATE	REVISED

PREPARED BY:
LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Groundwater and Environmental Engineering Services
4 Westchester Park Drive
Suite 175
White Plains, New York 10604
(914) 438-9567

DRAWN: SL | CHECKED: SG | DATE: 8/13/15 | FIGURE: 2

Document Path: C:\Users\slong\Documents\SML_projects\GowanusGIS\Maps_local\Figure 2 - Extent of Excavation Activities.mxd



LEGEND

- BOTTOM CONFIRMATION SOIL SAMPLE
- SIDEWALL CONFIRMATION SOIL SAMPLE
- PROPERTY BOUNDARY
- EXISTING BUILDING FOOTPRINT
- EXCAVATION EXTENTS (AUGUST 2015)
- COMPLETED SOURCE AREA EXCAVATION EXTENT (~4 FT BELOW STATIC GW TABLE)
- GATE WELLS (APPROX.)
- EXPOSED/BROKEN/CLEANED INTAKE TUNNEL
- ASSUMED PATH OF INTAKE TUNNEL (NOT EXPOSED)
- TIMBER SHORING CONTAINING INTAKE TUNNEL
- CONDENSATE TUNNELS BENEATH BUILDING SLAB (APPROX.)

ABBREVIATIONS

PCBs: Polychlorinated biphenyls
ND: Not detected above laboratory reporting limit
ug/kg: Micrograms per kilogram
ft AD: Feet above datum (Brooklyn Datum)
ft bg: Feet below surface grade

8/10/15 (0.5/2.9): ND (~3/0.5): **1,200**

Sample date

Concentration (ug/kg)
***BOLD** text: exceeds restricted use residential, commercial, restricted-residential criteria*

Sample elevation (ft AD)

Sample depth (ft bg)

NOTES:
AERIAL PHOTOGRAPH COLLECTED AUGUST, 2015. GEOREFERENCED USING ARCGIS 10.3,
APPROXIMATE LOCATIONS FOR DISPLAY USE ONLY.
NOT FOR USE AS SITE SURVEY.

N E S W

0 20
SCALE IN FEET

GOWANUS VILLAGE, LLC
153 2ND STREET
BROOKLYN, KINGS COUNTY, NEW YORK
NYSDEC BCA SITE NO. C224099
INDEX NO. W2-1069-0506

Endpoint Confirmation Soil Sample Results - Total PCBs

DATE	REVISED	PREPARED BY: LEGGETTE, BRASHEARS & GRAHAM, INC. Professional Groundwater and Environmental Engineering Services, 4 Westchester Park Drive, Suite 175, White Plains, New York 10604, (914) 438-9567		
DRAWN: SL		CHECKED: SG	DATE: 8/24/15	FIGURE: 3

Document Path: C:\Users\slong\Documents\SML_projects\GowanusVillage\GIS\Maps_local\Figure 3 - Endpoint Confirmation Samples.mxd

LEGEND

PROPERTY BOUNDARY

EXISTING BUILDING FOOTPRINT

INTERIOR WALL SURFACE CORE SAMPLE LOCATIONS (SAMPLES COLLECTED 2014)

NOTES:
PCB = POLYCHLORINATED BIPHENYLS
PPM = PARTS PER MILLION

SERVICE LAYER CREDITS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, I-CUBED, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEX, GETMAPPING, AEROGRID, IGN, IGP, SWISSTOPO, AND THE GIS USER COMMUNITY

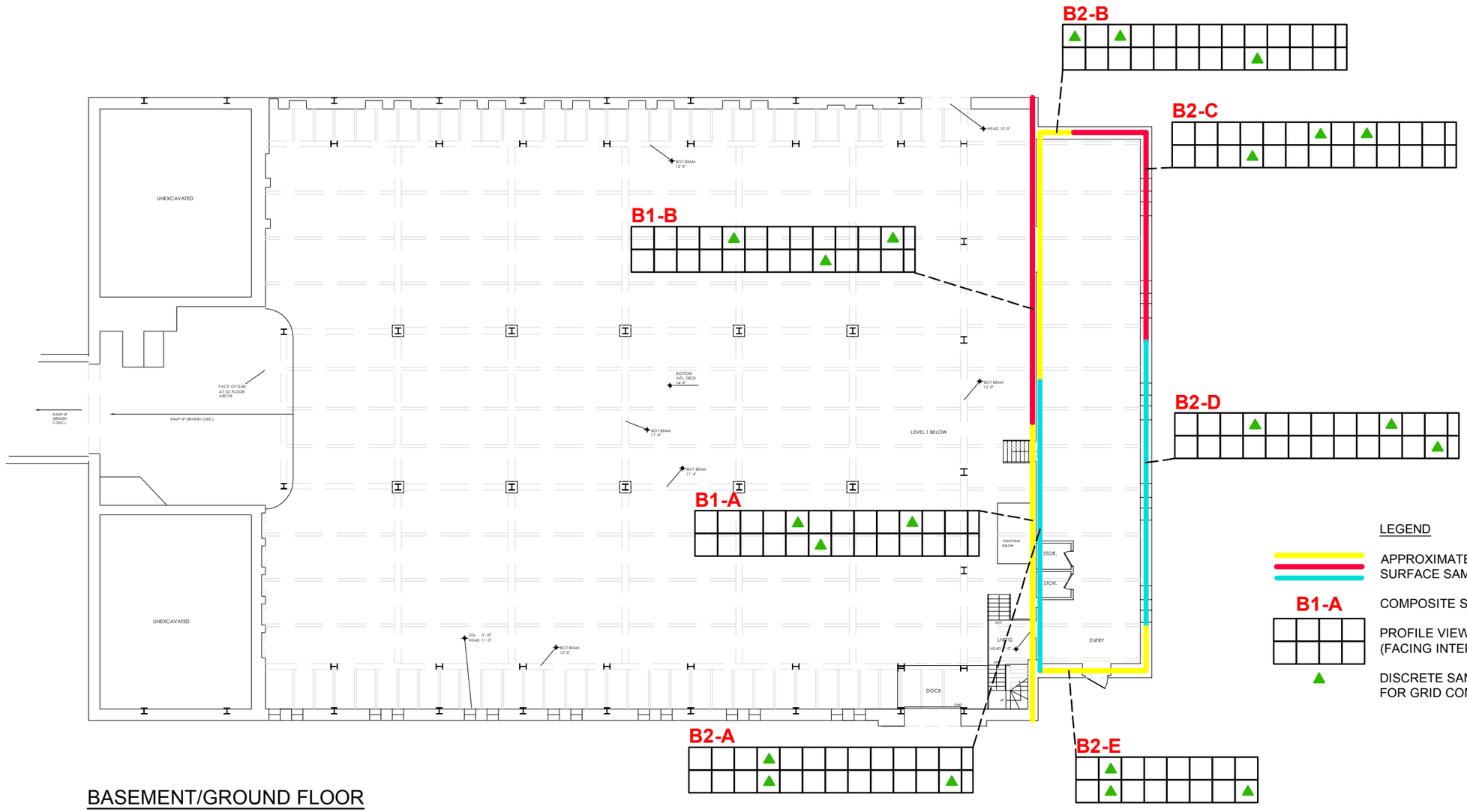
0 30
SCALE IN FEET

GOWANUS VILLAGE I, LLC
153 2ND STREET
BROOKLYN, KINGS COUNTY, NEW YORK
NYSDEC BCA SITE NO. C224099
INDEX NO. W2-1069-0506

BUILDING INTERIOR WALL CORE SAMPLING (2014)

DATE	REVISED	PREPARED BY: LEGGETTE, BRASHEARS & GRAHAM, INC. Professional Groundwater and Environmental Engineering Services, 4 Westchester Park Drive, Suite 175, White Plains, New York 10604, (914) 438-9567		
DRAWN: PAS		CHECKED: SG	DATE: 2/25/15	FIGURE: 4

Document Path: C:\GIS_Projects\GowanusMaps\EPA_Submittal\FIGURE 5 (BUILDING INTERIOR WALL CORE SAMPLING).mxd



BASEMENT/GROUND FLOOR

LEGEND

APPROXIMATE LATERAL EXTENTS OF SURFACE SAMPLE GRIDS

B1-A

COMPOSITE SAMPLE IDENTIFICATION

PROFILE VIEW OF SAMPLE GRID (FACING INTERIOR WALL); TO SCALE

DISCRETE SAMPLE LOCATION USED FOR GRID COMPOSITE SAMPLE

0 20

SCALE IN FEET

GOWANUS VILLAGE I, LLC
153 2nd STREET
BROOKLYN, KINGS COUNTY, NEW YORK
NYSDEC BCA SITE NO. C224099
INDEX NO. W2-1069-0506

INTERIOR SURFACE SAMPLE LOCATIONS: WALLS
BASEMENT/GROUND FLOOR - JUNE 23, 2015

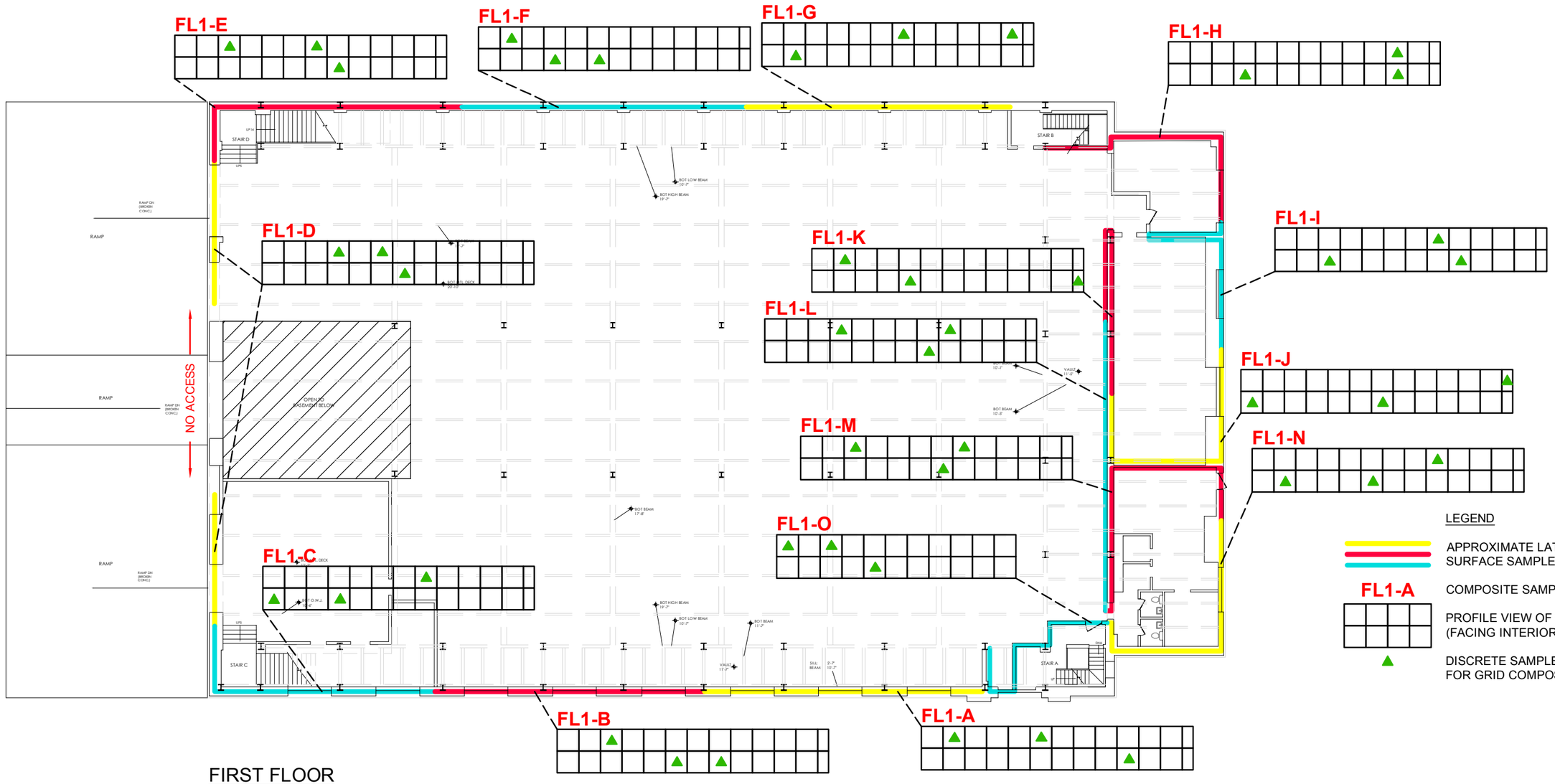
DATE	REVISED

PREPARED BY:

LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Groundwater and Environmental Engineering Services
4 Westchester Park Drive
Suite 175
White Plains, NY 10604
(914) 694-5711

DRAWN:	RAC	CHECKED:	DM	DATE:	09/08/15	FIGURE:	5

O:\DWG\Gowanus\Floor Plans-Wall Samples.dwg, Basement, 9/8/2015 2:21:03 PM, AcroPlot.pc3



FIRST FLOOR

LEGEND

APPROXIMATE LATERAL EXTENTS OF SURFACE SAMPLE GRIDS

FL1-A COMPOSITE SAMPLE IDENTIFICATION

PROFILE VIEW OF SAMPLE GRID (FACING INTERIOR WALL); TO SCALE

DISCRETE SAMPLE LOCATION USED FOR GRID COMPOSITE SAMPLE

0 20
SCALE IN FEET

GOWANUS VILLAGE I, LLC
153 2nd STREET
BROOKLYN, KINGS COUNTY, NEW YORK
NYSDEC BCA SITE NO. C224099
INDEX NO. W2-1069-0506

INTERIOR SURFACE SAMPLE LOCATIONS: WALLS
FIRST FLOOR - JUNE 18 AND 19, 2015

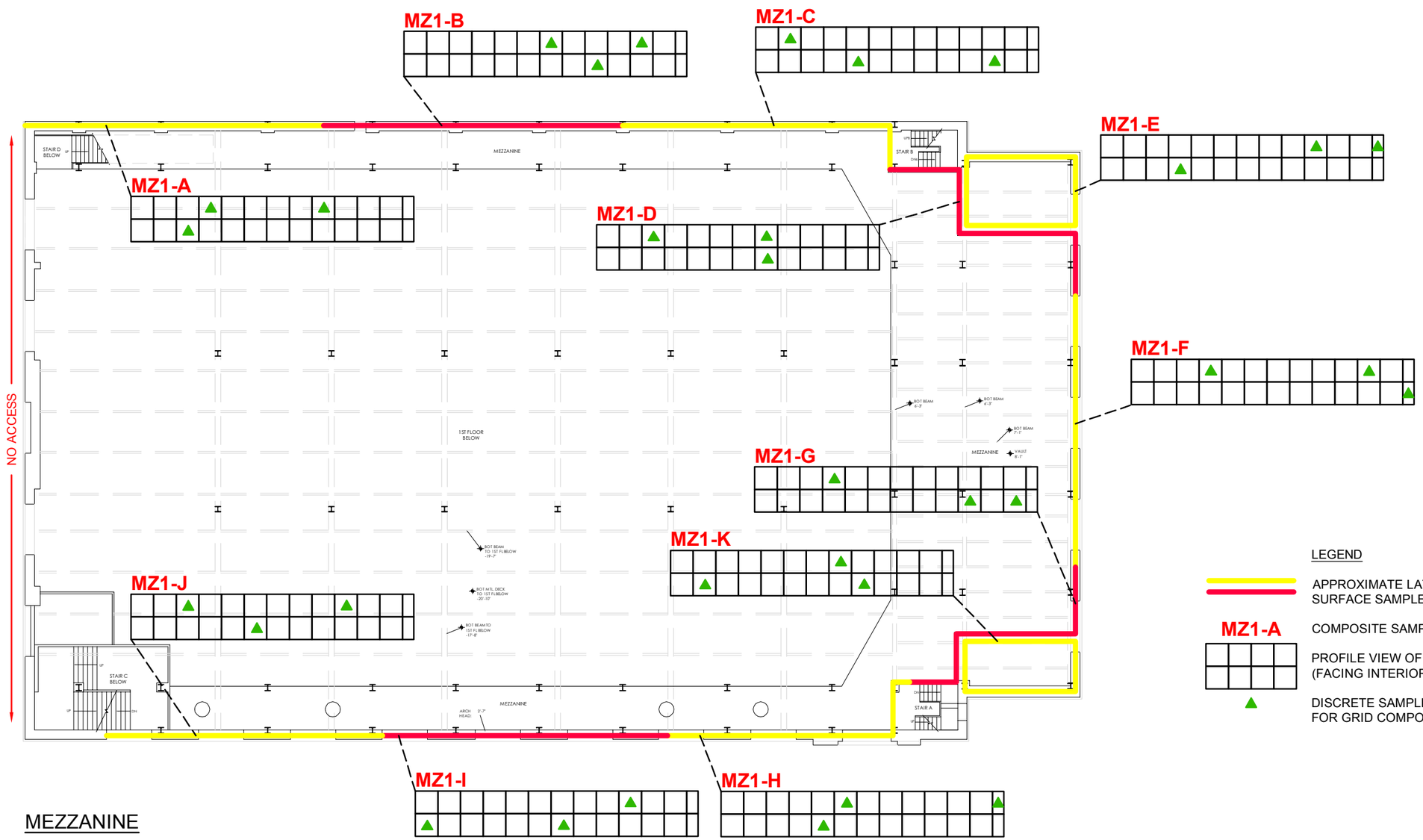
DATE	REVISED

PREPARED BY:

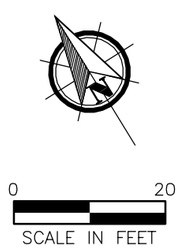
LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Groundwater and Environmental Engineering Services
4 Westchester Park Drive
Suite 175
White Plains, NY 10604
(914) 694-5711

DRAWN:	RAC	CHECKED:	DM	DATE:	09/08/15	FIGURE:	6

O:\DWG\Gowanus\Floor Plans-Wall Samples.dwg, 1st Floor, 9/8/2015 2:21:11 PM, AcroPlot.pc3



MEZZANINE



GOWANUS VILLAGE I, LLC
153 2nd STREET
BROOKLYN, KINGS COUNTY, NEW YORK
NYSDEC BCA SITE NO. C224099
INDEX NO. W2-1069-0506

INTERIOR SURFACE SAMPLE LOCATIONS: WALLS
MEZZANINE - JUNE 18 AND 22, 2015

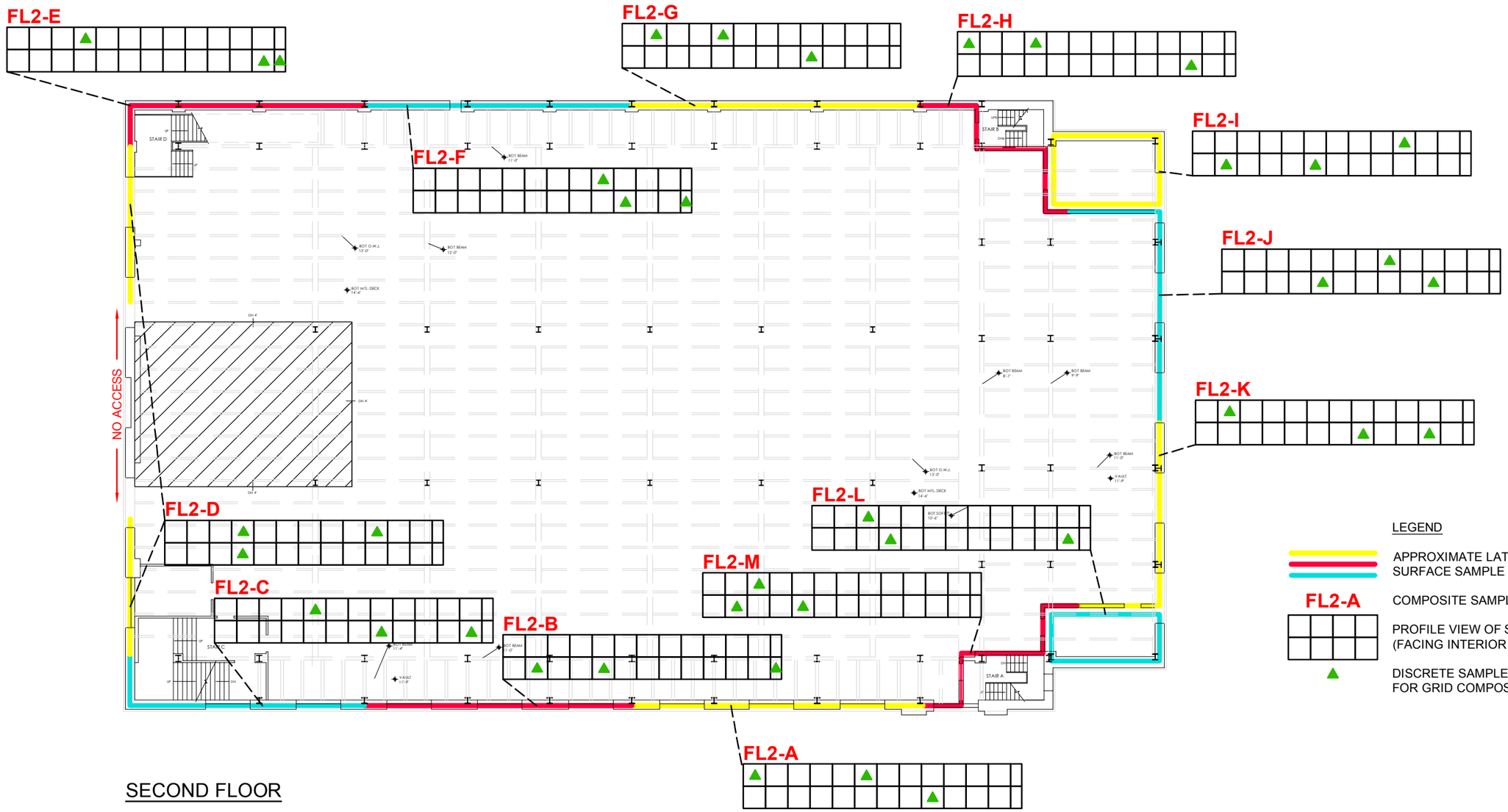
DATE	REVISED

PREPARED BY:

LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Groundwater and Environmental Engineering Services
4 Westchester Park Drive
Suite 175
White Plains, NY 10604
(914) 694-5711

DRAWN:	RAC	CHECKED:	DM	DATE:	09/08/15	FIGURE:	7

O:\DWG\Gowanus\Floor Plans-Wall Samples.dwg, Mezzanine, 9/8/2015 2:21:21 PM, AcroPlot.pc3



SECOND FLOOR

LEGEND

APPROXIMATE LATERAL EXTENTS OF SURFACE SAMPLE GRIDS

FL2-A COMPOSITE SAMPLE IDENTIFICATION

PROFILE VIEW OF SAMPLE GRID (FACING INTERIOR WALL); TO SCALE

DISCRETE SAMPLE LOCATION USED FOR GRID COMPOSITE SAMPLE

0 20
SCALE IN FEET

GOWANUS VILLAGE I, LLC
153 2nd STREET
BROOKLYN, KINGS COUNTY, NEW YORK
NYSDEC BCA SITE NO. C224099
INDEX NO. W2-1069-0506

INTERIOR SURFACE SAMPLE LOCATIONS: WALLS
SECOND FLOOR - JUNE 16 AND 17, 2015

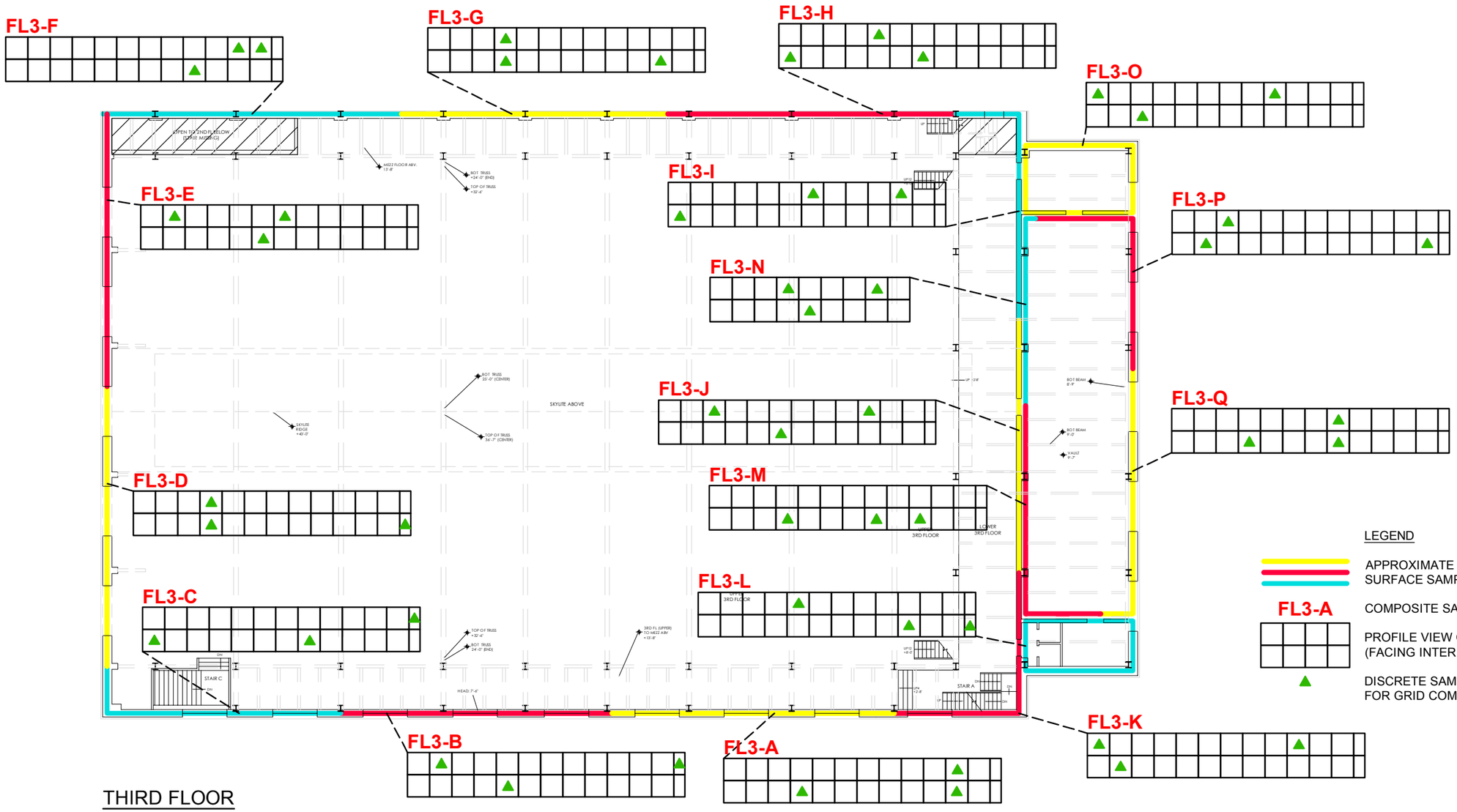
DATE	REVISED

PREPARED BY:

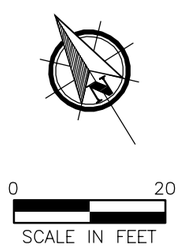
LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Groundwater and Environmental Engineering Services
4 Westchester Park Drive
Suite 175
White Plains, NY 10604
(914) 694-5711

DRAWN:	RAC	CHECKED:	DM	DATE:	09/08/15	FIGURE:	8

O:\DWG\Gowanus\Floor Plans-Wall Samples.dwg, 2nd Floor, 9/8/2015 2:21:31 PM, AcroPlot.pc3



THIRD FLOOR



GOWANUS VILLAGE I, LLC
153 2nd STREET
BROOKLYN, KINGS COUNTY, NEW YORK
NYSDEC BCA SITE NO. C224099
INDEX NO. W2-1069-0506

INTERIOR SURFACE SAMPLE LOCATIONS: WALLS
THIRD FLOOR - JUNE 10, 11 AND 12, 2015

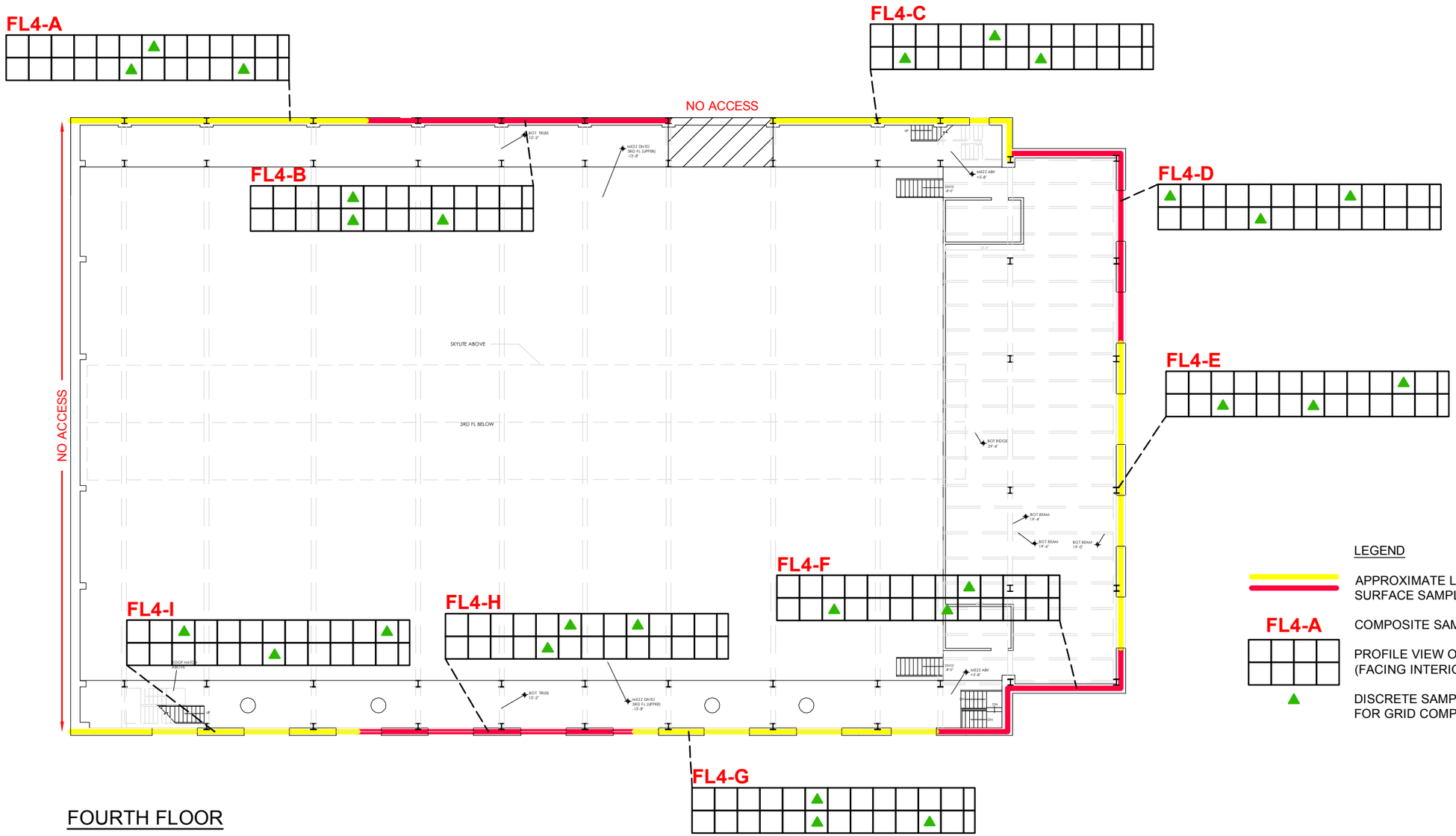
DATE	REVISED

PREPARED BY:

LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Groundwater and Environmental Engineering Services
4 Westchester Park Drive
Suite 175
White Plains, NY 10604
(914) 694-5711

DRAWN:	RAC	CHECKED:	DM	DATE:	09/08/15	FIGURE:	9

O:\DWG\Gowanus\Floor Plans-Wall Samples.dwg, 3rd Floor, 9/8/2015 2:21:42 PM, AcroPlot.pc3



FOURTH FLOOR

LEGEND

APPROXIMATE LATERAL EXTENTS OF SURFACE SAMPLE GRIDS

FL4-A — COMPOSITE SAMPLE IDENTIFICATION

PROFILE VIEW OF SAMPLE GRID (FACING INTERIOR WALL); TO SCALE

DISCRETE SAMPLE LOCATION USED FOR GRID COMPOSITE SAMPLE

0 20

SCALE IN FEET

GOWANUS VILLAGE I, LLC
153 2nd STREET
BROOKLYN, KINGS COUNTY, NEW YORK
NYSDEC BCA SITE NO. C224099
INDEX NO. W2-1069-0506

INTERIOR SURFACE SAMPLE LOCATIONS: WALLS
FOURTH FLOOR - JUNE 11, 12 AND 16, 2015

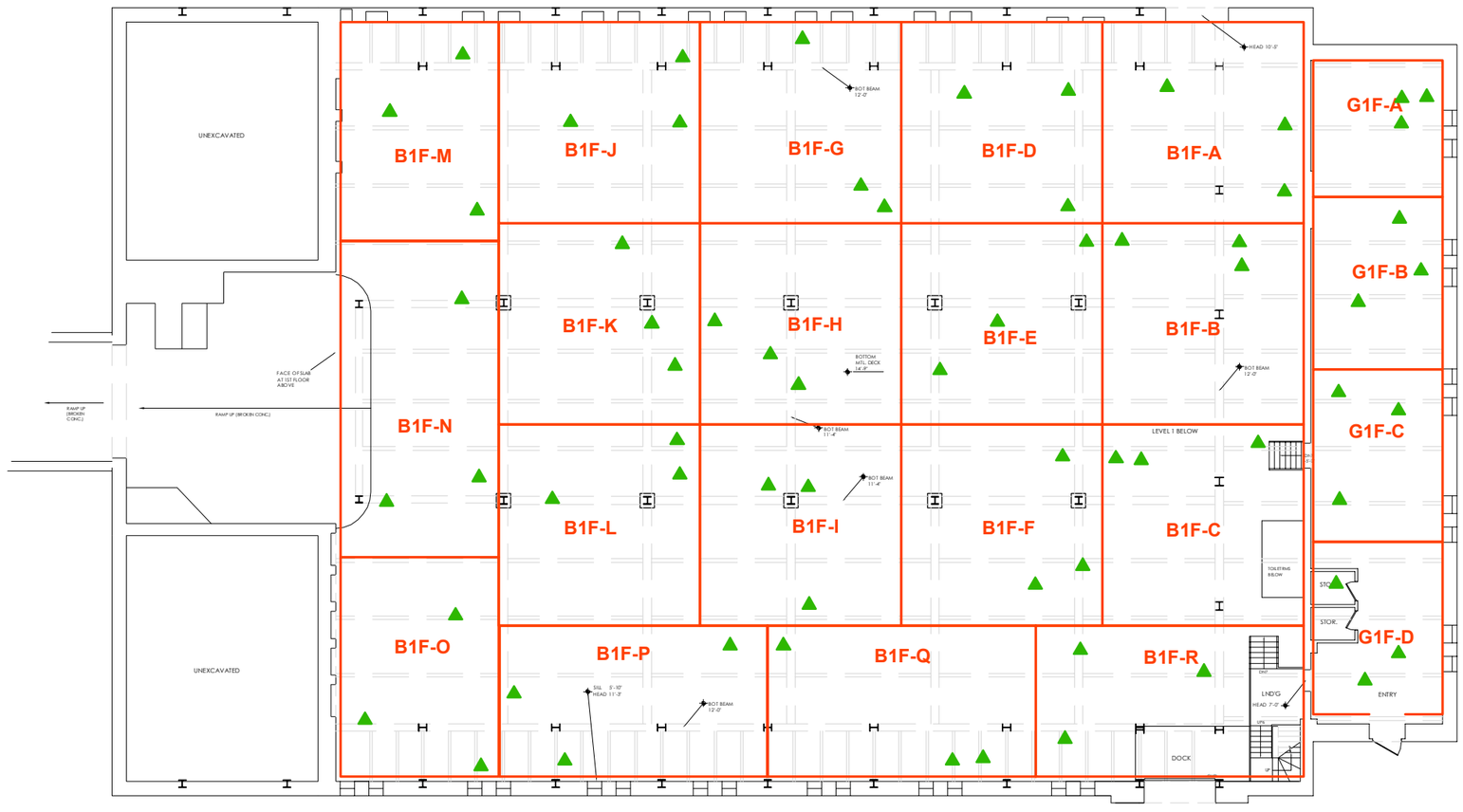
DATE	REVISED

PREPARED BY:

LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Groundwater and Environmental Engineering Services
4 Westchester Park Drive
Suite 175
White Plains, NY 10604
(914) 694-5711

DRAWN:	RAC	CHECKED:	DM	DATE:	09/08/15	FIGURE:	10

O:\DWG\Gowanus\Floor Plans-Wall Samples.dwg, 4th Floor, 9/8/2015 2:21:50 PM, AcroPlot.pc3



BASEMENT/GROUND FLOOR

LEGEND

B1F-A — APPROXIMATE SAMPLE GRID AREA

COMPOSITE SAMPLE IDENTIFICATION

DISCRETE SAMPLE LOCATION USED FOR GRID COMPOSITE SAMPLE

0 20

SCALE IN FEET

GOWANUS VILLAGE I, LLC
153 2nd STREET
BROOKLYN, KINGS COUNTY, NEW YORK
NYSDEC BCA SITE NO. C224099
INDEX NO. W2-1069-0506

INTERIOR SURFACE SAMPLE LOCATIONS: FLOORS
BASEMENT/GROUND FLOOR - JUNE 24, 25 AND JULY 9, 2015

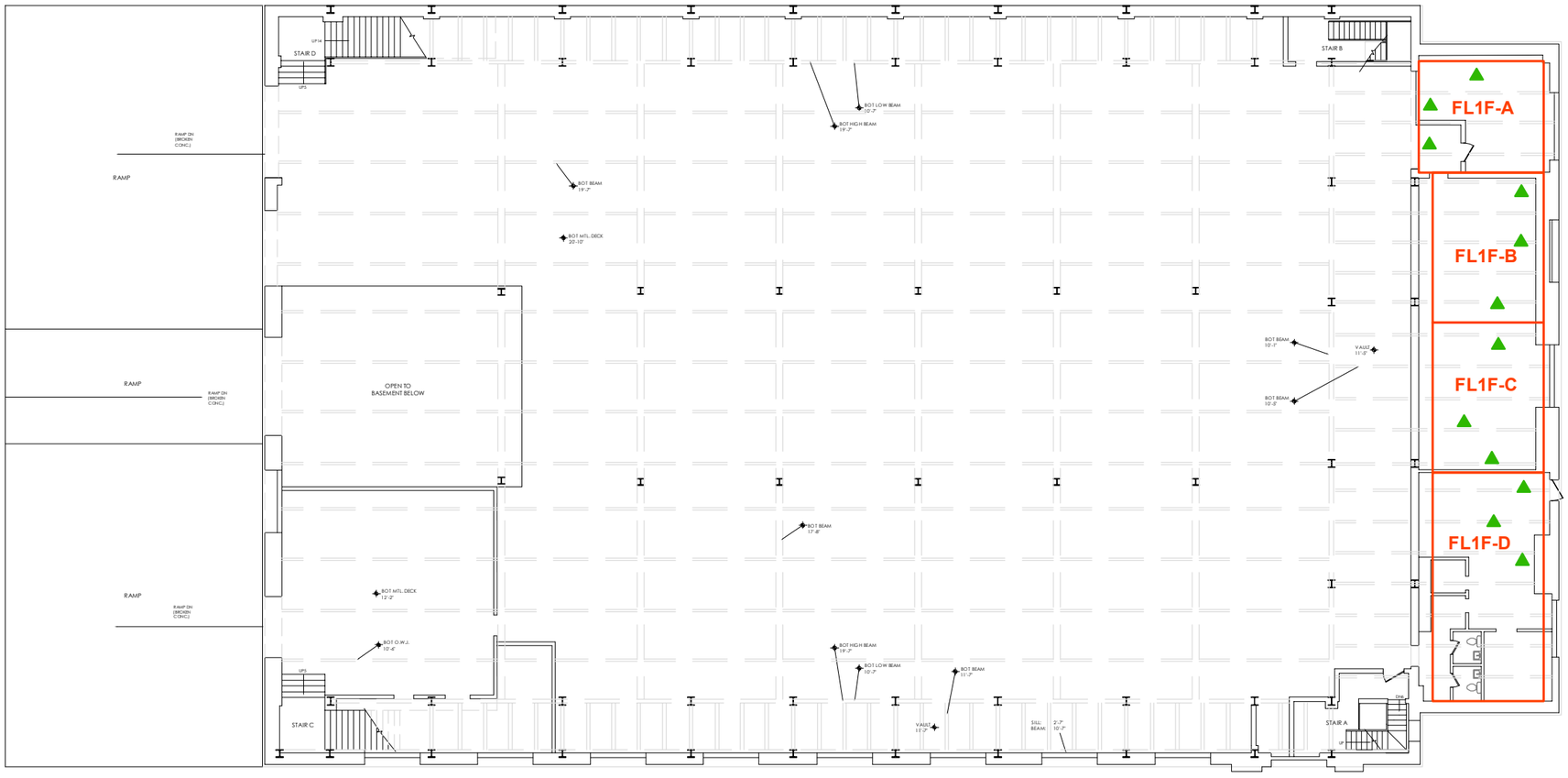
DATE	REVISED

PREPARED BY:

LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Groundwater and Environmental Engineering Services
4 Westchester Park Drive
Suite 175
White Plains, NY 10604
(914) 694-5711

DRAWN:	RAC	CHECKED:	DM	DATE:	09/08/15	FIGURE:	11

O:\DWG\Gowanus\Floor Plans-Floor Samples.dwg, Basement, 9/8/2015 2:22:06 PM, AcroPlot.pc3



FIRST FLOOR

LEGEND

APPROXIMATE SAMPLE GRID AREA

FL1F-A — COMPOSITE SAMPLE IDENTIFICATION

▲ DISCRETE SAMPLE LOCATION USED FOR GRID COMPOSITE SAMPLE

0 20
SCALE IN FEET

GOWANUS VILLAGE I, LLC
153 2nd STREET
BROOKLYN, KINGS COUNTY, NEW YORK
NYSDEC BCA SITE NO. C224099
INDEX NO. W2-1069-0506

INTERIOR SURFACE SAMPLE LOCATIONS: FLOORS
FIRST FLOOR - JULY 8 AND 9, 2015

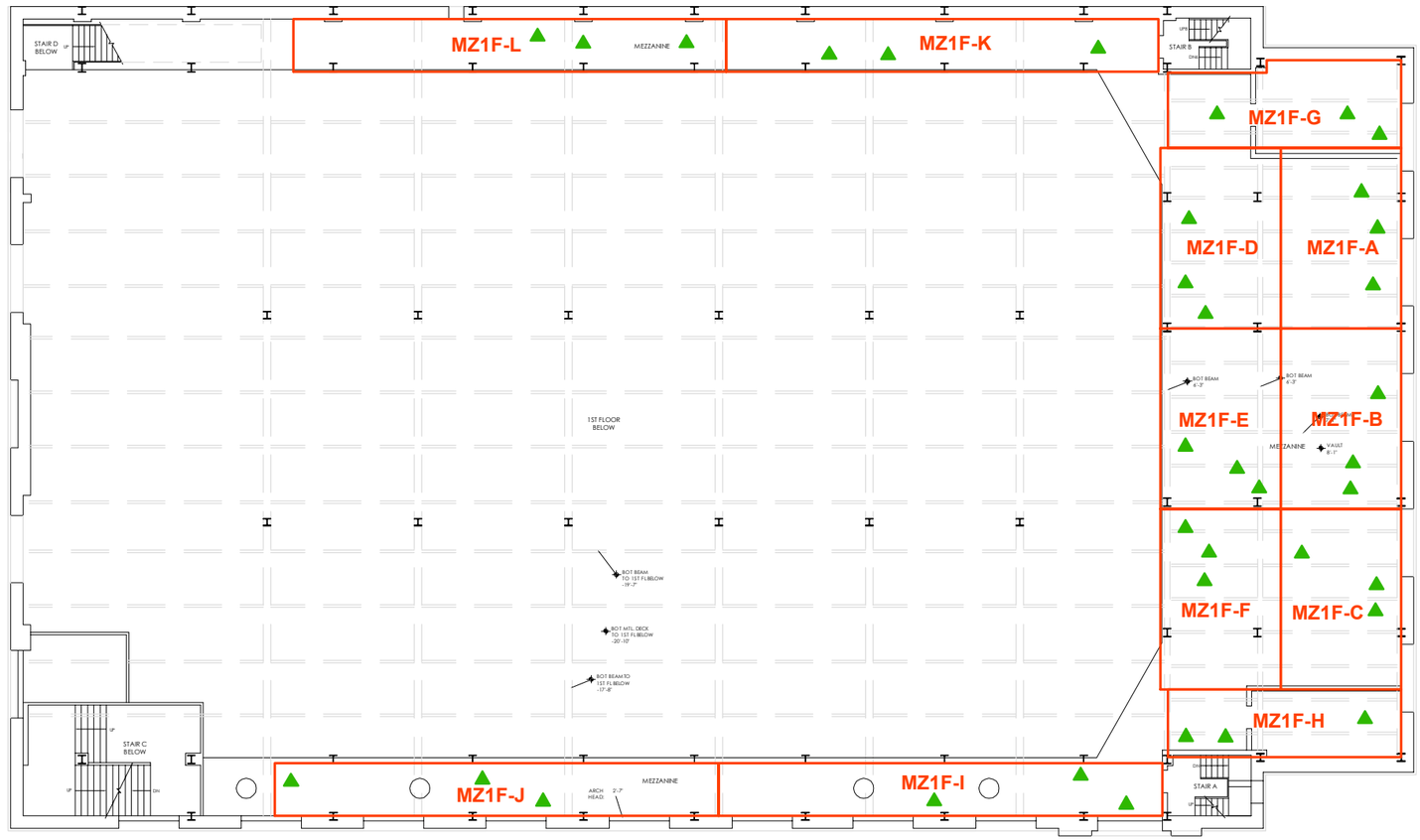
DATE	REVISED

PREPARED BY:

LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Groundwater and Environmental Engineering Services
4 Westchester Park Drive
Suite 175
White Plains, NY 10604
(914) 694-5711

DRAWN:	RAC	CHECKED:	DM	DATE:	09/08/15	FIGURE:	12

O:\DWG\Gowanus\Floor Plans-Floor Samples.dwg, 1st Floor, 9/8/2015 2:22:14 PM, AcroPlot.pc3



LEGEND

APPROXIMATE SAMPLE GRID AREA

MZ1F-A COMPOSITE SAMPLE IDENTIFICATION

DISCRETE SAMPLE LOCATION USED FOR GRID COMPOSITE SAMPLE

MEZZANINE

0 20

SCALE IN FEET

GOWANUS VILLAGE I, LLC
153 2nd STREET
BROOKLYN, KINGS COUNTY, NEW YORK
NYSDEC BCA SITE NO. C224099
INDEX NO. W2-1069-0506

INTERIOR SURFACE SAMPLE LOCATIONS: FLOORS
MEZZANINE - JULY 8, 2015

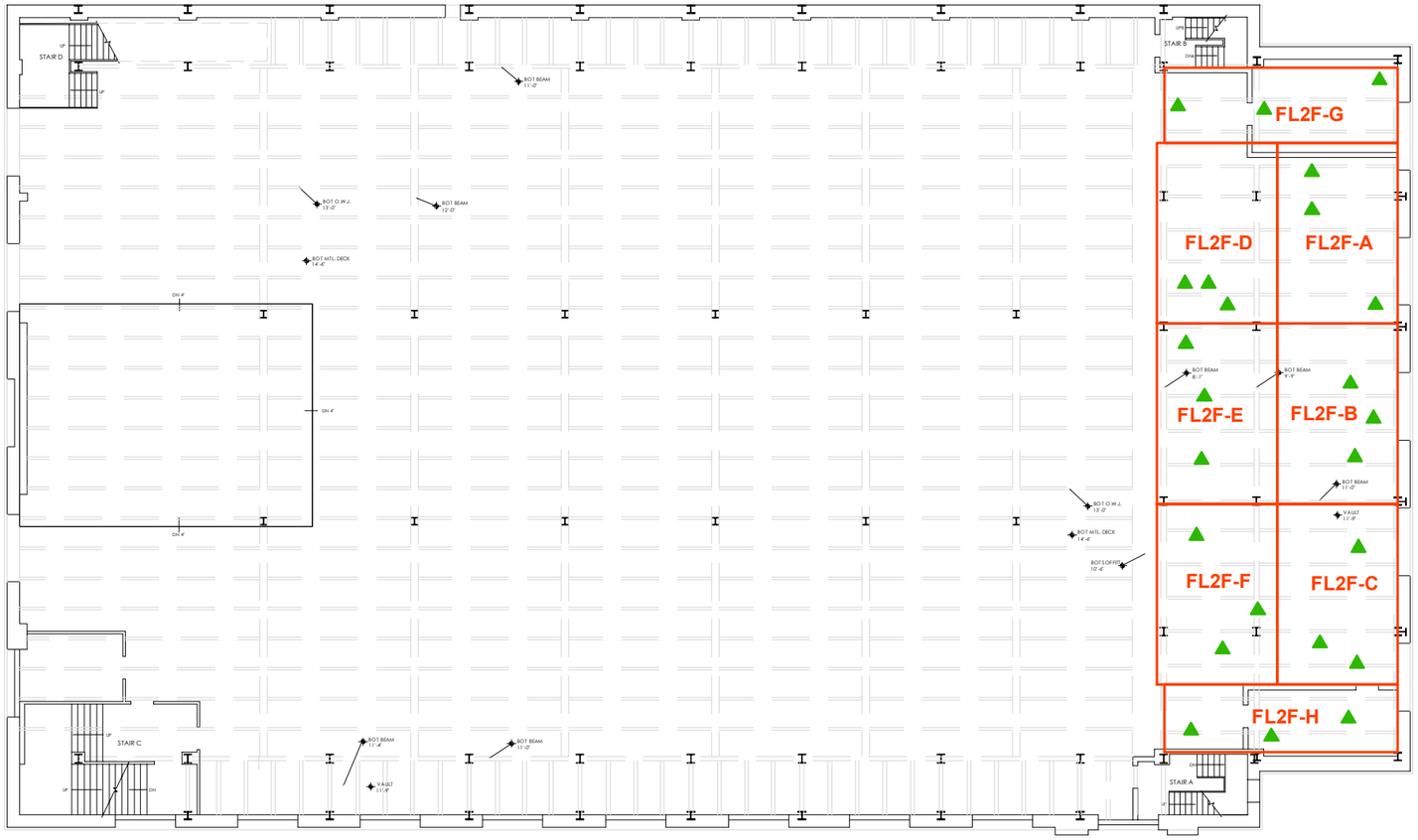
DATE	REVISED

PREPARED BY:

LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Groundwater and Environmental Engineering Services
4 Westchester Park Drive
Suite 175
White Plains, NY 10604
(914) 694-5711

DRAWN:	RAC	CHECKED:	DM	DATE:	09/08/15	FIGURE:	13

O:\DWG\Gowanus\Floor Plans-Floor Samples.dwg, Mezzanine, 9/8/2015 2:22:22 PM, AcroPlot.pc3



SECOND FLOOR

LEGEND

APPROXIMATE SAMPLE GRID AREA

FL2F-A COMPOSITE SAMPLE IDENTIFICATION

DISCRETE SAMPLE LOCATION USED FOR GRID COMPOSITE SAMPLE

0 20

SCALE IN FEET

GOWANUS VILLAGE I, LLC
153 2nd STREET
BROOKLYN, KINGS COUNTY, NEW YORK
NYSDEC BCA SITE NO. C224099
INDEX NO. W2-1069-0506

INTERIOR SURFACE SAMPLE LOCATIONS: FLOORS
SECOND FLOOR - JULY 1, 2015

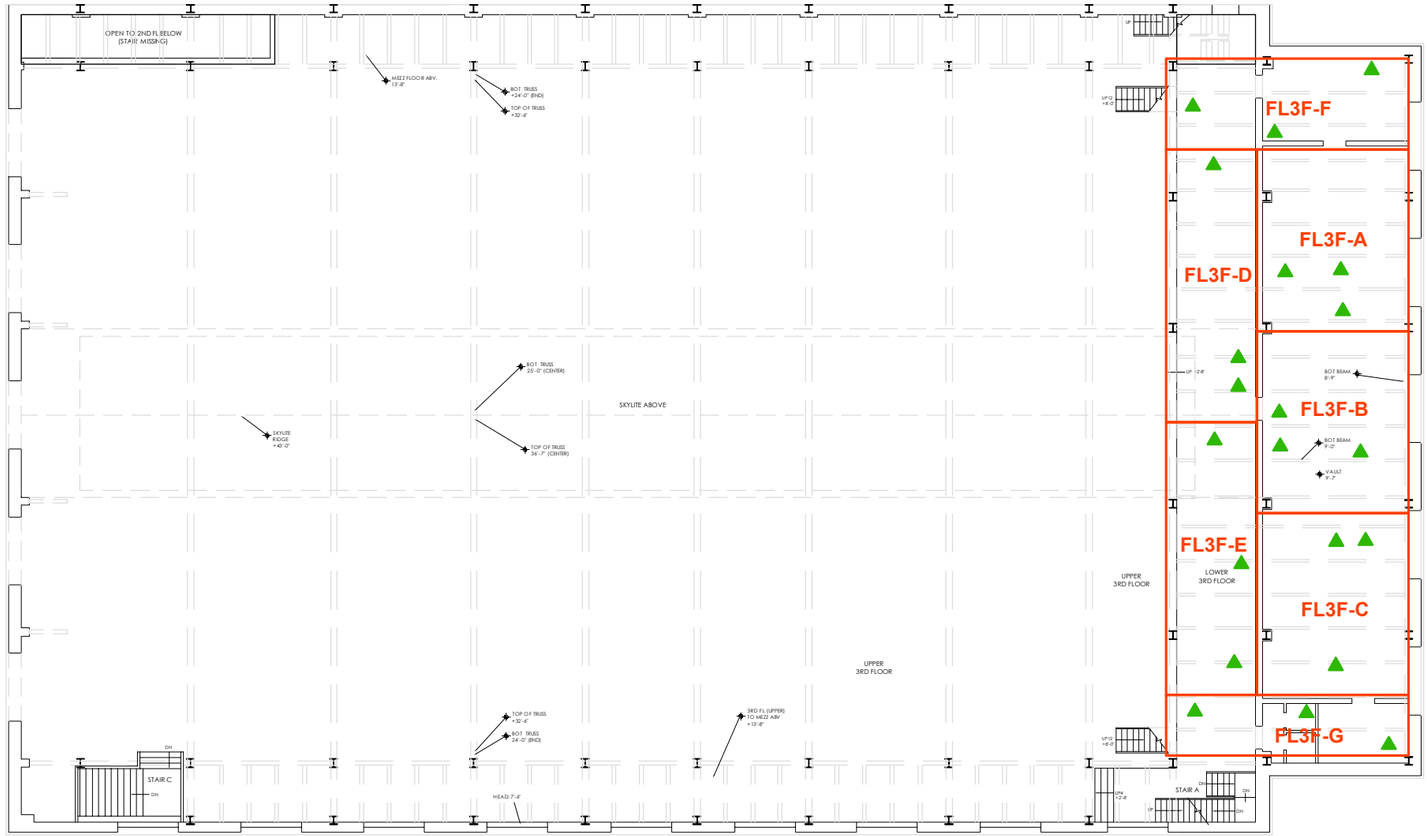
DATE	REVISED

PREPARED BY:

LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Groundwater and Environmental Engineering Services
4 Westchester Park Drive
Suite 175
White Plains, NY 10604
(914) 694-5711

DRAWN:	RAC	CHECKED:	DM	DATE:	09/08/15	FIGURE:	14

O:\DWG\Gowanus\Floor Plans-Floor Samples.dwg, 2nd Floor, 9/8/2015 2:22:30 PM, AcroPlot.pc3



THIRD FLOOR

LEGEND

APPROXIMATE SAMPLE GRID AREA

FL3F-A COMPOSITE SAMPLE IDENTIFICATION

DISCRETE SAMPLE LOCATION USED FOR GRID COMPOSITE SAMPLE

0 20
SCALE IN FEET

GOWANUS VILLAGE I, LLC
153 2nd STREET
BROOKLYN, KINGS COUNTY, NEW YORK
NYSDEC BCA SITE NO. C224099
INDEX NO. W2-1069-0506

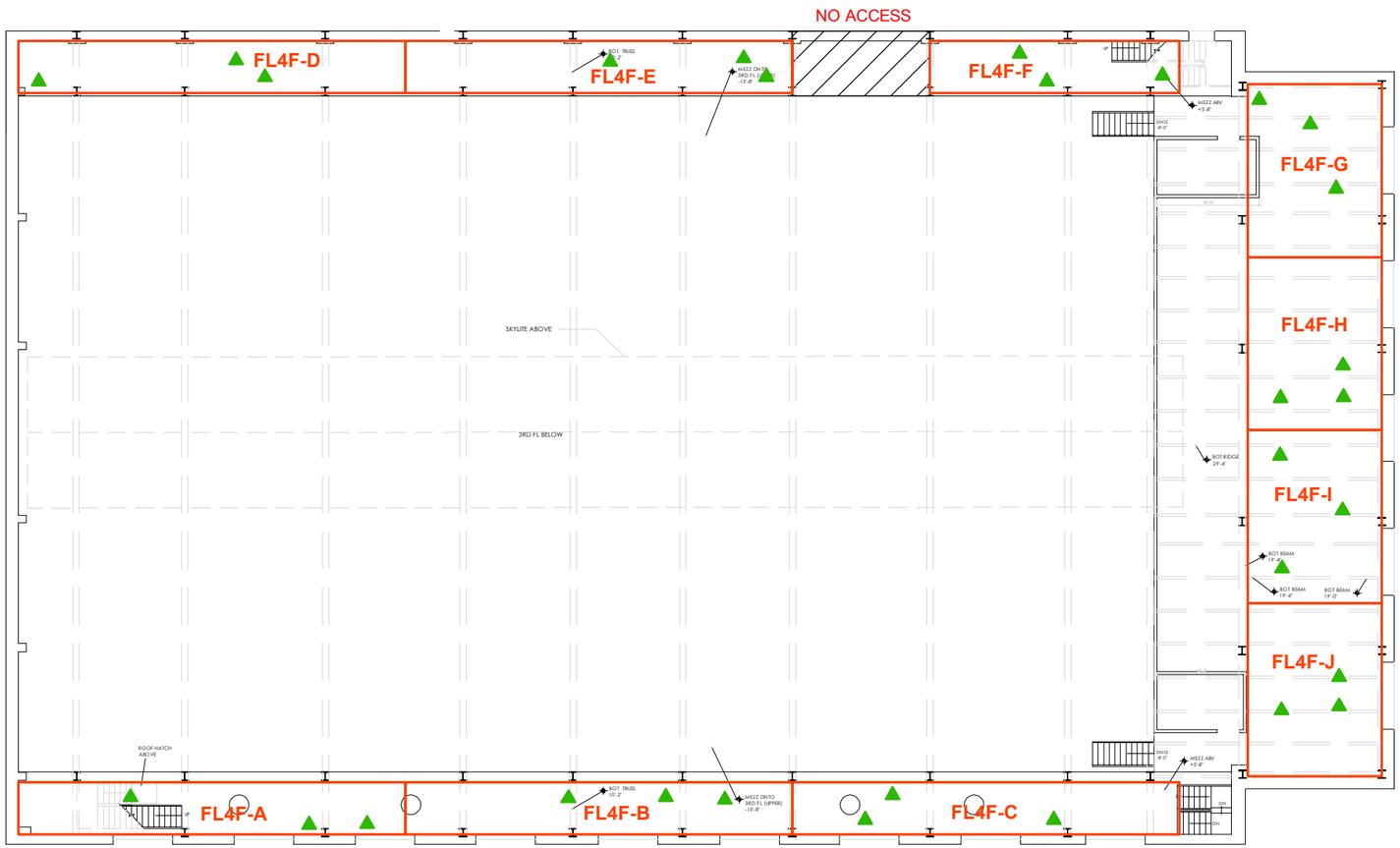
INTERIOR SURFACE SAMPLE LOCATIONS: FLOORS
THIRD FLOOR - JULY 6, 2015

DATE	REVISED

PREPARED BY:
LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Groundwater and Environmental Engineering Services
4 Westchester Park Drive
Suite 175
White Plains, NY 10604
(914) 694-5711

DRAWN:	RAC	CHECKED:	DM	DATE:	09/08/15	FIGURE:	15

O:\DWG\Gowanus\Floor Plans-Floor Samples.dwg, 3rd Floor, 9/8/2015 2:22:38 PM, AcroPlot.pc3



LEGEND

APPROXIMATE SAMPLE GRID AREA

FL4F-A COMPOSITE SAMPLE IDENTIFICATION

DISCRETE SAMPLE LOCATION USED FOR GRID COMPOSITE SAMPLE

FOURTH FLOOR

0 20

SCALE IN FEET

GOWANUS VILLAGE I, LLC
153 2nd STREET
BROOKLYN, KINGS COUNTY, NEW YORK
NYSDEC BCA SITE NO. C224099
INDEX NO. W2-1069-0506

INTERIOR SURFACE SAMPLE LOCATIONS: FLOORS
FOURTH FLOOR - JULY 6 AND 7, 2015

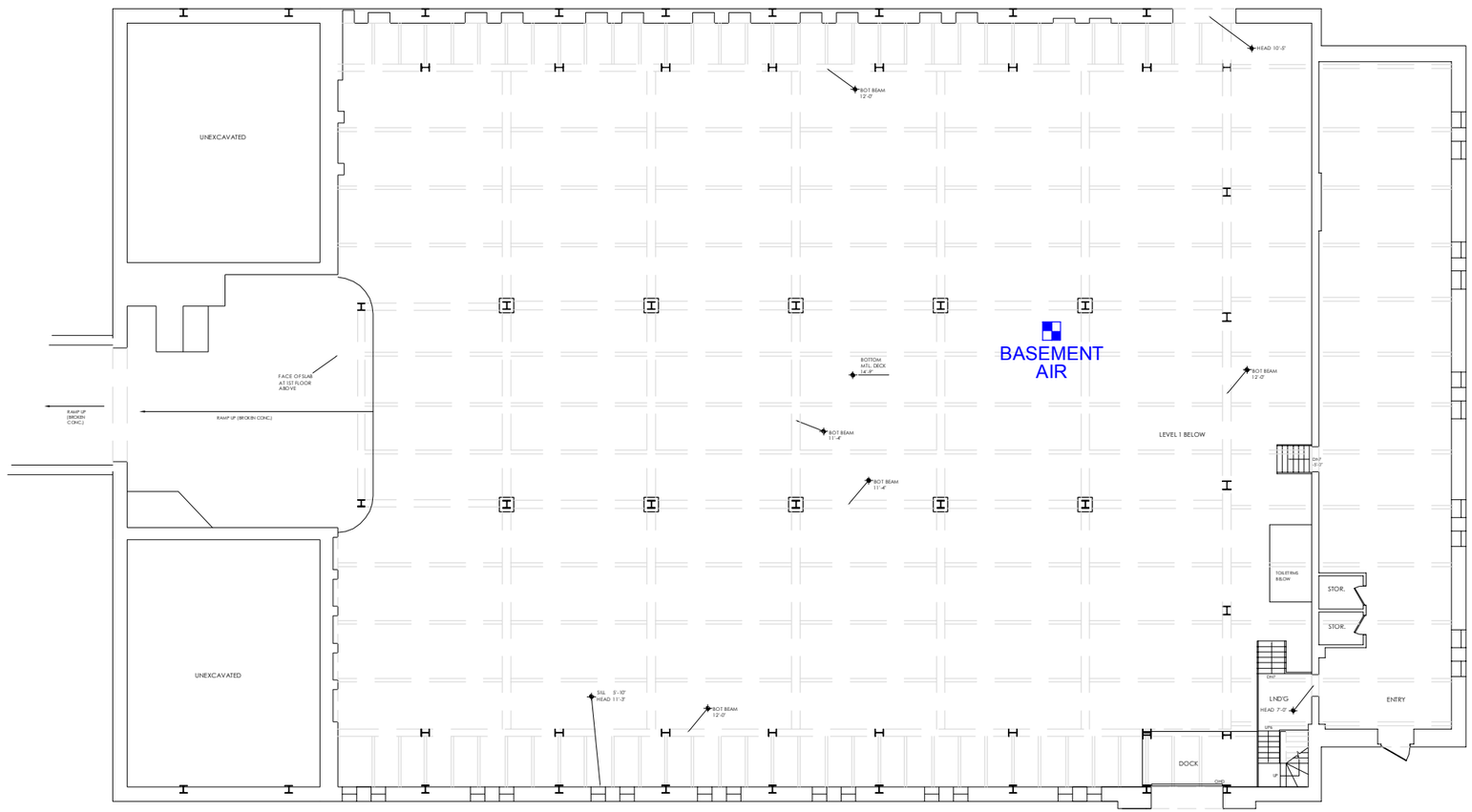
DATE	REVISED

PREPARED BY:

LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Groundwater and Environmental Engineering Services
4 Westchester Park Drive
Suite 175
White Plains, NY 10604
(914) 694-5711

DRAWN:	RAC	CHECKED:	DM	DATE:	09/08/15	FIGURE:	16

O:\DWG\Gowanus\Floor Plans-Floor Samples.dwg, 4th Floor, 9/8/2015 2:22:46 PM, AcroPlot.pc3



BASEMENT/GROUND FLOOR

LEGEND

AIR SAMPLE LOCATION

0 20

SCALE IN FEET

GOWANUS VILLAGE I, LLC
153 2nd STREET
BROOKLYN, KINGS COUNTY, NEW YORK
NYSDEC BCA SITE NO. C224099
INDEX NO. W2-1069-0506

INTERIOR AIR SAMPLE LOCATION:
BASEMENT/GROUND FLOOR - JULY 31, 2015

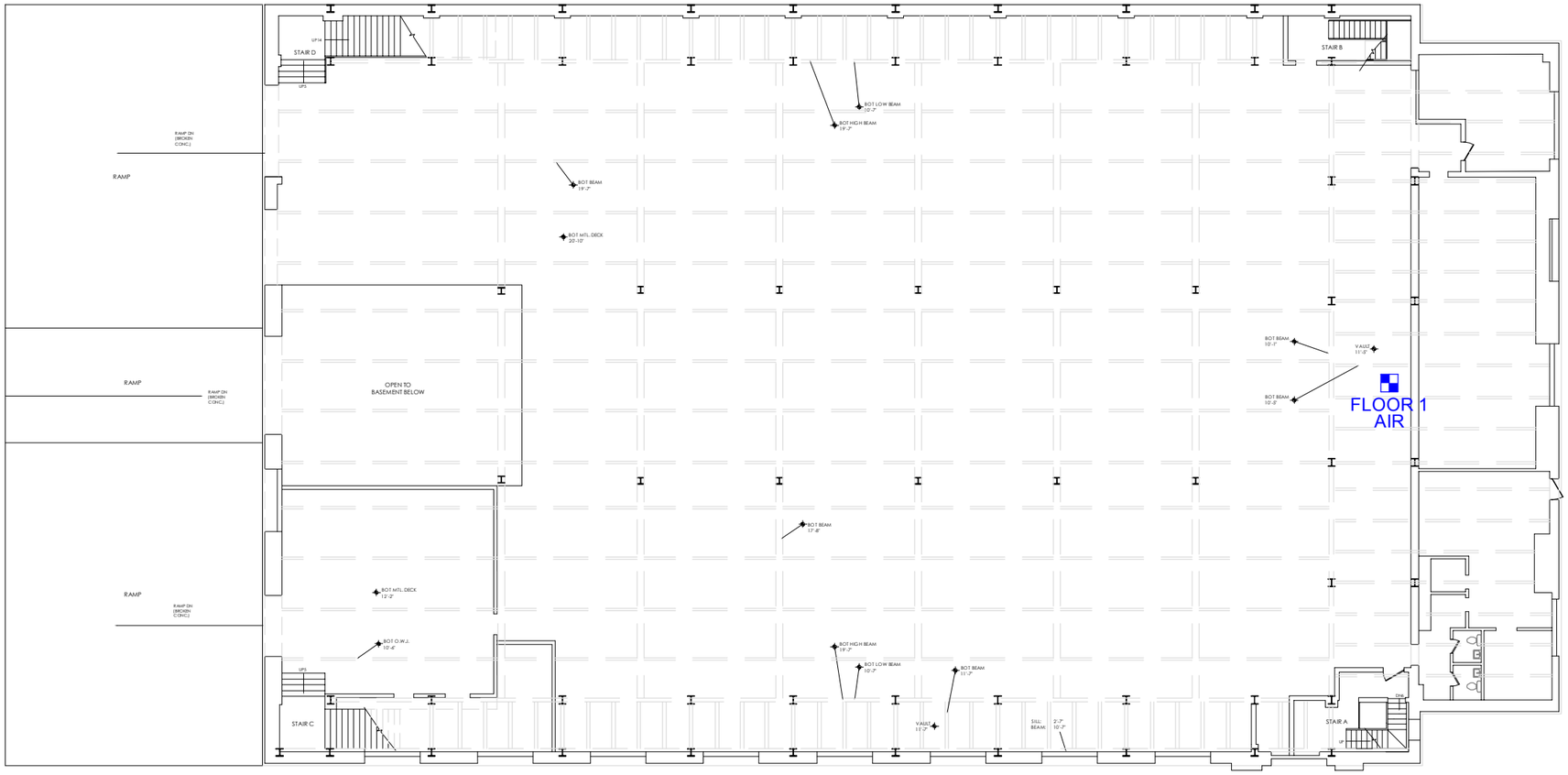
DATE	REVISED

PREPARED BY:

LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Groundwater and Environmental Engineering Services
4 Westchester Park Drive
Suite 175
White Plains, NY 10604
(914) 694-5711

DRAWN:	RAC	CHECKED:	DM	DATE:	08/26/15	FIGURE:	17

O:\DWG\Gowanus\Floor Plans-Air Samples.dwg, Basement, 9/8/2015 2:23:01 PM, AcroPlot.pc3



LEGEND

AIR SAMPLE LOCATION

FIRST FLOOR

0 20

SCALE IN FEET

GOWANUS VILLAGE I, LLC
153 2nd STREET
BROOKLYN, KINGS COUNTY, NEW YORK
NYSDEC BCA SITE NO. C224099
INDEX NO. W2-1069-0506

INTERIOR AIR SAMPLE LOCATION:
FIRST FLOOR - JULY 30, 2015

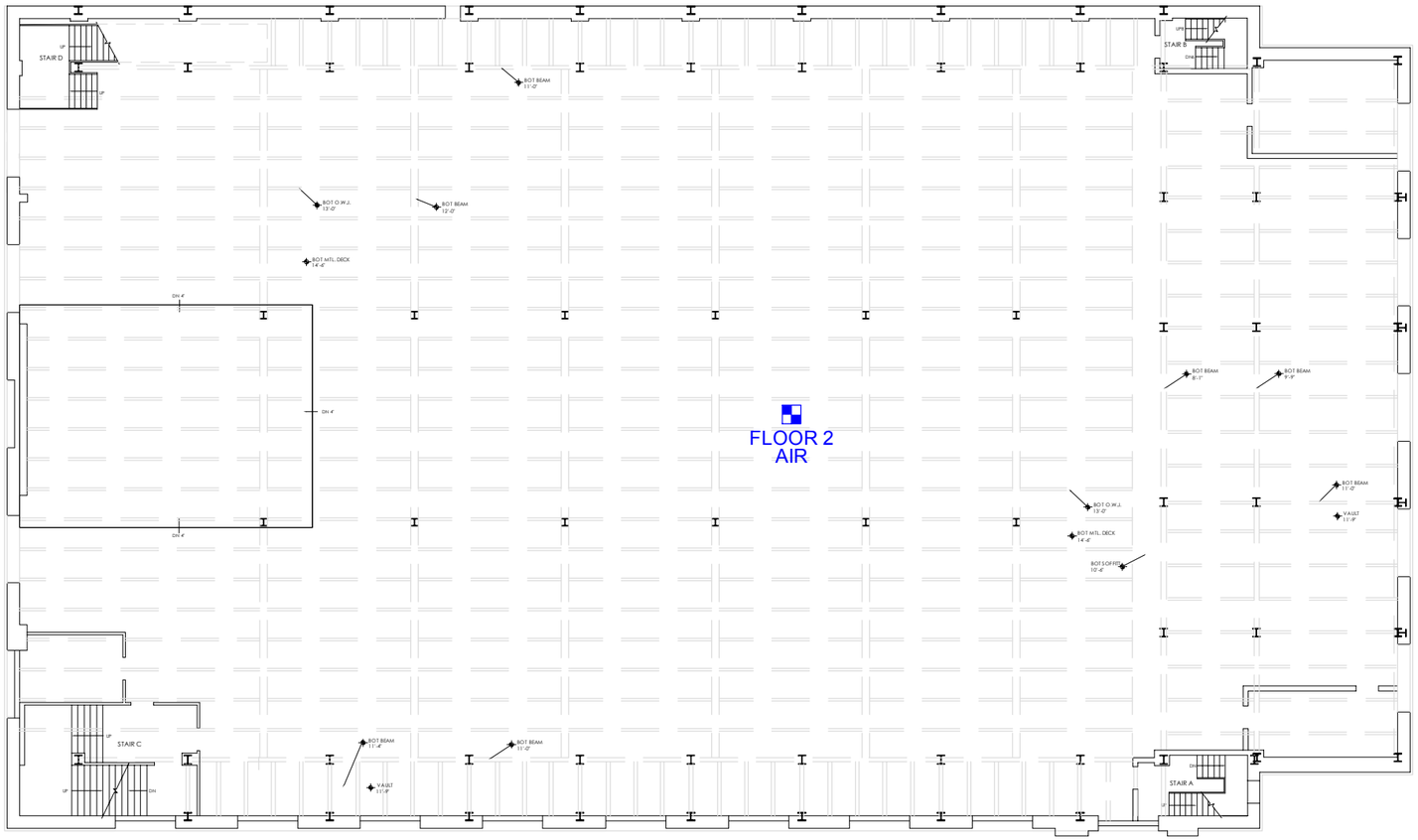
DATE	REVISED

PREPARED BY:

LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Groundwater and Environmental Engineering Services
4 Westchester Park Drive
Suite 175
White Plains, NY 10604
(914) 694-5711

DRAWN:	RAC	CHECKED:	DM	DATE:	08/26/15	FIGURE:	18

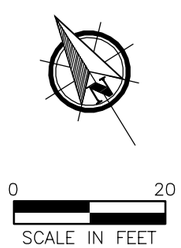
O:\DWG\Gowanus\Floor Plans-Air Samples.dwg, 1st Floor, 9/8/2015 2:23:09 PM, AcroPlot.pc3



LEGEND

AIR SAMPLE LOCATION

SECOND FLOOR



GOWANUS VILLAGE I, LLC
153 2nd STREET
BROOKLYN, KINGS COUNTY, NEW YORK
NYSDEC BCA SITE NO. C224099
INDEX NO. W2-1069-0506

INTERIOR AIR SAMPLE LOCATION:
SECOND FLOOR - JULY 30, 2015

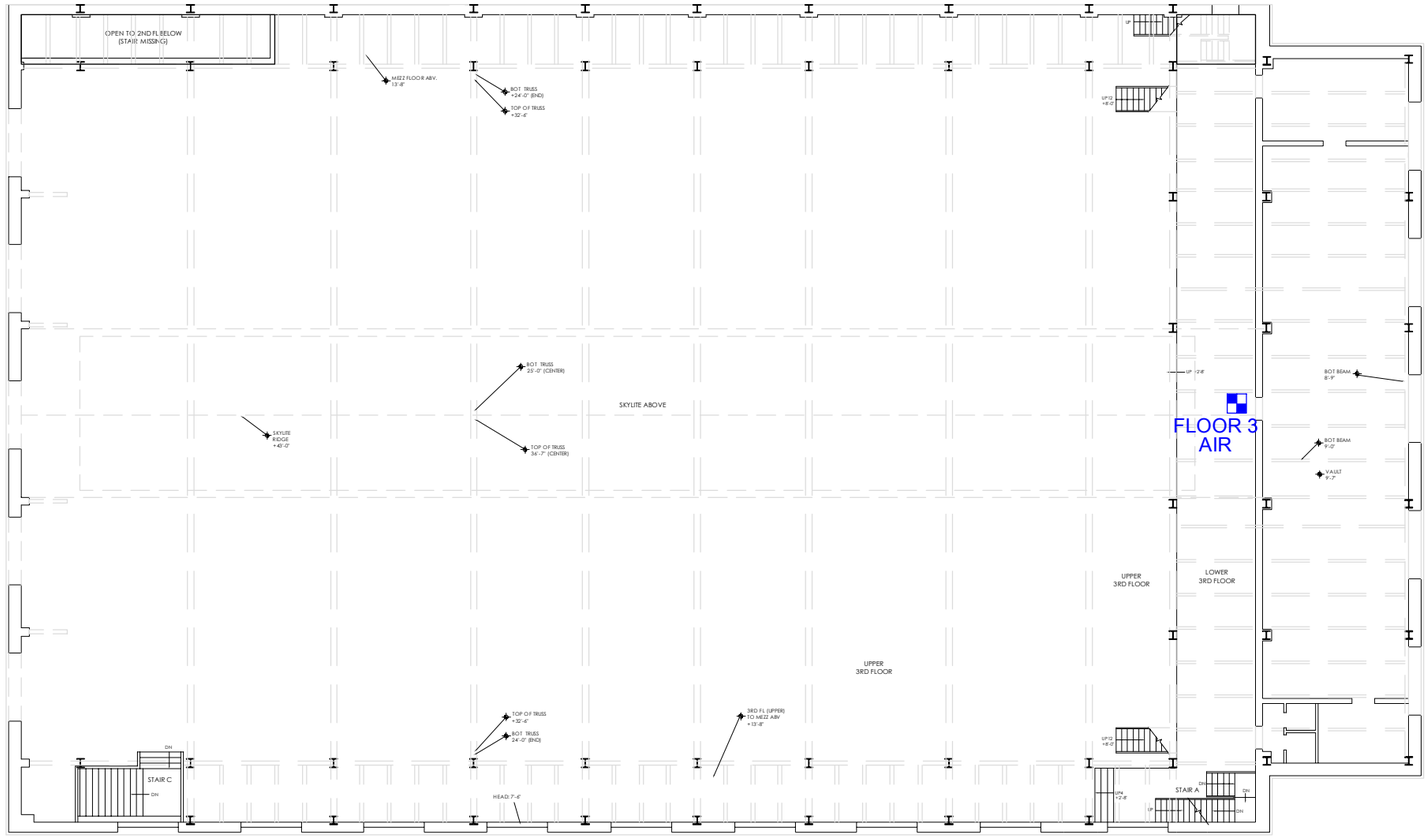
DATE	REVISED

PREPARED BY:

LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Groundwater and Environmental Engineering Services
4 Westchester Park Drive
Suite 175
White Plains, NY 10604
(914) 694-5711

DRAWN:	RAC	CHECKED:	DM	DATE:	08/26/15	FIGURE:	19

O:\DWG\Gowanus\Floor Plans-Air Samples.dwg, 2nd Floor, 9/8/2015 2:23:25 PM, AcroPlot.pc3



THIRD FLOOR

LEGEND

AIR SAMPLE LOCATION

0 20

SCALE IN FEET

GOWANUS VILLAGE I, LLC
153 2nd STREET
BROOKLYN, KINGS COUNTY, NEW YORK
NYSDEC BCA SITE NO. C224099
INDEX NO. W2-1069-0506

INTERIOR AIR SAMPLE LOCATION:
THIRD FLOOR - JULY 29, 2015

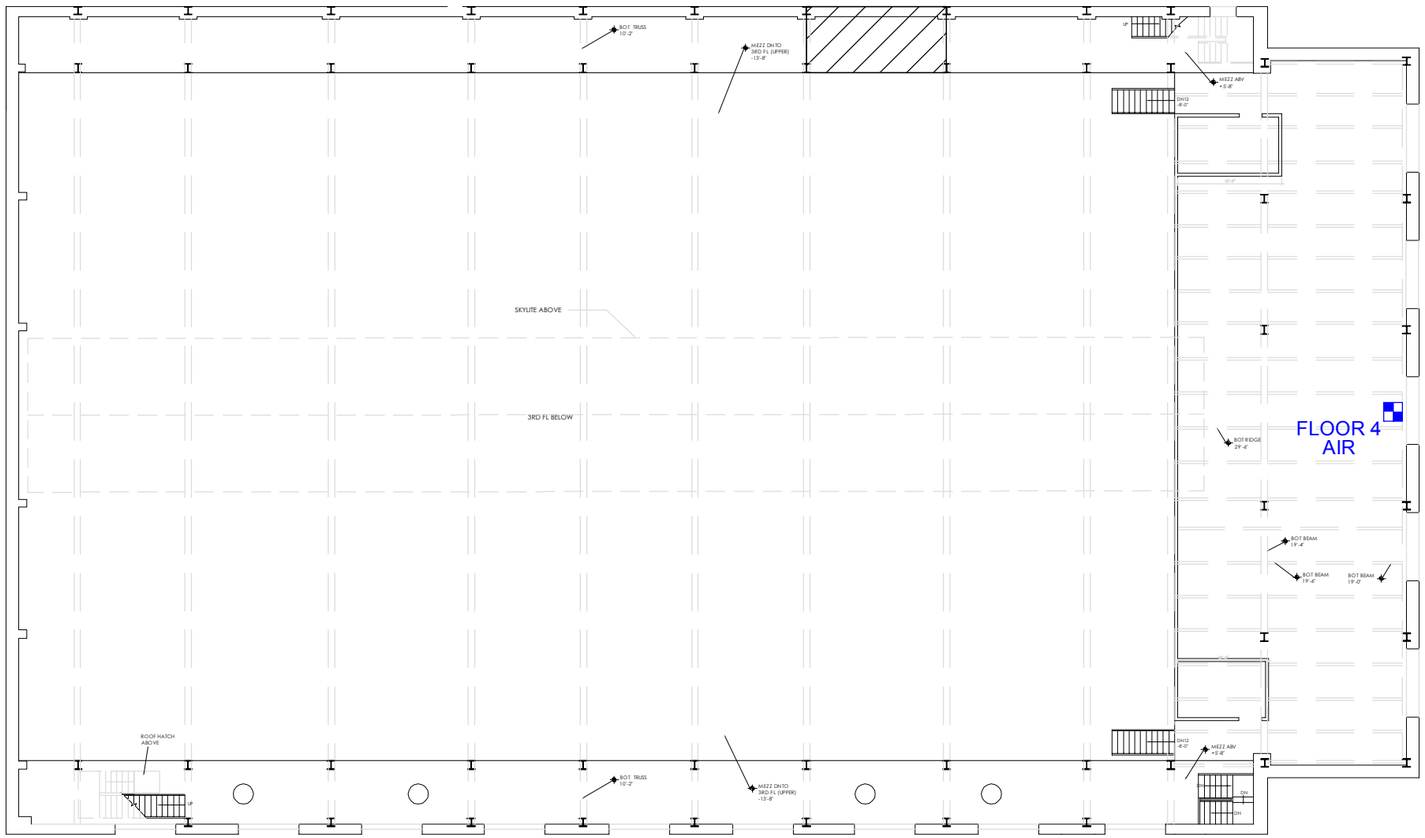
DATE	REVISED

PREPARED BY:

LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Groundwater and Environmental Engineering Services
4 Westchester Park Drive
Suite 175
White Plains, NY 10604
(914) 694-5711

DRAWN:	RAC	CHECKED:	DM	DATE:	08/29/15	FIGURE:	20

O:\DWG\Gowanus\Floor Plans-Air Samples.dwg, 3rd Floor, 9/8/2015 2:23:32 PM, AcroPlot.pc3



LEGEND

AIR SAMPLE LOCATION

FOURTH FLOOR

0 20

SCALE IN FEET

GOWANUS VILLAGE I, LLC
153 2nd STREET
BROOKLYN, KINGS COUNTY, NEW YORK
NYSDEC BCA SITE NO. C224099
INDEX NO. W2-1069-0506

INTERIOR AIR SAMPLE LOCATION:
FOURTH FLOOR - JULY 29, 2015

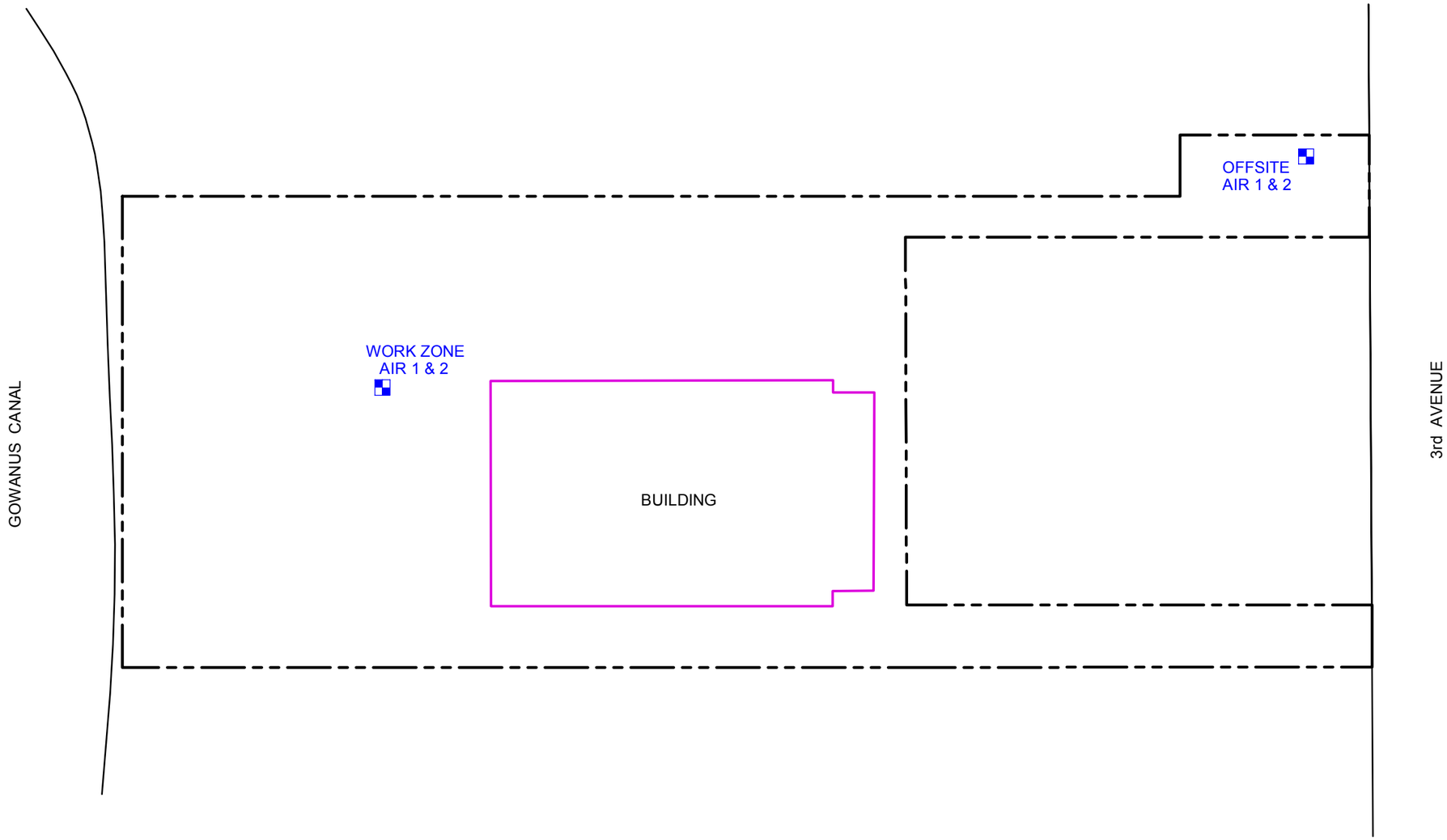
DATE	REVISED

PREPARED BY:

LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Groundwater and Environmental Engineering Services
4 Westchester Park Drive
Suite 175
White Plains, NY 10604
(914) 694-5711

DRAWN:	RAC	CHECKED:	DM	DATE:	08/26/15	FIGURE:	21

O:\DWG\Gowanus\Floor Plans-Air Samples.dwg, 4th Floor, 9/8/2015 2:23:40 PM, AcroPlot.pc3



LEGEND

APPROXIMATE PROPERTY BOUNDARY

EXISTING BUILDING FOOTPRINT

AIR SAMPLE LOCATION

0 60

SCALE IN FEET

GOWANUS VILLAGE I, LLC
153 2nd STREET
BROOKLYN, KINGS COUNTY, NEW YORK
NYSDEC BCA SITE NO. C224099
INDEX NO. W2-1069-0506

EXTERIOR AIR SAMPLE LOCATIONS
JULY 29, 30 AND 31, 2015

DATE	REVISED

PREPARED BY:

LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Groundwater and Environmental Engineering Services
4 Westchester Park Drive
Suite 175
White Plains, NY 10604
(914) 694-5711

DRAWN:	RAC	CHECKED:	DM	DATE:	08/26/15	FIGURE:	22

O:\DWG\Gowanus\Fig22.dwg, Layout1, 9/8/2015 2:23:54 PM, AcroPlot.pc3

COMPENDIUM METHOD TO-10A FIELD TEST DATA SHEETS

LEGGETTE, BRASHEARS & GRAHAM, INC.

COMPENDIUM METHOD TO-10A
FIELD TEST DATA SHEET (FTDS)

I. GENERAL INFORMATION

PROJECT: Gowanus
SITE: 322 3rd Ave
LOCATION: Gowanus, NY
224-PCXR4 ← INSTRUMENT MODEL NO.: ____
PUMP SERIAL NO.: 602132

DATE(S) SAMPLED: 7/29/15
TIME PERIOD SAMPLED: see below
OPERATOR: Dave Morelli
CALIBRATED BY: Same
RAIN: ____YES ____NO

ADSORBENT CARTRIDGE INFORMATION:

	Cartridge 1	Cartridge 2	Cartridge 3	Cartridge 4
Type:	SKC PUF Tube			
Adsorbent:	PUF/TNX			
Serial No.:	59210			
Sample No.:	1			

II. SAMPLING DATA

→ Offaine Air 1

Cartridge Identification	Sampling Location	Ambient Temp., °F	Ambient Pressure, in Hg	Flow Rate (Q), mL/min		Sampling Period		Total Sampling Time, min.	Total Sample Volume, L
				Cartridge 1	Cartridge 2	Start	Stop		
1		85	29.97	4500		0745	1235	290	1,297

III. FIELD AUDIT

	Cartridge 1	Cartridge 2	Cartridge 3	Cartridge 4
Audit Flow Check Within 10% of Set Point (Y/N)?	pre- 4515	pre-	pre-	pre-
	post- 4430	post-	post-	post-

CHECKED BY: [signature]

DATE: 8/5/15

Figure 5. Compendium Method TO-10A field test data sheet.

COMPENDIUM METHOD TO-10A
FIELD TEST DATA SHEET (FTDS)

I. GENERAL INFORMATION

PROJECT: Gowanus
SITE: 322 3rd Ave
LOCATION: Gowanus, NY
224-PCXR4 ← INSTRUMENT MODEL NO.: _____
PUMP SERIAL NO.: A034510

DATE(S) SAMPLED: 7/31/15
TIME PERIOD SAMPLED: See below
OPERATOR: Dave Morelli
CALIBRATED BY: Same
RAIN: ____YES _____NO

ADSORBENT CARTRIDGE INFORMATION:

	Cartridge 1	Cartridge 2	Cartridge 3	Cartridge 4
Type:	SKC PUF Tube			
Adsorbent:	PUF/TNX			
Serial No.:	59210			
Sample No.:	2			

II. SAMPLING DATA

→ Offsite Air 2

Cartridge Identification	Sampling Location	Ambient Temp., °F	Ambient Pressure, in Hg	Flow Rate (Q), mL/min		Sampling Period		Total Sampling Time, min.	Total Sample Volume, L
				Cartridge 1	Cartridge 2	Start	Stop		
2		85	29.88	4500		0650	1120	270	1,216

III. FIELD AUDIT

	Cartridge 1	Cartridge 2	Cartridge 3	Cartridge 4
Audit Flow Check Within 10% of Set Point (Y/N)?	pre- 4515	pre-	pre-	pre-
	post- 4490	post-	post-	post-

CHECKED BY: D. Morelli

DATE: 8/5/15

Figure 5. Compendium Method TO-10A field test data sheet.

COMPENDIUM METHOD TO-10A
FIELD TEST DATA SHEET (FTDS)

I. GENERAL INFORMATION

PROJECT: Gowanus
SITE: 322 3rd Ave
LOCATION: Gowanus, NY
224-PCXR4 ← INSTRUMENT MODEL NO.: ____
PUMP SERIAL NO.: 602132

DATE(S) SAMPLED: 7/30/15
TIME PERIOD SAMPLED: See below
OPERATOR: Dave Morelli
CALIBRATED BY: Same
RAIN: ____YES ____NO

ADSORBENT CARTRIDGE INFORMATION:

	Cartridge 1	Cartridge 2	Cartridge 3	Cartridge 4
Type:	SKC PUF Tube			
Adsorbent:	PUF/TNX			
Serial No.:	59210			
Sample No.:	3			

II. SAMPLING DATA

→ Work Zone Air 1

Cartridge Identification	Sampling Location	Ambient Temp., °F	Ambient Pressure, in Hg	Flow Rate (Q), mL/min		Sampling Period		Total Sampling Time, min.	Total Sample Volume, L
				Cartridge 1	Cartridge 2	Start	Stop		
3		85	29.89	4500		0720	1155	275	1,214

III. FIELD AUDIT

	Cartridge 1	Cartridge 2	Cartridge 3	Cartridge 4
Audit Flow Check Within 10% of Set Point (Y/N)?	pre- 4450	pre-	pre-	pre-
	post- 4380	post-	post-	post-

CHECKED BY: [signature]

DATE: 8/5/15

Figure 5. Compendium Method TO-10A field test data sheet.

COMPENDIUM METHOD TO-10A
FIELD TEST DATA SHEET (FTDS)

I. GENERAL INFORMATION

PROJECT: Gowanus DATE(S) SAMPLED: 7/31/15
SITE: 322 3rd Ave TIME PERIOD SAMPLED: see below
LOCATION: Gowanus, NY OPERATOR: Dave Morelli
224-PCXRY ← INSTRUMENT MODEL NO.: ____ CALIBRATED BY: Same
PUMP SERIAL NO.: 602132 RAIN: ____YES ____NO

ADSORBENT CARTRIDGE INFORMATION:

	Cartridge 1	Cartridge 2	Cartridge 3	Cartridge 4
Type:	SKC PUF Tube			
Adsorbent:	PUF/TNX			
Serial No.:	59210			
Sample No.:	4			

II. SAMPLING DATA

→ Work Zone Air 2

Cartridge Identification	Sampling Location	Ambient Temp., °F	Ambient Pressure, in Hg	Flow Rate (Q), mL/min		Sampling Period		Total Sampling Time, min.	Total Sample Volume, L
				Cartridge 1	Cartridge 2	Start	Stop		
4		85	29.88	4500		0900	1330	270	1,234

III. FIELD AUDIT

	Cartridge 1	Cartridge 2	Cartridge 3	Cartridge 4
Audit Flow Check Within 10% of Set Point (Y/N)?	pre- 4500	pre-	pre-	pre-
	post- 4640	post-	post-	post-

CHECKED BY: D. Morelli

DATE: 8/5/15

Figure 5. Compendium Method TO-10A field test data sheet.

COMPENDIUM METHOD TO-10A
FIELD TEST DATA SHEET (FTDS)

I. GENERAL INFORMATION

PROJECT: Gowanus
DATE(S) SAMPLED: 7/31/15
SITE: 322 3rd Ave
TIME PERIOD SAMPLED: See below
LOCATION: Gowanus, NY
OPERATOR: Dave Morelli
224-PCXR4 ← INSTRUMENT MODEL NO.: ____
CALIBRATED BY: Same
PUMP SERIAL NO.: 666217
RAIN: ____YES ____NO

ADSORBENT CARTRIDGE INFORMATION:

	Cartridge 1	Cartridge 2	Cartridge 3	Cartridge 4
Type:	SKC PUF Tube			
Adsorbent:	PUF/TNX			
Serial No.:	59210			
Sample No.:	5			

II. SAMPLING DATA

→ Basement Air

Cartridge Identification	Sampling Location	Ambient Temp., °F	Ambient Pressure, in Hg	Flow Rate (Q), mL/min		Sampling Period		Total Sampling Time, min.	Total Sample Volume, L
				Cartridge 1	Cartridge 2	Start	Stop		
5		85	29.88	4500		0640	1110	270	1,214

III. FIELD AUDIT

	Cartridge 1	Cartridge 2	Cartridge 3	Cartridge 4
Audit Flow Check Within 10% of Set Point (Y/N)?	pre- 4510	pre-	pre-	pre-
	post- 4480	post-	post-	post-

CHECKED BY: Dave Morelli

DATE: 8/5/15

Figure 5. Compendium Method TO-10A field test data sheet.

COMPENDIUM METHOD TO-10A
FIELD TEST DATA SHEET (FTDS)

I. GENERAL INFORMATION

PROJECT: Gowanus
SITE: 322 3rd Ave
LOCATION: Gowanus, NY
224-PCXR4 ← INSTRUMENT MODEL NO.: _____
PUMP SERIAL NO.: 666217

DATE(S) SAMPLED: 7/30/15
TIME PERIOD SAMPLED: See below
OPERATOR: Dave Morelli
CALIBRATED BY: Same
RAIN: ____YES _____NO

ADSORBENT CARTRIDGE INFORMATION:

	Cartridge 1	Cartridge 2	Cartridge 3	Cartridge 4
Type:	SKC PUF Tube			
Adsorbent:	PUF/TNX			
Serial No.:	59210			
Sample No.:	6			

II. SAMPLING DATA

→ Floor 1 Air

Cartridge Identification	Sampling Location	Ambient Temp., °F	Ambient Pressure, in Hg	Flow Rate (Q), mL/min		Sampling Period		Total Sampling Time, min.	Total Sample Volume, L
				Cartridge 1	Cartridge 2	Start	Stop		
6		85	29.89	4500		0710	1140	270	1,197

III. FIELD AUDIT

	Cartridge 1	Cartridge 2	Cartridge 3	Cartridge 4
Audit Flow Check Within 10% of Set Point (Y/N)?	pre- 4480	pre-	pre-	pre-
	post- 4390	post-	post-	post-

CHECKED BY: Dave Morelli

DATE: 8/5/15

Figure 5. Compendium Method TO-10A field test data sheet.

COMPENDIUM METHOD TO-10A
FIELD TEST DATA SHEET (FTDS)

I. GENERAL INFORMATION

PROJECT: Gowanus DATE(S) SAMPLED: 7/30/15
SITE: 322 3rd Ave TIME PERIOD SAMPLED: see below
LOCATION: Gowanus, NY OPERATOR: Dave Morelli
224-PCXR4 ← INSTRUMENT MODEL NO.: ____ CALIBRATED BY: Same
PUMP SERIAL NO.: A034510 RAIN: ____YES ____NO

ADSORBENT CARTRIDGE INFORMATION:

	Cartridge 1	Cartridge 2	Cartridge 3	Cartridge 4
Type:	SKC PUF Tube			
Adsorbent:	PUF/TNX			
Serial No.:	59210			
Sample No.:	7			

II. SAMPLING DATA

→ Floor 2 Air

Cartridge Identification	Sampling Location	Ambient Temp., °F	Ambient Pressure, in Hg	Flow Rate (Q), mL/min		Sampling Period		Total Sampling Time, min.	Total Sample Volume, L
				Cartridge 1	Cartridge 2	Start	Stop		
7		85	29.89	4500		0655	1130	275	1,229

III. FIELD AUDIT

	Cartridge 1	Cartridge 2	Cartridge 3	Cartridge 4
Audit Flow Check Within 10% of Set Point (Y/N)?	pre- 4515	pre-	pre-	pre-
	post- 4425	post-	post-	post-

CHECKED BY: D. Morelli

DATE: 8/5/15

Figure 5. Compendium Method TO-10A field test data sheet.

COMPENDIUM METHOD TO-10A
FIELD TEST DATA SHEET (FTDS)

I. GENERAL INFORMATION

PROJECT: Gowanus DATE(S) SAMPLED: 7/29/15
SITE: 322 3rd Ave TIME PERIOD SAMPLED: see below
LOCATION: Gowanus, NY OPERATOR: Dave Morelli
224-PCXR4 ← INSTRUMENT MODEL NO.: ____ CALIBRATED BY: Same
PUMP SERIAL NO.: 666217 RAIN: ____YES ____NO

ADSORBENT CARTRIDGE INFORMATION:

	Cartridge 1	Cartridge 2	Cartridge 3	Cartridge 4
Type:	SKC PUF Tube			
Adsorbent:	PUF/TNX			
Serial No.:	59210			
Sample No.:	8			

II. SAMPLING DATA

→ Floor 3 Air.

Cartridge Identification	Sampling Location	Ambient Temp., °F	Ambient Pressure, in Hg	Flow Rate (Q), mL/min		Sampling Period		Total Sampling Time, min.	Total Sample Volume, L
				Cartridge 1	Cartridge 2	Start	Stop		
8		85	29.97	4500		0730	1215	285	1,263

III. FIELD AUDIT

	Cartridge 1	Cartridge 2	Cartridge 3	Cartridge 4
Audit Flow Check Within 10% of Set Point (Y/N)?	pre- 4505	pre-	pre-	pre-
	post- 4360	post-	post-	post-

CHECKED BY: D. Morelli

DATE: 8/5/15

Figure 5. Compendium Method TO-10A field test data sheet.

COMPENDIUM METHOD TO-10A
FIELD TEST DATA SHEET (FTDS)

I. GENERAL INFORMATION

PROJECT: Gowanus DATE(S) SAMPLED: 7/29/15
SITE: 322 3rd Ave TIME PERIOD SAMPLED: See below
LOCATION: Gowanus, NY OPERATOR: Dave Morelli
224-PCXR4 ← INSTRUMENT MODEL NO.: ____ CALIBRATED BY: Same
PUMP SERIAL NO.: A034510 RAIN: ____YES ____NO

ADSORBENT CARTRIDGE INFORMATION:

	Cartridge 1	Cartridge 2	Cartridge 3	Cartridge 4
Type:	SKC PUF Tube			
Adsorbent:	PUF/TNX			
Serial No.:	59210			
Sample No.:	9			

II. SAMPLING DATA

→ Floor 4 Air

Cartridge Identification	Sampling Location	Ambient Temp., °F	Ambient Pressure, in Hg	Flow Rate (Q), mL/min		Sampling Period		Total Sampling Time, min.	Total Sample Volume, L
				Cartridge 1	Cartridge 2	Start	Stop		
9		85	29.97	4500		0745	1225	290	1,304

III. FIELD AUDIT

	Cartridge 1	Cartridge 2	Cartridge 3	Cartridge 4
Audit Flow Check Within 10% of Set Point (Y/N)?	pre- 4510	pre-	pre-	pre-
	post- 4480	post-	post-	post-

CHECKED BY: Dave Morelli

DATE: 8/5/15

Figure 5. Compendium Method TO-10A field test data sheet.

COMPENDIUM METHOD TO-10A
FIELD TEST DATA SHEET (FTDS)

I. GENERAL INFORMATION

PROJECT: Gowanus
SITE: 322 3rd Ave
LOCATION: Gowanus, NY
INSTRUMENT MODEL NO.: NA
PUMP SERIAL NO.: NA

DATE(S) SAMPLED: 7/31/15
TIME PERIOD SAMPLED: see below
OPERATOR: Dave Morelli
CALIBRATED BY: Same
RAIN: ____YES _____NO

ADSORBENT CARTRIDGE INFORMATION:

	Cartridge 1	Cartridge 2	Cartridge 3	Cartridge 4
Type:	SKC PUF Tube			
Adsorbent:	PUF/TNX			
Serial No.:	59210			
Sample No.:	10			

II. SAMPLING DATA

Field Blank

Cartridge Identification	Sampling Location	Ambient Temp., °F	Ambient Pressure, in Hg	Flow Rate (Q), mL/min		Sampling Period		Total Sampling Time, min.	Total Sample Volume, L
				Cartridge 1	Cartridge 2	Start	Stop		
10		85	29.88	NA		0640	1110	270	NA

III. FIELD AUDIT

	Cartridge 1	Cartridge 2	Cartridge 3	Cartridge 4
Audit Flow Check Within 10% of Set Point (Y/N)?	pre- NA	pre-	pre-	pre-
	post- NA	post-	post-	post-

CHECKED BY: D. Morelli

DATE: 8/5/15

Figure 5. Compendium Method TO-10A field test data sheet.

JOB _____ OF _____

SHEET NO. _____ DATE _____

CALCULATED BY _____ DATE _____

CHECKED BY _____ DATE _____

SCALE _____

LEGGETTE, BRASHEARS & GRAHAM, INC.
110 CORPORATE PARK DRIVE
SUITE 112
WHITE PLAINS, NY 10604
(914) 694-5711 • FAX (914) 694-5744
www.lbgweb.com

Gowanus - Air Sample Summary

8/3/15

		START Time / Rate	END Time / Rate	Avg Rate (L/min)	Total Volume (L)
1)	Offsite Air 1	0745 / 4.515	1235 / 4.430	4.473 (290 min)	= 1,297
2)	Offsite Air 2	0650 / 4.515	1120 / 4.490	4.503 (270 min)	= 1,216
3)	Work Zone Air 1	0720 / 4.450	1155 / 4.380	4.415 (275 min)	= 1,214
4)	Work Zone Air 2	0900 / 4.500	1330 / 4.640	4.570 (270 min)	= 1,234
5)	Basement Air	0640 / 4.510	1110 / 4.480	4.495 (270 min)	= 1,214
6)	FL1 Air	0710 / 4.480	1140 / 4.390	4.435 (270 min)	= 1,197
7)	FL2 Air	0655 / 4.515	1130 / 4.425	4.470 (275 min)	= 1,229
8)	FL3	0730 / 4.505	1215 / 4.360	4.433 (285 min)	= 1,263
9)	FL4	0745 / 4.510	1225 / 4.480	4.495 (290 min)	= 1,304
10)	Field Blank → No air flow				

Cooler: Yes [ ] No [ ]
Coolant: IPK [ ] ICE [ ] No [ ]
Temp °C Pg of

PHOENIX Environmental Laboratories, Inc.

NY/NJ CHAIN OF CUSTODY RECORD

587 East Middle Turnpike, P.O. Box 370, Manchester, CT 06040
Email: info@phoenixlabs.com Fax (860) 645-0823
Client Services (860) 645-8726

Contact Options:
[ ] Fax:
[ ] Phone:
[✓] Email: groszkowski@lbgny.com

Customer: LBG, Inc. (Sean Groszkowski)
Address: 4 Westchester Pk Dr, Ste 175
White Plains, NY 10604

Project: Gowanus
Report to: 2 LBG
Invoice to: 3 Sean Groszkowski

Project P.O:

This section MUST be completed with Bottle Quantities.

Client Sample - Information - Identification

Sampler's Signature: [signature] Date: 7/31/15

Matrix Code:
DW=Drinking Water GW=Ground Water SW=Surface Water WW=Waste Water
RW=Raw Water SE=Sediment SL=Sludge S=Soil SD=Solid W=Wipe
OIL=Oil B=Bulk L=Liquid

Analysis Request

PHOENIX USE ONLY SAMPLE #	Customer Sample Identification	Sample Matrix	Date Sampled	Time Sampled	PCBs (TO-10A)	Soil VOA Vials [ ] methanol [ ] H2O	GL Soil container ( )oz	GL Soil container ( )oz	40 ml VOA Vial [ ] As is [ ] HCl	GL Amber 1000ml [ ] As is [ ] H2SO4	PL As is [ ] 250ml [ ] 500ml [ ] 1000ml	PL H2SO4 [ ] 250ml [ ] 500ml	PL HNO3 250ml	PL NaOH 250ml	Bacteria Bottle
1	Offsite Air 1		7/29/15	1235	✓										
2	Offsite Air 2		7/31/15	1120	↓										
3	Work Zone Air 1		7/30/15	1155	↓										
4	Work Zone Air 2		7/31/15	1330	↓										
5	Basement Air		7/31/15	1110	↓										
6	FL1 Air		7/30/15	1140	↓										
7	FL2 Air		↓	1130	↓										
8	FL3 Air		7/29/15	1215	↓										
9	FL4 Air		↓	1225	↓										
10	Field Blank		7/31/15	1105	↓										

Relinquished by:	Accepted by:	Date:	Time:
[signature]		8/3/15	0700

Comments, Special Requirements or Regulations:

Turnaround:
[ ] 1 Day*
[ ] 2 Days*
[ ] 3 Days*
[ ] 5 Days
[ ] 10 Days
[ ] Other
* SURCHARGE APPLIES

NJ
[ ] Res. Criteria
[ ] Non-Res. Criteria
[ ] Impact to GW Soil Cleanup Criteria
[ ] GW Criteria

NY
[ ] NY 375 GWP
[ ] NY375 Unrestricted Use Soil
[ ] NY375 Residential Soil
[ ] Restricted/Residential
[ ] Commercial
[ ] Industrial

Data Format
[ ] Phoenix Std Report
[✓] Excel
[✓] PDF
[ ] GIS/Key
[ ] EQuIS
[ ] NJ Hazsite EDD
[ ] NY EZ EDD (ASP)
[ ] Other

Data Package
[ ] NJ Reduced Deliv. *
[ ] NY Enhanced (ASP B) *
[ ] Other

State where samples were collected: NY

APPENDIX B

Quality Assurance Protection Plan

GOWANUS VILLAGE I, LLC
322 3rd AVENUE
BROOKLYN, KINGS COUNTY, NEW YORK

QUALITY ASSURANCE PROTECTION PLAN
NYSDEC BCP SITE NO. C224099
INDEX NO. W2-1069-0506

Prepared For

Gemini Arts Initiative, Inc.

July 2013

Prepared By:

LBG ENGINEERING SERVICES, P.C.
Professional Environmental & Civil Engineers
110 Corporate Park Drive, Suite 112
White Plains, NY 10604
(914) 695-5711

TABLE OF CONTENTS

Page

1.0 INTRODUCTION 1
- 1.1 Site Contaminants and Cleanup Objectives 2
- 1.2 QAPP Structure 3
- 1.3 Data Quality Objectives and Criteria 4

2.0 PROJECT MANAGEMENT 10
- 2.1 Project Management Team 10
  - 2.1.1 Field Sampling 10
  - 2.1.2 Field Personnel 11
  - 2.1.3 Laboratories 11
  - 2.1.4 Third Party Data Validator 12
  - 2.1.5 Certifications 13
- 2.2 Field Data Management 13
  - 2.2.1 Daily Field Sheets 13
  - 2.2.2 Sample Collection Field Sheets (SCFSs) 14
  - 2.2.3 Sample Labeling 15
  - 2.2.4 Electronic (Digital Data) 16
  - 2.2.5 Chain-of-Custody (COC) Documentation 16
  - 2.2.6 Laboratory Data Analytical Reports 18
  - 2.2.7 Project Reports 21
  - 2.2.8 Use of Historic Data 22

3.0 DATA GENERATION AND ACQUISITION 23
- 3.1 Sampling Process Design 23
- 3.2 Sampling Methods 23
  - 3.2.1 Soil/Sediment Sampling 25
    - 3.2.1.1 Grab Sampling 26
    - 3.2.1.2 Hand Auger Sampling 26
    - 3.2.1.3 Geoprobe Macrocore Sampling 26
    - 3.2.1.4 Split-Spoon Sampling 27
  - 3.2.2 Groundwater Sampling 27
  - 3.2.3 Soil Gas, Indoor Air, Ambient Air and Effluent Vapor 28
    - 3.2.3.1 Soil Vapor 29
    - 3.2.3.2 Indoor Air 29
    - 3.2.3.3 Outdoor Ambient Air 30
    - 3.2.3.4 (Remediation System) Sampling 30
- 3.3 Sample Handling and Custody 30
  - 3.3.1 Documentation/Chain-of-Custody 31
  - 3.3.2 Sample Handling 31
  - 3.3.3 Laboratory Chain-of- Custody Procedures 32
  - 3.3.4 Final Evidence File Custody Procedure 32
- 3.4 Analytical Methods 33
  - 3.4.1 Field Analytical Procedures 33

TABLE OF CONTENTS
(continued)

Page

3.4.2 Laboratory Analytical Procedures 34
3.5 Quality Control 36
3.5.1 Field Quality Control Requirements 36
3.5.2 Laboratory Quality Control Requirements 37
3.6 Instrument/Equipment Testing, Inspection and Maintenance 39
3.6.1 Field Instrumentation 39
3.6.2 Laboratory Instruments 39
3.7 Instrument/Equipment Calibration and Frequency 40
3.7.1 Field Instrument/Equipment Calibration and Frequency 40
3.7.2 Laboratory Instrument/Equipment Calibration and Frequency 40
3.8 Inspection/Acceptance of Supplies and Consumbable 41
3.9 Non-Direct Measurements 41
3.10 Data Management 41

4.0 ASSESSMENT AND OVERSIGHT 42
4.1 Technical System Audits 42
4.1.1 Field Data 43
4.1.2 Reports 43
4.1.3 Laboratory Data 44
4.2 Performance Evaluation Audits 44
4.2.1 Field Performance Evaluation Audits 44
4.2.2 Laboratory Performance Evaluation Audits 44
4.3 Audit Records 46
4.4 Reports to Management 46
4.4.1 Progress Reports 46
4.4.2 QA Reports 47

5.0 DATA VALIDATION AND USABILITY 47
5.1 Data Review, Verification, and Validation 48
5.1.1 Data Review 48
5.1.2 Data Verification 48
5.1.3 Data Validation 48
5.1.4 Data Usability Assessment 49
5.2 Verification and Validation Methods 50
5.2.1 Verification 50
5.2.2 Validation 50
5.2.3 Validation and Verification Procedures 50
5.2.4 Data Assessment 53
5.3 Data Requirement Compliance Evaluation 53
5.3.1 Data Quality Indicators Evaluation Criteria Details 54
5.3.1.1 Precision Assessment 54

TABLE OF CONTENTS
(continued)

Page

5.3.1.2 Accuracy Assessment 55
5.3.1.3 Sample Representativeness 55
5.3.1.4 Completeness Assessment 56
5.3.1.5 Comparability Assessment 56
5.3.1.6 Sensitivity and Quantification Limits 56
5.3.1.7 Sample Bias Assessment 57
5.3.2 Data Limitations and Corrective Actions 57
5.3.2.1 Field Corrective Action 58
5.3.2.2 Laboratory Corrective Action 58
5.3.2.3 Corrective Action During Data Review/Validation and Assessment 58

APPENDICES

LIST OF APPENDICES
(at end of report)

Appendix

I	Analytical Laboratories - QA Plans, SOPs and Certifications
II	Sample Collection Field Sheet Template
III	Sample Chain-of-Custody Form

LIST OF TABLES
(at end of report)

Table

1 Sample Containers, Preservatives and Holding Times

2 General QA/QC Sample Collection and Analysis Frequency

ACRONYMS AND ABBREVIATIONS

(J)	Quality Estimated
ASP	Analytical Services Protocol
ASTM	American Society for Testing and Materials
AWQS	Ambient Water Quality Standards
CCV	Continuing Calibration Verification
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulation
COCs	Contaminants of Concern
DOT	Department of Transportation
DQA	Data Quality Assessment
DQIs	Data Quality Indicators
DQOs	Data Quality Objectives
DUSR	Data Usability Summary Reports
EarthSoft	EarthSoft, Inc.
EDD	Electronic Data Deliverable
EIMS	Environmental Information Management System
ELAP	Environmental Laboratory Accreditation Program
EPA	United States Environmental Protection Agency
FER	Final Engineering Report
GAII	Gemini Arts Initiative, Inc.
GC/MS	Gas Chromatography/Mass Spectrometer
GPS	Global Positioning System
GWPT	Groundwater Pump and Treat System
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
ICAL	Initial Calibration
ICV	Initial Calibration Verification

ACRONYMS AND ABBREVIATIONS
(continued)

IDW	Investigation Derived Waste
LBGES/LBG	LBG Engineering Services, P.C./Leggette, Brashears & Graham, Inc.
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
LOQ	Limit of Quantitation
MDL	Method Detection Limit
ml/min	Milliliter Per Minute
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NELAC	National Environmental Laboratory Accreditation Conference
NYCRR	New York Codes, Rules and Regulations
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OQ	Operator Qualifications
OSHA	Occupational Safety and Health Administration
PCBs	Polychlorinated Biphenyls
PDF	Portable Document Format
PID	Photoionization Detector
QA/QC	Quality Assurance/Quality Control
QAO	Quality Assurance Officer
QAPP	Quality Assurance Protection Plan
QSM	Quality Systems Manual
RAOs	Remedial Action Objectives
RAWP	Remedial Action Work Plan
RL	Reporting Limit

ACRONYMS AND ABBREVIATIONS
(continued)

RPD	Relative Percent Differences
RUSCOs	Restricted Use Soil Cleanup Objectives
SCFS	Sample Collection Field Sheets
SCGs	Standards, Criteria and Guidance
SCOs	Site Cleanup Objectives
SOPs	Standard Operating Procedures
SSDS	Sub-Slab Depressurization System
SVE	Soil-Vapor Extraction
SWDA	Safe Drinking Water Act
TOGS	Technical and Operational Guidance Series
ug/kg	Micrograms Per Kilogram
USGS	United States Geological Survey
VOC	Volatile Organic Compounds

GOWANUS VILLAGE I, LLC
322 3rd AVENUE
BROOKLYN, KINGS COUNTY, NEW YORK

QUALITY ASSURANCE PROTECTION PLAN
NYSDEC BCP SITE NO. C224099
INDEX NO. W2-1069-0506

1.0 INTRODUCTION

This Quality Assurance Protection Plan (QAPP) provides a framework for how environmental characterization samples will be collected to achieve specific project objectives, and describes the procedures that will be implemented to obtain data of known and adequate quality. The QAPP has been prepared as a formal document describing in comprehensive detail the necessary Quality Assurance (QA)/Quality Control (QC) and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria. This document includes proposed sampling methods and analytical methods for both characterization sampling and end-point sampling.

This QAPP will provide sufficient detail to demonstrate that:

- the project technical and quality objectives are identified and agreed upon;
- the intended measurements, data generation, or data acquisition methods are appropriate for achieving project objectives;
- assessment procedures are sufficient for confirming that data of the type and quality needed and expected are obtained; and,
- any limitations on the use of the data can be identified and documented.

Most environmental data operations require the coordinated efforts of many individuals, including managers, engineers, scientists, statisticians and others. This QAPP integrates the contributions and requirements of everyone involved into a clear, concise statement of what is to be accomplished, how it will be done, and by whom. It provides understandable instructions to those who must implement the QAPP, such as the field sampling team, the analytical laboratory, modelers, and the data reviewers. In all aspects of the QAPP, the use of national consensus standards and practices are encouraged.

In order to be effective, the QAPP specifies the level or degree of QA and QC activities needed for the particular environmental data operations. Because this will vary according to the purpose and type of work being done, a graded approach will be used in planning the work.

1.1 Site Contaminants and Cleanup Objectives

The Site-specific contaminants of concern (COCs) related to the Remedial Action Work Plan (RAWP) include:

1. polychlorinated biphenyls (PCBs);
2. metals;
3. volatile organic compounds (VOCs); and,
4. semivolatile organic compounds (SVOCs).

The onsite work activities will include collection of samples from some or all of the following media at the Site:

Check All That Apply	Environmental Media
	Air (Ambient, Indoor, and/or Subsurface)
☑	Ambient air
☑	Indoor air
☑	Soil Vapor
☐	Sub-slab Soil Vapor
☑	**Sediment**
☑	**Sludge**
☑	**Soil**
	Water
☐	Drinking Water
☑	Groundwater (treated and/or untreated)
☑	Surface water (treated and/or untreated)
☑	Wastewater
	Other Media
☑	Surface Wipe Samples

Check All That Apply	Environmental Media
☑	Free Product (NAPL)
☑	Spent Carbon, Organo-Clay, and/or Zeolite
☑	Spent mitigation materials (e.g., fabric filters, sorbent booms, tyvek, pipe, etc.)
☑	Spent sampling materials (e.g., gloves, bailer, rope, etc.)
☐	Other (specify):

The overall Site Cleanup Objectives (SCOs) applicable to the RAWP are established by the Standards, Criteria & Guidance (SCGs) applicable to each medium sampled as outlined in the following regulatory guidance documents:

- Overall Project Implementation: New York State Department of Environmental Conservation (NYSDEC) DER-10/Technical Guidance for Site Investigation and Remediation;
- Soil/Fill/Sediment: NYSDEC's 6 New York Codes, Rules and Regulations (NYCRR) Part 375 Environmental Remediation Programs, 6 Part 375-6.8: Restricted Use Soil Cleanup Objectives (RUSCOs) for Restricted Residential;
- Groundwater: NYSDEC's June 1998 Ambient Water Quality Standards (AWQS) and Guidance Values and Groundwater Effluent Limitations in the Technical and Operational Guidance Series (TOGS) 1.1.1; and,
- Soil Vapor: New York State Department of Health (NYSDOH) Guidance for Evaluating Soil Vapor Intrusion in the State of New York - October 2006.

In the event that an additional/alternative regulatory guidance document is applicable to the SCOs, all substantive requirements will be complied with relative to the performance of the RAWP.

1.2 QAPP Structure

The QAPP is composed of elements covering the entire project from planning, through implementation, to assessment. These elements are presented in that order and have been ar-

ranged for convenience into four general groups. The four groups of elements and their intent are summarized as follows:

1. Project Management;
2. Data Generation and Acquisition;
3. Assessment and Oversight; and,
4. Data Validation and Usability.

All applicable elements, including the content and level of detail under each element, are addressed in the QAPP. If an element is not applicable, it will be stated in the QAPP. Documentation, such as the approved RAWP, may be referenced in response to a particular required QAPP element to reduce the size of the QAPP.

1.3 Data Quality Objectives and Criteria

Data Quality Objectives (DQOs) are qualitative and quantitative statements that specify the quality of the data that is required to support decisions made during the investigation or mitigation activities. The overall DQOs for this project are:

- to develop and implement procedures for field measurements and sampling, COC, laboratory analysis, and reporting that will provide legally defensible results;
- to define tolerable limits on the probability of making a decision error due to uncertainty in the data; and,
- to assess the adequacy of the data (new or existing) in relation to their intended use.

Data collected during the project will be used to evaluate the immediate and/or long-term risks to human health and the environment from residual onsite contamination, to characterize the magnitude and extent of impacted media, to define areas of concern, and to gauge the effectiveness of clean-up efforts to ensure protection of human health and the environment. The data will be compared to State-specific mandated codes or guidance for risk screening levels and/or corrective action objectives (clean-up criteria) that will be used to monitor risk and remedial progress for the project. A description of the remedial activities, project goals, con-

taminants and media of concern, and Site-specific mandated screening and/or clean-up criteria is presented in the RAWP.

Specific procedures for sampling, COC, laboratory instrument calibration, laboratory analysis, data reporting, internal quality control, audits, preventive maintenance of field equipment, and corrective action are described in other sections of this QAPP.

Throughout the remedial project some sampling will be conducted for screening purposes. Data generated from screening samples will be produced by using portable equipment and/or field laboratory analyses. QA activities for the screening will be limited to calibration and periodic checks of the instrumentation. All analytical data will meet the requirements of these sections.

DQOs for field measurements and laboratory analytical data produced during this project will be addressed in terms of data quality indicators (DQIs) such as precision, accuracy, representativeness, completeness, comparability, sensitivity and bias. For each DQI, there are various quality assurance methodologies and objectives for both field data and laboratory data for the project. Meeting the DQOs will require that sampling and measurements are performed using consistent Standard Operating Procedures (SOPs) and standard methods, with properly operated and calibrated equipment, conducted by trained personnel. These project DQIs as well as the quality assurance methodologies and objectives that will apply to each respective DQI are outlined below.

A. DQI – Precision

The measure of agreement among repeated measurements of the same property under identical or substantially similar conditions; calculated as either the range or as the standard deviation. Precision may also be expressed as a percentage of the mean of the measurements, such as relative range or relative standard deviation (coefficient of variation).

1. Field Data Quality Determination Methodologies and Objectives:

- Collect and measure field blanks and trip blanks and adhere to all sample handling, preservation, and holding time criteria. Sample containers,

preservatives and holding times for each sample matrix and analytical methodology are summarized in table 1.

- Trip blanks are used when VOC analysis is required and are prepared with a sample of reagent grade water from the laboratory. *Every shipping container (e.g., cooler) with aqueous VOC samples will contain a trip blank sample.*
- Field blanks are collected by pouring distilled water over sampling equipment and collecting the effluent in the proper containers. *Field blanks will be collected once per sampling area.*
- Field duplicates are collected by using identical sampling methods from a single sampling location and storing the sample in the proper containers. *Field duplicates will be collected once per sampling area.*

2. Laboratory Data Quality Determination Methodologies and Objectives:

- Analysis of a laboratory control sample (LCS)/laboratory control sample duplicate (LCSD), matrix spike (MS)/matrix spike duplicate (MSD) and field duplicate pairs.
- Evaluation of the relative percent differences (RPD) between duplicate pairs (the relative percent difference is calculated by measuring the same sample twice and dividing the difference of those two results by the average of the two results).
- The precision limits are specific for each laboratory and analysis.

B. DQI – Accuracy

Accuracy is the measure of the overall agreement of a measurement to a known value; includes a combination of random error (precision) and systematic error (bias) components of both sampling and analytical operations.

1. **Field Data Quality Determination Methodologies and Objectives:**
   - Collect and measure field blanks and trip blanks and adhere to all sample handling, preservation, and holding time criteria.
   - Trip blanks are used when VOC analysis is required and are prepared with a sample of reagent grade water from the laboratory. *Every shipping container (e.g., cooler) with aqueous VOC samples will contain a trip blank sample.*
   - Field blanks are collected by pouring distilled water over sampling equipment and collecting the effluent in the proper containers. *Field blanks will be collected once per sampling area.*
2. **Laboratory Data Quality Determination Methodologies and Objectives:**
   - Analysis of analytical spikes and/or reference standards, MS/MSD, LCS, surrogate compounds, or equivalent and the determination of percent recoveries.
   - At a minimum, *one sample spike should be included in every set of 20 samples tested on each instrument, for each sample matrix* (e.g., groundwater, soil, etc.) to be tested.

C. DQI – Representativeness

Representativeness is a qualitative term that expresses "the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition." (ANSI/ASQC 1995)[1]

1. **Field Data Quality Determination Methodologies and Objectives:**
   - Ensure that sampling locations were properly selected to provide data representative of Site conditions.
   - Follow all sampling and analysis protocols in the QAPP, other project specific work plans, and all pertinent SOPs. These will include the anal-

[1] American National Standards Institute/American Society for Quality Control S2-1995: Introduction to Attribute Sampling

ysis of trip blank and field blank data as well as calibration and documentation review of field instruments.

2. Laboratory Data Quality Determination Methodologies and Objectives:

- Following the proper analytical procedures and appropriate analytical methods, adhering to the appropriate sample holding times, and analyzing blanks and duplicates will ensure representativeness.
- The QA goal will be to have all laboratory measurements representative of the samples being analyzed.

D. DQI – Completeness

Completeness is a measure of the amount of valid data needed to be obtained from a measurement system.

1. Field Data Quality Determination Methodologies and Objectives:

- The equation for completeness is presented in Section 5.3.1 of this QAPP.

2. Laboratory Data Quality Determination Methodologies and Objectives:

- The equation for completeness is presented in Section 5.3.1 of this QAPP.

E. DQI – Comparability

Comparability is a qualitative term that expresses the measure of confidence that one data set can be compared to another and can be combined for the decision(s) to be made.

1. Field Data Quality Determination Methodologies and Objectives:

- Use standard sampling techniques and strict adherence to the project's SOPs.

2. Laboratory Data Quality Determination Methodologies and Objectives:

- Use of similar sampling, preservation, and analytical methods and reporting limits as documented in this QAPP.

- To the extent possible, the same laboratory will be used throughout a specific phase of the project, or for particular types of media to be analyzed.

F. DQI – Sensitivity

Sensitivity is the capability of a method or instrument to discriminate between measurement responses representing different levels of the variable of interest.

1. Field Data Quality Determination Methodologies and Objectives:

- Ensure that the field instrument and/or equipment used is/are utilized within the manufacturer specified sensitivity ranges for the measurements being taken.

2. Laboratory Data Quality Determination Methodologies and Objectives:

- Method detection limit (MDL) is defined as the minimum concentration of a substance that can be identified, measured, and reported with a 99 percent confidence that the analyte concentration is greater than zero and is determined from repeated analysis of a sample in a given matrix containing the analyte. Laboratory MDLs have been determined as required in Title 40 of the Code of Federal Regulation (CFR) Part 136B. The reporting limit (RL) is greater than or equal to the lowest standard used to establish the calibration curve. Results greater than the MDL and less than the RL will be qualified estimated (J) by the laboratory. The laboratory analyte reporting parameters (MDLs, RLs and project sensitivity goals) are identified in Appendix I.

G. DQI - Bias

Bias is the systematic or persistent distortion of a measurement process that causes errors in one direction.

1. **Field Data Quality Determination Methodologies and Objectives:**
   - Ensure that calibration standards have not expired and perform field instrument calibrations per manufacturer recommendations.
2. **Laboratory Data Quality Determination Methodologies and Objectives:**
   - Use reference materials or analyze spiked matrix samples to check for bias (see Accuracy DQI objectives).

2.0 PROJECT MANAGEMENT

2.1 Project Management Team

The Project Management Team will consist of the associated personnel as outlined in the RAWP. This will include:

- the Site Owner;
- the Site General Contractor;
- Site Owner's Environmental Council;
- Site Remedial Consultant (LBG Engineering Services, P.C. [LBGES]/Leggette, Brashears & Graham, Inc. [LBG]);
  - Principal In Charge;
  - Remedial Engineer;
  - Project Manager;
  - Project Field Supervisor;
  - Health and Safety Officer; and
  - Substitute field personnel.
- Construction Sub-Contractors; and,
- Analytical Laboratories.

2.1.1 Field Sampling

Field sampling activities will consist of air, sediment, soil, sludge, groundwater, surface water and/or spent environmental treatment media sampling within or around the Site. Some sampling activities will require intrusive techniques, such as drilling and/or excavation in

order to obtain representative samples necessary to delineate impacts or to evaluate the adequacy or progress of a particular response action. As such, contractors and personnel completing these activities shall have sufficient knowledge and on-the-job training to follow the procedures required for the activities listed above. Sample collection techniques are included in Section 3.2, below.

2.1.2 Field Personnel

All field personnel involved in field observation, analyses and sample collection work will have completed the appropriate Occupational Safety and Health Administration (OSHA) and Hazardous Waste Operations and Emergency Response (HAZWOPER) health and safety training including annual refreshers of the same. Training and record retention requirements are included in the RAWP and Health and Safety Plan (HASP).

All contractors performing onsite work activities will comply with the HASP as well as maintain all insurance certificates as required by Gemini Arts Initiative, Inc. (GAII). Depending on the nature of the work, additional certifications and/or requirements may be required for Contractors. For example, excavation contractors shall comply with the Department of Transportation's (DOT) Operator Qualification (OQ) and applicable requirements.

2.1.3 Laboratories

Laboratories utilized for sample analyses associated with the project will be certified to perform the specific analyses using the specified methodologies by the State of New York. When required, all laboratories used will have a current National Environmental Laboratory Accreditation Conference (NELAC) certification. If additional certifications are required for specific analyses, the laboratory certifications will be verified prior to work.

Laboratory requirements for laboratory analysts are listed in the laboratory's QA Plan and/or Quality Systems Manual (QSM) and the laboratory has self-declared compliance with the listed requirements.

Soil, sediment, groundwater, surface water, soil vapor, air, investigation derived waste (IDW) and/or spent environmental treatment media samples will be collected during the project and submitted for laboratory analysis of a number of COCs.

The laboratories to be used for this project are listed below. The QA Plans, SOPs and certifications for each laboratory are presented in Appendix I.

Laboratory	Address	Contact Person	Phone Number
AMRO Environmental Laboratories Corporation	111 Herrick Street Merrimack, NH 03054	Nancy Stewart	(603) 424-2022
American Analytical Laboratories	56 Toledo Street Farmingdale, NY 11735	Lori Beyer	(631) 454-6100
Eurofins Lancaster Laboratories, Inc.	2425 New Holland Pike Lancaster, PA 17601	Amek Carter	(717) 556-7252

Each of these labs is qualified to perform specific analyses required for the project, and is certified by the State of New York. When samples are collected the laboratory will be selected based on capability (qualification to analyze the specific media using the specified method for the parameters requested), available capacity and required turnaround time. To the extent practical, the same laboratory will be utilized to analyze similar sample types throughout the project life-cycle.

A summary of contaminated media expected at the Site as well as the COCs are provided in Section 1.1. A summary of analytical methods are provided in Section 3.4.2 and in detail on table 1.

2.1.4 Third Party Data Validator

A Third Party Data Validator will be an independent entity not otherwise involved with the project. Full data validation will be conducted on endpoint confirmation samples (and additional samples where required) in accordance with DER-10 and 6 NYCRR Part 375. Data Usability Summary Reports (DUSR) will be prepared for all selected samples and analytical methods. The Third Party Data Validator will communicate data issues and final validation reports (when required) to the Project Manager for evaluation of any potential corrective ac-

tions and for final reporting. The remaining analytical data will be reported by the laboratory and will be reviewed/validated by the Project Manager.

2.1.5 Certifications

All contractors conducting work activities for the project will be licensed and/or certified to complete the specific work activity as required in the State of New York. In addition, some work (such as engineering design, reporting, surveying) may require that individuals overseeing the work also be licensed in their respective field of expertise (e.g., professional engineer, professional land surveyor, professional geologist, etc.) by the State of New York. In these cases, only qualified individuals and/or entities shall conduct the work activities.

2.2 Field Data Management

2.2.1 Daily Field Sheets

All work completed in the field for the project will be recorded in field logbooks and additionally will be summarized in daily field sheets. Field logbooks will be bound field survey books or notebooks. Entries will be described in as much detail as possible so that a particular situation can be reconstructed without reliance on memory.

Each logbook used at the Site will be dedicated project-specific logbooks, not used on other project sites. The Project Field Supervisor or designee will be responsible for collecting and filing the completed books. The cover page of each logbook will include the Project name and the Project start date.

Entries into the logbook will be made in permanent ink and contain a variety of information, including, but not limited to, the following:

- date, start time, and weather conditions at the beginning of each entry;
- names and purpose of individuals and/or contractors present;
- summary of any critical project-related communications during the field work, including the time, subject matter, decisions or requests made, and personnel involved;
- summary of work being conducted and equipment being used;

- summary of any field calibrations completed or the date in which the instrument was last calibrated;
- records of measurements made and samples collected, including a detailed description of the location and depth (if applicable). Sample locations may include compass and distance measurements or latitude and longitude information obtained by using a global positioning system (GPS); and,
- summary of any photographs taken.

If an incorrect entry is made in the field logbook, the incorrect information will be crossed out with a single strike mark, and the change initialed and dated by the person making the change. At the end of each entry period (i.e., the end of the work shift for the individual making the entry) the time will be recorded.

2.2.2 Sample Collection Field Sheets (SCFSs)

Sample Collection Field Sheets (SCFSs) will also be completed for each sample collected. The SCFS will include information specific to the type of sample collected and the SOP required. Typical information entered on the SCFS may include, but not be limited to:

- sample date, time and weather conditions;
- signature or initials of personnel conducting sampling;
- equipment used;
- sample identification and matrix;
- sample type (i.e., grab or composite);
- sample description (i.e., color, odor, texture, appearance, etc.);
- sample depth (if applicable);
- sample volume;
- description of sample containers and preservatives used;
- sample location;
- sample procedure and/or stabilization data; and,

- summary of photographs of sample or sample location and direction photo was taken (if required).

The SCFSs will be turned in to the Project Manager at the end of each day. The Project Manager or his designee will crosscheck the SCFSs for completeness and accuracy. A SCFS template is included in Appendix II.

2.2.3 Sample Labeling

The sampling location, distribution and frequency is outlined in the RAWP. The samples will be successively numbered, taking into account previous sampling events and/or locations, and may also include a date and time number element to ensure a unique sample identification number. The following are typical sample location designation prefixes:

Air/Vapor:
- Emission Point = EP
- Indoor Air Sample = IAS
- Sub-Slab Vapor Point = SSV
- Vapor Monitoring Point = VMP

Borings:
- Geoprobe = GP
- Hand Auger = HA
- Test Boring = TB

Excavation Limits/Soil, Sediment and Waste Sampling:
- East Side Wall = ESW
- West Side Wall = WSW
- North Side Wall = NSW
- South Side Wall = SSW
- Excavation Bottom/Base = B
- Roll-off Container = RO
- Stockpile = SP
- Sediment = SED
- Test Pit = TP

Water/Wells
- City Well = CW
- Domestic Well = DW
- Extraction Well = EW
- Injection Well = IJW
- Irrigation Well = IRW
- Monitoring Well = MW
- Piezometer = PZ
- Recovery Well = RW
- Groundwater = GW
- Surface Water = SW
- Wastewater = WW

Remediation:
- Air Sparge Point = ASP
- Air Stripper = AS
- Bag Filter = BF
- Biosparge Point = BSP
- Carbon Vessel = CV
- Density Driven Convection = DDC
- Diffused Aeration Tank = DAT
- Dissolved Oxygen Injection = DOI
- Drum = DR
- Effluent = EFF
- Extraction Well = EW
- Free Product = FP
- Groundwater Treatment System = GWTS
- Influent = INF
- Injection Point = IP
- Injection Well = IJW
- Injection Trench = IT
- In-Situ Chemical Oxidation = ISCO
- Multi-Phase Extraction = MPE
- Oil-Water Separator = OWS
- Organo-Clay Filter = OCF
- Outfall = OF
- Oxidizer = OX
- Recovery Well = RW
- Roll-off Container = RO
- Soil Vapor Extraction = SVE
- Spent Carbon = SC
- Tank = TNK
- Zeolite Filter = ZF

Miscellaneous:
- Duplicate = DUP

All labels will be filled out with waterproof ink. The unique sample location number will be utilized throughout the project to record field documentation, sample result reporting, and final report presentation documentation. The sample label shall indicate:

- project name;
- unique sample location number;
- depth interval (if applicable);
- sample type (grab or composite);
- date;
- time; and,
- sampler name or initials, and company.

2.2.4 Electronic (Digital Data)

Electronic data collected in the field (such as digital photos, GPS coordinates, pressure transducer readings, etc.) and stored in memory devices will be downloaded onto computer files by the field staff and submitted to the Project Manager at the end of each day, or as required.

2.2.5 Chain-of-Custody Documentation

The purpose of the chain-of-custody procedure is to:

- summarize the samples collected and the analyses requested;
- provide an inventory of sample containers shipped;
- prevent misidentification of samples;
- prevent tampering of the samples during shipment and storage; and,
- allow for easy tracking of possession.

The chain-of-custody will include much of the same information listed in the SCFS for all samples included in the same shipping container, including signatures of the individuals relinquishing and receiving the samples, and the date and time the samples were relinquished and received. If an incorrect entry is made on the chain-of-custody, the error will be crossed out

with a single strike mark, and the change initialed and dated by the person making the chain-of-custody change. A copy will be kept by the sampling team and will be turned in to the Project Manager with the associated field logbooks and SCFSs at the end of the day.

If the chain-of-custody is broken at any time from sample collection through sample analysis, the Project Manager and the applicable laboratory will be notified. The Project Manager is responsible for implementing corrective action and responsible for ensuring that all necessary documentation is completed. Chain-of-custody record will be completely filled out for every shipment and every sample to trace sample possession including:

- sample number and/or identification;
- printed name and signature of sample collector;
- date and time of sample collection;
- place of sample collection;
- sample type (water, soil, etc.);
- sample preservatives;
- sample container;
- requested analysis;
- signature of person involved with sample possession;
- inclusive dates of sample possession; and,
- pertinent comments and/or notes.

The laboratory portion of the chain-of-custody form will be completed by the designated analytical laboratory person and contain the following information:

- inclusive dates of sample possession;
- pertinent comments and/or notes;
- name of person receiving the sample;
- laboratory sample number;
- date of sample receipt;
- analysis requested; and,
- sample condition and temperature.

The laboratory will compare the samples entered on the chain-of-custody forms with the sample containers received by the laboratory. If the laboratory finds any discrepancies, the laboratory will contact the Project Manager for resolution. The chain-of-custody forms will be the primary source of information for the laboratory to enter data into the laboratory's sample tracking system.

2.2.6 Laboratory Data Analytical Reports

Laboratory reports will include a raw data package and a QC summary package and will be submitted in hard copy and portable document format (PDF). An electronic data deliverable (EDD) will also be provided. This will be a Microsoft Excel format for inclusion by the Project Manager into a database. The file provided in Excel format will be prepared in accordance with the Environmental Information Management System (EIMS) implemented by the NYSDEC. The EIMS uses the database software application EQuIS™ (EQuIS) from EarthSoft® Inc. (EarthSoft). The use of the NYSDEC standardized EDD format (required for all data submitted) will allow for the incorporation of the analytical data into a comprehensive geospatial database.

The laboratory reports will also be submitted electronically to the Project Manager for verification, and to a third party data validator, as required. The contents of the QC summary package include:

- cover sheet;
- laboratory case narrative,
    - date of issuance;
    - laboratory analysis performed;
    - any deviations from intended analytical strategy;
    - laboratory batch number;
    - numbers of samples and respective matrices;
    - QC procedures utilized and also references to the acceptance criteria;
    - laboratory report contents;
    - project name and number;

  - condition of samples "as-received";
  - discussion of whether or not sample holding times were met;
  - discussion of technical problems or other observations which may have created analytical difficulties; and,
  - discussion of any laboratory QC checks which failed to meet project criteria.
- cooler receipt forms;
- chain-of-custody copy;
- analytical results;
- surrogate summary forms;
- blank summary forms;
- laboratory control sample summary forms; and,
- matrix spike/matrix spike duplicate/laboratory duplicates summary forms.

Raw data packages will be provided in two different levels of QC documentation – Level II data packages and Level IV data packages (based on the former Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA] classification scheme for analytical methods). Level II data packages are generally used for analyzing data in the field (data packages produced by mobile laboratories). This type of analytical data is limited mostly to volatiles and metals and is not considered accurate enough for public health risk assessments. Level II data packages are also referred to as Category A Deliverables. Level IV is laboratory analysis using United States Environmental Protection Agency's (USEPA) contract laboratory program protocols and produces information needed for data validation by EPA national functional guidelines. Level IV data packages are also referred to as Category B Deliverables.

Both Level II and Level IV data packages will consist of the elements presented in the QC summary package but will additionally include the raw data, including, chromatograms, mass spectra, manual integration correction data, quantitation reports, calibration data, prepa-

ration logs, and analytical logs. Data in Level II and Level IV data packages will consist of the following information:

- case narrative for each analyzed batch of samples;
- summary page indicating dates of analyses for samples and laboratory QC checks;
- cross referencing of laboratory sample to project sample identification numbers;
- description of data qualifiers to be used;
- sample preparation and analyses for samples;
- sample results (analytical results will be reported as estimated J when detected above the MDL and below the RL);
- results of method reagent and preparation blanks; and,
- results of surrogate spiked LCSs, laboratory duplicates, and field QC samples.

Level IV data packages will include the Level II data package information plus the following additional information.

- raw data for sample results and laboratory QC samples (including LCS, MS/MSD, surrogates, serial dilutions, blanks, etc.);
- results of surrogate spiked LCSs, laboratory duplicates, and field QC samples;
- results of internal standards;
- results of (dated) initial and continuing calibration checks; and,
- gas chromatography and mass spectrometer (GC/MS) tuning results.

All samples will be submitted and analyzed by a New York State Department of Health (NYSDOH) Environmental Laboratory Accreditation Program (ELAP) certified laboratory. Laboratory analysis of soil and groundwater samples will consist of Category A (as defined in the Analytical Services Protocol [ASP]) or Category Spills laboratory data deliverables for all sampling performed at the Site with the exception of confirmatory (post remediation) samples and final delineation samples.

For all confirmatory (post remediation) samples and final delineation samples, Category B laboratory data deliverables as defined in the ASP will be submitted. In addition, for samples analyzed according to Category B laboratory data deliverables, a DUSR will be prepared by a party independent from the laboratory performing the analysis, when required by the NYSDEC.

For all soil gas and indoor air quality sampling, Category B laboratory data deliverables as defined in the ASP will be submitted.

In accordance with the DER-10 guidance document, analytical results without all QC documentation and raw data may be provided for all intermediate sampling events and for all long-term groundwater monitoring samples where the Site has Department of Environmental Remediation oversight, provided the following information is submitted:

- a cover page, including facility name and address, laboratory name and address, laboratory certification number, if applicable, date of analytical report preparation and signature of laboratory director;
- a listing of all field sample identification numbers and corresponding laboratory sample identification numbers;
- a listing of all analytical methods used, including matrix cleanup method;
- the method detection limit and practical quantitation level for each analyte for each sample analysis;
- all sample results including date of analysis;
- all method blank results; and,
- all chain-of-custody documentation.

2.2.7 Project Reports

Other project records used or generated for the project are summarized in the RAWP. These may include, but not be limited to:

- Site-specific workplans;
- HASP;
- required Site permits;

- project data summaries and databases;
- inspection, assessment, and corrective action reports;
- progress reports;
- technical memorandums, meeting notes and/or other written correspondences;
- model evaluation summaries;
- presentations;
- historical data documents, literature research/review files, weather data, and/or external database queries (such as State or county well indices);
- drawings, maps, tables and figures;
- photos;
- soil boring logs;
- subcontractor reports;
- QA reports (such as data review/validation and/or assessment reports), and,
- final reports.

These records (if applicable) will be incorporated in the Final Engineering Report (FER).

2.2.8 Use of Historic Data

Historical data, if available, will be utilized to help identify previous areas of environmental concern, and to estimate, approximate, or forecast the behavior, risks, fate and transport of COC before new data is obtained. The data may also be used to determine the types of analytical parameters, depths, location, and matrix to be sampled for subsequent field activities. Data may include, but not be limited to:

- maps, including Platte maps, topographic maps, utility maps, site maps, contaminant delineations, groundwater elevation contour maps, etc.;
- geological and hydrogeological information (i.e., previous boring logs, groundwater elevation data, etc.);
- soil, sediment, soil vapor, indoor air, surface water and/or groundwater analytical data generated via historical Site investigation activities;

- receptor survey information and/or State or County well indices/databases; and,
- survey data.

3.0 DATA GENERATION AND ACQUISITION

3.1 Sampling Process Design

The RAWP and/or supplemental sampling plan outline the following information:

- list samples required by type and number;
- State sample network design and rationale;
- identify sampling locations and sampling frequency; and,
- identify sample matrices.

Specific parameters critical to meeting the Remedial Action Objectives (RAOs) are indicated in the RAWP. If project-specific sampling activities are not addressed as part of this QAPP, further data will be provided as necessary in the RAWP.

3.2 Sampling Methods

Sampling methods to be used during the field activities will be consistent throughout the project, and will follow SOPs for the type of sample being collected. The SOPs for collection or measurement of each type of sample or field data are outlined in this Section. The SOPs describe the equipment required and the specific procedure to follow for collecting the sample and/or data. Sample methods, containers, preservatives, and holding time requirements for each sample parameter and matrix to be analyzed are presented in table 1.

Detailed field records for all site activities will be kept by the personnel performing or supervising the work. Recordkeeping will be completed in a field notebook, SCFSs and the daily field sheets. These documents will be used to record pertinent observations (odors, visual observation, matters of interest, weather), all field measurements (water levels, pH, specific conductance) and any irregularities or deviations from the prescribed sampling procedures. All entries into the field book and/or preprinted data sheets will be with waterproof ink

pen, initialed by the person completing the measurements/observations, and the pages of the field book numbered.

During sample collection, extreme care will be taken in order to ensure that high quality data are obtained. The sampling team will avoid fueling vehicles, using permanent marking pens or any other materials containing volatile organic compounds (VOCs) which can cause sample interference in the field. Field Blank will be prepared in the field by passing analyte-free water from the full bottle to the empty Field Blank container. The purpose of the Field Blank is to demonstrate ambient field conditions and/or equipment conditions that may potentially affect the quality of the samples. One field blank will be collected per every main sampling area. Additionally, one trip blank will be collected per shipping container of aqueous samples for VOCs in groundwater.

In general, most samples collected will be grab-type samples. Exceptions will include: samples collected for soil or sediment waste disposal characterization in which a composite sample will be collected; and indoor air samples which are extended-duration time-weighted samples. Sampling locations, including preliminary sampling locations used for screening and planning purposes, will be measured using GPS equipment with a real-time horizontal accuracy of less than one meter. Monitoring wells, staff gauges, select soil, sediment, and/or soil vapor sample locations, confirmatory sample locations, and/or other features will be professionally surveyed to within one foot horizontal and one inch vertical accuracy, traceable to an established system such as United States Geological Survey (USGS) datum. Sample depths will be directly measured in the field via measuring tape or other means and recorded in the field sampling documentation (field logbooks, SCFSs and daily field sheets).

In addition to sample locations and depths, the equipment used to collect samples will be noted, along with the time of sampling, sample description, volume, and number of containers in the field logbooks, SCFSs and daily field sheets. Sample identification numbers will be assigned prior to sample collection. Field duplicate samples, which will receive a unique sample identification number, will be noted in the field logbooks, SCFSs and daily field sheets.

In the event of any additional soil, groundwater and soil gas/indoor air sampling, latex gloves will be worn and changed between sampling locations. All of the samples will be preserved for holding time (if necessary) and properly labeled in the field as per Section 2.2.3.

3.2.1 Soil/Sediment Sampling

Soil samples may be collected in association with activities at the Site. As per the 2012 New York State (NYS) ELAP accreditation update, VOC soil/sediment samples submitted for low-level volatile analysis (less than 200 ug/kg) must be collected according to 5035 low-level specifications. As per the requirement, the soil/sediment sample must be identified on the laboratory report or associated chain-of-custody as collected in a water miscible solvent (such as methanol). The reporting limit for a field-preserved sample may vary depending on the dilution factors, percent moisture, and the range of the initial calibration curve. If 5035 low-level specifications have not been met, the lab must notify the client that the sample does not meet their sample acceptance criteria and provide the client an opportunity to re-collect the sample. If the client chooses not to re-collect and requests the samples to still be analyzed, the lab must qualify any reported sample concentrations that are below 200 ug/kg. The qualification statement will indicate that the results may be biased low due to the sample not being collected according to the 5035-L/5035A-L low-level specifications.

For any soil/sediment samples which were not collected in a water miscible solvent preservative, any reported concentrations less than 200 ug/kg must be qualified indicating they may be biased low due to the sample not being collected according to 5035/5035A low-level specifications. The 200 ug/kg concentration may not be reduced (even if supported by the low end of the initial calibration curve) as this concentration is the limit for high level sample collection – not the analytical procedure. The collection of samples without use of a chemical preservative is appropriate for those samples or wastes suspected of percent level contamination. Reporting levels must be supported by a limit of quantitation (LOQ) study that includes all sample processing steps.

Soil/sediment samples may be collected several ways: grab sample, hand auger, geoprobe macrocore and split-spoon sampling. These methods are summarized in sections below.

3.2.1.1 Grab Sampling

Grab samples are collected from exposed surficial soil and from stockpiled soil. Collection of a grab sample will be performed with the field personnel using latex or nitrile sampling gloves. The soil sample(s) will be placed into laboratory prepared sampling containers and stored on ice. The sample will then be shipped to the laboratory under chain-of-custody procedures.

3.2.1.2 Hand Auger Sampling

Pending access to the subsurface, the hand auger would be advanced from grade to the designated termination depth. Samples will be removed from the hand auger and placed on polyethylene liner for observation. During advancement of the hand auger, the samples obtained will be screened in the field for VOCs using a photoionization detector (PID). The soil samples will be handled by field personnel using new latex or nitrile sampling gloves for each sampling interval. Pending review of all samples collected, the previously collected soil samples will be stored in plastic Ziploc bags to prevent off-gassing of VOCs. The soil sample(s) selected for analysis will be placed into laboratory prepared sampling containers and stored on ice. The sample will then be shipped to the laboratory under chain-of-custody procedures.

Following completion of each individual boring, the hand auger sampling point and extension rods will be decontaminated using alconox and water.

3.2.1.3 Geoprobe Macrocore Sampling

Soil samples may be collected from the Site using a Geoprobe drill rig. This rig uses direct push technology to recover 4-foot or 5-foot long macrocore samples. The samples are collected in dedicated polyethylene liners. The liners are then cut open to expose the soil cross-section. The soil is then characterized on a geologic log. The soil samples will be handled by field personnel using new latex or nitrile sampling gloves for each sampling interval. Pending review of all samples collected, the previously collected soil samples will be stored in plastic Ziploc bags to prevent off-gassing of

VOCs. The soil sample(s) selected for analysis will be placed into laboratory prepared sampling containers and stored on ice. The sample will then be shipped to the laboratory under chain-of-custody procedures.

Following completion of each macrocore sample, the macrocore will be decontaminated using alconox and water and a new dedicated polyethylene sleeve will be used.

3.2.1.4 Split-Spoon Sampling

Soil samples may be collected from the Site using a stainless steel split-spoon sampler in association with a hollow-stem auger and/or mud-rotary drill rig. This technique involves sending a 2-foot sampling device to the termination depth of a drill boring and hammering the sampler through the soil. The samples are collected within the split-spoon sampler and prevented from falling out of the sampler with a plastic basket at the bottom. After the split-spoon sampler is advanced two feet, it is removed from the boring. The split-spoon sampler is then taken apart exposing the soil sample. The soil is then characterized on a geologic log. The soil samples will be handled by field personnel using new latex or nitrile sampling gloves for each sampling interval. Pending review of all samples collected, the previously collected soil samples will be stored in plastic Ziploc bags to prevent off-gassing of VOCs. The soil sample(s) selected for analysis will be placed into laboratory prepared sampling containers and stored on ice. The sample will then be shipped to the laboratory under chain-of-custody procedures.

Following completion of each split-spoon sample, the split-spoon sampler will be decontaminated using alconox and water.

3.2.2 Groundwater Sampling

In the interest of generating additional groundwater parameter information, a low-flow sample technique will be used. Groundwater will be sampled from onsite monitor wells using a peristaltic sampling pump. The pump intake will be placed at predetermined positions within

each well and, if necessary, lowered as pumping progresses. The pump intake position within each well was determined from geologic logs.

The low-flow purge and sample methodology will be utilized for the collection of groundwater samples. Prior to sampling, the depth to water with respect to the top of well casing and total depth of each well will be measured with an electric tape and/or weighted steel tape. Both measurements will be recorded in a field logbook. Dedicated polyethylene tubing will be set within each well at the predetermined well screen interval and connected to a variable speed peristaltic pump. The peristaltic pump will be operated at a discharge rate of 100-500 ml/min (milliliters per minute) and will discharge to a Flow-Through Cell. Geochemical parameters of the associated groundwater such as pH, conductivity, dissolved oxygen and temperature will be continuously monitored inside the Flow-Through Cell using a Horiba multi-parameter meter. Once all of the above geochemical parameters stabilize, a groundwater sample will be collected from the dedicated polyethylene tubing through an inline sampling port prior to the Flow-Through Cell. During the sampling, latex gloves will be worn and changed between sampling locations.

All of the samples will be preserved for holding time and properly labeled in the field. A chain-of-custody form will be filled out and the samples will be placed in a cooler with ice. The sample will then be shipped to the laboratory under chain-of-custody procedures.

3.2.3 Soil Gas, Indoor Air, Ambient Air and Effluent Vapor

The purpose of soil gas and indoor air sampling is to determine the following:

- potential for current human exposure;
- potential for future human exposure;
- necessary measures to be implemented for removal of vapors from the subsurface and/or indoor air;
- potential for offsite soil vapor contamination;
- determine any offsite preferential migration pathways;
- characterize the vapors in the vadose zone; and,
- investigate the relationship between contaminated groundwater and soil vapor.

3.2.3.1 Soil Vapor

Soil vapor samples may be collected from both existing soil vapor sampling points and from soil vapor points yet to be installed. If additional soil vapor points are installed at the Site, they will be installed following the construction specifications as described in the New York State Department of Health Center for Environmental Health, Bureau of Environmental Exposure Investigation Guidance for Evaluating Soil Vapor Intrusion in the State of New York.

Soil vapor samples may be collected from the soil vapor sampling points using the following procedures.

- a soil vapor sample will be collected from a soil vapor sampling point after one to three volumes of the soil vapor sampling point and the tube are purged using a peristaltic pump;
- the flow rate for purging will not exceed 0.2 liters per minute; and,
- each sample will be collected using a Summa canister fitted with a flow regulator to collect a 1-liter soil vapor sample over a 2 to 8 hour period.

The soil vapor sample will then be sent to the laboratory via overnight courier service under chain-of-custody procedures. The soil vapor samples will be analyzed by EPA Method TO-15.

3.2.3.2 Indoor Air

In the event that it is deemed necessary, indoor air samples may be collected from within the building. If this sampling is to constitute a soil vapor intrusion investigation, the indoor air samples will be collected concurrent with the soil vapor samples from similar building areas. The indoor air sampling would be used to characterize the indoor air quality and; if sampled concurrently with soil vapor samples, also to evaluate the relationship between the indoor air and the soil vapor concentrations the Site. A 6-liter Summa canister will be placed in the sample location at a slightly elevated height of approximately 3-4 feet above the ground surface. Each Summa canister used for

collecting indoor air samples will be fitted with a dedicated regulator calibrated to allow 1 liter of air flow over an 8-hour sampling period. The indoor air sample will then be sent to the laboratory via overnight courier service under chain-of-custody procedures. The indoor air sample will be analyzed by a NYSDOH ELAP certified laboratory by EPA Method TO-15.

3.2.3.3 Outdoor Ambient Air

Outdoor ambient air samples (if collected) will be collected from predetermined locations at the perimeter of the building onsite. One location will be upwind of the Site and one location will be downwind of the Site. A 6-liter Summa canister will be placed in each sample location at a slightly elevated height. Each Summa canister used for collecting outdoor ambient air samples will be fitted with a dedicated regulator calibrated to allow 1 liter of air flow over an 8-hour sampling period. The outdoor ambient air samples will then be sent to the laboratory via overnight courier service under chain-of-custody procedures. The outdoor ambient air samples will be analyzed by a NYSDOH ELAP certified laboratory by EPA Method TO-15.

3.2.3.4 (Remediation System) Sampling

Soil-Vapor Extraction (SVE) System, Sub-Slab Depressurization System (SSDS) and Groundwater Pump and Treat System (GWPT) sampling protocol for the remediation system will be conducted as described in the RAWP.

3.3 Sample Handling and Custody

Following the completion of field sample collection, custody protocols that will be followed are divided into three parts: sample handling, laboratory analysis and final evidence files. Sample containers, preservatives and holding times for each sample matrix and analytical methodology are summarized in table 1. Chain-of-custody documentation and procedures will be completed for all samples generated. Final evidence files including all original laboratory reports will be maintained under document control in a secure area. The following sec-

tions describe in detail the different aspects of sample handling and shipment, the sample identification system that will be used, and documentation.

When samples are released from the sampler's immediate control (i.e., shipment to laboratory), custody seals will be placed across the lid opening of the container. The custody seals will bear the collector's name and the date signed. The sample custody seal is used to ensure that the samples in the shipping container have not been tampered with, therefore ensuring sample integrity.

An analytical data control check will be established by utilizing trip blanks. Trip blanks will be prepared in the laboratory using organic free water. Trip blanks will accompany a batch of samples from the start of sampling to delivery of samples to the laboratory for analysis, remaining unopened. The purpose of the trip blank is to measure possible cross contamination of samples during the shipping and handling stages.

3.3.1 Documentation/Chain-of-Custody

Samples will be documented and maintained in custody continuously. The chain-of-custody process begins immediately after collection of the samples. The documentation will include field logbooks, SCFSs, daily field sheets, the chain-of-custody form, sample identification label, custody seal and any shipping documents. Details of the chain-of-custody procedures are outlined in Section 2.2.5, above.

The following scenarios describe when samples are considered to be in custody of the field personnel:

- samples are in actual possession of the field personnel;
- samples are still in the personnel's view after being in the personnel's possession; or
- samples are deposited by the personnel in a designated secured area.

3.3.2 Sample Handling

Packaging of sample coolers is an integral part of the field activities. The sample storage container will be secured to ensure that the samples are not disturbed during transport. A

sufficient amount of padding material (bubble wrap, packaging paper or similar material) will be used to ensure that glass sample containers are protected during shipping and to prevent sample containers from breaking during transport to the laboratory. Water, soil and sediment samples will be properly packaged on ice at 4 ±2 degree Celsius (°C) in coolers for shipment. Air samples will be properly packaged and shipped in coolers or boxes. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the chain-of-custody to document the transfer.

All sample containers to be shipped will be sent to the appropriate laboratory for analysis, with a separate signed chain-of-custody enclosed in and secured to the inside top of each container (sample box or cooler). Once the samples are properly packaged, the shipping containers will be closed and secured with strapping tape and custody seals for shipment to the laboratory. The custody seals will be signed and dated by the field team leader and attached across the lid opening of the box or lid opening and body of the cooler.

3.3.3 Laboratory Chain-of-Custody Procedures

The selected analytical laboratory will perform laboratory custody procedures in accordance with their SOPs for sample receiving and login, storage, and tracking during sample preparation, analysis, and storage of data. Specific laboratory SOPs are provided in Appendix I.

3.3.4 Final Evidence File Custody Procedure

All field documentation (such as field logbooks, SCFSs, daily field sheets, chain-of-custodies, etc.) completed by the field sampling technicians will be submitted to the Project Field Supervisor at the end of each day. The Project Field Supervisor will make copies of field logbook pages, and submit these copies and all original SCFSs and chain-of-custodies to the Project Manager. The original copy of any completed field logbook will also be submitted by the Project Field Supervisor to the Project Manager.

Electronic data/information collected in the field, such as GPS data, pressure transducer data, digital photos, etc. will be downloaded each day by the field technicians into electronic

files and e-mailed to, or saved on a portable storage device (e.g., flash drive) and submitted to the Project Manager. The Project Manager will evaluate the data and also file the data and archive.

The Project Field Supervisor will be responsible for the custody and filing of all field documentation and analytical reports. The Project Manager will maintain the final evidence file until the completion of the project. The final evidence file will be the main archive for all documents, which constitute evidence relevant to sampling and analysis activities as described in this QAPP.

3.4 Analytical Methods

3.4.1 Field Analytical Procedures

Various field measurements and/or analyses will be required during the project to generate data for field screening purposes, verifying sample representativeness, identifying sample locations, depths, and/or volume, evaluating sample quality (e.g., stabilization data measurements for groundwater samples), delineating impacts, measuring or calculating recovery rates, etc. Procedures for field measurements and analyses are presented in the RAWP. The RAWP will detail the aspects of the data acquisition for the investigation or mitigation activities.

Field instruments/equipment will be checked/inspected daily. Sections 3.6 and 3.7 describe general procedures for instrument/equipment checks, maintenance and calibration.

A list of common field measurements and/or analyses generally required is provided in the table below. The list includes an example(s) of the field instrument typically used to take the measurement or perform the analyses.

Field Measurement/Analysis	Example Field Instrument
Air	
Physical Property	
- Pressure/Vacuum	Pressure/vacuum gauge, manometer, barometer
- Flow/velocity	Pitot tube, venturi meter, rotameter, anemometer
- Temperature	Temperature gauge
Chemical Property	
- Ammonia	Field test kit, Ammonia sensor/monitor
- Carbon Dioxide	Single or multi-gas meter

Field Measurement/Analysis	Example Field Instrument
- Carbon Monoxide	Single or multi-gas meter
- Hydrogen Sulfide	Single or multi-gas meter
- Lower Explosive Limit (LEL)	Explosimeter, multi-gas meter
- Methane	Single or multi-gas meter
- Organic Vapor Concentration	Photoionization detector (PID), flame ionization detector (FID)
- Oxygen	Single or multi-gas meter
Soil/Sediment	
- Weight	Scale
- Organic Vapor Concentration	Photoionization detector (PID), flame ionization detector (FID)
- Sheen tests	Glass jar and deionized water – visual observation
Water	
Physical Property	
- Pressure	Pressure gauge, pressure transducer
- Flow/velocity	Turbine, electromagnetic, nutating disc flow meters, flumes, weirs,
- Temperature	Temperature gauge
- Depth	Tape measure, staff gauge, water-level indicator
Chemical Property	
- Specific Conductance	Single parameter or multi-parameter probe
- Dissolved Oxygen (DO)	Dissolved oxygen sensor or probe, multi-parameter water probe
- pH	pH meter, multi-parameter probe
- Turbidity	Single parameter or multi-parameter probe
- Oxidation-Reduction Potential	Single parameter or multi-parameter probe
Other	
- Location	Global Positioning System (GPS), Transit and Stadia Rod
- Depth to Product/Product	Product interface probe
- Other (specify):	

3.4.2 Laboratory Analytical Procedures

The laboratories utilized for the project will implement the appropriate project-required SOPs. Laboratory SOPs are based on analytical methods published by the USEPA (USEPA Test Method for Evaluating Solid Waste, Physical/Chemical Methods, Final Update IIIB, June 2005) or consistent with specific method requirements under the Safe Drinking Water Act (SWDA) and/or other applicable methods (such as American Society for Testing and Materials [ASTM]). The laboratory SOPs are provided in Appendix I.

Appropriate analytical methods will be used to provide adequate detection limits for COCs, and for the final intended data usage. A list of anticipated laboratory analytical methods is provided below and also presented in table 1. Of note, table 1 also includes additional analytical methods (not anticipated at the Site based on historical Site characterization activi-

ties), however, if required are available for analytical characterization. If different or additional contaminants of concern or analytical methods not presented in table 1 are determined to be required for the project, the pertinent information will be added to the QAPP as an addendum.

Parameter	Water, Soil/Sediment Method	Air Method
Organic Analyses:		
- Poly Chlorinated Biphenyls (PCBs)	SW 846 8082A	---
- Polynuclear Aromatic Hydrocarbons (PAHs/SVOCs)	SW 846 8270C	---
- Volatile Organic Compounds (VOCs)	SW 846 8260B	TO-15
- Pesticides	SW 846 8081B	---
- VOCs - TCLP	SW 846 1311, 8260B	---
Metals Analyses:		
- Metals – Target Analyte List	SW 846 6010B	---
- Metals – TCLP	SW 846 1311, 6010B,	---
- Mercury	SW 846 7470A, 7471A	---
- Hexvalent Chromium	SW 846 9176A	---
Other Analyses:		
- Flashpoint	SW 846 1010A	---
- pH	SW 846 9040C, 9045D	---

The analytical procedures will follow laboratory in-house limits; as appropriate. MDLs for the anticipated laboratory methods will comply with the regulatory limit requirements as outlined in DER-10 to ensure appropriate analytical sensitivity. The laboratory will report all detections at or above the MDL.

The RLs are typically three to five times the MDL and are presented in the laboratory analyte reporting parameters included in Appendix I for each analytical method. Values above the MDL and below the RL will be qualified as estimated (J). The laboratory will analyze a RL check sample for each parameter and an MDL check sample for organic parameters. In house limits will be used where no QSM limits exist.

3.5 Quality Control

The QC necessary to monitor the data quality process during the remedial project is described in this section for both the field and the laboratory environment. A summary of the general field and laboratory QA/QC sample collection/analysis frequency is included in table 2.

3.5.1 Field Quality Control Requirements

Replicate measurements, equipment calibration checks, and data verification by field personnel will be rigorously applied to provide the necessary QC checks on the data generated. Duplicate samples, field blanks, VOC trip blanks, and temperature blanks will be used to assess field sampling precision, data quality and integrity, and are described in more detail below:

- Duplicate samples are analyzed to check for sampling and analytical reproducibility, and to evaluate the precision and bias of the entire sampling and analyses process including homogeneity, handling, transportation, storage, and analyses. The selected laboratory will provide pre-cleaned sample containers with preservatives, as required, and as specified by the USEPA. *Field duplicate samples will be typically collected at a frequency of one duplicate sample during each representative sampling area for each media type*. Duplicate samples will be submitted as "blind" duplicates meaning the specific sample location will not be identified in the sample name on the chain-of-custody. The duplicate sample will be identified on the chain-of-custody with the suffix "DUP" followed by the number of the duplicate. Duplicate sample locations and identifications will be specifically noted on the daily field sheets and field logbooks for identification purposes. Duplicate samples will generally be analyzed for all target analytical parameters.
- Field blanks (also referred to as equipment blanks or rinse blanks), are used to assess decontamination of reusable sampling equipment, or to assess whether contamination has occurred during sampling or transportation. *Field blanks are*

typically taken at a rate of one per day per sampling crew when using sampling equipment that requires decontamination between samples. However, when the daily sampling volume is low, field blanks will typically be taken at a rate of one during each representative sampling area for each media type. It should be noted that field blanks will not be collected when dedicated disposable sampling equipment is used. Field blanks will generally be analyzed for all target analytical parameters.

- Trip blanks are generated in the laboratory and used to assess contamination resulting from shipping and handling. *A trip blank will be included in each shipment of aqueous VOC samples.* Trip blanks will be analyzed for VOCs.
- Temperature blanks are provided by the laboratory to ensure proper packaging and preservation at the prescribed temperature for certain sample types (e.g., samples for VOC analyses). *One temperature blank will be included for each shipping container (cooler) of samples requiring preservation at a particular temperature.*

3.5.2 Laboratory Quality Control Requirements

Each laboratory utilized for project has a QC program and SOPs in place to ensure the reliability and validity of the analysis performed at their laboratory. The Laboratory QA Manager will be responsible for assessing and assuring that the data precision and accuracy is maintained according to their specification.

Method blank, laboratory control and MS samples will be analyzed to assess the quality of the data resulting from the analytical programs.

- Method blank samples are generated within the laboratory and used to assess contamination resulting from laboratory procedures. A method blank will be analyzed by the laboratory with each analytical batch of samples for organic analyses and for metals analyses. Samples for organic analyses will be re-analyzed if common laboratory contaminants are detected above the RL or when non-laboratory contaminants are reported greater than one-half the RL. Samples

for metals analyses will be re-analyzed if the blank concentration is greater than the RL.

- LCSs provide information about the accuracy of the analytical system, independent of matrix. LCSs are laboratory-generated sample spikes with target analytes. Investigative samples and the associated LCS will be re-analyzed if more than 5 percent of the LCS recoveries are less than the lower limit or any one recovery is less than one-half the lower limit.
- MS/MSDs provide information about the effect of the sample matrix on the digestion and measurement methodology. MS/MSD samples are designated/collected for organic and metals analyses only.

The general level of the QC effort will be one MS/MSD, LCS and blank for every 20 samples collected, or 1 for each batch of samples of similar method and matrix. A summary of laboratory analyte reporting parameters (accuracy, precision and reporting limits) are provided in Appendix I.

In addition to the QC analyses identified above, the laboratory will perform additional QC checks as part of the analytical method. In general, these QC checks may include, but are not limited to the following:

- reagent/preparation/calibration blanks (applicable to inorganic analysis);
- instrument blanks;
- initial calibration (ICAL);
- initial calibration verification (ICV);
- continuing calibration verification (CCV);
- MDL verification;
- method RL verification;
- surrogate spikes;
- laboratory duplicates;
- laboratory control standards;
- internal standard areas for GC/MS analysis; and,

- mass tuning for GC/MS analysis.

In general, QA samples will be collected at a frequency of 5% and will be analyzed by each respective laboratory.

Laboratory QA/QC data will be properly recorded, allowing the recipients of data packages to reconstruct QC information and compare it to QC criteria. When analyses are not in conformance with the established QC criteria, the laboratory will reanalyze the samples if sufficient volume is available. It is expected that sufficient volumes/weights of samples will be collected to allow for reanalysis when necessary.

3.6 Instrument/Equipment Testing, Inspection, and Maintenance

3.6.1 Field Instrumentation

Field instrumentation and equipment may include (but not be limited to) the devices listed in Section 3.4.1. Field instrumentation and equipment will be inspected on a daily basis prior to use. Equipment will be maintained as required in the manufacturer's operation manuals. Preventive maintenance will be completed and documented by qualified project personnel.

Replacement batteries or, if possible, fully charged spares will be kept onsite to reduce downtime due to drained batteries. Equipment found to be in need of maintenance or repair will be replaced immediately with like or better equipment. Field technicians will be responsible for reporting any equipment issues to the Project Field Supervisor and/or the Project Manager.

3.6.2 Laboratory Instruments

Contracted laboratories will conduct a routine preventative maintenance program to minimize the occurrence of instrument failure and other system malfunctions. All maintenance that is performed is documented in the laboratory's operating record. All laboratory instruments are maintained in accordance with manufacturer's specifications. The frequency of laboratory preventive maintenance is identified in the laboratory's QA Plan (Appendix I).

3.7 Instrument/Equipment Calibration and Frequency

The instrument calibration and frequency for both field instruments and laboratory instrumentation are provided below.

3.7.1 Field Instrument/Equipment Calibration and Frequency

Field personnel will examine and calibrate field equipment prior to use in order to ensure proper operation and accuracy. The field instruments will be calibrated as described in the manufacturer's manual and procedures. *In general, instruments will be calibration checked at the beginning of each day and calibrated weekly unless otherwise directed in the instrument manuals*. If a piece of equipment or instrument cannot be properly calibrated, it will be noted in the field log and replaced.

All calibration procedures and maintenance performed will be documented on the daily field sheet and/or field logbook, and will include the date/time of calibration/maintenance, name of person performing the calibration/maintenance, reference standard used, temperature at which readings were taken, and the readings. Multiple readings on one sample or standard, as well as readings on replicate samples, will likewise be documented.

The Project Field Supervisor and/or the Project Health and Safety Officer will be responsible for ensuring that field instrument calibration records are maintained and adequate. The Project Manager and/or Remedial Engineer may conduct field inspections to ensure proper equipment handling, testing and calibration procedures are followed.

3.7.2 Laboratory Instrument/Equipment Calibration and Frequency

The specific Laboratory QA Manager will have the responsibility for assuring that the laboratory instrumentation is maintained and calibrated in accordance with specifications. Preventive maintenance and corrective actions for the laboratory instruments will follow the laboratory SOPs.

All laboratory instrumentation will be calibrated in accordance with the respective analytical method. In general, calibration procedures for a specific laboratory instrument will consist of initial calibrations (three or five points), initial calibration verifications, and contin-

uing calibration verification. The laboratory will maintain a sample logbook for each instrument which will contain the following information: instrument identification, serial number, date of calibration, analyst, calibration solutions run, and the samples associated with these calibrations.

3.8 Inspection/Acceptance of Supplies and Consumables

Field personnel will be responsible for inspecting supplies and consumables needed for the performance of field activities. The inspection shall insure that all materials and ancillary sampling equipment are free of defects, compatible with equipment used or elements sampled, within recommended use periods (i.e., reagents not expired), and/or adequate for its intended use. Results of the inspection will be recorded in the logbook. Any issues observed will be reported to and resolved by the Project Field Supervisor and/or the Project Manager.

Laboratory personnel, under management of the specific Laboratory QA Manager, will be responsible for inspection and either accepting or rejecting supplies and consumables in the laboratory.

3.9 Non-Direct Measurements

Historical data that may be used for the project is identified and discussed in Section 2.2.8. Use of historical data or any non-direct measurements (e.g., such as weather data from an online weather station) will be limited to identifying previous areas of environmental concern, forecasting fate and transport before new data is obtained, and providing a reference point for establishing the sampling plan.

3.10 Data Management

The Project Field Supervisor and/or the Project Health and Safety Officer will manage field data under the supervision of the Project Manager Quality Assurance Officer (QAO). The RAWP will specify the data to be collected.

Daily field sheets, the field logbook and SCFS will be used to record the appropriate raw data measured or recorded during field activities. As described in Section 4.4.1, copies of

field logbooks, daily field sheets, SCFSs and field copies of any chain-of-custodies will be turned in to the Project Manager, and will be distributed electronically to the Project Management Team on a daily basis. In addition, electronic data generated in the field will be downloaded and e-mailed or stored on portable storage devices (e.g., flash drives) and given to the Project Manager on a daily basis. The Project Manager or designee will electronically scan original field data and documentation to provide duplication of field data information, and originals will be filed in the permanent project files in document control. The Project Manager or designee will review the data, perform QA/QC checks, and compile the data on an ongoing basis.

The laboratory's internal data management QA/QC measures will be performed in accordance with the laboratory specific Quality Assurance Manual and SOPs. All analytical data will be transmitted both electronically and as hard copy to the Project Manager. The Project Manager and/or designee will be responsible for processing the data. The data will be summarized in tables and on figures for data analysis and presentation. Once the data has been reviewed and QC checks have been verified, both electronic and hard copy laboratory data reports will be archived in the electronic and permanent project files in document control.

4.0 ASSESSMENT AND OVERSIGHT

System and performance audits may be conducted to ensure compliance with the sampling and analytical mandates of this QAPP and RAWP. The audits will verify documentation and implementation of the QA program, assess the effectiveness of work plans, identify any non-conformances, and verify corrective action of identified deficiencies. Below summarizes the audit procedures for field and laboratory activities.

4.1 Technical System Audits

This section describes the details for technical system audits and performance evaluation audits. The technical system audits are for field data, report preparation, and laboratory data. The performance evaluation audits cover file and laboratory processes.

Repeated failure or gross irregularities in field duplicate, QA split, and calibration or quality control samples may warrant the need for an audit. Follow up audits may be required to correct deficiencies and to verify that QA procedures are maintained throughout the investigation. Nonconformance with performance criteria will be addressed and resolved by the Project Manager and/or designee.

4.1.1 Field Data

The Project Manager and/or designee will be in daily contact with the Field Manager(s) to ensure that the DQOs outlined in this QAPP, and the sampling protocol outlined in the RAWP are followed. The Project Field Supervisor and/or designee will report any modification or variance from SOPs to the Project Manager. Any anticipated changes or modifications to measurement or sampling procedures will be reported to the Project Manager and/or Remedial Engineer. Field personnel will document any modification or variance in the field logbooks and daily field sheets.

Collection and analysis of sample duplicates and equipment blanks will be used to assess sampling data precision. Copies of the field logbooks and daily field sheets will be transmitted or delivered to the Project Team on a daily basis. These data and records will allow the Project Manager and/or Remedial Engineer to assess the field data for completeness, comparability, accuracy and quality. The Project Manager and/or Remedial Engineer may also inspect field activities as needed during the project to observe progress, field procedures, and other aspects of the project.

4.1.2 Reports

Project reporting will be performed in accordance with the RAWP. Reports and technical correspondence will be reviewed by the Project Manager, Remedial Engineer and Principal in Charge prior to final submission to the NYSDEC.

4.1.3 Laboratory Data

The Laboratory QA Manager will review the laboratory results to ensure compliance with the DQO criteria and the laboratory specific Quality Assurance Manual. The internal system audits will include an examination of laboratory documentation on sample receiving, sample log-in, sample storage, chain-of-custody procedures, sample preparation and analysis, instrument operating records, etc.

4.2 Performance Evaluation Audits

This section outlines the field and laboratory audits required to ensure that the DQOs are met.

4.2.1 Field Performance Evaluation Audits

The Project Field Supervisor will oversee all investigation and mitigation field activities. Field personnel will document sample collection procedures, follow chain-of-custody protocol, and prepare samples for proper shipping to the laboratory. The Project Field Supervisor will verify with the laboratory that the sample numbers are correct, the proper analytical requests are on the chain-of-custody, dates and times are correct, and the sampler's signature is recorded on the form. A sample copy of a chain-of-custody form is included in Appendix III. Instrument calibrations, which are included in the field logbooks, will be submitted to the Project Manager on a daily basis for review.

An audit by the Project Manager will be conducted on the first day of field activities. The Project Manager, Remedial Engineer and/or designee may inspect field activities as needed during the project to observe progress, field procedures, and other aspects of the project.

4.2.2 Laboratory Performance Evaluation Audits

All analytical work for the project will be conducted by the laboratories following contractual protocol, laboratory specific Quality Assurance Manuals, and the associated SOPs.

The Laboratory QA Manager will be responsible for assuring that laboratory data QA/QC is maintained in accordance with specification and laboratory SOPs.

Internal laboratory performance audits (if performed) will involve preparing blind QC samples and submitting them, along with project samples, to the laboratory for analysis throughout the project. The Project Manager will evaluate the analytical results of these blind performance samples to ensure the laboratory maintains acceptable QC performance. If the laboratory fails the QC sample analysis, they will be given another opportunity for blind QC sample analysis. A second failure will be cause for termination of the laboratory from the project.

External laboratory performance audits may be conducted by the Project Manager prior to, during, or after sampling and analysis activities. These audits may or may not be announced. Repeated failure or gross irregularities in the field duplicate, QA split, and calibration or quality control samples may warrant the need for an audit. The external audit may include any or all of the following:

- review of laboratory analytical procedures;
- laboratory onsite visits to review:
    - sample receipt procedures;
    - custody and sample security log in procedures;
    - sample throughput tracking procedure;
    - instrument calibration records;
    - instrument logs and statistics;
    - QA procedures;
    - logbooks;
    - sample preparation procedures;
    - sample analytical SOP;
    - instrument integrity;
    - glassware preparation; and,
    - lab conditions and interview personnel.
- submission of performance evaluation samples to the laboratory for analysis.

The laboratory will be given one week to address any non-conformances to the satisfaction of the Project Manager, Remedial Engineer and/or designee. Failure to resolve any or all audit procedures chosen can lead to laboratory disqualification and the requirement that another suitable laboratory be chosen.

4.3 Audit Records

If an audit is conducted, the Project Manager or designee will prepare an audit report. Nonconformance issues will be addressed and resolved by the Project Manager. The audit report and original records generated for the audit will be retained within the main project archives. Records will include audit reports, written replies, the record of completion of corrective actions, and documents associated with the conduct of audits, which support audit findings and corrective actions as appropriate.

4.4 Reports to Management

4.4.1 Progress Reports

Project reporting will be performed in accordance with the RAWP. Copies of the daily field sheets will be transmitted or delivered to the Project Manager, and distributed to the Project Management Team on a daily basis. These data and records will allow the Project Manager and/or Remedial Engineer to assess the field data for completeness, comparability, accuracy and quality. The Project Manager and/or Remedial Engineer may also inspect field activities as needed during the project to observe progress, field procedures, and other aspects of the project. The daily field sheets will be sent via e-mail by the Project Field Supervisor or designee. The purpose of these reports is to inform the NYSDEC of the progress of the project and pertinent interim findings. This information will allow issues to be evaluated and addressed as necessary. In addition to progress reports, appropriate reports will be completed according to State requirements.

4.4.2 QA Reports

QA Reports will include verbal and/or written assessments of fieldwork progress and quality, and data accuracy and precision to the project team. The Project Field Supervisor will report to the Project Manager on a daily basis regarding progress of the fieldwork and quality control issues associated with field activities. Any corrective actions necessary will be documented by the Project Manager.

Laboratory analytical reports will include QA/QC summary data as described in Sections 3.5, 3.6 and 3.7. If, during laboratory analyses, any QA problems are encountered, the Laboratory QA Manager will call the Project Manager immediately for corrective action and also issue a written report.

The laboratory will submit analytical reports to the Project Field Supervisor and the Project Manager. The Project Manager and/or designee(s) will review each data set for the accuracy and precision of the data.

After all activities associated with the project are complete and all data has been reviewed, verified and validated, a final QA assessment will be performed. The assessment will summarize the quality assurance and audit information (if completed), indicating any corrective actions taken and the overall results of QAPP compliance. The Project Manager, Remedial Engineer and/or designee(s) will prepare this final review. The final QA data assessment be utilized during the decision-making process to assess data validation prior to incorporation as part of the FER.

5.0 DATA VALIDATION AND USABILITY

This section describes QA activities that will be conducted to ensure that the collected data are scientifically defensible, properly documented, of known quality, and meet project objectives. As appropriate, analytical data collected for the project may be validated. The following steps will be followed to ensure that project data quality needs are met.

5.1 Data Review, Verification, and Validation

5.1.1 Data Review

Data will be presented in tables and figures to identify trends, relationships, and/or anomalies. Data review is an in-house examination to ensure that the data have been recorded, transmitted, and processed correctly. This includes checking for data entry, transcription, calculation, reduction, and transformation errors. It is also a completeness check to ensure all data is accounted for and all sample information, such as sample matrixes, blanks, duplicates, shipping dates, preservatives, holding times, etc., is available. The Project Manager will be responsible for data review.

5.1.2 Data Verification

Data verification is a process of evaluating the completeness, correctness, and contractual compliance of a data set against the method standard, SOP, or contract requirements. Field data verification will be performed by the Project Manager. Laboratory data verification will be performed internally by the laboratory generating the data. Data may also be checked by an external entity.

Data verification is generally done before data validation. Data verification may result in accepted, qualified, or rejected data.

5.1.3 Data Validation

Data validation is an analyte- and sample-specific process that extends the qualification of data beyond method, procedural, or contractual compliance (i.e., data verification) to determine the quality of specific data sets. Data validation criteria are based on the measurement performance criteria of the project QAPP.

A third party data validator not otherwise involved with the project will be responsible for performing data validation analysis. Data validation may occur both during and at the end of the project. Data validation may result in accepted, qualified, or rejected data.

One hundred percent (100%) of the data will undergo a data review by the Project Manager and/or designee(s). The data review will include the review of the QC parameters discussed in this QAPP.

Sample analyses for each matrix will be validated by a third party validator for all confirmatory (post remediation) samples and final delineation samples for which Level IV (Category B Deliverables) laboratory analysis was performed. Following the third party data validation, they will issue a DUSR outlining the results of the data validation. This data will be the primary source of data for risk and final cleanup evaluation. In the event the data are unacceptable, additional validation may be required.

5.1.4 Data Usability Assessment

A data usability assessment is the process of evaluating validated data to determine if the data can be used for the purpose of the project (i.e., to answer project-required questions or to make qualified environmental decisions). Data usability will include the following sequence of evaluation:

1. individual data sets will be evaluated to identify the measurement performance/usability issues or problems affecting the ultimate achievement of the project DQOs;
2. an overall evaluation of all data generated for the project will be conducted; and,
3. the project-specific measurement performance criteria and data validation criteria will be evaluated to determine if they were appropriate for meeting project DQOs.

In order to complete the data evaluation steps above, the reported data will be supported by complete data packages which will include sample receipt and tracking information, chain-of-custody records, tabulated data summary forms, and raw analytical data for all field samples, standards, QC checks and QC samples, and all other project-specific documents that are generated.

5.2 Verification and Validation Methods

This section describes the process that will be followed to verify and validate the project data.

5.2.1 Verification

The Project Manager will verify that sampling, sample handling and field screening procedures as described in the QAPP were met. The laboratory data will be verified with respect to the chain-of-custody, units of measure, and citation of analytical methods. The Project Manager will also verify the use of blanks and duplicates. All applicable reference and identification codes and numbers will be reviewed as part of the documentation.

5.2.2 Validation

All sampling, handling, field analytical data, and fixed laboratory data will be validated by entities external to the data generator. The validation procedure will specify the verification process of every quality control measure used in the field and laboratory. Each analytical report will be reviewed for compliance with the applicable method and for the quality of the data reported.

5.2.3 Validation and Verification Procedures

The following procedures will be implemented to verify and validate data collected during a project:

- Sampling Design – How closely a measurement represents the actual environment at a given time and location is a complex issue. Each sample will be checked for compliance with specific work plan requirements, including type and location. The Project Field Supervisor will note deviations from the work plan requirements, and discuss them with the Project Manager.
- Sample Collection Procedures – Sample collection procedures identified in the RAWP will be followed. If field conditions require deviations, they will be communicated to the Project Manager and reported in the FER.

- Field Data Reporting - Field data reporting will be conducted principally through the transmission of report sheets containing tabulated results of all measurements made in the field and documentation of all field calibration activities.
- Sample Handling and Custody – Deviations from the planned sample handling procedures will be noted on the chain-of-custody forms, field logbooks and field sheets. Data collection activities will indicate any events that may occur during sample handling that may affect the integrity of the samples. Field technical staff members will evaluate the sample containers and the preservation methods used to ensure that they are appropriate to the nature of the sample and the type of data generated from the sample. Checks on the identity of the sample will be made to ensure that the sample continues to be representative of its native environments as it progresses through the analytical process.
- Analytical Procedures – Each sample will be verified to ensure that the procedures used to generate the data were implemented as specified. Data validation activities will be used to determine how seriously a sample deviated beyond the acceptance limit so that the potential effects of the deviation can be evaluated.
- Quality Control – QC checks that are to be performed during sample collections, handling, and analysis are specified in an earlier section of this QAPP. For each specified QC check, the procedures, acceptance criteria, and corrective action should be specified. During data validation, any corrective actions taken, any samples affected, and the potential effect of the actions on the validity of the data will be documented.
- Calibration – Field and laboratory instrument calibrations will be documented to ensure that calibrations:
    - were performed within an acceptable time prior to measurement data;
    - were performed in proper sequence;
    - included the proper number of calibration points;

- were performed using a standard that bracketed the range of reported measurement results; and,
- had acceptable linearity checks and other checks to ensure that the measurement system was stable when calibration was performed.

When calibration problems are identified, any data produced between the suspect calibration event and any subsequent recalibration will be flagged to alert data users.

- Data Reduction and Processing – Checks on data integrity will be performed to evaluate the accuracy of raw data and include the comparison of important events and duplicate re-keying of data to identify data entry errors.
  - All data generated through field activities or by the laboratory operation will be reduced and validated internally (via remedial project team and analytical laboratory) prior to final reporting. The laboratory will not disseminate data until it has been subjected to these procedures. All third party data validation (when required) for data generated through field activities will be reduced and validated prior to final reporting.
  - Field Data: All field data will be written into field logbooks and daily field sheets immediately after measurements are taken. If errors are made, results will be legibly crossed out, initialed, and dated by the field member, and corrected in a space adjacent to the original (erroneous) entry. Periodically throughout the field sampling effort, the Project Field Supervisor and/or designee will review the logbooks and daily field sheets to determine whether any errors have been made.
  - Laboratory Data: Laboratory data reduction procedures are located in the laboratory Quality Programs.

5.2.4 Data Assessment

After all data have been reviewed and validated, the third party validator will prepare a DUSR. Within the DUSR, all data points observed as having either a high or low bias (qualified data) will be evaluated for determination of data usability.

All laboratory and field data obtained will be reviewed and both qualitatively and quantitatively assessed by the Project Manager and/or designee on a project-wide, matrix-specific, parameter-specific, and/or unit-specific basis to confirm that it complies with this QAPP. The results of this assessment will be presented and discussed in detail in the FER. In addition, the Principal in Charge will review all data generated during this project as a part of the process of preparing the FER. Data that does not meet QC objectives will be qualified and will be used for decision-making purposes in accordance with the qualifiers.

5.3 Data Requirement Compliance Evaluation

The quality and quantity of data generated for the project will be compared to the project specific DQO that was developed. This section describes the scientific and statistical procedures/methods that will be used to determine whether data are of the right type, quality, and quantity to support environmental decision making for the project.

The Data Quality Assessment (DQA) process is described in Guidance for the Data Quality Assessment Process: Practical Methods for Data Analysis, EPA QA/G9, July 1996[2]. EPA QA/G-9 will be used, as appropriate, to guide the data assessment on the projects. The DQA process consists of five steps:

1. review DQO and sampling design;
2. conduct preliminary data review;
3. select statistical test;
4. verify assumptions; and,
5. draw conclusions from the data.

[2] United States Environmental Protection Agency (USEPA). 1996. Guidance for the Data Quality Assessment Process: Practical Methods for Data Analysis, EPA QA/G9, July

5.3.1 Data Quality Indicators Evaluation Criteria Details

The DQOs for field measurements and laboratory data during this project will be addressed in terms of the DQIs summarized in Section 1.3, above. Assessment and interpretation of DQI results are described in more detail below.

5.3.1.1 Precision Assessment

The methods outlined in Section 1.1 will be implemented to ensure that the data is precise. The RPD between the spike and matrix spike, or matrix spike and sample duplicate in the case of metals, and field duplicate pair or laboratory duplicate pair is calculated to assess data precision. The RPD is calculated according to the following formula.

$$RPD = \left[\frac{|Amount\ in\ Sample\ 1 - Amount\ in\ Sample\ 2|}{\frac{Amount\ in\ Sample\ 1 + Amount\ in\ Sample\ 2}{2}}\right] * 100$$

Poor overall precision may be the result of one or more of the following:

- field instrument variation;
- analytical measurement variation;
- poor sampling techniques;
- sample transport problems; and/or
- heterogeneous matrices.

In order to identify the cause of any identified imprecision, the field sampling design rationale and sampling techniques should be evaluated by the Project Manager and Remedial Engineer, and both field and analytical duplicate/replicate sample results should be reviewed. If poor precision is indicated in both the field and analytical duplicates/replicates, then the laboratory may be the source of error. If poor precision is limited to the field duplicate/replicate results, then the sampling technique, field instrument variation, sample transport, or heterogeneous sample matrices may be the source of error.

5.3.1.2 Accuracy Assessment

The methods outlined in Section 1.1 will be implemented to ensure that the data is accurate. To ensure the accuracy of field procedures, field blanks and/or trip blanks will be collected and measured, and all sample handling, preservation, and holding time criteria will be adhered. Every shipping container (e.g., cooler) with aqueous VOC samples will contain a trip blank sample. Field blanks will be collected once per day of sampling.

In order to ensure the accuracy of the analytical procedures, analysis of analytical spikes and/or reference standards (MS/MSD, LCS, surrogate compounds, or equivalent) will be conducted as required, and percent recoveries will be determined.

Percent recovery for MS/MSD results is determined according to the following equation:

$$\%R = \left(\frac{Amount\ in\ Spiked\ Sample - Amount\ in\ Parent\ Sample}{Amount\ of\ Spike\ Added}\right) * 100$$

Percent recovery for LCS and surrogate compound results is determined according to the following equation:

$$\%R = \left(\frac{Amount\ Found\ in\ Spiked\ Sample}{Amount\ of\ Spike\ Added}\right) * 100$$

The accuracy limits are specific for each laboratory and analysis. Accuracy control limits are given in Appendix I.

5.3.1.3 Sample Representativeness

The methods outlined in Section 1.1 will be implemented to ensure that sample data is representative of the samples collected. QC check and sample data will be reviewed to assess sample representativeness. If field duplicate precision checks indicate potential spatial variability, data usability will be evaluated by the Project Manager and

Remedial Engineer. Subsequent re-sampling may be required in order to collect data that are more representative of a non-homogeneous Site.

5.3.1.4 Completeness Assessment

The methods outlined in Section 1.1 will be implemented to ensure that data is complete. Completeness is the ratio of the number of valid sample results to the total number of samples analyzed with a specific matrix and/or analysis. Following completion of the analytical testing, the percent completeness will be calculated by the following equation:

$$Completeness = \left(\frac{Number\ of\ Valid\ Measurements}{Total\ Number\ of\ Measurements}\right) * 100$$

5.3.1.5 Comparability Assessment

The methods outlined in Section 1.1 will be implemented to ensure that data is comparable. For long-term monitoring projects, data comparability is extremely important. Project data will be compared to previously generated data to determine the possibility of false positives and/or false negatives. Variations detected in the data may reflect a changing environment or indicate sampling and/or analytical error. Comparability criteria will be established to evaluate these data sets in order to identify statistical outliers.

5.3.1.6 Sensitivity and Quantification Limits

The methods outlined in Section 1.1 will be implemented to ensure that data meets the measurement performance criteria for sensitivity as specified. Low point calibration standards should produce a signal at least ten times the background noise levels and should be part of a linear calibration curve. The procedures for calculating minimum MDLs and RLs will be documented. If Data Validation Reports indicate that sensitivity and/or RLs were not achieved, then the impact of that lack of sensitivity and/or higher RLs on data usability will be evaluated.

5.3.1.7 Sample Bias Assessment

The methods outlined in Section 1.1 will be implemented to ensure that data is not biased. Bias is systematic error, an example of which is calibration drift - a non-random change in a measurement system over time. Field calibration checks and a variety of QC samples (such as reference standards, matrix spike samples, and matrix-specific QC samples) will be used to determine the degree of bias (see Accuracy Assessment in Section 5.3.2).

5.3.2 Data Limitations and Corrective Actions

Corrective action is the process of identifying, recommending, approving, and implementing measures to counter out-of-QC performance that can affect data quality. Corrective action can occur during field activities, laboratory analyses, data validation, and data assessment. Sources of sampling and analytical error identified will be corrected as early as possible prior to the onset of subsequent sample collection activities. All corrective action proposed and implemented will be documented in regular QA reports to management. Corrective action will only be implemented after approval by the Project Manager, Remedial Engineer or designee.

An ongoing data assessment process will be incorporated during the project to facilitate the early detection and correction of problems, ensuring that project quality objectives are met. For noncompliance problems, a formal corrective action program will be determined and implemented at the time the problem is identified. The person who identifies the problem is responsible for notifying the Project Manager who will in turn relay the information to the Remedial Engineer. If the problem is analytical in nature, information on these problems will be promptly communicated to the analytical laboratory.

Any nonconformance with the established QC procedures in the QAPP will be identified and corrected in accordance with the QAPP. The Project Manager, Remedial Engineer or designee will issue a nonconformance report for each nonconformance condition.

5.3.2.1 Field Corrective Action

Situations may occur in which corrective action in the field may be needed (i.e., when sampling procedures and/or field analytical procedures require modification due to unexpected conditions). The field staff in consultation with the Project Manager and/or the Remedial Engineer will recommend a corrective action. The Project Manager will approve the corrective measure (after consultation with and concurrence by the NYSDEC Project Manager) which will be implemented by the field team. It will be the responsibility of the Project Manager to ensure the corrective action has been implemented. All corrective actions implemented will be documented in the field logbooks.

5.3.2.2 Laboratory Corrective Action

Situations may occur prior to, during, and/or after initial analyses in which corrective action in the laboratory may be needed (e.g., broken sample containers, multiple phases, low/high pH readings, potentially high concentration samples, QC criteria not met, etc.). Depending on the condition encountered, the Laboratory QA Manager may consult the Project Manager for input. All laboratory corrective actions (i.e., method-specific corrective actions) will be documented and also identified in the case narrative of the data packages.

The laboratory will reanalyze any samples analyzed in non-conformance with the QC criteria, if sufficient volume is available and holding times for samples have not been exceeded. It is expected that sufficient volumes/weights of samples will be collected to allow for possible reanalysis if necessary.

5.3.2.3 Corrective Action During Data Review/Validation and Assessment

If the need for corrective action is discovered during either the data review/validation or data assessment process, the Project Field Supervisor and/or associated data evaluation personnel will report the situation to the Project Manager and/or the Remedial Engineer. The Project Manager will be responsible for approving the im-

plementation of corrective action. The Project Manager will be responsible for documenting the corrective action. Potential types of corrective action may include resampling by the field team or re-extraction/re-analysis of samples by the laboratory.

dmd
July 16, 2013
f:\reports\sive paget\gowanus\phase 3 - bcp alternatives analysis & remedial action work plan\rawp\appendix h - quality assurance project plan (qapp)\site-specific qapp.doc

TABLES

TABLE 1

GOWANUS VILLAGE I, LLC
322 3rd AVENUE
BROOKLYN, KINGS COUNTY, NEW YORK
NYSDEC BCP SITE NO. C224099
INDEX NO. W2-1069-0506

Quality Assurance Project Plan

Sample Guidelines for Matrix, Parameter, Method, Containers, Preservative and Holding Time

Matrix	Parameter	Method	Container	Preservative	Holding Time
Aqueous Samples	VOC	SW846 8260B	Three (3) 40 mL VOA glass vials	4 ±2 ^{o}C, HCl	14 days to analysis
	PCBs	SW 846 8082A	Two (2) Liter Amber glass bottle	4 ±2 ^{o}C	7 days to extract, 40 days to analysis
	Pesticides	SW 846 8081B	Two (2) Liter Amber glass bottle	4 ±2 ^{o}C	7 days to extract, 40 days to analysis
	Metals	SW 846 6010B	One (1) 500 mL - Plastic bottle	4 ±2 ^{o}C, HNO_3	28 days for Mercury, 180 days for all other metals
	Mercury	SW 846 7470A	One (1) 500 mL - Plastic bottle	4 ±2 ^{o}C, HNO_3	28 days
	Hexvalent Chromium	SW 846 9176A	500 mL - Plastic bottle (No Acid)	4 ±2 ^{o}C, HCl	24 hours
	PAHs (SVOCs)	SW 846 8270C	One (1) Liter Amber glass bottle	4 ±2 ^{o}C	7 days to extract, 40 days to analysis
	GRO	SW 846 8015B	Two (2) 40 mL VOA glass vials	4 ±2 ^{o}C, HCl	14 days to analysis
	DRO	SW 846 8015B	One (1) Liter Amber glass bottle	4 ±2 ^{o}C, HCl	7 days to extract, 40 days to analysis
	ORO	SW 846 8015B	One (1) Liter Amber glass bottle	4 ±2 ^{o}C, HCl	7 days to extract, 40 days to analysis
	Cyanide	SW 846 9012B	250 mL - Plastic or glass bottle	4 ±2 ^{o}C, NaOH to pH>12, Ascorbic Acid	14 days to analysis
	Ethanol, Methanol	SW 846 8015B	Two (2) 40 mL VOA glass vials	4 ±2 ^{o}C, HCl	14 days to analysis
	Tetraethyl Lead	SW 846 8270C	One (1) Liter Amber glass bottle	4 ±2 ^{o}C	7 days to extract, 40 days to analysis
	Ammonia	SM 4500-NH3	250 mL - Plastic bottle	4 ±2 ^{o}C, H_2SO_4	28 days
	Nitrate	SM 4500-NO3	150 mL - Plastic bottle	4 ±2 ^{o}C	28 days
	Nitrite	SM 4500-NO2	150 mL - Plastic bottle	4 ±2 ^{o}C	48 hours
	pH	SW 846 9040C	100 mL - Plastic or Glass bottle	4 ±2 ^{o}C	Immediately
Soil / Sediment Samples	VOC	SW 846 8260B	Encore device	4 ±2 ^{o}C	14 days to analysis
			4-oz Glass jar w/ no headspace,	4 ±2 ^{o}C	14 days to analysis
			2-oz weighed jar - 25 grams of soil	4 ±2 ^{o}C, Methanol	14 days to analysis
	PCBs	SW 846 8082A	4-oz Glass jar	4 ±2 ^{o}C	14 days to analysis
	Pesticides	SW 846 8081B	4-oz Glass jar	4 ±2 ^{o}C	14 days to analysis
	GRO	SW 846 8015B	Encore device	4 ±2 ^{o}C	14 days to analysis
			4-oz Glass jar w/ no headspace	4 ±2 ^{o}C	14 days to analysis
			2-oz weighed jar - 25 grams of soil	4 ±2 ^{o}C, Methanol	14 days to analysis
	DRO	SW 846 8015B	8-oz Glass jar	4 ±2 ^{o}C	14 days to extract, 40 days to analysis
	ORO	SW 846 8015B	8-oz Glass jar	4 ±2 ^{o}C	14 days to extract, 40 days to analysis
	PAHs (SVOCs)	SW 846 8270C	8-oz Glass jar	4 ±2 ^{o}C	14 days to extract, 40 days to analysis
	Metals	SW 846 6010B	4-oz Glass jar	4 ±2 ^{o}C	14 days to extract, 40 days to analysis
	Mercury	SW 846 7471A	4-oz Glass jar	4 ±2 ^{o}C	28 days to analysis
	Hexvalent Chromium	SW 846 6010B	4-oz Glass jar	4 ±2 ^{o}C	30 days to analysis
	Cyanide	SW 846 9012B	8-oz Glass jar	4 ±2 ^{o}C	14 days to analysis
	TCLP Metals	SW 846 1311/6010B	8-oz Glass jar	4 ±2 ^{o}C	28 days for Mercury, 180 days for all other metals
	TCLP VOCs	SW 846 1311/8260B	4-oz Glass jar	4 ±2 ^{o}C	14 days to extract, 14 days to analysis
	Ethanol, Methanol	SW 846 8015B	4-oz Glass jar	4 ±2 ^{o}C	14 days to analysis
	Tetraethyl Lead	SW 846 8270C	8-oz Glass jar	4 ±2 ^{o}C	14 days to extract, 40 days to analysis
	Ammonia	SM 4500-NH3	4-oz Glass jar	4 ±2 ^{o}C	28 days
	Nitrate	EPA 353.2	4-oz Glass jar	4 ±2 ^{o}C	28 days
	Nitrite	EPA 353.2	4-oz Glass jar	4 ±2 ^{o}C	28 days
	Flashpoint	SW 846 1010A	4-oz Glass jar	N/A	N/A
	pH	SW 846 9045D	4-oz Glass jar	4 ±2 ^{o}C	ASAP
Air Samples	VOC	TO-15	Summa Canister	None	30 days
		TO-15 Modified	Tedlar Bag	None	72 hours
	Butane	TO-15	Summa Canister	None	30 days
	Propane	TO-15	Summa Canister	None	30 days
	Ammonia	OSHA ID-188/164	Sorbent Tube	None	14 days
	Ethanol	TO-15	Summa Canister	None	30 days
		TO-15 Modified	Tedlar Bag	None	72 hours
	Methanol	TO-3	Summa Canister	None	30 days
		TO-3	Tedlar Bag	None	72 hours

Notes:
VOC = Volatile Organic Compound
GRO = Gasoline Range Organics
DRO = Diesel Range Organics
ORO = Oil Range Organics
PAHs = Polynuclear Aromatic Hydrocarbons
TCLP = Toxic Chemical Leaching Procedure
mL = milliliters
VOA = Volatile Organic Analysis
^{o}C = degrees Celsius
HCl = Hydrochloric Acid
HNO_3 = Nitric Acid
H_2SO_4 = Sulfuric Acid

TABLE 2

GOWANUS VILLAGE I, LLC
322 3rd AVENUE
BROOKLYN, KINGS COUNTY, NEW YORK
NYSDEC BCP SITE NO. C224099
INDEX NO. W2-1069-0506

Quality Assurance Project Plan

General Field and Laboratory QA/QC Sample Collection/Analysis Schedule

Quality Assurance/Quality Control Sample	Frequency
Field Sample Duplicate	1 set per sampling area per media type
Field (Equipment) blank	1 set per sampling area
Trip bank	1 per shipping container of aqueous samples for VOC analysis
Temperature blank	1 per shipping container of samples requiring cool temperature preservation
Laboratory Method Blank	1 per 20 samples, or 1 for each batch of samples of similar method and matrix
Laboratory Control Sample	1 per 20 samples, or 1 for each batch of samples of similar method and matrix
Laboratory Matrix Spike/Matrix Spike Duplicate	1 per 20 samples, or 1 for each batch of samples of similar method and matrix
Surrogate Spike	1 for every sample for organic analyses when required by method

APPENDIX I

Analytical Laboratories - QA Plans, SOPs and Certifications

AMRO Environmental Lab Corp.

LBG ENGINEERING SERVICES, P.C.

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2014
Issued April 01, 2013

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MS. NANCY STEWART
AMRO ENVIRONMENTAL LAB CORP
111 HERRICK STREET
MERRIMACK, NH 03054

NY Lab Id No: 11278

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Acrylates

Acrolein (Propenal)	EPA 624
	EPA 8260B
Acrylonitrile	EPA 624
	EPA 8260B

Amines

2-Nitroaniline	EPA 8270C
3-Nitroaniline	EPA 8270C
4-Chloroaniline	EPA 8270C
4-Nitroaniline	EPA 8270C
Aniline	EPA 8270C
Pyridine	EPA 8270C

Benzidines

3,3'-Dichlorobenzidine	EPA 625
	EPA 8270C
Benzidine	EPA 625
	EPA 8270C

Chlorinated Hydrocarbon Pesticides

4,4'-DDD	EPA 608
	EPA 8081A
4,4'-DDE	EPA 608
	EPA 8081A
4,4'-DDT	EPA 608
	EPA 8081A
Aldrin	EPA 608

Chlorinated Hydrocarbon Pesticides

Aldrin	EPA 8081A
alpha-BHC	EPA 608
	EPA 8081A
beta-BHC	EPA 608
	EPA 8081A
Chlordane Total	EPA 608
	EPA 8081A
delta-BHC	EPA 608
	EPA 8081A
Dieldrin	EPA 608
	EPA 8081A
Endosulfan I	EPA 608
	EPA 8081A
Endosulfan II	EPA 608
	EPA 8081A
Endosulfan sulfate	EPA 608
	EPA 8081A
Endrin	EPA 608
	EPA 8081A
Endrin aldehyde	EPA 608
	EPA 8081A
Heptachlor	EPA 608
	EPA 8081A
Heptachlor epoxide	EPA 608
	EPA 8081A
Lindane	EPA 608

Serial No.: 48581

Property of the New York State Department of Health. Certificates are valid only at the address shown, must be conspicuously posted, and are printed on secure paper. Continued accreditation depends on successful ongoing participation in the Program. Consumers are urged to call (518) 485-5570 to verify the laboratory's accreditation status.

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2014
Issued April 01, 2013

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MS. NANCY STEWART
AMRO ENVIRONMENTAL LAB CORP
111 HERRICK STREET
MERRIMACK, NH 03054

NY Lab Id No: 11278

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Chlorinated Hydrocarbon Pesticides

Lindane	EPA 8081A
Methoxychlor	EPA 608
	EPA 8081A
Toxaphene	EPA 608
	EPA 8081A

Chlorinated Hydrocarbons

1,2,4-Trichlorobenzene	EPA 625
	EPA 8270C
2-Chloronaphthalene	EPA 625
	EPA 8270C
Hexachlorobenzene	EPA 625
	EPA 8270C
Hexachlorobutadiene	EPA 625
	EPA 8270C
Hexachlorocyclopentadiene	EPA 625
	EPA 8270C
Hexachloroethane	EPA 625
	EPA 8270C

Demand

Biochemical Oxygen Demand	SM 18-21 5210B (01)
Carbonaceous BOD	SM 18-21 5210B (01)
Chemical Oxygen Demand	HACH 8000

Haloethers

4-Bromophenylphenyl ether	EPA 625

Haloethers

4-Bromophenylphenyl ether	EPA 8270C
4-Chlorophenylphenyl ether	EPA 625
	EPA 8270C
Bis(2-chloroethoxy)methane	EPA 625
	EPA 8270C
Bis(2-chloroethyl)ether	EPA 625
	EPA 8270C
Bis(2-chloroisopropyl) ether	EPA 625
	EPA 8270C

Mineral

Alkalinity	SM 18-21 2320B (97)
Calcium Hardness	EPA 200.7 Rev. 4.4
Chloride	EPA 300.0 Rev. 2.1
	SM 18-20 4500-Cl- C
Fluoride, Total	EPA 300.0 Rev. 2.1
Hardness, Total	EPA 200.7 Rev. 4.4
Sulfate (as SO4)	ASTM D516-90 02 & 07
	EPA 300.0 Rev. 2.1

Nitroaromatics and Isophorone

2,4-Dinitrotoluene	EPA 625
	EPA 8270C
2,6-Dinitrotoluene	EPA 625
	EPA 8270C
Isophorone	EPA 625
	EPA 8270C

Serial No.: 48581

Property of the New York State Department of Health. Certificates are valid only at the address shown, must be conspicuously posted, and are printed on secure paper. Continued accreditation depends on successful ongoing participation in the Program. Consumers are urged to call (518) 485-5570 to verify the laboratory's accreditation status.

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2014
Issued April 01, 2013

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MS. NANCY STEWART
AMRO ENVIRONMENTAL LAB CORP
111 HERRICK STREET
MERRIMACK, NH 03054

NY Lab Id No: 11278

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Nitroaromatics and Isophorone

Nitrobenzene	EPA 625
	EPA 8270C

Nitrosoamines

N-Nitrosodi-n-propylamine	EPA 625
	EPA 8270C
N-Nitrosodiphenylamine	EPA 625
	EPA 8270C

Nutrient

Ammonia (as N)	SM 19-21 4500 NH3-C (97)
Kjeldahl Nitrogen, Total	SM 19-21 4500 NH3-C (97)
Nitrate (as N)	EPA 300.0 Rev. 2.1
Nitrite (as N)	EPA 300.0 Rev. 2.1
Orthophosphate (as P)	SM 18-21 4500-P E
Phosphorus, Total	SM 18-21 4500-P E

Phthalate Esters

Benzyl butyl phthalate	EPA 625
	EPA 8270C
Bis(2-ethylhexyl) phthalate	EPA 625
	EPA 8270C
Diethyl phthalate	EPA 625
	EPA 8270C
Dimethyl phthalate	EPA 625
	EPA 8270C
Di-n-butyl phthalate	EPA 625

Phthalate Esters

Di-n-butyl phthalate	EPA 8270C
Di-n-octyl phthalate	EPA 625
	EPA 8270C

Polychlorinated Biphenyls

PCB-1016	EPA 608
	EPA 8082
PCB-1221	EPA 608
	EPA 8082
PCB-1232	EPA 608
	EPA 8082
PCB-1242	EPA 608
	EPA 8082
PCB-1248	EPA 608
	EPA 8082
PCB-1254	EPA 608
	EPA 8082
PCB-1260	EPA 608
	EPA 8082

Polynuclear Aromatics

Acenaphthene	EPA 625
	EPA 8270C
Acenaphthylene	EPA 625
	EPA 8270C
Anthracene	EPA 625
	EPA 8270C

Serial No.: 48581

Property of the New York State Department of Health. Certificates are valid only at the address shown, must be conspicuously posted, and are printed on secure paper. Continued accreditation depends on successful ongoing participation in the Program. Consumers are urged to call (518) 485-5570 to verify the laboratory's accreditation status.

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2014
Issued April 01, 2013

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MS. NANCY STEWART
AMRO ENVIRONMENTAL LAB CORP
111 HERRICK STREET
MERRIMACK, NH 03054

NY Lab Id No: 11278

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Polynuclear Aromatics		Priority Pollutant Phenols	
Benzo(a)anthracene	EPA 625	2,4,5-Trichlorophenol	EPA 625
	EPA 8270C		EPA 8270C
Benzo(a)pyrene	EPA 625	2,4,6-Trichlorophenol	EPA 625
	EPA 8270C		EPA 8270C
Benzo(b)fluoranthene	EPA 625	2,4-Dichlorophenol	EPA 625
	EPA 8270C		EPA 8270C
Benzo(ghi)perylene	EPA 625	2,4-Dimethylphenol	EPA 625
	EPA 8270C		EPA 8270C
Benzo(k)fluoranthene	EPA 625	2,4-Dinitrophenol	EPA 625
	EPA 8270C		EPA 8270C
Chrysene	EPA 625	2-Chlorophenol	EPA 625
	EPA 8270C		EPA 8270C
Dibenzo(a,h)anthracene	EPA 625	2-Methyl-4,6-dinitrophenol	EPA 625
	EPA 8270C		EPA 8270C
Fluoranthene	EPA 625	2-Methylphenol	EPA 8270C
	EPA 8270C	2-Nitrophenol	EPA 625
Fluorene	EPA 625		EPA 8270C
	EPA 8270C	4-Chloro-3-methylphenol	EPA 625
Indeno(1,2,3-cd)pyrene	EPA 625		EPA 8270C
	EPA 8270C	4-Nitrophenol	EPA 625
Naphthalene	EPA 625		EPA 8270C
	EPA 8270C	Cresols, Total	EPA 8270C
Phenanthrene	EPA 625	Pentachlorophenol	EPA 625
	EPA 8270C		EPA 8270C
Pyrene	EPA 625	Phenol	EPA 625
	EPA 8270C		EPA 8270C

Serial No.: 48581

Property of the New York State Department of Health. Certificates are valid only at the address shown, must be conspicuously posted, and are printed on secure paper. Continued accreditation depends on successful ongoing participation in the Program. Consumers are urged to call (518) 485-5570 to verify the laboratory's accreditation status.

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2014
Issued April 01, 2013

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MS. NANCY STEWART
AMRO ENVIRONMENTAL LAB CORP
111 HERRICK STREET
MERRIMACK, NH 03054

NY Lab Id No: 11278

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Residue	
Solids, Total	SM 18-21 2540B (97)
Solids, Total Dissolved	SM 18-21 2540C (97)
Solids, Total Suspended	SM 18-21 2540D (97)
Semi-Volatile Organics	
Benzoic Acid	EPA 8270C
Benzyl alcohol	EPA 8270C
Dibenzofuran	EPA 8270C
Volatile Aromatics	
1,2-Dichlorobenzene	EPA 624
	EPA 8260B
1,3-Dichlorobenzene	EPA 624
	EPA 8260B
1,4-Dichlorobenzene	EPA 624
	EPA 8260B
Benzene	EPA 624
	EPA 8260B
Chlorobenzene	EPA 624
	EPA 8260B
Ethyl benzene	EPA 624
	EPA 8260B
Styrene	EPA 624
	EPA 8260B
Toluene	EPA 624
	EPA 8260B
Total Xylenes	EPA 624
Volatile Aromatics	
Total Xylenes	EPA 8260B
Volatile Halocarbons	
1,1,1-Trichloroethane	EPA 624
	EPA 8260B
1,1,2,2-Tetrachloroethane	EPA 624
	EPA 8260B
1,1,2-Trichloroethane	EPA 624
	EPA 8260B
1,1-Dichloroethane	EPA 624
	EPA 8260B
1,1-Dichloroethene	EPA 624
	EPA 8260B
1,2-Dichloroethane	EPA 624
	EPA 8260B
1,2-Dichloropropane	EPA 624
	EPA 8260B
2-Chloroethylvinyl ether	EPA 624
	EPA 8260B
Bromodichloromethane	EPA 624
	EPA 8260B
Bromoform	EPA 624
	EPA 8260B
Bromomethane	EPA 624
	EPA 8260B
Carbon tetrachloride	EPA 624

Serial No.: 48581

Property of the New York State Department of Health. Certificates are valid only at the address shown, must be conspicuously posted, and are printed on secure paper. Continued accreditation depends on successful ongoing participation in the Program. Consumers are urged to call (518) 485-5570 to verify the laboratory's accreditation status.

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2014
Issued April 01, 2013

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MS. NANCY STEWART
AMRO ENVIRONMENTAL LAB CORP
111 HERRICK STREET
MERRIMACK, NH 03054

NY Lab Id No: 11278

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Volatile Halocarbons	
Carbon tetrachloride	EPA 8260B
Chloroethane	EPA 624
	EPA 8260B
Chloroform	EPA 624
	EPA 8260B
Chloromethane	EPA 624
	EPA 8260B
cis-1,2-Dichloroethene	EPA 8260B
cis-1,3-Dichloropropene	EPA 624
	EPA 8260B
Dibromochloromethane	EPA 624
	EPA 8260B
Dichlorodifluoromethane	EPA 624
	EPA 8260B
Methylene chloride	EPA 624
	EPA 8260B
Tetrachloroethene	EPA 624
	EPA 8260B
trans-1,2-Dichloroethene	EPA 624
	EPA 8260B
trans-1,3-Dichloropropene	EPA 624
	EPA 8260B
Trichloroethene	EPA 624
	EPA 8260B
Trichlorofluoromethane	EPA 624
	EPA 8260B

Volatile Halocarbons	
Vinyl chloride	EPA 624
	EPA 8260B
Volatiles Organics	
2-Butanone (Methylethyl ketone)	EPA 8260B
2-Hexanone	EPA 8260B
4-Methyl-2-Pentanone	EPA 8260B
Acetone	EPA 8260B
Carbon Disulfide	EPA 8260B
Vinyl acetate	EPA 8260B
Wastewater Metals I	
Barium, Total	EPA 200.7 Rev. 4.4
	EPA 6010B
Cadmium, Total	EPA 200.7 Rev. 4.4
	EPA 200.9 Rev. 2.2
	EPA 6010B
Calcium, Total	EPA 200.7 Rev. 4.4
	EPA 6010B
Chromium, Total	EPA 200.7 Rev. 4.4
	EPA 6010B
Copper, Total	EPA 200.7 Rev. 4.4
	EPA 6010B
Iron, Total	EPA 200.7 Rev. 4.4
	EPA 6010B
Lead, Total	EPA 200.7 Rev. 4.4
	EPA 200.9 Rev. 2.2

Serial No.: 48581

Property of the New York State Department of Health. Certificates are valid only at the address shown, must be conspicuously posted, and are printed on secure paper. Continued accreditation depends on successful ongoing participation in the Program. Consumers are urged to call (518) 485-5570 to verify the laboratory's accreditation status.

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2014
Issued April 01, 2013

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MS. NANCY STEWART
AMRO ENVIRONMENTAL LAB CORP
111 HERRICK STREET
MERRIMACK, NH 03054

NY Lab Id No: 11278

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Wastewater Metals I

Lead, Total	EPA 6010B
Magnesium, Total	EPA 200.7 Rev. 4.4
	EPA 6010B
Manganese, Total	EPA 200.7 Rev. 4.4
	EPA 6010B
Nickel, Total	EPA 200.7 Rev. 4.4
	EPA 6010B
Potassium, Total	EPA 200.7 Rev. 4.4
	EPA 6010B
Silver, Total	EPA 200.7 Rev. 4.4
	EPA 200.9 Rev. 2.2
	EPA 6010B
Sodium, Total	EPA 200.7 Rev. 4.4
	EPA 6010B
Strontium, Total	EPA 200.7 Rev. 4.4
	EPA 6010B

Wastewater Metals II

Aluminum, Total	EPA 200.7 Rev. 4.4
	EPA 6010B
Antimony, Total	EPA 200.7 Rev. 4.4
	EPA 200.9 Rev. 2.2
	EPA 6010B
Arsenic, Total	EPA 200.7 Rev. 4.4
	EPA 200.9 Rev. 2.2
	EPA 6010B

Wastewater Metals II

Arsenic, Total	EPA 7060A
Beryllium, Total	EPA 200.7 Rev. 4.4
	EPA 6010B
Chromium VI	EPA 7196A
	SM 18-19 3500-Cr D
Mercury, Total	EPA 245.1 Rev. 3.0
	EPA 7470A
Selenium, Total	EPA 200.7 Rev. 4.4
	EPA 200.9 Rev. 2.2
	EPA 6010B
Vanadium, Total	EPA 200.7 Rev. 4.4
	EPA 6010B
Zinc, Total	EPA 200.7 Rev. 4.4
	EPA 6010B

Wastewater Metals III

Cobalt, Total	EPA 200.7 Rev. 4.4
	EPA 6010B
Molybdenum, Total	EPA 200.7 Rev. 4.4
	EPA 6010B
Thallium, Total	EPA 200.7 Rev. 4.4
	EPA 200.9 Rev. 2.2
	EPA 6010B
Tin, Total	EPA 200.7 Rev. 4.4
	EPA 6010B
Titanium, Total	EPA 200.7 Rev. 4.4

Serial No.: 48581

Property of the New York State Department of Health. Certificates are valid only at the address shown, must be conspicuously posted, and are printed on secure paper. Continued accreditation depends on successful ongoing participation in the Program. Consumers are urged to call (518) 485-5570 to verify the laboratory's accreditation status.

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2014
Issued April 01, 2013

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MS. NANCY STEWART
AMRO ENVIRONMENTAL LAB CORP
111 HERRICK STREET
MERRIMACK, NH 03054

NY Lab Id No: 11278

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Wastewater Metals III

Titanium, Total	EPA 6010B

Wastewater Miscellaneous

Boron, Total	EPA 200.7 Rev. 4.4
	EPA 6010B
Cyanide, Total	EPA 9014
	SM 18-21 4500-CN E (99)
Oil and Grease Total Recoverable (HEM	EPA 1664A
Phenols	EPA 420.1 Rev. 1978
Specific Conductance	EPA 120.1 Rev. 1982

Sample Preparation Methods

EPA 200.2
EPA 3010A
EPA 3510C
EPA 5030B
SM 18-20 4500-CN C
SM 18-21 4500-N Org B or C (97)
SM 18-21 4500-NH3 B (97)

Serial No.: 48581

Property of the New York State Department of Health. Certificates are valid only at the address shown, must be conspicuously posted, and are printed on secure paper. Continued accreditation depends on successful ongoing participation in the Program. Consumers are urged to call (518) 485-5570 to verify the laboratory's accreditation status.

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2014
Issued April 01, 2013

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MS. NANCY STEWART
AMRO ENVIRONMENTAL LAB CORP
111 HERRICK STREET
MERRIMACK, NH 03054

NY Lab Id No: 11278

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE
All approved analytes are listed below:

Acrylates

Acrolein (Propenal)	EPA 8260B
Acrylonitrile	EPA 8260B

Amines

2-Nitroaniline	EPA 8270C
3-Nitroaniline	EPA 8270C
4-Chloroaniline	EPA 8270C
4-Nitroaniline	EPA 8270C
Aniline	EPA 8270C
Carbazole	EPA 8270C

Benzidines

3,3'-Dichlorobenzidine	EPA 8270C
Benzidine	EPA 8270C

Characteristic Testing

Reactivity	SW-846 Ch7 Sec. 7.3
TCLP	EPA 1311

Chlorinated Hydrocarbon Pesticides

4,4'-DDD	EPA 8081A
4,4'-DDE	EPA 8081A
4,4'-DDT	EPA 8081A
Aldrin	EPA 8081A
alpha-BHC	EPA 8081A
beta-BHC	EPA 8081A
Chlordane Total	EPA 8081A
delta-BHC	EPA 8081A

Chlorinated Hydrocarbon Pesticides

Dieldrin	EPA 8081A
Endosulfan I	EPA 8081A
Endosulfan II	EPA 8081A
Endosulfan sulfate	EPA 8081A
Endrin	EPA 8081A
Endrin aldehyde	EPA 8081A
Heptachlor	EPA 8081A
Heptachlor epoxide	EPA 8081A
Lindane	EPA 8081A
Methoxychlor	EPA 8081A
Toxaphene	EPA 8081A

Chlorinated Hydrocarbons

1,2,4-Trichlorobenzene	EPA 8270C
2-Chloronaphthalene	EPA 8270C
Hexachlorobenzene	EPA 8270C
Hexachlorobutadiene	EPA 8270C
Hexachlorocyclopentadiene	EPA 8270C
Hexachloroethane	EPA 8270C

Haloethers

4-Bromophenylphenyl ether	EPA 8270C
4-Chlorophenylphenyl ether	EPA 8270C
Bis(2-chloroethoxy)methane	EPA 8270C
Bis(2-chloroethyl)ether	EPA 8270C
Bis(2-chloroisopropyl) ether	EPA 8270C

Serial No.: 48582

Property of the New York State Department of Health. Certificates are valid only at the address shown, must be conspicuously posted, and are printed on secure paper. Continued accreditation depends on successful ongoing participation in the Program. Consumers are urged to call (518) 485-5570 to verify the laboratory's accreditation status.

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2014
Issued April 01, 2013

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MS. NANCY STEWART
AMRO ENVIRONMENTAL LAB CORP
111 HERRICK STREET
MERRIMACK, NH 03054

NY Lab Id No: 11278

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE
All approved analytes are listed below:

Metals I

Barium, Total	EPA 6010B
Cadmium, Total	EPA 6010B
Calcium, Total	EPA 6010B
Chromium, Total	EPA 6010B
Copper, Total	EPA 6010B
Iron, Total	EPA 6010B
Lead, Total	EPA 6010B
Magnesium, Total	EPA 6010B
Manganese, Total	EPA 6010B
Nickel, Total	EPA 6010B
Potassium, Total	EPA 6010B
Silver, Total	EPA 6010B
Sodium, Total	EPA 6010B

Metals II

Aluminum, Total	EPA 6010B
Antimony, Total	EPA 6010B
Arsenic, Total	EPA 6010B
	EPA 7060A
Beryllium, Total	EPA 6010B
Chromium VI	EPA 7196A
Mercury, Total	EPA 7471A
Selenium, Total	EPA 6010B
Vanadium, Total	EPA 6010B
Zinc, Total	EPA 6010B

Metals III

Cobalt, Total	EPA 6010B
Molybdenum, Total	EPA 6010B
Thallium, Total	EPA 6010B
Tin, Total	EPA 6010B

Miscellaneous

Boron, Total	EPA 6010B
Cyanide, Total	EPA 9014

Nitroaromatics and Isophorone

2,4-Dinitrotoluene	EPA 8270C
2,6-Dinitrotoluene	EPA 8270C
Isophorone	EPA 8270C
Nitrobenzene	EPA 8270C
Pyridine	EPA 8270C

Nitrosoamines

N-Nitrosodimethylamine	EPA 8270C
N-Nitrosodi-n-propylamine	EPA 8270C
N-Nitrosodiphenylamine	EPA 8270C

Nutrients

Nitrite (as N)	EPA 9056A

Phthalate Esters

Benzyl butyl phthalate	EPA 8270C
Bis(2-ethylhexyl) phthalate	EPA 8270C
Diethyl phthalate	EPA 8270C

Serial No.: 48582

Property of the New York State Department of Health. Certificates are valid only at the address shown, must be conspicuously posted, and are printed on secure paper. Continued accreditation depends on successful ongoing participation in the Program. Consumers are urged to call (518) 485-5570 to verify the laboratory's accreditation status.

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2014
Issued April 01, 2013

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MS. NANCY STEWART
AMRO ENVIRONMENTAL LAB CORP
111 HERRICK STREET
MERRIMACK, NH 03054

NY Lab Id No: 11278

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE
All approved analytes are listed below:

Phthalate Esters

Dimethyl phthalate	EPA 8270C
Di-n-butyl phthalate	EPA 8270C
Di-n-octyl phthalate	EPA 8270C

Polychlorinated Biphenyls

PCB-1016	EPA 8082
PCB-1221	EPA 8082
PCB-1232	EPA 8082
PCB-1242	EPA 8082
PCB-1248	EPA 8082
PCB-1254	EPA 8082
PCB-1260	EPA 8082

Polynuclear Aromatic Hydrocarbons

Acenaphthene	EPA 8270C
Acenaphthylene	EPA 8270C
Anthracene	EPA 8270C
Benzo(a)anthracene	EPA 8270C
Benzo(a)pyrene	EPA 8270C
Benzo(b)fluoranthene	EPA 8270C
Benzo(ghi)perylene	EPA 8270C
Benzo(k)fluoranthene	EPA 8270C
Chrysene	EPA 8270C
Dibenzo(a,h)anthracene	EPA 8270C
Fluoranthene	EPA 8270C
Fluorene	EPA 8270C
Indeno(1,2,3-cd)pyrene	EPA 8270C

Polynuclear Aromatic Hydrocarbons

Naphthalene	EPA 8270C
Phenanthrene	EPA 8270C
Pyrene	EPA 8270C

Priority Pollutant Phenols

2,4,5-Trichlorophenol	EPA 8270C
2,4,6-Trichlorophenol	EPA 8270C
2,4-Dichlorophenol	EPA 8270C
2,4-Dimethylphenol	EPA 8270C
2,4-Dinitrophenol	EPA 8270C
2-Chlorophenol	EPA 8270C
2-Methyl-4,6-dinitrophenol	EPA 8270C
2-Methylphenol	EPA 8270C
2-Nitrophenol	EPA 8270C
4-Chloro-3-methylphenol	EPA 8270C
4-Nitrophenol	EPA 8270C
Pentachlorophenol	EPA 8270C
Phenol	EPA 8270C

Semi-Volatile Organics

2-Methylnaphthalene	EPA 8270C
Acetophenone	EPA 8270C
Benzoic Acid	EPA 8270C
Benzyl alcohol	EPA 8270C
Dibenzofuran	EPA 8270C

Serial No.: 48582

Property of the New York State Department of Health. Certificates are valid only at the address shown, must be conspicuously posted, and are printed on secure paper. Continued accreditation depends on successful ongoing participation in the Program. Consumers are urged to call (518) 485-5570 to verify the laboratory's accreditation status.

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2014
Issued April 01, 2013

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MS. NANCY STEWART
AMRO ENVIRONMENTAL LAB CORP
111 HERRICK STREET
MERRIMACK, NH 03054

NY Lab Id No: 11278

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE
All approved analytes are listed below:

Volatile Aromatics

1,2,4-Trimethylbenzene	EPA 8260B
1,2-Dichlorobenzene	EPA 8260B
1,3,5-Trimethylbenzene	EPA 8260B
1,3-Dichlorobenzene	EPA 8260B
1,4-Dichlorobenzene	EPA 8260B
2-Chlorotoluene	EPA 8260B
4-Chlorotoluene	EPA 8260B
Benzene	EPA 8260B
Bromobenzene	EPA 8260B
Chlorobenzene	EPA 8260B
Ethyl benzene	EPA 8260B
Isopropylbenzene	EPA 8260B
n-Butylbenzene	EPA 8260B
sec-Butylbenzene	EPA 8260B
Styrene	EPA 8260B
tert-Butylbenzene	EPA 8260B
Toluene	EPA 8260B
Total Xylenes	EPA 8260B

Volatile Halocarbons

1,1,1,2-Tetrachloroethane	EPA 8260B
1,1,1-Trichloroethane	EPA 8260B
1,1,2,2-Tetrachloroethane	EPA 8260B
1,1,2-Trichloroethane	EPA 8260B
1,1-Dichloroethane	EPA 8260B
1,1-Dichloroethene	EPA 8260B

Volatile Halocarbons

1,2-Dichloroethane	EPA 8260B
1,2-Dichloropropane	EPA 8260B
2-Chloroethylvinyl ether	EPA 8260B
Bromodichloromethane	EPA 8260B
Bromoform	EPA 8260B
Bromomethane	EPA 8260B
Carbon tetrachloride	EPA 8260B
Chloroethane	EPA 8260B
Chloroform	EPA 8260B
Chloromethane	EPA 8260B
cis-1,3-Dichloropropene	EPA 8260B
Dibromochloromethane	EPA 8260B
Dichlorodifluoromethane	EPA 8260B
Tetrachloroethene	EPA 8260B
trans-1,3-Dichloropropene	EPA 8260B
Trichloroethene	EPA 8260B
Trichlorofluoromethane	EPA 8260B
Vinyl chloride	EPA 8260B

Volatile Organics

1,4-Dioxane	EPA 8260B
2-Butanone (Methylethyl ketone)	EPA 8260B
2-Hexanone	EPA 8260B
4-Methyl-2-Pentanone	EPA 8260B
Acetone	EPA 8260B
Carbon Disulfide	EPA 8260B

Serial No.: 48582

Property of the New York State Department of Health. Certificates are valid only at the address shown, must be conspicuously posted, and are printed on secure paper. Continued accreditation depends on successful ongoing participation in the Program. Consumers are urged to call (518) 485-5570 to verify the laboratory's accreditation status.

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2014
Issued April 01, 2013

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MS. NANCY STEWART
AMRO ENVIRONMENTAL LAB CORP
111 HERRICK STREET
MERRIMACK, NH 03054

NY Lab Id No: 11278

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE
All approved analytes are listed below:

Volatile Organics

Vinyl acetate	EPA 8260B

Sample Preparation Methods

EPA 3010A
EPA 3050B
EPA 3051
EPA 3541

Serial No.: 48582

Property of the New York State Department of Health. Certificates are valid only at the address shown, must be conspicuously posted, and are printed on secure paper. Continued accreditation depends on successful ongoing participation in the Program. Consumers are urged to call (518) 485-5570 to verify the laboratory's accreditation status.

AMRO Environmental Laboratories Corporation

111 Herrick Street, Merrimack, NH 03054
TEL: (603) 424-2022 • FAX: (603) 429-8496
www.amrolabs.com

QUALITY SYSTEMS MANUAL

For

ENVIRONMENTAL ANALYSES POTABLE WATER, NON POTABLE WATER AND SOLID AND HAZARDOUS WASTE

AMRO ENVIRONMENTAL LABORATORIES CORPORATION

Revision No.: 14

JANUARY 2012

Reviewed and Approved by

Nancy Stewart/
Lead Technical Director & Quality Assurance Manager

1-30-2012
Date

Prepared by: Nancy Stewart (01/12)

Property of AMRO Environmental Laboratories Corporation

TABLE OF CONTENTS

SECTION #	TOPIC	DATE	REVISION
1	**Policy Statement**	06/08	6
2	**Organizational Structure** 2.1 Organizational Structure	01/12	10
3	**Approved Signatories**	03/11	9
4	**Qualifications and Training** 4.1 Qualifications 4.2 Training	09/09	8
5	**Sample Collection and Receipt** 5.1 Bottle Preparation 5.2 Sampling and Preservation 5.3 Sample Receipt	09/09	7
6	**Incoming Work Review** 6.1 New Work 6.2 Existing Work 6.3 Current Work	09/09	5
7	**Analytical Procedures** 7.1 Analytical Procedures 7.2 Standard Operating Procedures	03/11	12
8	**Instrument/Equipment and Facilities** 8.1 AMRO Equipment/Instrumentation List 8.2 Facilities 8.3 Support Services used by AMRO	13/11	8
9	**Traceability** 9.1 Chemical Receipt 9.2 Standard Preparation 9.3 Standard Tracking 9.4 Solution Check Analysis 9.5 Solvent Check Analysis 9.6 Distilled Water Check Analysis	01/10	7

SECTION #	TOPIC	DATE	REVISION
10	**Calibration/Verification of Test Procedures**	03/11	12
	10.1 Method Detection Limits (MDL)		
	10.2 Precision and Accuracy Studies		
	10.3 GC/MS (Volatile Organics)		
	10.4 GC/MS (Semivolatile Organics)		
	10.5 GC Pesticides		
	10.6 GC PCBs		
	10.7 GC Fingerprint		
	10.8 Instrumental Detection Limits (IDL)		
	10.9 Graphite Furnace (GFAA)		
	10.10 ICP		
	10.11 Mercury Analyzer System		
	10.12 Ion Chromatography		
11	**Instrument Equipment Calibration**	13/11	10
	11.1 Calibration Checks and Frequencies		
	11.2 Instrument Maintenance/Repair		
12	**Quality Control Samples**	01/08	5
	12.1 Quality Assurance		
	12.2 Accuracy		
	12.3 Precision		
	12.4 Completeness		
	12.5 Representativeness		
	12.6 Comparability		
	12.7 QC Sample Types		
	12.8 Proficiency Testing		
	12.9 Internal Verification		
	12.10 Control Charts		
13	**Corrective Action**	02/04	3
	13.1 General		
	13.2 Definition		
	13.3 Initiation of Action		
	13.4 Documentation of Corrective Action		
	13.5 Training		
	13.6 Non-Conforming Data Report		
	13.7 Documentation of Non-Conforming Report Data		
	13.8 Client Requested Investigation		
	13.9 Complaints		

SECTION #	TOPIC	DATE	REVISION
14	**Departures From Documented Policies and Procedures**	02/02	3
15	**Data Handling and Reporting** 15.1 Gathering and Reporting Data 15.2 Data Review 15.3 Analytical Values 15.4 Data Reporting 15.5 Records Management 15.6 Records Transfer	01/12	12
16	**Confidentiality and Proprietary Rights**	03/03	1
17	**Audits and Certifications** 17.1 System Audits 17.2 Performance Evaluation Audits 17.3 Internal Audits 17.4 External Audits 17.5 Data Integrity Audits 17.6 Certifications	01/12	11
18	**Record Retention and Data Archiving** 18.1 Data Security/Archiving 18.2 Forms 18.3 Logbooks 18.4 SOP's 18.5 Certificates	03/11	5
19	**References**	01/10	10

ATTACHMENTS

Attachment 1 – AMRO Ethics and Data Integrity Agreement
Attachment 2 – AMRO Qualification Card
Attachment 3 – AMRO Bottle Preparation Preservation Requirements
Attachment 4 – AMRO Sample Container, Preservation and Holding Time Requirements
Attachment 5 – AMRO Chain-Of-Custody
Attachment 6– AMRO Project Number Assignment Log
Attachment 7a&b – AMRO Sample Receipt Checklist
Attachment 8 – AMRO Sample Receipt fax to clients
Attachment 9 – AMRO Internal Chain of Custody Form
Attachment 10 – AMRO Incoming Notice Form
Attachment 11 – AMRO GC/MS Method Information Form
Attachment12- AMRO Instrument List
Attachment 13 – AMRO Chemical Receiving Log Form
Attachment 14 – AMRO Inorganic Standard Log Form
Attachment 15 – AMRO Mercury Standard Log Form
Attachment 16– AMRO Optima ICP Standard Log Form
Attachment 17 – AMRO Graphite Furnace Standard Log Form
Attachment 18 – AMRO Inorganic Reagent Log Form
Attachment 19 – AMRO Organic Standard Log Index Form
Attachment 20 – AMRO Organic Stock Standard Log Form
Attachment 21 – AMRO Organic Working Standard Log Form
Attachment 22 – AMRO Method Detection Limit Checklist
Attachment 23 – AMRO Precision and Accuracy Checklist
Attachment 24 – AMRO Corrective Actions Report and Status
Attachment 25 – AMRO Surveillance Report
Attachment 26 – AMRO Non-Conforming Data Report
Attachment 27 – AMRO GC and GC/MS Data Review Checklist
Attachment 28 – AMRO ICP Data Review Checklist
Attachment 29 – AMRO GFAA and CVAA Data Review Checklist
Attachment 30 – AMRO Wet Chemistry Data Review Checklist
Attachment 31a&b – AMRO Data Review Checklist
Attachment 32 – AMRO Report Packages List
Attachment 33– AMRO Storage Boxes Tracking Log
Attachment 34– AMRO Sign Out Storage Boxes Log
Attachment 35 – AMRO Interim Change Notification Form

SECTION 1. POLICY STATEMENT

This policy statement serves to establish the top management's objectives and commitments to the laboratory

AMRO Environmental Laboratories Corporation of Merrimack, New Hampshire was incorporated in 1987 to provide environmental testing services. AMRO's capabilities include volatile organics, semivolatile organics, pesticides, PCB's, petroleum hydrocarbon fingerprinting, EPH, VPH, industrial solvents, trace metals and inorganic analyses in wastewater, drinking water, soil, sediment, solid and hazardous wastes. AMRO also has the capability to perform the Toxicity Characteristics Leaching Procedure (TCLP) and Hazardous waste characteristics testing.

The owners of AMRO are committed to producing the highest quality results possible with the objective of continuously improving all areas of our operation. These objectives are accomplished through the quality systems that are in place throughout the laboratory. Management stresses to the staff that quality is considered to be the responsibility of all AMRO personnel. Laboratory personnel should be free from any undue internal or external commercial, financial or other pressure and influences that may adversely affect the quality of their work. Any personnel that experiences any such pressure should immediately inform one of the owners. All analysts are thoroughly trained, tested in each method and where applicable required to pass a precision and accuracy study before analyzing actual samples. All procedures require an initial startup check to demonstrate the ability to produce acceptable results prior to implementation. Experienced staff members review all results prior to data being released to clients. Employees are also required to sign an "Ethics and Data Integrity Agreement" upon starting employment at AMRO (Attachment 1). This statement helps to ensure employee awareness of the commitment the company has to produce quality data and the role of the employee in realizing this goal.

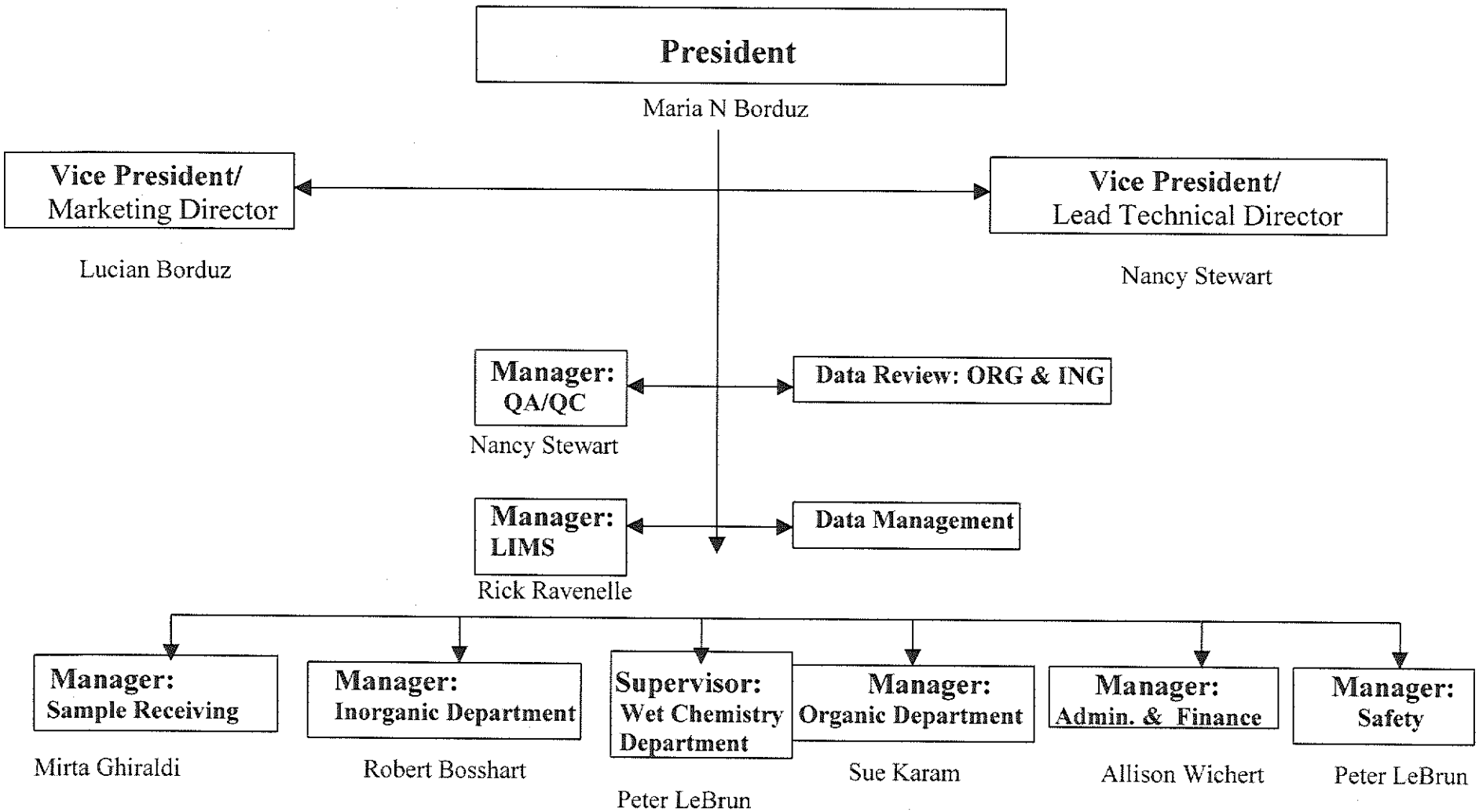
The Quality Systems Manual and all the laboratory Standard Operating Procedures (SOP's) meet the requirements of the National Environmental Laboratory Accreditation Conference (NELAC), Massachusetts Contingency Plan (MCP) and Department of Defense (DOD).

This Quality Systems Manual defines the quality assurance and quality control procedures that are employed here at AMRO to ensure the accuracy, precision, completeness, representatives and comparability of the analytical data generated in our laboratory. The Quality Assurance/Quality Control (QA/QC) Manager is responsible for controlling and updating the Quality Systems Manual as needed. It is reviewed and updated annually, at a minimum. All employees are required to read and sign the Quality Systems Manual the first day of employment and annually after Manual is updated.

SECTION 2. ORGANIZATIONAL STRUCTURE

2.1 The organizational structure of AMRO is outlined in Figure 1. and shows the different areas within the laboratory. AMRO is managed by Maria N. Borduz, President; Nancy Stewart, Vice President and Lead Technical Director; and Lucian Borduz, Vice President and Chief Operational Officer. All three hold degrees in chemistry and each has between 35 to 50 years of experience in analytical chemistry.

AMRO Environmental Laboratories Corporation
Corporate Organizational Structure



SECTION 3. APPROVED SIGNATORIES

The following Personnel are considered approved signatories for the items indicated:

President: Maria N. Borduz- Approved signatory of the Quality Systems Manual, final data package, Corrective Actions Report, SOP's, Non-Conformance Reports, and purchasing.

Vice President/Lead Technical Director: Nancy Stewart – Approved signatory of the Quality Systems Manual, final data package, Corrective Actions Report, SOP's, Non-Conformance Reports, and purchasing.

QA/QC Manager: Nancy Stewart – Approved signatory of the Quality Systems Manual, final data packages, laboratory training, SOP's approval for the laboratory, Corrective Actions, and Non-Conformance Report.

Organic Section Manager: Sue Karam – Approved signatory of the final semivolatiles and volatiles report review, final data package, SOP's, Corrective Actions, Non-Conformance Report, organic section approval of training and organic section approval for purchasing.

VOA Supervisor: Sue Karam- Approved signatory of the final volatiles report review, SOP's, Corrective Actions, Non-Conformance Report, VOA section approval of training and organic section approval for purchasing.

Inorganic Manager: Robert Bosshart - Approved signatory of the final inorganic/metals report, final data package, SOP's, Corrective Actions, Non-Conformance Report, approval for the inorganic/metals section, inorganic/metals section approval of training and inorganic/metals section approval for purchasing.

Wet Chemistry Supervisor: Peter LeBrun - Approved signatory of the final wet chemistry report, SOP's, Corrective Actions, Non-Conformance Report, wet chemistry section approval of training and wet chemistry section approval for purchasing.

SECTION 4. QUALIFICATIONS AND TRAINING

4.1 QUALIFICATIONS

4.1.1 Lead Technical Director

Responsibilities:

- To oversee the technical performance of the laboratory and is responsible for laboratory operations.
- The overall financial and technical performance of the Laboratory
- To review and approve chemical procedures
- To review reports to clients
- Designated as substitute for Organic Manager and QA/QC Manager

Qualifications - Education: B.S. or B.A. in chemistry or related science.

Experience:

- Minimum of 15 years experience in laboratory operation.
- Demonstrated proficiency in management of one or more laboratory departments.
- Demonstrated proficiency in program design and implementation, selection of equipment, procedure development, data evaluation and interpretation, report preparation, supervision of personnel and knowledgeable in necessary aspects of chemical measurement.
- Thoroughly familiar with functional and analytical aspects of current program.

4.1.2 Laboratory Information Management Systems (LIMS) Manager

Responsibilities:

- Ensure proper functionality of the LIMS.
- Perform routine network maintenance in regards to internet connection, electronic messaging services, virus protection and data backup and storage.
- Evaluate impact of upgrades to the LIMS
- Document procedures for LIMS use.
- Implement, training and troubleshooting the LIMS including instrument data acquisition to ensure optimal efficiency of laboratory data processing and data integrity.
- Implement system security.

Qualifications- Education: B.S. or B.A. in chemistry or computer science.

Experience:

- 6 months experience in design/implementation of Access97 database or equivalent.

4.1.3 Manager Organic Department

Responsibilities:

- Responsible for organic laboratory operations.
- To review reports to clients.
- To review and approve organic chemical procedures.
- To respond to client inquiries concerning analyses and results.
- Designated substitute for the Laboratory Director and QA/QC Manager.

Qualifications- Education: B.S. or B.A. in chemistry or related science.

Experience:

- Minimum 6 years experience in laboratory operations.
- Demonstrated proficiency in supervision of one or more laboratory departments.
- Thoroughly familiar with functional and analytical aspects of the organic department.

4.1.4 Supervisor Volatile Department

Responsibilities:

- Responsible for daily operations of the department.
- To prepare procedures and suggest modifications for improvement of quality systems in the volatiles laboratory.
- To review and approve volatile chemical procedures.
- To review volatile reports and results.
- To review specific QC procedures and implement corrective action where necessary.
- To respond to client inquiries concerning volatile analyses and results.
- Responsible for review of external Performance Evaluation sample results.
- Reports to the Laboratory Director.

Qualifications- Education: B.S. or B.A. in Chemistry or related science.

Experience:

- Minimum of 4 years experience in analytical chemistry.
- 2 years experience in volatile analysis.
- Thoroughly familiar with the laboratory analytical and QA/QC procedures of the VOA department.
- Capable of following complex procedures and instructing others to do the same.

4.1.5 Manager Inorganic Department

Responsibilities:

- Responsible for daily inorganic/metals laboratory operations.
- To prepare procedures and suggest modifications for improvement of quality systems in the inorganic/metals section of the laboratory.
- To review and approve inorganic/metals chemical procedures.
- To review inorganic/metals reports and results.
- To review specific QC procedures and implement corrective action where necessary.
- To respond to client inquiries concerning inorganic/metals analyses and results.
- Responsible for review of external Performance Evaluation sample results.
- Reports to the Laboratory Director.

Qualifications- Education: B.S. or B.A. in chemistry or related science.

Experience:

- Minimum 6 years experience in laboratory operations.
- Minimum of 4 years experience in analytical chemistry.
- Minimum of 2 years experience in metals analysis.
- Demonstrated proficiency in supervision of one or more laboratory departments.
- Thoroughly familiar with functional and analytical aspects of the department.
- Thoroughly familiar with the laboratory analytical and QA/QC procedures of the department.
- Capable of following complex procedures and instructing others to do the same.

4.1.6 Supervisor Wet Chemisty Department

Responsibilities:

- Responsible for daily operations of the Wet Chemistry Department
- Responsible for technical support of the Wet Chemistry Department.
- To prepare procedures and suggest modifications for improvement of quality systems in the wet chemistry section of the laboratory.
- To review and approve wet chemistry chemical procedures.
- To review wet chemistry reports and results.
- Review specific QC procedures and implement corrective action where necessary.
- Responsible for reviewing external Performance Evaluation results.
- Responds to client inquiries concerning wet chemistry analyses and results.
- Reports to the Laboratory Director.

Qualifications- Education: B.S. or B.A. in Chemistry or related science.

Experience:

- Minimum of 4 years experience in analytical chemistry.
- Thoroughly familiar with the laboratory analytical and QA/QC procedures of the department.
- Capable of following complex procedures and instructing others to do the same.

4.1.7 Quality Assurance/Quality Control (QA/QC) Manager

Responsibilities:

- To supervise the QA/QC program.
- To evaluate the result of internal and external quality control sample results.
- To perform internal audits.
- To audit specific QC procedures.
- To participate in external audits.
- To review and approve Case Narrative.
- To review report and QC results.
- To review and document analyst training.
- To review and document standard operating procedures for the laboratory.

- Reports to the President of the Company.

Qualifications- Education: B.S. or B.A. in Chemistry or related science

Experience:

- Minimum of 10 years experience in analytical chemistry.
- Thoroughly familiar with QA/QC aspects of current programs.
- Capable of following complex procedures and instructing others to do the same.

4.1.8 Customer Service Representative

Responsibilities:

- To receive customer inquiries for services and to ensure prompt response.
- To respond to customer inquiries regarding project status.
- To inform clients of any problems associated with projects.
- To receive customer complaints or other issues and to ensure prompt response.
- To inform the laboratory of concerns associated with projects communicated by the client.
- To inform the laboratory of incoming work.
- Reports to the Laboratory Director.

Qualifications - Education : B.S or B.A. in chemistry or related field or 5 years experience.

Experience:

- Demonstrated proficiency in performance of duties.
- Instructed in specific customer service, sample receiving and handling procedures.

4.1.9 Chemists

Preparation Chemists

Responsibilities:

- To prepare standards and samples in accordance with SOPs and the AMRO Quality Systems Manual.
- To maintain preparation logs.
- To maintain instrumentation.
- To be familiar with analysis methods and their requirements.
- To report data and all associated QC.
- To properly document all preparation procedures.
- To have knowledge of safety procedures.

- Reports to the appropriate section supervisor.

Qualifications - Education: B.S. or B.A. in chemistry or related science.

Experience:

- Instructed in specific laboratory procedures.
- Demonstrated proficiency in specific laboratory procedures.

Instrumentation Chemists
Responsibilities:

- To prepare standard and samples in accordance with SOPs and the AMRO Quality Systems Manual.
- To maintain preparation and instrument run logs.
- To maintain instrumentation.
- To be familiar with analysis methods and their requirements.
- To run instruments.
- To evaluate and report data and all associated QC.
- To maintain proper documentation.
- To have knowledge of safety procedures.
- Reports to the appropriate section supervisor.

Qualifications - Education: B.S. or B.A. in chemistry or related science.

Experience: 6 months experience in the laboratory section.

4.1.10 Data Review
Responsibilities:

- To be familiar with analysis methods and their requirements.
- To be familiar with project requirements.
- To evaluate data.
- To check for completeness of all data including logbooks, reports and Non-Conformance Data Reports.
- To report data and all associated QC.
- To verify and maintain proper documentation.
- Reports to the appropriate section supervisor.

Qualifications - Education: B.S. or B.A. in chemistry or related science.

Experience: Minimum of 5 years experience.

4.1.11 Sample Receiving Technician
Responsibilities:

- To receive samples from couriers, customers and delivery services.
- To assign project numbers for each sample set, schedule analyses, label bottles and properly store samples.
- To communicate with various sections of the laboratory about incoming samples.
- To prepare and send out bottle orders per client requests.
- To receive ordered supplies, standards and reagents for the laboratory.
- Reports to the Customer Service Representative.

Qualifications - Education: H.S. diploma, college chemistry courses preferred.

4.1.12 Lab Technician
Responsibilities:

- To prepare samples in accordance with SOPs and the AMRO Quality Systems Manual.
- To be instructed in sample preparation techniques.
- To be instructed in specific laboratory procedures such as dry weight determination, glassware and sample container preparation.
- To demonstrate proficiency in specific laboratory procedures.
- To have knowledge of safety procedures.
- Reports to the appropriate section supervisor.

Qualifications - Education: H. S. diploma, college chemistry courses preferred.

4.1.13 Mass Spectral Interpretation Specialist:

Qualifications - Education: B.S. in Chemistry, or Physical Sciences
Experience: Completed a specialized training course in mass spectral interpretation.

Two years of experience in mass spectral

interpretation.

4.1.14 Inductively Coupled Plasma (ICP) Specialist:

Qualifications - Education: B.S. in Chemistry, or Physical Sciences

Experience: Completed a specialized training course in ICP Spectroscopy.

Two years of experience in ICP analysis of Environmental samples.

4.2 TRAINING

4.2.1 Every analyst is required to read the Quality Systems Manual and the Safety Plan on their first day of employment.

4.2.2 Each employee is trained in those areas that are applicable to their particular laboratory position.

4.2.3 Employees are required to record all observations, calculations and results in black, ball point pen. Errors, if made, shall be crossed out with a single line, initialed and dated. If the reason for the correction is not obvious, a brief explanation should be provided in the data. **Under no circumstances will correction fluid (i.e. whiteout) be used.**

4.2.4 Employees are required to be familiar with the analytical procedures associated with the laboratory section they are working in and the laboratory equipment that is needed to perform the analyses.

4.2.5 The training for each procedure should follow the following steps:

4.2.5.1 Read the SOP and/or EPA Method for the procedure and discuss with a qualified trainer.

4.2.5.2 Become familiar with all reagents, equipment, and laboratory areas designated for the procedure.

4.2.5.3 Observe a qualified analyst perform the procedure while following along in the SOP. Any questions can be answered during this process.

4.2.5.4 Perform the procedure with a qualified analyst observing. The qualified analyst should offer any assistance and the trainee should clarify any outstanding questions associated with the analysis.

4.2.5.5 Repeat the procedure until the qualified analyst, trainee and the supervisor are satisfied with the performance of the method.

4.2.5.6 Analyze a QC sample and produce acceptable results.

4.2.5.7 The Qualification Card (Attachment 2) with the supporting document are submitted to the QA/QC department to be filed.

4.2.5.8 Periodic review may be necessary in the event of method changes or technique modifications.

4.2.5.9 At least once per year the qualified personnel shall be repeating the performance examination. The data sheets and any other documentation of the analysis shall be attached to a new Qualification Card.

4.2.5.10 At least once per year all personnel shall be trained on data integrity issues and record keeping. This training will include laboratory procedures, responsibilities, examples of unethical conduct, notification procedures, disciplinary action and confidential reporting procedures.

SECTION 5. SAMPLE COLLECTION AND RECEIPT

5.1 Bottle Preparation

All glass sample bottles and vials are purchased pre-cleaned. Oldest bottles are used first to ensure inventory is rotated. Each lot of VOA vials is checked by adding DI water to a vial from the lot and analyzing for Volatile Organic compounds to ensure that no target analytes are present above ½ the RL. Protocols for cleaning are as follows:

5.1.1 Volatile Organic Containers:

Glass containers, Teflon/silicone septa and Teflon liners are washed in laboratory grade non-phosphate detergent and tap water.
They are rinsed with tap water and with ASTM Type 1 Organic-Free water.
They are dried at 105°C for one hour.
They are cooled to room temperature in an enclosed contaminant-free environment.
They are assembled in an organic-free environment.
They are labeled with a lot number on the exterior of each case.
They are stored in a contaminant-free storage area.

5.1.2 Organic Containers:

Glass containers and Teflon liners are washed in laboratory grade non-phosphate detergent and tap water.
They are rinsed with tap water and with ASTM Type 1 Organic-Free water.
They are dried at 105°C for one hour.
They are cooled to room temperature in an enclosed contaminate-free environment.
They are assembled in an organic-free environment.
They are labeled with a lot number on the exterior of each case.
They are stored in a contaminant-free storage area.

5.1.3 Plastic Containers:

The plastic sample collection bottles supplied by AMRO are also purchased and preserved if required prior to being provided to client. Blanks are analyzed monthly to monitor the bottles for contamination and ensure that no analytes are present above ½ the RL.

5.1.4 Bacteria:

All plastic bottles used for Bacteria samples are purchased pre-sterilized. (Bacteria containers are purchased for subcontract work.)

5.2 Sampling and Preservation

All samples analyzed at AMRO are collected by clients or by an environmental sampling firm. When sample bottles are provided by AMRO for specific analytical tests, they are preserved by the laboratory with the appropriate preservative for the particular tests that are going to be performed and labeled accordingly. Laboratory personnel use the preservation list to determine the correct preservative, volume of preservative and bottle type for each analysis (Attachment 3). Pre-preserved bottles are labeled to include the preservative and the analysis required. These bottles are packed into coolers with COCs, ice packs, custody seals if required, plastic bags if required, and any other items required for sampling that are provided by the laboratory. The bottles are then mailed out or delivered to the client by our couriers. A copy of the bottle and preservation checklist that also lists holding times (Attachment 4) is provided to clients with each set of bottles.

5.3 Sample Receipt

5.3.1 Chain-of-Custody

The Chain-of-Custody (COC) (Attachment 5) documents the transfer of custody of each sample from collection to receipt in the laboratory. Each person that has custody of the sample(s) must sign and date the COC before relinquishing it and when receiving it. Once a sample(s) is brought into the laboratory, it is turned over to the Sample Receiving Technician. The Sample Receiving Technician checks all of the information on the COC for accuracy and completeness.

5.3.2 Project Number Assignment

Upon receipt by the laboratory, each project has a 7 digit number assigned to it in the project number logbook (Attachment 6). The project numbers are sequential with the first numbers representing the year and month the project was received. Also documented are the date received, the time received, the client name and comments.

5.3.3 The Sample Receiving Checklist (SRC)

The Sample Receiving Checklist (Attachment 7a and 7b) (SRC) is used to document the condition of the samples that are received by the laboratory. This includes sample preservation, labeling, bottle type, amount of sample provided, temperature of samples upon receipt, and completeness of the COC. The temperature of the samples when received

is measured and documented on the COC and on the SRC as indicated in laboratory Standard Operating Procedure, GL-1004 " Temperature of Measurement" section 10.3. Any problems with the samples that require client input are communicated to the client via fax or email. The client is required to respond to the fax or email to resolve any issues prior to the beginning of analysis. The samples are labeled with the assigned AMRO project number. The pH of samples is adjusted if necessary with the appropriate reagent. The laboratory shall flag the sample results for any sample received improperly preserved. The information is recorded on the back of the SRC. The samples are stored in a refrigerator at 4°C ± 2°C.

5.3.4 Sample Condition Receipt Form

When samples are found to be unacceptable for one reason or another (for example, they are received broken or the labels are illegible), AMRO's policy is to send a FAX out to the client (Attachment 8)or an email. The Sample Receiving Technician lists the problems with the samples and the client is requested to let AMRO know, by FAX or email, what action should be taken with the samples and if they want us to continue with the analyses. The client is requested to sign and date the FAX form with any further instructions to the laboratory or and return to the laboratory to be included in the project folder. The FAX/email is kept with the project in the project folder.

5.3.5 Project Folder Organization, Preparation and Review

A project folder for each project is assembled after the samples have been logged in by the Sample Receiving Technician. Once all the information is verified, the original COC, the Sample Receiving Form, and the SRC are put into a manila folder labeled with the project number, date sampled, date received and date due to the client. Login is checked, the Preliminary Invoice and Work Order Summary forms which contain all the requested analyses are produced and put into the folder. If samples were delivered with a shipping receipt, such as a bill of lading, it is also included in the project folder. Any documentation from the client, including telephone logs and emails, are to be placed in the project folder.

5.3.6 Sample Storage/ Internal Chain of Custody Log

All samples are stored in a refrigerator at 4°C ± 2°C. Samples to be analyzed for volatile organic compounds (VOC's) are stored in a separate refrigerator from other samples. All Low–Level aqueous samples (e.g. drinking water and ground water samples) are segregated from potentially high level VOC soil samples (e.g. collected for UST work). An "Internal Chain of Custody Form" (Attachment 9) is maintained and anytime the sample is removed from the refrigerator the employee must sign and date this logbook. When the analyst is finished with the sample, it is returned to the refrigerator and the sample is signed back into the "Internal Chain of Custody Log". Tracking of custody between analysts while samples are signed out must be documented on the Internal Chain of Custody Log also. Custody is

continued for sample extracts and digestates in the form of logbook page custody areas on the extraction and digestion logbooks that are required to be completed.

5.3.7 Subcontracting Samples

Samples that require subcontracting to another laboratory are required to have the appropriate section completed on the SRC to indicate the analyses being subcontracted, where they are being sent, the date and who is sending the samples. A COC is completed and the subcontract laboratory is contacted to ensure they can perform the analyses in the required time frame. The samples are sent via courier or delivery service to the appropriate laboratory. A copy of the subcontract COC is included in the project folder. The client is always informed and permission is obtained prior to subcontracting any work. It is determined that the subcontract laboratory holds the appropriate certifications needed for any given test when applicable.

5.3.7.1 When AMRO subcontracts work whether because of unforeseen reasons (e.g., workload, need for further expertise or temporary incapacity) or on a continuing basis (e.g., for tests not performed in-house), this work shall be placed with a laboratory accredited under NELAP for the tests to be performed or with a laboratory that meets applicable statutory and regulatory requirements for performing the tests and submitting the results of tests performed. The laboratory performing the subcontracted work shall be indicated in the final report and non-NELAP accredited work shall be clearly identified.

Subcontractor Laboratories:

• Subcontractor laboratories must have an established and documented laboratory quality system that complies with the requirements of the project being subcontracted.
• For USACOE or Navy projects the subcontractor laboratories must be approved by the specific DoD Component laboratory approval process.
• Subcontractor laboratories must demonstrate the ability to generate acceptable results from the analysis of proficiency testing (PT) samples, subject to availability, using each applicable method, in the specified matrix, and provide appropriate documentation to the client.
• Subcontractor laboratories must receive project-specific approval from the client before any samples are analyzed.
• Subcontractor laboratories are subject to project-specific, on-site assessments by the client or their designated representatives. These requirements apply to the use of any laboratory under the same corporate umbrella, but at a different physical facility.

5.3.7.2 AMRO shall advise the client of the arrangement in writing and, when possible, gain the approval of the client, preferably in writing.

5.3.7.3 AMRO is responsible to the client for the subcontractor's work, except in the case where the client or a regulatory authority specifies which subcontractor is to be used.

5.3.7.4 AMRO shall maintain a register of all subcontractors that it uses for environmental tests and a record of the evidence of compliance with 4.5.1.

5.3.8 LIMS System

Every sample is assigned a unique sequential identification number. The sample information is entered into a computer program known as Omega ELIMS. This program is used to schedule samples for analyses, provide work lists, produce sample reports and invoice work. The Sample Receiving Technician or designee will enter sample ID, sample date and requested analyses into the Omega ELIMS database. Work lists are printed daily in order to schedule work. Samples are printed by order of holding time to ensure the analyses are performed according to method criteria.

5.3.9 Security

AMRO is equipped with an alarm system that is activated during non-work hours. The sample storage refrigerators are locked during non-business hours. All visitors are required to sign in and are escorted within the building.

5.3.10 Sample Disposal

Any unused sample volume and all sample extracts and metals digestates will be held for 30 days from the date the report was mailed or shipped unless the client requests the sample be held longer. All U.S. Army Corps of Engineers samples will be held for 60 days from the time the report is received. All samples are disposed of by assigned laboratory personnel into appropriate waste containers. Waste disposal containers are housed in an area designed for waste storage. All hazardous samples are handled as hazardous wastes and are disposed of appropriately. extremely hazardous samples (example: samples with high levels of cyanide, mercury, PCBs) must be marked to ensure they are disposed of in the proper waste stream containers. A waste disposal company is employed to remove the waste containers when full and within the applicable time frame.

5.3.11 Sample Bottle and Vial Disposal

All used glass and plastic sample bottles, when empty, are disposed of in broken glass containers or in the general trash. Sample bottles and vials containing samples, standards, or extracts are handled as hazardous waste and are disposed of according to the characteristics of the waste.

SECTION 6. INCOMING WORK REVIEW

6.1 New Work

6.1.1 Bid work:

AMRO Environmental Laboratories has sales people responsible for seeking out new work projects for the laboratory. They accomplish this through business contacts, regulatory agencies, and current clients. They obtain bid proposals from various jobs and distribute them to appropriate laboratory personnel, QA/QC, and customer service for review and comment prior to placing any bids. Bid review includes evaluation of analyses requested, reporting limit requirements, QA/QC requirements and data deliverable requirements. AMRO will inform the client of this review if it indicates any potential conflict, deficiency, lack of appropriate accreditation status, or inability on the laboratory's part to complete the clients work. Based on input from the laboratory, prices are set and bids are submitted. The marketing personnel communicate to the laboratory the status of bids submitted. Jobs that are won by AMRO are scheduled based on the project scope of work. Any differences between the request or tender and the contract shall be resolved before any work commences. Each contract shall be acceptable both to the laboratory and the client. Copies of bids are kept in individual folders by customer service and are available for review as needed.

6.1.2 Non-bid work:

The marketing and sales personnel evaluate any work that does not have a bid associated with it. They complete the "Incoming Notice Form" (Attachment 10) to be evaluated by the appropriate laboratory personnel, QA/QC and customer service. This form contains pertinent information the laboratory personnel requires to determine it's ability to perform the job. Based on input from the laboratory, prices are set. Copies of the Incoming Work forms are kept in client folders by customer service and are available for review as needed.

6.2 Existing Work

6.2.1 AMRO has projects from customers that are required to be performed on a regular basis. Pertinent information concerning these projects is kept on file by customer service and is available for review as needed. Records of review, including any significant changes, shall be maintained. Records shall also be maintained of pertinent discussion with the client relating to the client's requirements or the results of the work during the period of execution of the contract. AMRO will inform the client of any deviation from the contract.

6.2.2 If a contract needs to be amended after work has commenced, the same contract review process shall be repeated and any amendments shall be communicated to all affected personnel. Suspension of accreditation, revocation of accreditation, or voluntary withdrawal of accreditation will be reported to the client.

6.3 Current Work

6.3.1 The status of projects currently at the laboratory for analysis is reviewed in daily production meetings. Topics reviewed in these meetings include the status of projects, incoming work, bid review, and QA/QC. The time frame of current project review is performed through to one day past the current day. Based on this information it is determined if there is a need to inform clients of any potential delays associated with their projects. The cause of any delays that result in late data is discussed. Any incoming projects are discussed as well as any QA/QC issues concerning data and general laboratory operations.

SECTION 7 - ANALYTICAL PROCEDURES

7.1 Analytical Procedures

The analytical procedures used at AMRO are listed below under the Method Reference column. The actual methodologies are outlined in great detail in the Standard Operating Procedures Manual (SOPs) available in the laboratory.

AMRO ANALYTICAL CAPABILITIES LIST

PARAMETERS	METHOD NUMBER	
WET CHEMISTRY	**AQUEOUS**	**SOIL / WASTE**
Alkalinity	2320-B SM19th	N/A
Hydroxide Alkalinity	4500-CO2D SM19th	N/A
Carbonate Alkalinity	4500-CO2D/2320-B SM19th	N/A
Bicarbonate Alkalinity	4500-CO2D SM19th	N/A
Ammonia as N	4500-NH3B,C SM19th	4500-NH3B,C SM19th Mod.
Biochemical Oxygen Demand (BOD)	5210B SM19th	N/A
Carbonaceous Biochemical Oxygen Demand (CBOD)	5210B SM19th	N/A
Bromide	300.0	9056
Chemical Oxygen Demand (COD)	Hach 8000/5220D SM19th	N/A
Chloride	300.0/4500-Cl- C SM19th	9056/4500-Cl C Mod. SM19th
Chlorine, Total Residual	SM 4500-Cl G Mod. SM19th	N/A
Corrosivity as pH	N/A	9045C
Color	110.2	N/A
Cyanide (Amenable to chlorine)	335.1/SM19th 4500-CN C,E 9010C/9014	9010C/9014
Cyanide, Total	4500-CN C,E SM19th 9010C/9014	9010C/9014
Fluoride	300.0	N/A
Hardness	6010B/2340B SM19th	N/A
Hexavalent Chromium	7196A/3500-Cr D SM19th	3060A/7196A
Nitrate as N	300.0	9056
Nitrite	300.0	9056
Oil & Grease, Gravimetric	1664A	1664A Mod
Ortho-phosphate as p	300.0/4500-P E SM19th	9056
Paint Filter Test	N/A	9095B
pH	9040B/4500-H+B SM19th	9045D
Phenolics (4 AAP)	420.1	9065
Phosphorus, Total	4500-P B.5,E SM19th	4500-P B.5,E SM19th Mod.

PARAMETERS	METHOD NUMBER	
WET CHEMISTRY	**AQUEOUS**	**SOIL / WASTE**
Sulfite	4500-SO3 ^{2} –B SM19th	N/A
Sulfate	300.0/D516-90,02	9038/9056
Sulfide	4500-S^{2} –F SM19th	N/A
Specific Conductivity	120.1	9050A Mod.
Total Kjeldahl Nitrogen (TKN)	4500-NorgC/4500-NH3C SM19th	4500-NorgC/4500-NH3C SM19th Mod.
Total Organic Carbon (TOC)	(subcontracted)	CFAS18
Total Solids (TS)	2540B SM19th	2540G SM19th
Total Dissolved Solids (TDS)	2540C SM19th	N/A
Total Suspended Solids (TSS)	2540D SM19th	N/A
Total Volatile Solids (TVS)	2540E SM 19th	SM2540G SM 19th
Settleable Solids	2540F SM19th	N/A
Total Petroleum Hydrocarbons, Grav.	1664A-SGT	1664A-SGT Mod
Turbidity	180.1	N/A

PARAMETERS	METHOD NUMBER	
TRACE METALS	**AQUEOUS**	**SOIL / WASTE**
Analyzed by Furnace	200.9,7000 series	7000 series
Analyzed by ICP	200.7/6010B/6010C	6010B/6010C
Mercury by Cold Vapor AA	245.1/7470A	7471A
Lead in paint	N/A	6010B
Digestion (Prep) – Aqueous	200 series/3010A/3015	N/A
Digestion (Prep) – Solid	N/A	3050B/3051

PARAMETERS	METHOD NUMBER	
ORGANIC TESTS	**AQUEOUS**	**SOIL / WASTE**
Volatile Organics (VOA by GC/MS)	624/8260B/OLM4.0	8260B
Volatile Organics (VOA by GC/MS)	524.2	N/A
Volatile Organics (Halogenated List)	624/8260B	8260B
Volatile Organics (Aromatics List)	624/8260B	8260B
Volatile Petroleum Hydrocarbons (VPH)	MADEP 1.1	MADEP 1.1
Extractions	3510C	5035/3541/3540
Semivolatile Organics (BNA)	625/8270C/8270D	8270C/8270D
Semivolatile Organics (B/N only)	625/8270C/8270D	8270C/8270D
Semivolatile Organics (Acid only)	625/8270C/8270D	8270C/8270D
Petroleum Hydrocarbon Fingerprinting (GC/FID)	8015B Mod.	8015B Mod.
Petroleum Hydrocarbon fingerprinting (P&T)	8260B Mod.	8260B Mod
Extractable Petroleum Hydrocarbons (EPH)	MADEP 1.1	MADEP 1.1
Pesticides	608/8081A/8081B	8081A/8081B
PCB's	608/8082/8082A	8082/8082A
PCB's in Oil	N/A	8082 Mod.
Polynuclear Aromatics (Low Level)	8270C SIM	8270C SIM
Herbicides	(subcontracted)	(subcontracted)
Diesel Range Organics (DRO)	8015B Mod.	8015B Mod.
Diesel Range Organics (DRO)- Maine	4.1.25 (9/06/25)	4.1.125 (9/06/95)
Gasoline Range Organics (GRO)	8015B Mod.	8015B Mod.
Gasoline Range Organics (GRO)-Maine	4.2.17 (9/06/95)	4.2.17 (9/06/95)
Extractable Total Petroleum Hydrocarbons (ETPH)	ETPH (CT Method)	ETPH (CT Method)

PARAMETERS	METHOD NUMBER	
WASTE CHARACTERISTICS	**AQUEOUS**	**SOIL / WASTE**
Ignitability	1010	1010/ASTM D92-90
Reactive Cyanide	SW846 ch 7.3.3.2	SW846 ch 7.3.3.2
Reactive Sulfide	SW846 ch 7.3.4.2	SW846 ch 7.3.4.2
Corrosivity by pH	9040C	9045D
Total Organic Halides (TOX)	(subcontracted)	(subcontracted)

PARAMETERS	METHOD NUMBER	
TOXICITY CHARACTERISTICS LEACHING PROCEDURE (TCLP)	**AQUEOUS**	**SOIL / WASTE**
Extraction Semivolatiles	1311	1311
Extraction Metals	1311	1311
Extraction Pesticides/Herbicides	1311	1311
ZHE Volatiles	1311	1311
8 RCRA Metals Analysis	6010B/6010C/7470A	6010B/6010C/7470A
Volatiles analysis	8260B	8260B
Semivolatiles analysis	8270C/8270D	8270C/8270D
Pesticide analysis	8081A/8081B	8081A/8081B
Herbicide analysis	8151A(subcontracted)	8151A(subcontracted)

PARAMETERS	METHOD NUMBER	
SP LEACHING PROCEDURE (SPLP)	**AQUEOUS**	**SOIL / WASTE**
Extraction Metals	1312	1312
Extraction Cyanide and Volatiles	1312	1312
Extraction Semivolatiles	1312	1312

NOTE: Some GC volatiles type work is performed by GC/MS. Attachment 11 is the documentation sent to clients to inform them of AMRO's procedures.

7.2 Standard Operating Procedures (SOP)

All procedures performed at AMRO are documented through Standard Operating Procedures (SOPs). The SOPs are based on referenced methods from the EPA, Standard Methods, NELAC, and other regulatory agencies. They document the actual steps performed by analysts to perform a specific task. Detailed information is documented in the SOP concerning instrumentation, reagents, standards, and procedures specific to AMRO Environmental Laboratories Corp. The process by which a standard operating procedure is accepted by the laboratory is as follows:

7.2.1 An analyst familiar with the procedure or a qualified designee writes the original draft of the SOP. The draft SOP is written based on the EPA format for SOPs and the appropriate method.

7.2.2 The draft is reviewed for accuracy and completeness and edited as necessary by an analyst knowledgeable in the procedure or the Section Manager.

7.2.3 An analyst familiar with the procedure as technical review, the appropriate Section manager or supervisor, the Laboratory Director and the QA/QC Manager reviews the final draft. Any final edits, corrections or clarifications are made at this time. A final draft is signed by a technical review designate, a section review designate, the Laboratory Director, and QA/QC Manager.

7.2.4 Copies of the laboratory's final SOPs are made and distributed to each appropriate section as Control Copies. Control Copies will be updated with each update to the SOPs. Original SOPs are kept on file with the QA/QC Manager.

7.2.5 Analysts are required to read the SOP and sign off on the appropriate form indicating they have read and understood the procedure prior to performing the analysis. The SOPs are available for referral when a procedure is being performed.

7.2.6 SOPs are reviewed on an annual basis unless procedural changes or method updates occur. Updates to SOPs are made as needed or occasionally an interim change notification form (Attachment 35) is used to notify the laboratory of procedural changes that will not be incorporated into the SOP until the next scheduled SOP review date. The interim change notification form is signed by all personnel in the section and is kept with the current SOP. A copy of the interim change notification form is also kept with the control copy of the SOP.

SECTION 8. INSTRUMENT/EQUIPMENT AND FACILITIES

8.1 AMRO Equipment/Instrumentation List

The following section lists the major equipment of AMRO Environmental Laboratories Corporation, also refer to Attachment 12 "Instrument List", this new tracking system was implemented as of August 2000:

AMRO EQUIPMENT / INSTRUMENT LIST	PURCHASE DATE
ANALYTICAL BALANCE - Sartorius Research (R 160 P)	1987
- O'Haus Explorer (E01240)	1998
- Mettler (BB300)	1998
- A&D (HF400)	1999
ASTM Class I Weight set – 1 mg to 100 g (Serial No. 98-J112277-3)	1998
ASTM Class I - 200 gram Weight (Serial No. 98-J38238-8)	1998
ASTM Traceable Thermometer -1 to 151°C – Serial No. B95-122)	1995
TURBIDIMETER - Hach-2100AN	1996
SPECTROPHOTOMETER - HACH DR2010 Spectrophotometer	1999
CLOSED CUP FLASH TESTER - CLEVELAND- PRECISION SCIENTIFIC BE-2	1994
LACHAT - QUIKCHEM 8000 AUTOMATED ION ANALYZER	1996
OXYGEN METER (YSI Model 59 and D.O. probe)	1996
MIDI REFLUX DISTILLATION APPARATUS for cyanides	1994
DIGESTION APPARATUS (Tecator Digestion System 6, 1007 Digestor, Serial #11947)	1991
HOT BLOCK DIGESTOR Mercury Prep. - Environmental Express	1998
DigiBLOC3000 SCP Science for metals digestions	1998
MERCURY ANALYZER SYSTEM and RECORDER - Perkin Elmer FIMS100 Mercury Analyzer with AS90 Autosampler	1999
SPECTROFLAME MODULA ICP, Model FTP-08 Spectro Analytical Instruments	1995
PE-3300 DV OPTIMA ICP, Model 3300, Serial #DV069N806302 Perkin Elmer	1998

AMRO EQUIPMENT / INSTRUMENT LIST	PURCHASE DATE
ZEEMAN ATOMIC ABSORPTION SPECTROPHOTOMETER / GRAPHITE FURNACE - PE4100 ZL	1993
AUTOMATIC SOXHLET EXTRACTORS:	
OI Analytical Soxtherm (4 with 6 units) (Serial #'s: 473343, 480005, 480007, 480009)	1997
OI Analytical Controllers (4 with 6 units) (Serial #'s: 473338, 480015, 480017, 480019)	1997
(2) ULTRASONIC PROCESSOR SONICATOR (Misonix Systems)	1993 & 1998
(4) ZYMARK TURBOVAP II TURBOVAPS	1998
N-EVAP ANALYTICAL EVAPORATOR 112 (Serial #: 82c1)	1997
GC / MS - Hewlett Packard 5972 Series Mass Selective Detector and 5890 GC with Tekmar LSC 2000/ Dynatech PTA - 30 W/S (MS Serial # 3341A01057) (V1a)	1997
GC / MS - Hewlett Packard 5971 Series Mass Selective Detector and 5890 GC with Tekmar LSC 2000/ Archon 5100A Purge &Trap (MS Serial # 33188A03542) (V2)	1991
GC / MS - Hewlett Packard 5971A Series Mass Selective Detector and 5890 GC with Dynatrap Purge and Trap / Autosampler System (MS Serial #3188A02799) (V3)	1994
GC / MS – Hewlett Packard 5973 Mass Selective Detector and 6890 GC with OI 4560 Purge and Trap/Archon 4552 Autosampler System (MS Serial #US81211039) (V4)	1998
GC / MS - Hewlett Packard 5972A Series Mass Selective Detector with HP 5890 Series II GC and Autosampler (MS Serial # 3501A02576) (SV2)	1996
GC / MS - Hewlett Packard 5972A Series Mass Selective Detector with HP 5890 Series II Plus GC and Autosampler (MS Serial # 3501A02436) (SV3)	1996
GC / MS – Hewlett Packard 5973 Series Mass Selective Detector with HP 6890 Series GC and Autosampler (MS Serial #US81210085) (SV4)	1998

AMRO EQUIPMENT / INSTRUMENT LIST	PURCHASE DATE
GC - Hewlett Packard 5890 with Autosampler and dual ECD (Serial # 2919A28651) (TRENT)	1991
GC - Hewlett Packard 5890 with Autosampler and dual ECD (Serial # 2843A20867) (ELVIS)	1997
GC – Hewlett Packard 5890 with Autosampler and dual ECD (Serial # 2919A22601) Purchased 1998 (DALI)	1998
GC - Hewlett Packard 5890 Series II Plus with Autosampler and FID (Serial # 3310A52905) (FING1)	1994
Culligan Deionized Water System (Aqua-Summa)	1990
Activated Charcoal/Reverse Osmosis Culligan Deionized Water System (Volatiles)	1999
MUFFLE FURNACE - Thermolyne Type 1400	1988
TCLP EXTRACTOR with 6 zero-head space extraction units	1990
TCLP Extractor with 8 spaces	1990
MICROSCOPE (Swift)	1993
DRYING OVENS (4)	1989-1997
INCUBATORS (2)	1991
REFRIGERATORS (13 of various brand names)	1989-1999
UNIVERSAL POWER SYSTEMS - POWER SUPPLY	1996
36 PC-IBM COMPATIBLE COMPUTERS	1989-2004
(2) SAG Electronics PII Xeon 450 Network Servers, (2) 9GB Hard Drives	1999

Software Packages Available: Windows; Excel; Word; Analytical Auto Spec., Omega II E-LIMS (1999), D-Base IV; HP Chem-Station and Enviroquant; Perkin Elmer AA Laboratory Software; FIMS software version 2.5, and PE Optima WinLab (ICP)

8.2 Facilities

AMRO operates in a modern 7,000 square foot laboratory located in Merrimack, New Hampshire. Working space at AMRO includes 142 linear feet of bench area with formica tops, formica and concrete flooring, three sinks, hot and cold water, and temperature control.

8.3 Support Services Used by AMRO

8.3.1 Caley and Whitemore located in Somerville, MA is used for annual balance calibration and service. They are also used for the spectrophotometer service and support.

8.3.2 Cal-Tek Co. Inc., North Billerica, MA is used for weight calibration checks.

8.3.3 Agilent and CompCo is used for support of the GC and GC/MS equipment.

8.3.4 Perkin Elmer is used for support of the Optima ICP, the PE4100ZL Graphite Furnace, the AAnalyst600 Graphite Furnace and the FIMS Mercury Analyzer. Optima and PE-6000.

8.3.5 LIMS – Khemia Co., Broomfield CO – Omega II E-LIMS

8.3.6 Waste Removal – EnPro Environmental Services

8.3.7 Bottles – H&L Distribution

8.3.8 Reagents – Fisher, VWR

8.3.9 Standards – AccuStandard, Supelco, Spex, Restek, VHG, Inorganic Ventures, HACH, ERA, APG are some of the vendors used for standards. Others are used if quality is acceptable for analysis.

SECTION 9. TRACEABILITY

9.1 Chemical Receipt

The receipt of all standards, neat compounds and reagents from commercial sources is documented in the "Chemical Receiving Log" by sample receiving personnel or designate (Attachment 13). Each solution or compound is assigned a unique standard receipt ID number, the letter "A" and a five digit sequential number. The date received, source, lot number, expiration date and disposal date are recorded. The expiration dates are provided from the manufacturer and AMRO employees complete the disposal dates when standards are used up or disposed.

9.2 Standards Preparation

Standards are prepared as written in the respective SOPs. In order to assure the accuracy of standards the following general guidelines are used:

9.2.1 AMRO purchases pesticide residue grade solvents and purge and trap grade Methanol for organic standard preparation and organic sample extractions.

9.2.2 Activated carbon cleaned water is generated for use with volatile sample and standard preparation.

9.2.3 ACS reagent grade chemicals are used when the method warrants.

9.2.4 A certificate of analysis accompanies any stock standards that are purchased from the manufacturer.

9.2.5 Class A volumetric glassware is used to prepare standards.

9.3 Standard Tracking

It is important to be able to track all analytical standards back to their sources. The following procedure is used by AMRO personnel to accomplish this:

9.3.1 Wet Chemistry and Mercury Standards - Working Standards and LCS solutions made from stock standards listed in the Chemical Receiving Log are documented in the Inorganic Standard Log. The corresponding analysis, preparation date, standard name, AMRO ID, amount used, initial concentration of standard, amount used, final volume, final concentration, Standard ID, expiration date, storage location, and analyst initials are recorded. The initial concentration of the standard is obtained from the certificates received from the manufacturer. The Standard ID is written as an "S" followed by a five digit sequential number. The expiration of working standards varies depending on the use. Standards should be used in accordance with method specifications and manufacturer's instructions. See (Attachments 14 and 15).

9.3.2 Metals Standards

9.3.2.1 Axial Standards Log (Optima) - Preparation and Standard ID's are listed in the Standard Log. Standards include: S1 (Calibration #1 & CCV), S2 (Calibration #2 & IPC), RL1 (Reporting Limit), RL2 (two times the Reporting Limit), ICSA &ICSAB (Interference Check Standards), ICV (Independent Source QC Standards), and Stock Solutions for Matrix/LCS spike additions. The Solution ID is written as the ID followed by the date prepared (example: S1042798 is standard S1 prepared on 042798). After a conformational analysis to verify the new standard and just prior to its use, the new ID is entered into the Optima software. Until updated, this will be the ID printed on every run log and standard page for hardcopy tracking. An example of the Metals Standard Tracking information for Optima is included as (Attachment 16).

9.3.2.2 Graphite Furnace Standard Logs (GFAA): Preparation and Standard ID's listed in this log include: Purchased Stock Certificates: Intermediate Calibration, CCV, ICV, LCS/MS Solutions: and final Calibration Solutions, final ICV final CCV and final reporting limit. These standards are prepared from the same stock solution as those used for the ICP. The nomenclature is essentially the same, but there are more dilutions needed, which necessitate Intermediate Solutions. Nomenclature for intermediate solutions includes "INT", the type of solution, and the date prepared. After a conformational analysis to verify the new standard and just prior to its use, the new ID is entered into the PE-4100ZL and/or AAnalyst600

software. Until updated, this will be the ID printed on every run log and standard page for hardcopy training. An example of the Metals Standard Tracking information for the Graphite Furnace is included as (Attachment 17).

9.3.4 Wet Chemistry and Metals Reagent Log - Working reagents are made from reagents listed in the Chemical Receiving Log and are documented in the Inorganic Reagent Log (Attachment 18). The corresponding analysis, preparation date, reagent name, AMRO ID, initial concentration, amount used, final volume, final concentration, Solution ID, expiration date, storage location, and analyst initials are recorded. The initial concentration is obtained from the certificate received from the manufacturer. The Solution ID is written as an "R" followed by a five digit sequential number. The expiration of prepared reagents varies. Reagents should be used in accordance with method specifications and manufacturer's instructions.

9.3.5 Organic Standard Tracking - The Organic Standards Tracking Log consists of Stock Standard Log, Working Standard Log and Standard ID Index (Attachment 19). The ID index assures that no two standards are assigned the same ID number.

9.3.5.1.1 Stock Section - Whenever a stock standard solution is opened or is prepared from a neat compound, this information is recorded in the Stock Standard Logbook section of the standard tracking log (Attachment 20). The stock solution is assigned a new ID number consisting of the date of preparation plus a letter suffix starting with the letter "A". This ID along with the compound name, concentration and expiration date is included on the label. Stock standards are good one year from the date prepared or the date provided by manufacturer, whichever is shorter. Example - The fourth volatile standard prepared on April 15, 2000 would have the standard ID A041500D. This number will be recorded in the logbook and written on the container.

9.3.5.1.2 Working Section - Whenever a working standard solution opened or is prepared, whether from AMRO stocks or commercially obtained stocks, the information is recorded in the Working Standard section of the standard tracking log (Attachment 21). The solution is assigned a new ID number based on the date it is prepared plus a letter suffix. This number along with a descriptive name, concentration (or conc. varied) and the initials of the person preparing the solution are included on the label. The expiration of working standards varies depending on the use. Standards should be

used in accordance with method specifications and manufacturer's instructions.

9.3.6 Standard Storage - Standards and reagents are stored per method specifications and manufacturer's instructions. Volatile standards are stored in a freezer at minus 10°C to 20°C with no other standards or reagents. Semivolatile, Pesticide, PCB and Petroleum standards are stored in refrigerators at 4°C± 2°C, freezers at minus 10°C, and ambient temperature depending upon the method and manufacturer requirements. Metals standards are stored in a dark, cool area of the lab in a labeled box. Wet Chemistry standards are stored at ambient temperature and in refrigerators at 4°C± 2°C depending upon the method and manufacturers requirements.

9.4 Solution Check Analysis

All solutions must be verified to contain the correct analytes and the desired concentrations prior to use with samples. Verification includes checking the accompanying documentation and information on the containers to ensure content, concentration, and expiration are correct. Verification consists of analysis of the solutions on the appropriate instrument. Single solutions used without dilution are confirmed with first use using analysis results. Prepared solutions are checked prior to use with samples. Result of these solution checks are reviewed by a trained analyst who will ensure that all analytes are present and the solution is within ±10% of the expected concentration or within acceptable limits as defined by the appropriate SOP. The solution checks are to be kept on file in each department and available for reference.

9.5 Reagents and Consumables Check Analysis

9.5.1 All extraction procedures are performed using pesticide residue grade solvents and a method or procedural blank analysis is performed to verify the absence of target analytes.

9.5.2 Procedural or method blanks are performed with every procedure to ensure that the quality of reagents and consumables used in the test do not adversely affect the quality of the results.

9.6 Distilled Water Check Analysis

9.6.1 The quality of the distilled water is monitored for Total Residual Chlorine, Specific Conductance and pH on a monthly basis.

9.6.2 Analysis for Trace Metals (Cd, Cr, Cu, Ni, Pb and Zn) is monitored monthly.

9.6.3 Listed below are the acceptable limits for reagent water:

ANALYSIS	ACCEPTABLE RANGE
pH	5.5-7.5 pH Units
Spec. Cond.	<2 µmhos/cm; 25°C
Total Residual Chlorine	<0.2mg/L
Pb, Cd, Cr, Cu, Ni, Zn	<0.05mg/L

SECTION 10. CALIBRATION/VERIFICATION OF TEST PROCEDURES

10.1 Method Detection Limit (MDL) Studies

The method detection limit is defined in 40 CFR 136 Appendix B. The MDL is determined annually for each analysis, for each preparation method, on each instrument performing the analysis. This is accomplished by the analysis of a minimum of seven replicate samples, all containing an analyte(s) of the same low-level concentration equaling 1 to 5 times the estimated MDL. These replicate samples are put through all the preparation steps that a sample is put through. The standard deviation of the results of these analyses is multiplied by the appropriate student T-test value depending on the number of replicates and the resulting value is deemed the method detection limit for that specific analyte. AMRO's internal criteria for MDLs are as follows:

A. The lowest standard or low level calibration verification standard (which is also the Reporting Limit) must be at least three times the MDL or greater.

B. The ratio of the spiking concentrations to calculated MDLs must be between 1 to 10.

If any of the acceptance criteria is not met the MDL must be repeated. See (Attachment 22) for a copy of the evaluation sheet completed by the analyst for each MDL study.

If multiple instruments with identical configurations are used in the laboratory, then the laboratory shall conduct an MDL study on at least one of the instruments and confirm the attainability of that MDL on all instruments by using an MDL verification check sample. The MDL verification check shall be performed quarterly on every instrument.

If multiple MDL results are generated from multiple instruments with identical configurations, then the highest MDL among those may be used in reporting data from all of those instruments. If a lower MDL is reported for specific samples, then the samples must have been run on that specific instrument on which the lower MDL was generated.

An MDL verification check shall always be performed immediately following an MDL study.

If an annual MDL study is not performed, MDL verification checks shall be performed **quarterly**. If the quarterly MDL verification check fails, additional MDL verification checks shall be performed at a higher level to set a higher MDL, or the MDL study shall be re-conducted.

Department of Defense (DOD) projects require that the MDL verification check sample be spiked at **approximately 2 times** the current reported MDL. The MDL verification check sample shall be acceptable if the laboratory can reliably detect and identify by method-specified criteria all analytes in the check sample. If the method has no confirmation, the check sample must produce a signal that is at least 3 times the instrument's noise level.

The matrix of MDL samples associated with solid samples must be a solid material. For metals teflon chips or glass beads may be used. For other analyses a clean sand (for example, Ottawa sand) may be used.

10.2 Limits of Detection (LOD) and Limits of Quantitation (LOQ)

The Limit of Detection (LOD) is defined as the estimate of the minimum amount of an analyte in a given matrix that an analytical process can reliably detect. Analysis of a low level standard at the detection limit , can be used to check this minimum amount.

The Limit of Quantitation (LOQ) is defined as the lowest concentration of a target analyte that can be reported with a high degree of confidence. The LOQ check sample is carried through the same preparation procedures as all samples and QC. The LOQ check sample should be analyzed at a level that is one to two times the reporting limit. The recoveries should be + / -50%. The LOQ will always be greater than the LOD.

10.3 Precision and Accuracy Studies

Accuracy is a measure of the degree to which the analytical result approaches the "true" value of the concentration of the analyte being determined. Precision in the laboratory is determined by the comparison of duplicates, where duplicate samples result from an original sample that has been split for identical analyses. Precision and Accuracy in the laboratory is assessed initially by the analyses of a minimum of 4 replicate samples at a mid-level point of the expected range. The percent recoveries and Relative Standard Deviations (%RSD) are evaluated and compared to method specifications or default limits where applicable.

If any of the acceptance criteria is not met the Precision and Accuracy Study must be repeated. See (Attachment 23) for a copy of the evaluation sheet completed by the analyst for each study.

The regular analysis of known standards such as the Laboratory Control Samples (LCS), and matrix and analytical spikes also assess accuracy. Accuracy within the laboratory is expressed in terms of percent recovery.

The precision of data is regularly evaluated by determining the Relative Percent Difference (%RPD) of duplicate (replicate) analyses.

10.3 GC/MS (Volatile Organics)

10.3.1 Initial Calibration Procedure

A multi-level calibration consisting of 0.5, 1, 2, 5, 10, 25, 50, 100, 200 and 300µg/L is performed using standards obtained commercially, according to the procedures outlined in Methods 624, 524.2 and 8260B. The three internal standards that are used: Fluorobenzene, Chlorobenzene-d5, and 1,4 Dichlorobenzene-d4 at a level of 25.0µg/L (10µg/L for 524.2). A separate calibration curve is analyzed for soils using 2mL of surrogate spiked Methanol/50 ml water to make up the standards. A separate calibration curve is analyzed for low level soils preserved with sodium bisulfate using 5 grams sand, 5mL sodium bisulfate solution, 5mL of calibration standard and a 40°C VOA vial purge temperature.

10.3.1.1 The average RRF (response factor) must be calculated for each compound using the 5-9 RF values calculated for each compound from the initial (5-9 point's) calibration curve. The RRF is calculated as follows:

$$RRF = \frac{(Ax \times Cis)}{(Ais \times Cx)}$$

where: Ax = Area of the characteristic ion for the compound being measured.
Ais = Area of the characteristic ion for the specific internal standard.
Cis = Concentration of the specific internal standard.
Cx = Concentration of the compound being measured.

If the % RSD of any compound is 15% or less, then the relative response factor is assumed to be constant over the calibration range, and the average relative response factor may be used for quantitation.

EPA Method 624 requires the %RSD must be less than 35% and SW-846 Method 8260B Method requires the %RSD must be less than 15% for the average response factor for each analyte. EPA Method 524.2 requires the %RSD for any compound is less than or equal to 20%. If it is exceeded linear regression or a quadratic equations must be used with a minimum correlation coefficient of 0.990.

10.3.1.2 If the % RSD of any compound is 15% or greater, construct calibration curves of area ratio (A / Ais) versus concentration ratio (Cx/ Cis) using first order (Linear Regression) or second order (Quadratic Regression) regression fit of the initial calibration points. The requirement for Linear Regression correlation coefficient is greater than 0.99. If the Linear Regression criteria are not met, then Quadratic equation (second order) may be used with a minimum of 6 data points. In either case, the curve must be printed and stored in the file with the initial calibration to document evaluation. The analyst should select the regression order, which introduces the least calibration error into the quantitation and minimizes the y-intercept value (constant term).

Linear and Quadratic Regressions each have several options available in the software. The analyst must chose which order will be used. Options available are equal weighting, inverse of conc., and inverse square of conc., and force (0,0). Do not force zero **or** use the (0,0) as a quantitation point because this option is not allowed by Method 8000B. The analyst should choose the curve order and weighting which gives the best coefficient of the determination (COD) and a y-intercept nearest to the origin, given the calibration blank is clean.

10.3.2 A system performance check should be made before this calibration curve is used. Five compounds (the System Performance Check Compounds, or SPCCs) are checked for a minimum average relative response factor. These compounds are:

Chloromethane
1,1-Dichloroethane
Bromoform
1,1,2,2-Tetrachloroethane
Chlorobenzene

These compounds typically have RFs of 0.100 - 0.400 and are used to check compound stability and to check degradation caused by contaminated lines or active sites in the system. See the Table for summary of the acceptance limits.

10.3.3. Using the RFs from the initial calibration, calculate and record the percent relative standard deviation (% RSD) for all compounds. The % RSD is calculated as follows:

$$\% \text{ RSD} = \frac{SD}{RF} \times 100$$

where:
RSD = relative standard deviation
RF = mean of 7 initial RFs for a compound
SD = standard deviation of average RFs for a compound

10.3.4 The percent relative standard deviation ***should*** be less than 15% for each compound. However, the % RSD for each individual calibration check compound (CCC) ***must*** be less than 30%. Late-eluting compounds usually have much better agreement. The CCCs are:

1,1-Dichloroethene
Chloroform
1,2-Dichloropropane
Toluene
Ethylbenzene
Vinyl chloride

10.3.5 If a % RSD greater than 30% is measured for any CCC, then corrective action to eliminate a system leak and/or column reactive sites is required before attempting another calibration.

Criteria for Initial and Continuing Calibration for 624 and 8260B

Volatile Compound		Initial and Continuing Calibration Minimum RRF	Initial Calibration Maximum % RSD		Continuing Calibration Maximum % Drift (8260) Daily Check LCS (624)	
		8260	624	8260	624	8260
Chloromethane	(SPCC)	(0.100)	35		0-40.80	
Bromomethane			35		2.80-37.20	
Vinyl chloride	(CCC)		35	(30%)	0.80-39.20	(20%)
1,1-Dichlororethane	(SPCC)	(0.100)	35		14.50-25.25.50	
1-1-Dichloroethene	(CCC)		35	(30%)	10.10-26.10	(20%)
Chloroform	(CCC)		35	(30%)	13.50-26.50	(20%)
1,2-Dichloroethane			35		13.60-26.40	
1,1,1-Trichlororethane			35		15-25	
Carbon tetrachloride			35		14.60-25.40	
Bromodichloromethane			35		13.10-26.90	
cis-1,3-Dichloropropene			35		4.80-35.20	
Trichloroethene			35		13.30-26.70	
Dibromochloromethane			35		13.50-26.50	
1,1,2-Trichloroethane			35		14.20-25.80	
Benzene			35		12.80-27.20	
trans-1,3-Dichloropropene			35		10-30	
Bromoform	(SPCC)	(0.100)	35		14.20-25.80	
Tetrachloroethene			35		14.70-25.30	
1,1,2,2-Tetrachloroethane	(SPCC)	(0.300)	35		12.10-27.90	
Toluene	(CCC)		35	(30%)	14.90-25.10	(20%)
Chlorobenzene	(SPCC)	(0.300)	35		13.20-26.80	
Ethylbenzene	(CCC)		35	(30%)	11.80-28.20	(20%)
Styrene			35			
Xylenes (total)			35			
Bromofluorobenzene			35			
1,2 Dichloropropane	(CCC)			(30%)	3.80-36.20	(20%)

10.3.6 GC/MS Daily Calibration Procedure

GC/MS calibration consists of verifying that the mass spectrometer is in tune, has adequate sensitivity, is standardizing for the compounds of interest, and is demonstrating that the system is free of interferences. Calibration begins with the analysis of Bromofluorobenzene (BFB). This performance test must be passed before any samples, blanks, or standards are analyzed. The calibration is good for twelve hours from the injection time of the BFB for SW-846 Method 8260B, EPA 524.2 and 24 hours for EPA Method 624. The laboratory shall use the BFB criteria as listed below as tuning acceptance criteria. Alternatively, other documented tuning criteria may be used

10.3.6.1 **Tuning** - 50 ng of BFB (40 µL of a 25ng/µL solution) is added to 100 mL of VOA free water. 5 mL is purged for 11 minutes and desorbed onto the chromatographic column. The analysis is performed at 100° C to 150° C. A scan delay of two to five minutes is used. After the scan delay, data is acquired for five to ten minutes. The expected elution time of the BFB is six to eight minutes from the start of data acquisition. The background corrected average of three scans at the apex or of the entire peak of the peak is checked against the tuning requirements in the SW-846 Method 8260B (Table 3). One simple subtraction of background is required within twenty scans of the left side of the peak. There is a procedure file program in the software that will **locate** and check the BFB for a passing spectrum in the manner explained above. This procedure will be used routinely to eliminate any subjectivity from the tuning process. If this procedure fails to produce ion abundances that meet the criteria, it will display the message "no passing spectrum found in data file: xxxxx" on the printer. If this occurs the BFB must be re-analyzed. If repeated analyses fail to produce acceptable results, then the instrument must be manually tuned according to the Hewlett-Packard reference manual. A single scan option can also be used but should not be required on a regular basis. Once an acceptable tune is obtained, the following items are documented in the analyzed log:

- The scan number(s) of the good tune and background corrections used to achieve it.
- The time of injection.
- Once a good spectrum is found a hardcopy of the following information is filed in the daily calibration file.

The following is the BFB tune criteria:

BFB Mass - Intensity Specifications

SW-846 Method 8260B and EPA Methods 624, 524.2:

Mass	Intensity Required (relative abundance)
50	15-40% of mass 95
75	30-60% of mass 95
95	Base peak, 100% relative abundance
96	5 to 9% of Mass 95
173	<2% of Mass 174
174	>50% of Mass 95
175	5 to 9% of mass 174
176	>95% but < 101% of Mass 174
177	5 to 9% of Mass 176

10.3.6.2 Daily Calibration Check:

10.3.6.2.1 The average response factor or calibration curve of the initial calibration is verified daily using the continuing calibration standard, the concentration of this standard is varied periodically. The acceptable criteria of CCC's <20% drift.

% Drift = c1 - c2/c2 x 100

where: c1 is the measured analyte concentration
c2 is the theoretical analyte concentration

10.3.6.2.2 The five SPCC compounds are checked for a minimum average relative response factors. The acceptance criteria is listed above.

10.3.6.2.3 All internal standards must be monitored for retention time and area of response. The internal standard areas may not vary more than a factor of 2 (i.e.- 50% to + 100%) and their retention times by ±30 seconds from the comparable standard in the initial calibration.

10.3.6.2.4 If a standard does not pass it may be should be checked for problems and corrected. Common causes of SPCC failure are: (1) purge flow too slow which will depress the RRFs of the poor purgers like bromoform and 1,1,2,2-tetrachloroethane, (2) purge flow too fast which will depress the RRFs of the gas analytes like chloromethane, (3) contamination in the autosampler/purge&trap system trap, valves, or lines which can degrade 1,1-dichloroethane and 1,1,2,2-tetrachloroethane.
New initial calibrations are always analyzed after major system changes such as replacing the column, cleaning the source, significant retuning of the mass spectrometer, significant changes in purge&trap conditions, etc.

<u>EPA Method 624</u>

10.3.6.2.5 The average response factor or calibration curve of the initial calibration is verified daily using a 20ug/L LCS and must meet the criteria for 624 which printed daily as a demonstration of compliance. LCS is from a source other that the standards used to calibrate the instrument.

10.3.6.2.6 If any of the compounds of the LCS do not meet the acceptance criteria for the QC check standard page5, then the system should be checked for possible problems, and the LCS

re-analyzed. If it does not pass 624 samples should not be analyzed.

EPA Method 524.2

10.3.6.2.7 The 524.2 standard (continuing calibration at 10ppb but varied periodically) must pass 524.2 criteria to continue. To meet 524.2 criteria, all target analytes must be within 30% of the true value in the daily standard analyzed at beginning of each 12- hour shift.

10.4 GC/MS Semivolatile Organics

10.4.1 Hardware Tuning - The GC/MS system must be hardware-tuned using a 50 ng injection of DFTPP. Analyses must not begin until the tuning criteria are met. The tuning procedure is required for SW-846 Method 8270C every 12 hours and for EPA Method 625 every 24 hours of sample analysis for as long as the calibration is valid, and prior to an initial calibration.

10.4.1.1 Under the HP ChemStation drop down menu item, select Tune. In the drop down menu select Autofind DFTPP to screen or printer. Alternately, the whole peak average spectrum and a single scan background correction may be evaluated. In either case, a hard copy showing the passing spectrum and passing criteria must be printed, dated and initialed by the analyst. A single scan option can also be used.

DFTPP Mass - Intensity Specifications

MASS	ION ABUNDANCE CRITERIA 8270C(1)	ION ABUNDANCE CRITERIA 625
51	10.0-80.0 % of mass 198	30.0-60.0 % of mass 198
68	< 2.0% of mass 69	< 2.0% of mass 69
70	< 2.0% of mass 69	< 2.0% of mass 69
127	10.0-80.0 % of mass 198	40.0-60.0 % of mass 198
197	< 2.0% of mass 198	< 1.0% of mass 198
198	Base peak, or >50% of Mass 442	Base peak, 100% relative abundance(2)
199	5.0-9.0 % of mass 198	5.0-9.0 % of mass 198
275	10.0-60.0 % of mass 198	10.0-30.0 % of mass 198
365	> 1.0% of mass 198	> 1.0% of mass 198
441	Present but less than 24% of mass 442	Present but less than mass 443
442	Base peak, or >50.0 % of mass 198	> 40.0 % of mass 198
443	15.0-24.0 % of mass 442	17.0-23.0 % of mass 442

Notes: 1. The criteria allowed by SW-846 Method 8270D

10.4.1.2 Use the DFTPP mass intensity criteria as tuning acceptance criteria.

NOTE: All subsequent standards, samples, MS/MSDs and blanks associated with a DFTPP analysis must use the identical mass spectrometer instrument conditions.

10.4.2 Initial Calibration

10.4.2.1 Using the HP 7673 autosampler, inject 1µl of each calibration standard (containing internal standards). Seven calibration levels are injected: 5.0 ng/µl, 10 ng/µl, 20 ng/µl, 50 ng/µl, 80 ng/µl, 120 ng/µl, and 160 ng/µl.
An injection volume of 1µl is used for all standards and sample extracts.
A set of at least 5 calibration standards is required. Additional higher level Standards may be used for analytes with large linear response ranges.

The data system software calculates relative response factors (RRFs) for each target analyte relative to one of the internal standards as follows:

$$RRF = \frac{A_s \times C_{is}}{A_{is} \times C_s}$$

where:

A_s = Peak area of the analyte's quantitation ion
A_{is} = Peak area of the internal standard's quantitation ion
C_s = Mass of analyte injected in nanograms (ng)
C_{is} = Mass of internal standard injected in nanograms (ng)

For EPA 625 analyses a minimum of 3 point initial calibration for all 625 target analytes is required and all must have RSD < 35% to allow use of the mean RF (Response Factor) for calibration. For analytes with RSD > 35% a linear regression or quadratic equation must be used.

10.4.2.2 System performance check compounds (SPCCs)

System Performance Check Compounds (SPCCs) are: N-nitroso-di-n-propylamine; hexachlorocyclopentadiene; 2,4-dinitrophenol; and 4-nitrophenol. The minimum acceptable average RRF for these compounds is 0.050 in the initial calibration curve. If the minimum response factors are not met, the system must be evaluated, and corrective action must be taken before sample analysis begins. Possible problems include standard mixture degradation, injection port inlet contamination, contamination at the front end of the analytical column, and active sites in the column or chromatographic system. This check must be met before sample analysis begins.

10.4.2.3 Calibration check compounds (CCCs) are as follows:

Base/Neutral Fraction	Acid Fraction

Acenaphthene	4-Chloro-3-Methylphenol
1,4-Dichlorobenzene	2,4-Dichlorophenol
Hexachlorobutadiene	2-Nitrophenol
N-Nitrosodiphenylamine	Phenol
Di-n-octyl phthalate	Pentachlorophenol
Fluoranthene	2,4,6-Trichlorophenol
Benzo(a)pyrene	

10.4.2.4 The data system calculates the mean response factor and the relative standard deviation (RSD) of the response factors for each target analyte. The RSD should be less than or equal to 15% for each target analyte. <u>However, the RSD for each individual CCC must be less than or equal to 30%.</u>

$$RSD = \frac{SD}{RF} * 100$$

Where: SD = Standard Deviation
RF = Relative Response Factor

10.4.2.5 If the RSD of any CCC is greater than 30%, then the chromatographic system is too reactive for analysis to begin. Evaluate possible causes of the problems, perform additional maintenance which may include replacing the injector liner, clipping 2 to 3 inches off the front of the capillary, or replacing the capillary column, then repeat the calibration procedure.

10.4.2.6 Evaluation of retention times - The relative retention time (RRT) of each target analyte in each calibration standard must agree within 0.06 RRT units.

10.4.2.7 Linearity of target analytes - If the RSD of any target analyte is 15% or less, then the relative response factor is assumed to be constant over the calibration range, and the average relative response factor is used for quantitation.

10.4.2.8 If the RSD of any target analyte is greater than 15%, linear regression or quadratic equation may be used but the

Coefficient of Determination (COD) must be greater than 0.99 for the calibration to be valid for the analyte.

10.4.2.9 Several compounds may not exhibit sufficient response at the lower calibration levels due to their chemical properties. These compounds have a Reporting Limit of 20µg/L in water. If the %RSD criteria cannot be met for any of these compounds with all seven data points then point(s), then one of the following actions should be taken:

10.4.2.9.1 linear regression or quadratic equation may be used but the Coefficient of Determination (COD) must be greater than or equal to 0.99 for the calibration to be valid for the analyte.

10.4.2.9.2 Dropping of standard point should be performed ONLY on either the high or the low standard. Any point dropping should be documented for the reason of dropping on the initial calibration form. The Section Supervisor must sign and date the initial calibration form.

10.4.3 GC/MS calibration verification - Calibration verification consists of five evaluation steps that are performed prior to sample extract analysis at the beginning of each 12 hour shift.

10.4.3.1 Prior to the analysis of samples or calibration standards, inject 50 ng of the tune standard into the GC/MS system. The resultant mass spectrum for DFTPP must meet the criteria given in 10.4.11 before sample analysis begins. Using the Enviroquant "Tailing" macro in QEDIT, evaluate and hardcopy the tailing factor for pentachlorophenol and benzidine. The tailing factors must be less than 5 and 3, respectively. Evaluate the DDT degradation using the following formula: ((DDD+DDE) / (DDT+DDD+DDE))*100 = %degradation. DDT degradation must be less than 20%. These criteria must be demonstrated each 12-hour shift during which samples are analyzed.

10.4.3.2 The initial calibration for each compound of interest is verified once every 12 hours prior to sample analysis, using the introduction technique and conditions used for samples. This

is accomplished by analyzing the 80 ng/µl calibration standard and verifying that the following criteria are met. All analytical queues containing USACE project samples must be followed by a closing CCV. CCV criteria do not apply to the closing standard and the results do not need to be reported, but the data must be available to USACE inspection if requested.

10.4.3.3 System performance check compounds (SPCCs) - A system performance check must be made during every 12-hour analytical shift. Each SPCC in the calibration verification standard must meet a minimum response factor of 0.050. This is the same check that is applied during the initial calibration.

If the minimum response factors are not met, the system must be evaluated, and corrective action must be taken before sample analysis begins. Possible problems include standard mixture degradation, injection port inlet contamination, contamination at the front end of the analytical column, and active sites in the column or chromatographic system. This check must be met before sample analysis begins.

10.4.3.4 Calibration check compounds (CCC's) - After the system performance check is met, the CCC's listed previously are used to check the validity of the initial calibration. Use percent difference when performing the average response factor model calibration. Use percent drift when calibrating using a regression or quadratic fit model. If the percent difference or drift for each CCC is less than or equal to 20%, then the initial calibration is assumed to be valid. If the criterion is not met (i.e., greater than 20% difference or drift) for any one CCC, then corrective action must be taken prior to the analysis of samples. If the CCCs are not included in the list of analytes for a project, then all analytes, which will be reported, must meet the 20% difference or drift criterion. Problems similar to those listed under SPCCs could affect the CCCs. If the problem cannot be corrected by other measures, a new initial calibration must be generated. The CCC criteria must be met before sample analysis begins.

10.4.3.5 Peak tailing will be evaluated by using the Enviroquant "Tailing" macro in QEDIT for each tune mix standard run and

printed. Tailing factor is calcluated by the software and must be <5 for Pentachlorophenol and <3 for Benzidine.

10.5 GC Pesticides

10.5.1 Retention Time Windows

10.5.1.1 Before establishing retention time windows, make sure that the chromatographic system is operating reliably and that the system conditions have been optimized for the target analytes and surrogates in the sample matrix to be analyzed.

10.5.1.2 Make three injections of all single and all multi-component analytes over the course of a 72 hours period. Serial injections or injections over a period of less than 72 hours may result in retention time windows that are too tight.

10.5.1.3 Record the retention times for all single analytes and three to five major peaks for multi-component analytes. Calculate the mean and standard deviation of the three absolute retention times of each single analyte and those peaks.

10.5.1.4 If the standard deviation of the retention times for a target compound is 0.000, then the laboratory uses a default standard of 0.01 minutes. Recording retention times to three decimal places rather than two should minimize the instances in which the standard deviation is calculated as 0.000.

10.5.1.5 The width of the retention time window for the single analytes, each major constituent in multi-component analytes and surrogates is defined as ±3 times the standard deviation of the mean absolute retention time established during a 72-hour period. If the default standard deviation is employed, the width of the window will be 0.03 minutes.

10.5.1.6 The absolute retention time windows must be calculated for each analyte and surrogate on each chromatographic column and instrument. New retention time windows must be established when a new GC column is installed.

10.5.1.7 Establish the center of the window for each analyte and surrogate by using the absolute retention time for each analyte and

surrogate from the calibration verification standard at the beginning of the analytical shift. For samples run during the same shift as an initial calibration, use the retention time of the mid-point standard of the initial calibration.

10.5.1.8 If the daily CCV falls outside the window, the analyst will evaluate the instrument and will recalibrate if necessary. For samples run during the same analytical shift as the Initial Calibration, use the RT of the midpoint standard. However, the experience of the GC analyst should weigh heavily in the interpretation of the chromatograms. The analyst may therefore qualify an analyte as present outside the RT window by using pattern recognition.

10.5.2 Initial Calibration.

10.5.2.1 Must contain a minimum of a 5-point curve for all surrogates & analytes of interest with %RSD's less than 20%.

10.5.2.2 In those instances where the RSD exceeds 20% for any analyte, then the quadratic equation which requires a six-point initial calibration curve may be used but the Coefficient of Determination (COD) must be greater than or equal to 0.990 for the calibration to be valid for the analyte.

10.5.2.3 The analysis of the multi-component analytes employs a single point calibration at the midpoint of the expected calibration range of each multi-component analyte. It is included with the initial calibration of the single component analytes and is used for pattern recognition and RT's.

10.5.2.4 A second source mid-point standard is injected and compared to the initial calibration curve. The percent recovery of each analyte should be ±15%. For USACOE and Navy projects, all analytes must be within ±20% of the expected value.

10.5.2.5 In reporting multi-component analytes, two processes are used: qualitative and quantitative. The first is qualitative, which is done matching the unknown sample to the multi-component standards evaluated during the initial calibration. In this case the pattern in the sample is compared to patterns of the standards. If a match is found, it is determined at what concentration the multi-component analyte is in the unknown, or its quantitative value. Three to five of the major peaks in the multi-component analyte pattern are chosen to measure the concentration of the positive hit.

10.5.3 Calibration Techniques. There are two calibration techniques used by AMRO acceptable for quantitation: average response factor calibration and linear calibration curve. This is the order of preference.

10.5.3.1 This is the Average Response Factor Calibration. For each analyte calculate the response factor of each compound using the equation:

$$\text{Response Factor (RF)} = \frac{\text{Peak Area of analyte}}{\text{Conc. of Analyte in standard}}$$

Calculate the Average of the Response Factors (Rfa) and the Standard Deviation (STD). Using the Rfa and STD, calculate the percent relative standard deviation (%RSD). When the RSD of Analytes are less than 20%, linearity through the origin can be assumed.

$$\%\ \text{RSD} = \frac{\text{Standard Deviation}}{\text{Average Response factor}} \times 100\%$$

Providing the % RSD for each analyte is less than 20%, the Average Response Factor (Rfa) can be using to calculate the sample results. If the %RSD is greater than 20% then a Linear Calibration Curve may be used providing the acceptance criteria is met.

10.5.3.2 Linear Calibration Curve. In order to use this technique, the data system must plot and evaluate a calibration curve by calculating the correlation coefficient against the first order equation:

$$Y = mX + b$$

The software option "Curve Fit" must be selected and the computer will evaluate the calibration based on the above equation.

The acceptance criteria for this equation is the correlation coefficient must be at least 0.990 and documented on the calibration data with analyst initials and the date. The curve must be printed for visual verification and stored with the calibration records.

If the %RSD is greater than 20% and the correlation coefficient is less than 0.990, the instrument must be re-calibrated.

10.5.4 Continuing Calibration Verification (CCV)

10.5.4.1 Verify calibration each 12 hours shift by injecting CCV's (Continuing Calibration Verification sample, a midpoint concentration standard) prior to any sample analysis. A CCV must also be injected at intervals not less than once every 20 client samples (or at the end of a 12 hour interval, whichever comes first). USACOE samples will be analyzed at intervals of no greater than 10 injections between CCV's.

10.5.4.2 The 12 hours shift begins with the injection of the first CCV. The shift ends after the <u>completion</u> of the analysis of the last sample or standard that can be <u>injected</u> within 12 hours of the beginning of the shift. A closing standard **MUST** be injected at the end of the 12 hours window. However, in continuous analysis, the closing CCV of one shift may also serve as the CCV of the next 12 hours shift. The concentration of the last CCV in the analytical batch should be different than the beginning CCV.

10.5.4.3 The CCV Std response must be within ± 15% of the initial calibration curve. If the percent Difference (%D) of an analyte is > 15%, but the average %D for all the analytes are within 15%, then the calibration has been verified.

$$\% D = \frac{\text{Calculated Concentration - Theoretical Conc.}}{\text{Theoretical conc.}} \times 100\%$$

$$\text{Ave. } \%D = \frac{\%D \text{ of Each Analyte}}{\text{Total \# of Analytes}}$$

No sample results can be reported associated with CCV > 15% for that analyte unless it is qualified as estimated. Reanalysis is recommended in these cases.

10.5.4.4 The initial CCV retention times must be compared to the RT windows established vs. the mid-concentration standard of the initial calibration.

10.5.4.4.1 If any analyte is outside the window, the chromatographic system must either be adjusted so re-analysis of the CCV falls within RT windows, or a new initial calibration must be performed and new retention time windows established.

10.5.4.5 Subsequent CCV retention times should be compared to the initial CCV of the 12-hour shift.

10.5.4.6 If the standard analyzed after a group of samples exhibits high response (>15%), and the analyte was not detected in the samples, it is okay to report. In contrast, if the response in the standard is low (by 15%), the sample must be reanalyzed per analyst discretion.

10.5.4.7 The CCV standards should include a PEM (pesticide evaluation mixture) which is used to determine the breakdown of Endrin and DDT. This standard should be analyzed before samples are analyzed, every 12-hour shift. Breakdown should be less than 15% for each compound. Results should be written on the raw data with analyst initials and date.

$$\% \text{ DDT Breakdown} = \frac{\text{Sum of DDE \& DDD areas}}{\text{Sum of DDT,DDE,DDD areas}} \times 100\%$$

$$\% \text{ Endrin Breakdown} = \frac{\text{Sum of Endrin Aldehyde + Endrin Ketone Areas}}{\text{Sum of Endrin, End. Alde, + Endrin Ketone Areas}} \times 100\%$$

10.6 GC PCBs

10.6.1 Retention Time Windows

10.6.1.1 Before establishing retention time windows, make sure that the chromatographic system is operating reliably and that the system conditions have been optimized for the target analytes and surrogates in the sample matrix to be analyzed.

10.6.1.2 Make three injections of all multi-component analytes over the course of a 72 hours period. Serial injections or injections over a period of less than 72 hours may result in retention time windows that are too tight.

10.6.1.3 Record the retention times for three to five major peaks for multi-component analytes. Calculate the mean and standard deviation of the three absolute retention times of those peaks.

10.6.1.4 If the standard deviation of the retention times for a target compound is 0.000, then the laboratory uses a default standard of 0.01 minutes. Recording retention times to three decimal places rather than two should minimize the instances in which the standard deviation is calculated as 0.000.

10.6.1.5 The width of the retention time window for each major constituent in multi-component analytes and surrogates is defined as ±3 times the standard deviation of the mean absolute retention time established during a 72 hours period. If the default standard deviation is employed, the width of the window will be 0.03 minutes.

10.6.1.6 The absolute retention time windows must be calculated for each analyte and surrogate on each chromatographic column and instrument. New retention time windows must be established when a new GC column is installed.

10.6.1.7 Establish the center of the window for each analyte and surrogate by using the absolute retention time for each analyte and surrogate from the calibration verification standard at the beginning of the analytical shift. For samples run during the same shift as an initial calibration, use the retention time of the mid-point standard of the initial calibration.

10.6.1.8 If the daily CCV falls outside the window, the analyst will evaluate the instrument and will recalibrate if necessary. For samples run during the same analytical shift as the Initial Calibration, use the RT of the midpoint standard. However, the experience of the GC analyst should weigh heavily in the interpretation of the chromatograms. The analyst may therefore qualify an analyte as present outside the RT window by using pattern recognition.

10.6.2 Initial Calibration.

10.6.2.1 Must contain a minimum of 5-point curve of Aroclor 1660 (this is a mixture of PCB's 1016 and 1260), along with the midpoint standards for the remaining 1221, 1232, 1242, 1248, 1254 Aroclors. These midpoints are to be used for pattern recognition and one-point calibration (the standards are used to determine the response factor appropriate for each individual PCB using the linear curve of the combination of PCB 1016 and PCB 1260). The %RSD of the 1660 curve must be ≤ to 20%. See Section 7.4.2.1 for action when the %RSD exceeds 20%.

10.6.2.2 A minimum of 3 peaks must be chosen for quantitation but preferably 5 peaks should be used especially with 1016 and 1260. The chosen peaks should be within 25% of the height of the largest Aroclor peak and should try to include at least one peak that is unique to each Aroclor.

10.6.2.3 In reporting, PCBs two processes are used: qualitative and quantitative. The first is qualitative, which is done matching the unknown sample to the Aroclor standards evaluated during the initial calibration. In this case the pattern in the sample is compared to patterns of the standards. If a match is found, it is determined at what concentration the Aroclor is in the unknown, or its quantitative value. Three to five of the major peaks in the Aroclor pattern are chosen to measure the concentration of the positive hit. Of the seven commercial Aroclors on the 8082 target list, 1016, 1242, and 1232 have similar major peaks, the difference being the ratio of these peaks to one another. Although the same peaks are used to quantitate a PCB hit, the same average response factors are not used.

10.6.3 Calibration Techniques. There are two calibration techniques used by AMRO acceptable for quantitation: average response factor calibration and linear calibration curve. This is the order of preference.

10.6.3.1 This is the Average Response Factor Calibration. For each analyte calculate the response factor of each compound using the equation:

$$\text{Response Factor (RF)} = \frac{\text{Peak Area of analyte}}{\text{Conc. of Analyte in standard}}$$

Calculate the Average of the Response Factors (Rfa) and the Standard Deviation (STD). Using the Rfa and STD, calculate the percent relative standard deviation (%RSD). When the RSD of Analytes are less than 20%, linearity through the origin can be assumed.

$$\%\ \text{RSD} = \frac{\text{Standard Deviation}}{\text{Average Response factor}} \times 100\%$$

Providing the % RSD for each analyte is less than 20%, the Average Response Factor (Rfa) can be using to calculate the sample results. If the %RSD is greater than 20% then a Linear Calibration Curve may be used providing the acceptance criteria is met.

10.6.3.2 Linear Calibration Curve. In order to use this technique, the data system must plot and evaluate a calibration curve by calculating the correlation coefficient against the first order equation:

$$Y = mX + b$$

The software option "Curve Fit" must be selected and the computer will evaluate the calibration based on the above equation.

The acceptance criteria for this equation is the correlation coefficient must be at least 0.99 and documented on the calibration data with analyst initials and the date. The curve must be printed for visual verification and stored with the calibration records.

10.6.3.3 If the %RSD is greater than 20% and the correlation coefficient is less than 0.99, the instrument must be re-calibrated.

10.6.4 Continuing Calibration Verification (CCV)

10.6.4.1 Verify calibration each 12-hour shift by injecting the mid pt 1660 std prior to any sample analyses. A CCV must also be injected at intervals not less than once every 20 client samples plus batch QC (or at the end of a 12- hour interval, whichever comes first). USACOE (U. S. Army Corp. of Engineers) samples will be analyzed at intervals of no greater than 10 injections between CCVs. The calibration verification process does **not** require reanalysis of the other Aroclor standards used for pattern recognition. .

10.6.4.2 The CCV Std response must be within ± 15% of the initial calibration curve.

$$\% D = \frac{\text{Calculated Concentration - Theoretical Conc.}}{\text{Theoretical conc.}} \times 100\%$$

10.6.4.3 The initial CCV retention times must be compared to the RT windows established vs. the mid-concentration standard of the initial calibration.

10.6.4.4 If any analyte is outside the window, the chromatographic system must either be adjusted so re-analysis of the CCV falls within RT windows, or a new initial calibration must be performed and new retention time windows established.

10.6.4.5 Subsequent CCV retention times should be compared to the initial CCV of the 12-hour shift.

10.6.4.6 The RTs of the CCV's must fall within the daily RT windows, otherwise the instrument is considered out of control.

10.6.4.7 If the standard analyzed after a group of samples exhibits high response (>15%), and the analyte was not detected in the samples, it is acceptable to report as is. In contrast, if the response in the standard is low (by <15%), the sample must be reanalyzed.

10.7 GC Fingerprints

10.7.1 Initial Calibration:

A minimum of five points are used for the initial calibration curve. The following components and their corresponding concentrations are listed in the reagent section of this document. The average response factor (RF) for each component is calculated.

$$\frac{\text{Conc. of standard}}{\text{Area of component}} = \text{RF}$$

The average RF is calculated by averaging the RF's from each calibration level. The average RF's must be less than or equal to 20% for each component. Any that are over 20% must be evaluated using linear regression. The criteria for linear regression is the correlation coefficient must be 0.990 or greater. If this criteria cannot be met a quadratic equation must be used. The criteria is a coefficient of determination of 0.990 or greater. If none of these criteria are met the instrument must be recalibrated. A 6th point must be added to use a quadratic regression. Do not force zero, and do not use 0,0 as a point. If linear regression or quadratic regression are used, a calibration factor (CF) must be calculated for each component:

$$\frac{\text{Total Area within the Retention Time (RT) range}}{} = \text{CF}$$

Mass injected in ng

10.7.2 The 50 ng/µl O-Terphenyl (OTP) Daily standard is run on the instrument. This standard must be within 20% of the initial curve. This standard is analyzed as the first standard of the day. If the 20% criteria is not met, a new OTP daily standard is prepared. If this OTP daily standard does not meet criteria and preventative maintenance does not correct the problem then a new initial calibration curve must be analyzed. If the standard is acceptable, analysis may continue.

10.7.3 After an acceptable daily standard is obtained, a daily reference standard containing the following components is analyzed:

Gas/Motor Oil:	1000 ng/µl
Fuel Oil#2:	2500 ng/ µl

These standards must be within 15% of the initial curve. If criteria is not met the daily reference standard is rerun. If it is still unacceptable a fresh daily standard is prepared and analyzed. If this is unacceptable and preventative maintenance does not solve the problem, a new calibration curve must be analyzed. Standards must be analyzed at least every 12 hours. Additional standards such as Fuel Oil#4, JP-4, JP-5, Gasoline, Mineral spirits, etc. are run as needed if any components are seen in the samples.

10.7.4 A retention time (RT) standard, working Florida TRPH standard, consisting of n-alkanes from C8 to C40, is then analyzed and evaluated for RT drift and confirmation of the DRO range boundaries if DRO will be reported.

10.7.4.1 The calibration curves consists of an ortho-Terphenyl (OTP) standard curve, a diesel standard curve and a gas/motor oil standard curve at 5 levels. An average RF (Response Factor) of 20% or less must be achieved or a linear regression with an acceptable limit for the correlation coefficient of 0.99 or greater is used.

10.7.4.2 The daily calibration check procedure for the GC/FID is as follows:

(a) Two solvent blanks consisting of Methylene Chloride are analyzed. The blanks are acceptable if there are no analytes detected.

(b) The ortho-Terphenyl (OTP) daily standard is analyzed and the recovery of the OTP must be within ± 15%.
(c) A diesel/#2 Fuel oil standard is analyzed next. The acceptance criteria for this standard is ± 15% compared to the initial calibration curve.
(d) A gas/motor oil standard is analyzed next. The acceptance criteria for this standard is ± 15% compared to the initial calibration curve.

10.8 Instrumental Detection Limits (IDL)

The Instrumental Detection Limit is calculated for metals on the ICP, GFAA and CVAA as part of initial startup and repeated if there is a significant change to the instrument. It is defined as the concentration equivalent to a signal due to the analyte which is equal to three times the standard deviation of a series of 7 replicate measurements of a standard solution at a concentration of 3 to 5 times the estimated instrument detection limit. The IDL is rounded upward and reported to three significant figures. The IDL must be less than or equal to the MDL.

10.9 Graphite Furnace (GFAA)

10.9.1 The instruments are calibrated starting with a calibration blank and four standards defining the range of the metal being analyzed, to establish the calibration curve. One of the standards is at the laboratory reporting limit. An acceptable correlation coefficient is ≥ 0.995.

10.9.2 If the peaks look clean and proportionally correct, an ICV or QCS (initial calibration verification or quality control sample) check sample is run. The ICV is prepared from a different source than the standards used for the calibration curve. The ICV check sample must be within 90-110 % recovery for SW846 and for EPA Method 200.9. If the acceptance criteria are not met the instrument will be re-calibrated.

10.9.3 An IPC (Instrument Performance Check) solution is analyzed for 200 series methods and must be within ±5% of the true value. This solution is the same as the CCV.

10.9.4 An ICB is analyzed and must be within ± one half the reporting limit of the analyte(s) being analyzed. If the acceptance limit is not met the analysis is stopped and the instrument is re-calibrated.

10.9.5 Next a reporting limit standard is run for the metal being analyzed. Internal warning limits are set at ± 30%.

10.9.6 To assure calibration accuracy throughout the analysis, a Continuing Calibration Verification (CCV) check standard is run at a frequency of 10% and at the end of the analytical run. If the CCV is outside the control limits of 90-110% for EPA Methods 200.9 and SW846 the analysis is stopped and the instrument is re-calibrated.

10.9.7 A Continuing Calibration Blank (CCB) check standard is run at a frequency of 10% and at the end of an analytical run with the CCV. The acceptance criteria for the CCB is ± one half the reporting limit. If acceptance limits are not met the analysis is stopped and the instrument is re-calibrated. For USACOE and Navy projects no analyte can be detected at > 2x the MDL.

10.10 ICP

10.10.1 The instrument is calibrated daily using a blank and between two and six standards containing the metals that are going to be analyzed. One of the standards is at the laboratory reporting limit. An acceptable correlation coefficient is ≥ 0.995.

10.10.2 Immediately after running the calibration curve an Initial Calibration Verification (ICV) is run and it is prepared at the mid-range of the calibration curve. The ICV is prepared from a different source than the standards for the calibration curve. The control limits for the ICV are 90 - 110% for SW846 and 95 - 105% for EPA Method 200.7. If outside of acceptance limits the instrument must be re-calibrated.

10.10.3 A Quality Control Sample (QCS) is prepared daily as required by EPA Method 200.7. The QCS is prepared from an independent source from the calibration standards and is run in duplicate. The average must be within 95 - 105% of the true value or the QCS must be remade. AMRO's QCS is the ICV.

10.10.4 An IPC (Instrument Performance Check) is run daily per Method 200.7, this is a mid-level QC standard prepared from the same stock as the calibration standards. The criteria are ±5%. The same solution is analyzed every ten samples, proceeding the CCB, as the CCV with an acceptance criteria of ±10%.

10.10.5 An Initial Calibration Verification Blank (ICB) is run next and it must be ± one half the reporting limit. A continuing calibration blank (CCB) is also run after every 10 samples and at the end of the run. For USACOE and Navy projects no analyte can be detected at > 2x the MDL.

10.10.6 A reporting limit standard is the next QC check. The reporting limit standard are analyzed at three concentrations (RL1, RL2 & RL4) at the beginning and end of the run. Internal warning limits are set at ± 30% for R1 and RL2. In addition, the RL 2 standard is the lowest standard for the Optima ICP.

10.10.7 An Interference Check Sample (ICS) is run next and at the end of each run batch. The control limits for the ICSA are ± two times the reporting limit and the acceptance limits for ICSAB are 80-120%. If the ICSAB is outside of acceptance limits but the ICSA is acceptable the data is reportable but the instrument channel must be monitored for potential problems. If the ICSA results are outside the ± two times the reporting limit the Interference Correction Factor must be checked and the samples must be evaluated to determine if re-analysis is required.

10.10.8 On an semi-annual basis all Inter-element Correction Factors (IEC's) and linear ranges are verified and updated as needed. This is done by analyzing single-element solutions of each element currently determined by ICP at the highest reported value for the element and verifying the apparent concentrations for the remaining elements are within the ± two times the Reporting limit criteria.

10.10.9 Once all these QC checks are acceptable, the instrument is considered calibrated and samples can be run.

10.10.10 A Continuing Calibration Verification (CCV) check is run after every 10 samples to assure the ICP is still in calibration. The acceptable limits for

the CCV check are 90-110% and it is always followed by a CCB (Continuing Calibration Blank). If the CCV or CCB results are not within acceptance limits it can be re-analyzed once more per EPA Method 200.7. If it is still not within acceptance limits a Non Conformance Report must be completed investigating the problem. If the CCV and/or CCBs continue to be outside of acceptance criteria the problem must be corrected and the samples re-analyzed.

Metals QC Requirements

QC requirements for 200.7/200.9

Instrument QC	**GFAA**	**ICP**
Calibration	Per Manufacturer	Per Manufacturer
IPC	95 - 105%	95 - 105 %
ICV/QCS - Ind Source*	90 - 110 %	95 - 105 %
ICB	± Reporting Limit (RL)	± Reporting Limit (RL)
RL	In the Calibration Curve	±30 % (Internal Warning Limits)
ICSA (SIC)	N/A	± Reporting Limit (RL)
ICSAB (SIC)	N/A	80 - 120 %
CCV (IPC)	90 - 110 %	90 - 110 %
CCB	± Reporting Limit (RL)	± Reporting Limit (RL)

QC requirements for SW-846

Instrument QC	**GFAA**	**ICP**
Calibration	Per Manufacturer	Per Manufacturer
ICV - Ind Source	90 - 110 %	90 - 110 %
ICB	± Reporting Limit (RL)	± Reporting Limit (RL)
RL	In the Calibration Curve	±30 % (Internal Warning Limits)
ICSA	N/A	± Reporting Limit (RL)
ICSAB	N/A	80 - 120 %
CCV	80 - 120 %	90 - 110 %
CCB	± Reporting Limit (RL)	± Reporting Limit (RL)

* - Verify QCS Quarterly or run daily

10.11 Mercury Analyzer System

10.11.1 The instruments are calibrated starting with a calibration blank and five standards defining the range of the metal being analyzed, to establish the calibration curve. One of the standards is at the laboratory reporting limit. An acceptable correlation coefficient is ≥ 0.995.

10.11.2 An ICV or QCS (initial calibration verification or quality control sample) check sample is run. The ICV is prepared from a different source than the standards used for the calibration curve. The ICV check sample must be within (90-110 %) recovery for SW846 and for EPA Method 245.1. If the acceptance criteria are not met the instrument will be re-calibrated.

10.11.3 An IPC (Instrument Performance Check) solution is analyzed for 200 series methods and must be within ±5% of the true value. This solution is the same as the CCV.

10.11.4 An ICB is analyzed and must be within ± one half the reporting limit of the analyte(s) being analyzed. If the acceptance limit is not met the analysis is stopped and the instrument is re-calibrated.

10.11.5 To assure calibration accuracy throughout the analysis, a Continuing Calibration Verification (CCV) check standard is run at a frequency of 10% and at the end of the analytical run. If the CCV is outside the control limits of (90-110%) for EPA Method 245.1 and (80-120%) for SW846 the analysis is stopped and the instrument is re-calibrated.

10.11.6 A reporting limit standard is the next QC check. Internal warning limits are set at ± 30%.

10.11.7 A Continuing Calibration Blank (CCB) check standard is run at a frequency of 10% and at the end of an analytical run with the CCV. The acceptance criteria for the CCB is ± one half the reporting limit. If acceptance limits are not met the analysis is stopped and the instrument is re-calibrated.

10.11.8

QC Sample	Frequency	Hg Action Level	Hg Action	Analyst Response
ICV	Once, after calibration	±5% of True Value for 245.1; ±10% of True Value for EPA Method 7470A	Stop	Correct problem and recalibrate
IPC	Once, after Calibration	±5% of True Value for EPA Method 245.1, Not applicable for Method 7470A	Stop	Correct problem and recalibrate
ICB	Once, after ICV	±2 X MDL (MDL Check)	Stop	Correct problem and recalibrate
CCV	10% of analytical samples	±10% of True Value for 245.1; ±20% of True Value for EPA Method 7470A	Stop	Correct problem and reanalyze affected samples
CCB	Following each CCV	±2 X MDL (MDL Check)	Stop	Correct problem and reanalyze affected samples

10.12 Ion Chromatography

10.12.1 The instrument is calibrated starting with a calibration blank and a minimum of six standards defining the range for each Anion of interest being analyzed, to establish the calibration curve. One of the standards is at the laboratory reporting limit. An acceptable correlation coefficient is ≥ 0.995.

10.12.2 The calibration curve must be verified on each working day, or whenever the Anion eluent is change, and after every 10 samples. The response for any analyte must be within ±10% from the excepted value. If the results more than ±10% use a fresh calibration standers. If the results are still more than ±10%, a new curve must be prepared for that analyte.

SECTION 11. INSTRUMENT/EQUIPMENT CALIBRATION

11.1 Calibration checks and frequencies

11.1.1 Analytical Balance - Sartorius Research R160P, Ohaus Explorer E02140

The analytical balance has a sensitivity of 0.01mg. It is checked using ASTM Class I weights at weights that bracket the target weight(s) on a daily basis and the actual weights are recorded in the Daily Balance Check Logbook. The balance is kept on a marble slab on a heavy table and is checked regularly to be sure it is level. The balance is calibrated annually by a certified service representative.

11.1.2 Top Loader Balance(s) - Mettler BB300, AND HF400

The top loader balances are checked daily using ASTM Class I weights at weights bracketing routinely measured weights on a daily basis and they are recorded in individual Quality Control logbooks. The top loader balances have a sensitivity of 0.01 g. The balances are calibrated annually by a certified service representative.

11.1.3 pH Meters – VWR SympHony SB20 and Thermo Electron Corp. Orion 3 Star

Since most of the samples received in the laboratory have a pH between 4 and 10, the pH meter is calibrated on a daily basis using three standard buffer solutions: pH of 4, pH of 7 and pH of 10. The calibration is carried out according to the 3-Buffer Calibration/ Automatic Mode outlined in the pH meter manual. The slope is read and it must be 92-102 mv or appropriate actions are taken. A standard 6 Buffer is read as the Lab QC Check sample. All standards are at room temperature and stirred during measurement. pH buffers at 2.0 and 12 are available to check samples outside the calibration range.

11.1.4 Conductivity Meter with Platinum Electrode – Fisher, Model 09-328

The conductivity meter has a range of 0 - 200,000 μmhos/cm and is calibrated daily by using a 1413 μmhos/cm standard. The deionized water system is checked daily to make sure the laboratory water has a very low specific conductance (<1 μmhos/cm).

11.1.5 Turbidimeters - Hach 2100AN

The Hach 2100AN is calibrated quarterly per manufacturers instructions. The Hach 2100AN turbidimeter is checked before use with a blank and standards of 1.0 and 20.0 NTU.

11.1.6 Spectrophotometer - HACH –DR2010

The Spectrophotometer is also calibrated annually by a certified service representative.

11.1.7 Drying Ovens (2)

All ovens have a selectable temperature control ranging from room temperature to 200°C. A long stem thermometer which is calibrated annually against a certified thermometer is inserted through a center ceiling port with the bulb of the thermometer located inside a cylinder filled with sand. A record of the temperature of the drying ovens is maintained for each day on which the drying ovens are in use. The temperature is recorded both before and after use. Records of the oven temperatures are found in the analytical logbooks associated with temperature dependent analyses.

11.1.8 Incubators

11.1.8.1 The temperature of the BOD incubator is recorded twice daily and the temperature is monitored using a calibrated thermometer immersed in glycerol that is stored in the incubator.

11.1.9 Refrigerators

The temperature of each refrigerator is recorded twice daily to be sure they maintain a temperature of 4°C±2°C. The thermometers used are calibrated against an NIST traceable thermometer on an annual basis. The thermometers are labeled with the date, thermometer ID and conversion factor and documented in the thermometer calibration logbook. Each thermometer is immersed in glycerol and placed on one of the shelves being used for sample storage. Refrigerators containing samples or sample extracts are monitored on non-working days with digital max/min thermometers.

11.1.10 Freezers

The temperature of each freezer is recorded daily to be sure they maintain a temperature of <-10°C. The thermometers used are calibrated against an NIST traceable thermometer on an annual basis. The thermometers are labeled with the date, thermometer ID and conversion factor and documented in the thermometer calibration logbook. Each thermometer is immersed in glycerol and placed on one of the shelves being used for sample storage. Freezers are monitored on non-working days with digital max/min thermometers.

11.1.11 Water Baths

11.1.11.1 Mercury Hot Block

The temperature of the mercury hot block is recorded daily when in use. It is monitored using a non-mercury thermometer that has been calibrated against a certified thermometer annually.

11.1.11.2 Oil and Grease Water Bath

The temperature of the oil and grease water bath is recorded when in use. It is monitored using a thermometer that has been calibrated against a certified thermometer annually.

11.1.11.3 Organic Water Baths

The temperature of the organic water baths is recorded daily when in use. It is monitored using thermometers that has been calibrated against a certified thermometer annually.

11.1.12 Thermometers

Thermometers are calibrated against a certified thermometer annually or quarterly (dial or digital). The certified thermometer is checked for accuracy at the ice point with each use. It is sent to an outside vendor for verification once every three years.

11.1.13 Weights

AMRO used Class I weights to check the calibration of the balances daily each day of use. The weights are inspected periodically for cleanliness. They are sent to an outside vendor for verification once every five years.

11.1.14 Pipette

All variable-volume pipettes are checked the day of use or weekly at two volumes that brackets the range of use. Fixed volume pipettes are checked quarterly.

11.2 Instrument Maintenance/Repair

Preventive maintenance is performed on all instruments to minimize instrument downtime. Spare parts are maintained for each instrument to replace worn out parts to further minimize downtime. Instrument maintenance and repair records are kept throughout the lab to document satisfactory instrument performance. The operator is responsible to see that records are well kept. Records of major maintenance and repair are kept in instrument maintenance logs.

11.2.1 GC/MS (Volatile Organics) Preventive Maintenance and Repair

11.2.1.1 Daily maintenance procedures. The following items should be checked on every day that an instrument is used for analysis.

- Trap and column performance. This is monitored by checking the response factor of key compounds which indicate trap and column degradation and observing column bleed. Change trap or column if necessary.

- Check that gases have adequate supply to last until the following day. Change tanks if necessary.

- Check data file space on the data system.

11.2.1.2 Biweekly maintenance procedures. The following items should

be done every two weeks.

- Check purge gas flow on the purge and trap systems. Adjust if necessary.
- Check Teflon ferrules on the purge and trap systems for wear. Replace if necessary.

- Check Teflon block on the autolab systems for wear. Replace if necessary.

11.2.1.3 Six month maintenance procedure.

- Every six months the vacuum pump oil and the adsorbent trap packing should be changed.

11.2.1.4 "As needed" maintenance.

The following service should be performed when system performance indicates.

- Clean the analyzer source. This will become necessary if a high background becomes apparent which is not attributable to column degradation or the system cannot meet BFB criteria.

- Replace the electron multiplier when the maximum gain no longer provides the required sensitivity.

- Replace the ion source filament as needed.

11.2.2 GC/MS (Semivolatile Organics) Preventive Maintenance and Repair

11.2.2.1 Daily maintenance procedures. The following procedures are performed each day an instrument is used for analysis.

- The GC septum and glass liner are removed and replaced if judged necessary by the analyst.

- Column performance is monitored by checking the response factor of key compounds which indicate column degradation and/or column bleed. Clip two or more inches from the head of the column if necessary.

- Check that gases have adequate supply to last until the following day. Change tanks if necessary.

- Check data file space and quant space on the MS Chem Station system.

11.2.2.2 Weekly maintenance procedures, or as needed.

- Clip column

- Swab shell weldment with methylene chloride or other appropriate solvent.

- Clean or replace gold seal

11.2.2.3 Six month maintenance procedure. Every six months the vacuum pump oil and the adsorbent trap packing should be changed.

11.2.2.4 "As needed" maintenance. The following services should be done when system performance indicates:

- Clean the analyzer source. This will become necessary if a high background becomes apparent which is not attributable to column degradation or the system cannot meet DFTPP criteria.

- Replace the electron multiplier when the maximum gain no longer provides the required sensitivity.

- Replace the ion source filament as needed.

11.2.3 GC Pesticide/PCB Preventative Maintenance and Repair

11.2.3.1 Daily maintenance procedures. The following procedures are performed each day an instrument is used for analysis if in the analyst's judgement, system performance requires them.

- The GC septum and glass liner are removed and replaced if judged necessary by the analyst.

- Column performance is monitored by checking the response factor of key compounds which indicate column degradation and/or column bleed. Clip two or more inches from the head of the column if necessary.

- Check that gases have adequate supply to last until the following day. Change tanks if necessary.

- Check data file space and quant space on the MS Chem Station system.

11.2.3.2 Weekly maintenance procedures, or as needed.

- Clip column

- Swab shell weldment with hexane or other appropriate solvent.

- Clean or replace inlet seal

11.2.4 GC Fingerprint Preventative Maintenance and Repair

11.2.4.1 Daily maintenance procedures. The following procedures are performed each day an instrument is used for analysis if in the analyst's judgement, system performance requires them.

- The GC septum and glass liner are removed and replaced if judged necessary by the analyst.

- Column performance is monitored by checking the response factor of key compounds which indicate column degradation and/or column bleed. Clip two or more inches from the head of the column if necessary.

- Check that gases have adequate supply to last until the following day. Change tanks if necessary.

- Check data file space and quant space on the MS Chem Station system.

11.2.4.2 Weekly maintenance procedures, or as needed.

- Clip column

- Swab shell weldment with methylene chloride or other appropriate solvent.

- Clean or replace inlet seal

11.2.5 Zeeman PE-4100 and AAnalyst 600 Atomic Absorption Spectrometer Maintenance and Repair

The following is a brief list of maintenance/checks that are done on the Atomic Absorption/Graphite Furnace Spectrometer when needed. Maintenance logs are located by each instrument.

11.2.5.1 Autosampler

- The autosampler waste bottle is emptied regularly; not allowed to overflow, nor is the liquid allowed to reach the end of the drain tube.

- The rinsing liquid bottle is kept filled with 2% Nitric Acid + 2% Hydrochloric Acid Solution in order to prevent cross contamination on the autosampler tip.

- The autosampler tubing and connections are checked regularly. If the tip of the sampling capillary appears damaged, it is trimmed back.

11.2.5.2 Cooling System

- The water level in the cooling system is checked regularly and filled up when necessary with deionized water.

11.2.5.3 Furnace

- The operator regularly checks the condition of the contact cylinders and if they are pitted or cracked they are replaced.

- The operator checks that the furnace windows are clean.

- The operator checks the gas connections and makes sure that the gas supply is delivering the correct pressure.

- The graphite tubes are checked for contamination and if they can't be cleaned, they are replaced.

11.2.5.4 Spectrometer

- The air filter is changed monthly or when it shows signs of becoming clogged with dust.

- A stock of replacement lamps should be on hand for all elements routinely used.

- Do not leave the EDL's lit longer than is necessary. However, Care should be taken to avoid lighting them an excessive number of times.

- The air filter should be cleaned monthly in order to keep dust out of the electronics compartment.

- Be careful not to hit the IEEE cable on the rear of the instrument when cleaning the bench. This could cause communication problems

11.2.5.5 The Graphite tube and platform must be changed when:

- When the portion of tube visible from the sample introduction port is rough.

- The instrument re-calibrates excessively without running samples.

- Blanks are contaminated after "burning out" the tube

  There are anomalies visible inside the tube.

11.2.5.6 The following must be done when replacing the tube and platform:

- Clean the contact rings with a cotton swab and 1.0 % nitric acid.

- Clean both the left and right windows with Methanol and wipe with lens paper before replacing.

- When handling any of the graphite parts wear gloves to prevent skin oils from contaminating the graphite. Fingerprints shorten tube life.

- After replacing all parts, condition the furnace with the element file "cond_hga".

- Clean the tip of the autosampler with Methanol and 1.0 % Nitric Acid to remove any residual organics. These may cause imprecise placement of the samples in the furnace.

11.2.6 Optima ICP Maintenance and Repair

To keep the ICP running optimally the following maintenance procedures are performed as indicated and recorded in the maintenance logbooks located beside each instrument:

11.2.6.1 Daily

- Check acid waste, pump tubing, argon pressure.

- Verify that intensity counts for first standard are in a range that indicates efficient sample introduction.

- Change pump tubing. The tygon tubing is checked daily before use and replaced, depending on usage. The capillary tubing is changed when it becomes frayed or is too short.

11.2.6.2 Weekly

- Drain acid waste.

- Check coolant level and top off with tap water.

- Make any standards that are low and verify concentration prior to use.

- Check Nebulizer and Spray Chamber and clean if necessary.

11.2.6.3 Bi-Weekly

- Clean torch by heating in dilute AquaRegia.

11.2.6.4 Monthly

- Change filters. The filters on the back of the power unit and monochromator are checked and cleaned on a regular basis.
- Wipe off Rail on Autosampler and oil lightly.
- Dust off instrument.
- Clean external optics.

11.2.6.5 Semiannual

- Drain chiller and flush with Acetic Acid (15 ml added to coolant) for 10-15 minutes. Refill with 50% tap water and 50% deionized water.
- Repairs/Service - Record any problems and resolutions.

11.2.7 Perkin Elmer FIMS 100 Automated Mercury Analyzer Maintenance

11.2.7.1 Daily

- Check acid waste, pump tubing, and argon pressure.
- Verify Peak Height for first standard is in a range that indicates efficient sample introduction.

11.2.7.2 Weekly

- Change Two-Stop pump tubing position every week. Tubing should last two weeks.

- Drain acid waste

- Clean Gas/Liquid separator - see manual pg 2-11. Replace filter as needed to keep water out of cell (can dry and reuse). Try adding Anti-Foaming agent to rinse to keep water off filter.

- Archive result files for the past week.

- Clean racks with DI and dust off instrument. Make any standards that are low and verify concentration prior to use.

11.2.7.3 Monthly

- FIMS-cell maintenance - see manual pages 2-7.

- Dust off instrument.

11.2.7.4 As Needed

- Replace the mercury lamp.

- Record problems, service calls, and their resolution.

11.2.8 Ion Chromatography DX-120 and Ion Chromatography ICS-2000 Maintenance and Repair

11.2.8.1 Monthly

- Once a month clean the column with 0.1M oxalic acid.

11.2.8.2 As Needed

- Check column and tubing for visible leaks. Replace if necessary.

- Disconnect the ionpac AS14a analytical column from the ASRS–ULTRA part and reverse the guard column from the analytical column, so that the guard column is the last part flowing to a waste container flush for 15 min., with D.I water pump for 60 min. with the clean up solution at 1.0mL/min rinse the column for 15min with D.I. water. Equilibrate the columns with eluent for 30min. Re-connect the analytical column to the ASRS-ULTRA and place the guard column back in line between the injection valve and analytical column.

SECTION 12. QUALITY CONTROL SAMPLES

12.1 Quality Assurance

Quality assurance is the system whereby the laboratory can assure its clients and other outside agencies that the laboratory is generating data of proven and known quality. By the same token, a Quality Assurance program helps within the laboratory, by letting the analysts know the quality of their results and giving them the data to prove those results if necessary.

AMRO's QA program is designed with the following objectives:

1. to demonstrate that the quality control operations are in fact being carried out in the laboratory,

2. to assure that the data reported is for the sample that it is reported on

3. to assure complete traceability and defensibility of reported data.

Quality control is defined as the operations undertaken in the laboratory to ensure that the data produced is generated within known probability limits of accuracy and precision.

12.2 Accuracy

Accuracy is a measure of the degree to which the analytical result approaches the "true" value of the concentration of the analyte being determined. Accuracy in the laboratory is assessed by the regular analysis of known standards such as the Laboratory Control Samples (LCS), and matrix and analytical spikes. Accuracy within the laboratory is expressed in terms of percent recovery.

12.3 Precision

Precision in the laboratory is determined by the comparison of duplicates, where duplicate samples result from an original sample that has been split for identical analyses. The precision of data is commonly determined by calculating the relative percent difference (RPD) of these duplicate (replicate) analyses and then using these values to determine confidence limits for subsequent analysis.

12.4 Completeness

The completeness of a project is measured as a percentage of the amount of acceptable data that is generated within the time frame requested, to the expected amount of total data multiplied by 100. This completeness includes the completion and acceptability of all the QC check analyses (ex. duplicates, spikes) for all the analyses requested. AMRO strives to provide 100% data completeness for all samples received.

12.5 Representativeness

In order to preserve the representativeness of the samples received in the laboratory, they are preserved and stored in accordance with EPA regulations. Documentation is kept to assure that protocols have been followed and that sample identification and integrity have been maintained. The analysts in the laboratory are also very careful about making sure the sample aliquots that are used for analysis are representative of the total sample.

12.6 Comparability

Comparability is a measure of how closely sample data generated by AMRO compares with sample data generated by other laboratories. Comparability is assured through the use of established and approved analytical methodologies. AMRO participates in EPA and State administered proficiency test programs to provide assurance of the comparability of our data.

12.7 Quality Control Samples

On a daily basis several types of Quality Control (QC) samples are analyzed to document the validity of data generated in the laboratory. The following is a description of the different quality control samples run in the laboratory.

12.7.1 Blank Samples

All analytical tests performed in the laboratory, including organics, metals and wet chemistry, are required to run blanks.

12.7.1.1 Trip Blank: "Trip blanks" are sent out when samples are going to be analyzed for volatile organics. A trip blank is a vial of VOA carbon filtered water or purge and trap methanol which is sent to the client, along with empty preserved VOA vials or VOA vials containing Methanol for sampling, and is returned with the other

samples to the lab for analysis. The purpose of the trip blank is to determine if there is any contamination during sample transport. Frequency is one trip blank per project per matrix type.

12.7.1.2 Field Blank: "Field blanks" are run when the client has run DI water through their collection proceedings. A field blank is used to detect any contamination that may occur during sampling. Frequency is one field blank per project per matrix type depending upon the sampling event requirements.

12.7.1.3 Method Blank: A laboratory DI water sample/or solvent that is carried through the entire analytical procedure with a batch of samples, whether it is a digestion or an extraction procedure, is referred to as a "method blank". Method blanks are important in identifying contamination that may occur during the analytical process. They are analyzed 1 for every batch of 20 samples for organics, metals and total petroleum hydrocarbons and 1 for every batch of 20 samples for wet chemistry.

12.7.1.4 Calibration Blank: The "calibration blank" is used to determine the "zero" concentration point for that particular instrument. The calibration blank consists of a sample of laboratory deionized water or solvent which has the same reagents added to it as the calibration standards, and it is used to "zero" in the instrument.

12.7.1.5 The Daily Blank: This is used to determine an instrument is free from contamination each day it is run. The Method Blank can be used as a Daily Blank for volatile analysis.

12.7.2 Spiked Samples

The following "spiked" samples are useful in determining the accuracy of a method throughout the entire procedure.

12.7.2.1 Blank Spike: A "blank spike" is a known volume of deionized water or clean sand into which a known amount of a particular analyte is added. The blank spike is taken through the entire analytical procedure, and the percent recovery of the spiked analyte(s) is calculated in order to assess the efficiency of the extraction/ digestion procedures and the final analyses. Blank spikes are referred to as Laboratory Control Sample (LCS). They are analyzed 1 for every batch of 20 samples of a similar matrix for organics, metals and total petroleum hydrocarbons and 1 for every

batch of 20 samples of a similar matrix for wet chemistry. The Laboratory Control Sample Duplicate (LCSD) shall be extracted/digested with every batch of samples of similar matrix when insufficient sample volume is provided to perform MS/MSD. This will ensure that each batch samples of a similar matrix will have both precision and accuracy.

12.7.2.2 Surrogate Spike: The "surrogate spike" is used in the analysis of organic compounds. These surrogate spikes are added to every blank, sample, matrix spike, duplicate and standard to evaluate the analytical efficiency of the method in individual sample matrices. The compounds used in the surrogate spikes are chemically similar to the target compounds.

12.7.2.3 Analytical Spike: The "analytical spike" is a specific aliquot of digested sample into which a known amount of compound is added. The analytical spike is analyzed immediately and the percent recovery is calculated in order to assess the matrix effect of the sample on the analytical system.

12.7.2.4 Matrix Spike: The "Matrix Spike" is a specific aliquot of sample (aqueous, soil or waste) into which a known amount of compounds are added. Like the blank spike, the matrix spike is also subjected to the entire extraction and analytical procedures. The percent recovery of the spiked compounds is calculated in order to assess the appropriateness of the method for that sample matrix. They are analyzed Matrix Spike (MS) and Matrix Spike Duplicate (MSD) for every batch of 20 samples for organic, with the exception of EPH and VPH, and for inorganic. Samples should be chosen for spiking randomly and rotated among clients and sites from batch to batch. In some cases, the client may specify which sample is to be used for MS/MSD; if not, the laboratory shall pick a representative sample based on the following:

12.7.2.4.1 Method of extraction or digestion
12.7.2.4.2 MS/MSD shall not be performed on Trip Blank, Rinsate Blank or Field Blank
12.7.2.4.3 Adequate sample weight/volume

12.7.3 Duplicate Samples

12.7.3.1 Duplicate samples are two aliquots of a sample which are carried through the same sample preparation and analysis procedures to verify the precision of the specific analytical method for that sample matrix. They are analyzed at a frequency of 1 per ten samples for inorganic analysis, EPH and VPH analysis require duplicates one every twenty samples. The %RPD is calculated from the original and the duplicate sample. If one sample result is above the reporting limit and one is less than four times the reporting limit the data is considered acceptable for metals analyses. Organic, metals and total petroleum hydrocarbon analyses requires duplicate spike samples per batch of 20 samples of a similar matrix. The %RPD is calculated from the Matrix Spike (MS) and Matrix Spike Duplicate (MSD) results. Metals for 200.7 and wet chemistry analyses require duplicates 1 every batch of 10 samples of a similar matrix. EPH and VPH analyses require 1 sample duplicate per batch of 20 samples of a similar matrix.
Samples should be chosen for either spiking randomly or duplicate rotated among clients and sites from batch to batch. In some cases, In some cases, the client may specify which sample is to be used for MS/MSD or Sample Duplicate; if not, the laboratory shall pick a representative sample based on the following:

12.7.3.1.1 Method of extraction or digestion
12.7.3.1.2 Duplicate shall not be performed on Trip Blank, Rinsate Blank or Field Blank
12.7.3.1.3 Adequate sample weight/volume

12.7.4 Internal Standards (IS) (Organic)

Internal Standards of a known concentration are added to every organic blank, sample, matrix spike, duplicate and standard vial prior to analysis on the GC/MS. Although these standards do not include the target compounds, they are used as the basis for quantifying the target compounds.

12.7.4.1 The retention times of the internal standards in the calibration verification standard must be evaluated immediately after or during data acquisition. If the retention time for any internal standard changes by more than 30 seconds from that of the mid-point standard of the initial calibration curve, then the

chromatographic system must be inspected for malfunctions and corrections must be made, as required. When corrections are made, reanalysis of samples analyzed while the system was malfunctioning is required.

12.7.4.2 Internal Standard Response - If the Extracted Ion Current Profile (EICP) area for any of the internal standards in the calibration verification standard changes by a factor of two (-50% to + 100%) from that in the mid-point standard of the initial calibration curve, the mass spectrometer must be inspected for malfunctions and corrections must be made, as required. When corrections are made, reanalysis of samples analyzed while the system was malfunctioning is required.

12.7.5 Surrogates (Organic)

Surrogates of a known concentration are added to every organic blank, sample, matrix spike, duplicate and standard vial prior to analysis by GC/MS and GC. They are used to evaluate extraction efficiency and to assist in the determination of matrix interference. They are known amounts of non-target analytes that response the same as target analytes during extraction and analysis.

12.7.6 Laboratory QC Check Samples

12.7.6.1 The Laboratory QC Check Samples (or independent calibration verifications) are prepared in the laboratory from a different source than the calibration standards are made from. This Lab. QC check sample is prepared at a concentration that is reproducible for the particular method. The check sample is run after the calibration of the instrument to verify the integrity for the initial calibration.

12.7.6.2 A continuing calibration check from the same source as the calibration curve and is analyzed every ten samples and at the end of the run for inorganic analyses to ensure instrument performance throughout the analyses. The frequency of continuing calibration for organics is specified per the methods.

12.7.7 Standard Reference Solutions (Wet Chemistry)

These standard reference solutions are from the same source as the initial calibration curve. They are required if a calibration curve is not performed daily to ensure the acceptability of the initial calibration.

12.7.8 Reporting Limit Standard (RL)

The reporting limit standard is a low level QC check that is analyzed at the beginning and end of ICP runs, distilled and un-distilled for Cyanides. It is the lowest standard of a calibration curve for organic, GFAA, CVAA and wet chemistry analyses. The results are used to verify the reporting limit for the given analyses.

12.7.9 Interference Check Standard Solutions (ICS) (Metals)

The interference check standard solutions are run on the ICP at the beginning and end of all runs. They are run to verify that these analytes do not interfere at the particular wavelengths at which the samples are being analyzed.

12.7.10 Serial Dilutions (Metals)

An aliquot of sample is diluted 1:4 with a matrix blank solution then analyzed to determine if there is any matrix effects present.

12.8 Proficiency Testing

AMRO participates in semi-annual proficiency testing studies for drinking water, wastewater and solid/hazardous waste parameters. The results of the studies are evaluated by the provider and returned to the laboratory. The laboratory reviews the scores and investigates any results that are outside of acceptance limits. The results of these studies with a summary of the investigations are distributed to State agencies from which laboratory certifications are obtained. The results are used as part of the evaluation of the ability of the laboratory to produce accurate results. Results are also provided to clients upon request.

12.9 Internal Verification

AMRO occasionally obtains known PE samples to submit to the laboratory as checks to the analytical system. Double Blind PE samples may be obtained as another way of verifying the analytical system.

12.10 Control Charts

Control charts are basic tools for quality assurance/quality control. They provide a graphical means to demonstrate statistical control, monitor a measurement process, diagnose measurement uncertainty, monitor trending and aid in methodology development and troubleshooting. Each analytical department of the laboratory shall be required to keep specific QC Charts, which pertain to the analyses performed within that department as determined by the QA Manager in consultation with the Laboratory Director. The QA Manager shall ensure that QC Charts are being utilized and updated.

SECTION 13. CORRECTIVE ACTION

13.1 General

Corrective action will be required whenever the measurement system generating the data is found to be out of control. The determination of whether a system is out of control will be based on the correlation between predetermined limits and the actual analytical values. The corrective action is intended to be initiated by the person closest to the actual problem or the first person to determine a problem exists. Ideally the analyst should initiate the action; however, supervisors also share the responsibility for determining if the analytical system is out of control. Corrective action involves investigation into the root cause, resolution of the problem and implementation of the solution. The Quality Assurance Manager shall be responsible for monitoring laboratory results to insure that measurements are in control. At anytime where an out of control measurement is found, appropriate laboratory personnel will be notified so as to take proper corrective action.

13.2 Definition

Corrective Action is the measures taken to rectify and/or prevent recurrence of a quality failure.

Preventive Action is a pro-active process to identify opportunities for improvement rather than a reaction to the identification of problems or complaints.

13.3 Initiation of Action

Corrective action may be initiated as a result of the following activities:

a. Daily quality control system failure.
b. Response to external or internal audits findings and performance evaluations.
c. Written follow-up to client and/or revision to client reports impacted by non-conforming analytical events discovered through audits, client complaints, or instrument malfunction.

13.4 Documentation of Corrective Action

The QA Manager shall document all corrective actions using the Corrective Action Report and Status Form (CARS) (Attachment 24). The corrective action shall be signed by the person responsible for completing the action to indicate acceptance of responsibility. The QA Manager shall verify and document completion and effectiveness of the corrective action by performing surveillance, using Surveillance Form (Attachment 25). The Laboratory Director and QA Manager shall sign and date the completed corrective action.

13.5 Training

Employees are trained in the proper procedures to perform their tasks. Included in this training is the identification of acceptable results versus not acceptable results. The employee is required to acknowledge and document any instance that is not acceptable for the task. This includes safety, analysis, sample receiving, data review, quality control, waste disposal, report preparation and data reporting. Documentation must be clearly stated and visible to all personnel reviewing the information.

13.6 Non-Conforming Data Report

The Non-Conforming Data Report (NCD) will be initiated as a result of the following:

a. Quality control criteria being "out of range".
b. Audit findings indicating systematic problems.
c. As a result of client inquiries.
d. Parameters (s) which failed in Performance Evaluation Samples (PE).
e. Holding times violations.
f. Calibration criteria not met.
g. Tune unacceptable.

13.7 Documentation of Non-Conforming Data

When a significant problem has occurred as mentioned above, a Non-Conforming Data Report (NCD)(Attachment 26) will be initiated. The person who discover the Non-Conforming Data shall complete the top portion of the NCD Report which consists of the following information:

a. NCD Number
b. Lab Order
c. Client's Name
d. Section
e. Sample(s) Affected
f. Date of Occurrence
g. Date Discovered
h. Discovered by
i. Description of the NCD

The responsible person(s) will correct the data report or investigate the cause for the PE failure. The responsible person shall then sign and date the NCD. The resolution of the NCD is reviewed, signed and dated by both the Section Supervisor and QA Manager. After the completion of the review, entering the closing date in the NCD tracking system shall close the NCD. The original NCD Form is placed in the project folder.

13.8 Client Requested Investigation

In cases of client requested data investigations the NCD is completed as instructed above. The corrective action will be initiated. A copy of the completed CARS will be sent to the client. The original copy is placed in the project folder.

13.9 Complaints

Customer complaints are often presented to various levels of personnel at AMRO. The statement is usually verbal, although occasionally they are written. They may be received by an AMRO courier, sample receiving technician, business development personnel, owners, managers, customer service and chemists.

If a member of the management, customer service or QA/QC received a telephone call, which requires further action, then the conversation is documented in the individual's communications log. The information recorded in the log includes the caller, the company, the date and time of the call, and a description of the discussion. Customer complaints are reviewed during daily production meetings during the "customer issues" agenda item. A copy of the telephone call log page is provided to the individual responding to the item. The resolution of the issue is documented in the original telephone call log along with the data and initials of the responder. The issue is discussed and a course of action is planned to resolve the issue or complaint.

SECTION 14. DEPARTURES FROM DOCUMENTED POLICIES AND PROCEDURES

14.1 In the event that it is required to deviate from documented policies and procedures established by the laboratory, the situation is brought to the attention of the appropriate section head.

14.2 The section head reviews the situation and options are discussed.

14.3 The options are presented to the QA/QC Manager, Director of Business Development and upper management and an acceptable decision is reached.

14.4 The decision is documented and analysis continues.

SECTION 15. DATA HANDLING AND REPORTING

To obtain meaningful data on sample analyses, the analyst must perform the proper analysis in the prescribed fashion according to AMRO Standard Operating Procedures, complete calculations, and convert results to final form for permanent recording of the analytical data in meaningful exact terms. These results are reported for future interpretation and use.

15.1 Gathering and Reporting Data

When an analysis of a sample is complete, the analysis for that sample should be checked and the data calculated as soon as possible to identify any problems while still within the holding time for the analysis. The following steps should be taken by the analyst to ensure that a good analysis has been obtained.

15.1.1 All the QC data collected during a specific calibration run must be within the predetermined QC acceptance ranges.

15.1.2 Any dilution factors, blank correction factors or dry weights are taken into consideration when making final calculations.

15.1.3 All data log sheets are checked to be sure they are completed and signed by the analyst.

15.1.4 Verify that no compounds exceeded the calibration range.

15.1.5 Check for cross contamination between samples and blank contamination.

15.1.6 For organic analyses check the chromatography, verify that any "unknown" peaks are not target analytes.

15.2 Data Review

15.2.1 Analyst Review:

When an analysis of a sample is complete, the analysis for that sample should be checked and the data calculated as soon as possible to identify any problems while still within the holding time for the analysis or sample preparation. The following steps should be taken to ensure that the analysis has met the method, SOP QC criteria as well as project requirements.

A. CALIBRATION: Date and initial all initial and continuing calibration data. Check that all initial and continuing calibration runs associated with the sample meet criteria. Check most current SOP and project specific documentation for acceptance criteria.
B. BLANKS: Date and initial all initial, continuing calibration and procedural blanks data. Check that all initial, continuing calibration and procedural blank runs associated with the sample meet criteria. Check most current SOP and project specific documentation for acceptance criteria.
C. LCS: Date and initial all LCS data. Check that all LCS runs associated with the sample meet criteria. Check most current SOP and project specific documentation for acceptance criteria.
D. Check that no compounds exceed the calibration range. For METALS check all elements (not just project required elements due to interference concerns) to see if they exceed calibration range. If any element exceeds its linear range the sample MUST be diluted. Consult section head to determine if there are any problems associated with client requirements.
E. Check to see if there are any other runs of the sample. If so, check to see if the data agrees. Provide all runs used or not for each project.
F. Verify that ALL project requirements have been met. If any project requirements are not met, they must be documented.
G. Ensure the holding time has been met for every sample.
H. Make sure any method required checks have been properly recorded in the appropriate logbook (i.e. pH checks, residual chlorine checks, etc.)
I. Note any observances associated with each sample. (i.e.- sample was wet, sample foamed, any color changes occurring during prep., formation of emulsions, etc.)
J. Note any dilutions on the quant output page or data page and the reason for the dilutions for each sample.
K. Check the run for carryover or contamination.
L. Note if there was not sufficient sample to perform required QC.
M. Make sure the frequency of QC was performed as required (i.e. 1 spike and 1 spike duplicate per twenty samples)

N. Make sure acceptance limits were met for QC: MS, MSD, Duplicates, Surrogates, serial dilutions, interference checks, internal standards. Any outside of acceptance limits must be noted and reported in the narrative or non-conformance summary where applicable.
O. Make sure all preparation sheets and run logs are completed and signed off by the analysts.
P. Make sure the logbooks are filled out correctly and completely including standard and reagent traceability information.
Q. Accurately complete the narrative form for each project.
R. Make sure all non-conformance summaries are provided and filled out completely and accurately. Make sure all signatures are present.
S. Perform the final calculations on any positively identified compound in the correct units, taking into consideration dilution factors, dry weights, blank corrections (WET CHEM), etc.
T. (METALS) Check that interference checks, ICVs, serial dilutions, LCS, IPC (200 series), MS, MSD, duplicates, and post spikes met criteria.
U. (ORG) Check the internal standard areas. They should be -50 to + 100% of the I.S. areas in the initial calibration.
V. (ORG) Compare the surrogate recoveries to the AMRO limits. Check the LCS surrogate recoveries for acceptability to determine if sample surrogates are out due to matrix effects or possibly spike solution problems.
W. (ORG) Check the chromatography. (Good peak shape, baseline not noisy, good sensitivity)
X. (ORG) Check that the amount of sample analyzed is correctly recorded in the chromatogram header along with client and extraction date information.
Y. (ORG) Check spectrum, area, and retention time of any positive hits on the quant output page.

Z. (ORG) Check the chromatogram for target peaks not picked up by the automated quantitation. If any suspicious peaks are present, check the spectrum to be sure it is not a target compound. If not a target compound, make a note on the chromatogram that the peak is an unknown. Print library search results for the unknown.

All problems discovered during this preliminary data check should be documented on the checklist. Problems may necessitate re-prep or re-analysis. A non-conformance data report (NCD) may be required in addition to the narrative form in writing with an explanation of why the data is being used.

All calculations should be written in black ball-point pen ink. All cross-outs must be a single line and should be initialed and dated. Analyst review is documented on the following Checklists:

1. GC and GC/MS Data Review Checklist (Attachment 27)
2. ICP Data Review Checklist (Attachment 28)
3. GFAA and CVAA Data Review Checklist (Attachment 29)
4. Wet Chemistry Data Review Checklist (Attachment 30)

The analyst shall sign and date the Data Review checklist.

15.2.2 Peer Review:

When all samples for a given project have been analyzed and the results have been calculated, the project goes through the following data review procedure. The Section Supervisor or Data Review Specialist performs the peer review. The function of this review is to provide an independent, complete peer review of the analytical batch data package. The final review of the data shall be performed by the "Data Review Specialist" using the Data Review Checklist (Attachments 31a&b). The following items must be verified and documented as part of data review. Level of review should be appropriate to the package level being produced.

A. The reviewer reads over all associated paperwork (C-O-C's, faxes, notes on folders, and sample receipt checklists) to become familiar with the requirements of the project.
B. CALIBRATION: Check that all initial and continuing calibration runs associated with the sample meet criteria. Verify acceptance criteria using with the most current SOP and project specific documentation.

C. BLANKS: Check that all initial, continuing calibration and procedural blank runs associated with the sample met criteria. Verify acceptance criteria using with the most current SOP and project specific documentation.
D. LCS: Check that all LCS runs associated with the sample meet criteria. Verify acceptance criteria using with the most current SOP and project specific documentation.
E. Check that no compounds exceed the calibration range. For METALS check all elements (not just project required elements due to interference concerns) to see if they exceed calibration range. If any element exceeds its linear range the sample MUST be diluted. Consult section head to determine if there are any problems associated with client requirements.
F. Spot check the final calculations on any positively identified compound in the appropriate units, taking into consideration dilution factors, dry weights, blank corrections (WET CHEM), etc.
G. Check to see if there are any other runs of the sample. If so, check to see if the data agrees. File any runs not reported in the project folder.
H. Verify that ALL project requirements have been met. If any project requirements are not met, they must be documented. Consult with QC or customer service if project requirements are not known.
I. Ensure the holding time has been met for every sample.
J. Make sure any method required checks have been properly recorded in the appropriate logbook (i.e. pH checks, residual chlorine checks, etc.)
K. Verify any observances associated with each sample were noted. (i.e. – sample was wet, sample foamed, any color changes occurring during prep., formation of emulsions, etc.)
L. Check the dilution factor and make sure it is written on the quant output page or data page.
M. Check the run for carryover or contamination.
N. Verify if there was not sufficient sample to perform required QC.
O. Make sure the frequency of QC was performed as required (i.e. one spike and one spike duplicate per twenty samples)
P. Make sure acceptance limits were met for QC: MS, MSD, Sample Duplicates, Surrogates, serial dilutions, interference checks, internal standards. Any outside of acceptance limits must be noted and reported in on the case narrative.
Q. Make sure all preparation sheets and run logs are completed and signed off by the analysts.
R. Make sure the logbooks are filled out correctly and completely including standard and reagent traceability information.
S. Accurately complete the narrative form for each project.
T. Make sure all Non-Conformance Data Reports are provided and filled out completely and accurately. Make sure all signatures are present.

U. Provide the QC data in the format required by the client for each project. Consult the AMRO Report Packages summary, the QC Reports summary, any project specific summaries provided, the QA/QC Manager or the Customer Service Manager for Package levels and any other project specific requirements.
V. (METALS) Check that interference checks, ICV's, serial dilutions, LCS, IPC (200 series), and post spikes met criteria.
W. (ORG) Check the internal standard areas of samples and QC. They should be -50 to + 100% of the I.S. areas in the initial calibration.
X. (ORG) Compare the surrogate recoveries to the AMRO limits. Check the LCS surrogate recoveries for acceptability to determine if sample surrogates are out due to matrix effects or possibly spike solution problems.
Y. (ORG) Check the chromatography. (Good peak shape, baseline not noisy, good sensitivity)
Z. (ORG) Check that the amount of sample analyzed is correctly recorded in the chromatogram header along with client and extraction date information.
AA. (ORG) Check spectrum, area, and retention time of any positive hits on the quant output page.
BB. (ORG) Verify the chromatogram for target peaks not picked up by quant. If any suspicious peaks are present, verify the spectrum to be sure it is not a target compound with the analyst. If not a target compound, make sure a note is on the chromatogram that the peak is an unknown. Verify a library search results for the unknown was printed.

Any problems encountered by the reviewer should be brought to the attention of the analyst for resolution. Once resolution is achieved, both the analyst and the reviewer must sign off on the data. If resolution between the reviewer and the analyst is not obtained, a third party must be consulted. All involved must sign off on the data once a decision is reached.

15.2.3 QA Review:

QA review is performed by the QA Officer. This review shall provide a total overview of the data package including sample receipt, to ensure its consistency and compliance with project-specific requirements. Review of the case narrative. This review is documented on the Data Review Checklist (Attachment 31b) with signature and date of the reviewer.

15.3 Analytical Values

Once the data is recorded and collected, it is put into reporting form through the use of significant figures and rounding off numbers.

15.3.1 Significant Figures

The proper use of significant figures gives an indication of the reliability of the analytical method used. A significant figure is a number that denotes the amount of the quantity in the particular decimal place in which it stands. Reported analytical values should contain only significant figures. A value is made up of significant figures when it contains all digits known to be true and one last digit in doubt. AMRO reports data in two significant figures where appropriate with the exception of Proficiency Samples and QC data, which are reported in three significant figures.

15.3.2 Rounding Off Data

Rounding off of numbers is a necessary operation in all analytical areas. It is automatically applied by the limits of measurement of every instrument and all glassware. Rounding off should be applied only as described below:

15.3.2.1 If the figure following those to be retained is less than 5, the figure is dropped, and the retained figures are kept unchanged.

15.3.2.2 If the figure following those to be retained is greater than 5, the figure is dropped, and the last retained figure is raised by 1.

15.3.2.3 If the figure following those to be retained is 5, and if there are no figures other than zeros beyond the five, the figure is dropped, and the last-place figure retained is increased by one if it is an odd number or it is kept unchanged if an even number.

15.4 Data Reporting

15.4.1 Many report options are available to clients of AMRO. It is AMRO policy to discuss with all clients their reporting requirements soon after receipt of the samples. Attachment 32 is a list of the QC report levels and the requirements for each level. It must be determined prior to sample receipt or shortly after the reporting requirements in order for the analysts to provide the required documentation. The data reviewers also require the QC level information in order to prepare the report package. The cover letter for the data reports will address any quality control problems, either with the condition of the samples upon receipt or with the analyses, or contain a statement that no quality control problems were encountered. This letter is an integral part of the data report and a statement indicating this is incorporated in the text of the letter.

15.4.2 Even though there is some customizing of reports, all reports contain the following information:

15.4.2.1 Date(s) of sampling, date sample was received in the laboratory, date sample was prepared, and date(s) which analysis(es) was performed.

15.4.2.2 A copy of the Chain of Custody for the project

15.4.2.3 The client's ID given to the samples and AMRO's ID numbers.

15.4.2.4 Which analyses were performed on the sample(s).

15.4.2.5 The results are listed on the report with the units of measure used.

15.4.2.6 The EPA method number is also included on the final report. An "M" after the method code indicates the laboratory uses a modified version of the method. Modifications are available upon request.

15.4.3 Listed below is the default reporting limits used by AMRO with units. These reporting limits are based on optimum sample size and typical sample matrix. ***All analytes listed below are not reported on all AMRO reports for all methods. Consult the laboratory to determine the exact analyte lists for particular methods. Reporting limits are subject to change. Do not include these lists in QAPP's without consulting the laboratory for current reporting lists and limits.***

AMRO Environmental Laboratories Corp. Reporting Limits
Organic Reporting Limits

Volatile Organics (GC/MS)

Analyte	Reporting Limit (µg/L) Aqueous	Reporting Limit (µg/L) Low Level Aqueous	Reporting Limit (µg/Kg) Low Level Soils/Solids *	Reporting Limit (µg/Kg) Medium Level Soils/Solids *
1,1,1,2-Tetrachloroethane	2	1	5	25
1,1,1-Trichloroethane	2	1	5	25
1,1,2,2-Tetrachloroethane	2	1	5	25
1,1,2-Trichloroethane	2	1	5	25
1,1-Dichloroethane	2	1	5	25
1,1-Dichloroethene	1	1	5	25
1,1-Dichloropropene	2	1	5	25
1,2,3-Trichlorobenzene	2	1	5	25
1,2,3-Trichloropropane	2	1	5	25
1,2,4-Trichlorobenzene	2	1	5	25
1,2,4-Trimethylbenzene	2	1	5	25
1,2-Dibromo-3-chloropropane	5	2	5	125
1,2-Dibromoethane (EDB)	2	1	5	25
1,2-Dichlorobenzene	2	1	5	25
1,2-Dichloroethane	2	1	5	25
1,2-Dichloroethene (cis)	2	1	5	25
1,2-Dichloroethene (trans)	2	1	5	25
1,2-Dichloropropane	2	1	5	25
1,3,5-Trichlorobenzene	2	1	5	25
1,3,5-Trimethylbenzene	2	1	5	25
1,3-Dichloropropane	2	1	5	25
1,3-Dichlorobenzene	2	1	5	25
1,4-Dichlorobenzene	2	1	5	25
1.4-Dioxane	50	50	250	250
2,2-Dichloropropane	2	1	5	25
2-Butanone (MEK)	10	5	25	250
2-Chloroethylvinylether	10	5	N/A	N/A
2-Chlorotoluene	2	1	5	25
2-Hexanone	10	5	25	250
4-Chlorotoluene	2	1	5	25
4-Isopropyltoluene	2	1	5	25
4-Methyl-2-Pentanone (MIBK)	10	5	25	250
Acetone	10	25	50	250

* Soil/Solid reporting limits are based on 100% dry weight. Actual sample reporting limits will vary based on sample moisture content.

** Analyte available only in limited methods.

Volatile Organics (GC/MS)

Analyte	Reporting Limit (µg/L) Aqueous	Reporting Limit (µg/L) Low Level Aqueous	Reporting Limit (µg/Kg) Low Level Soils/Solids *	Reporting Limit (µg/Kg) Medium Level Soils/Solids *
Acrolein**	75	N/A	N/A	N/A
Acrylonitrile**	10	N/A	N/A	N/A
Benzene	1	1	5	25
Bromobenzene	2	1	5	25
Bromochloromethane	2	1	5	25
Bromodichloromethane	2	1	5	25
Bromoform	2	1	5	50
Bromomethane	2	1	5	50
Chloroethane	5	2	5	50
Carbon Disulfide	2	1	5	50
Carbon tetrachloride	2	1	5	50
Chlorobenzene	2	1	5	50
Chloroform	2	1	5	25
Chloromethane	5	2	5	50
cis-1,2-Dichloroethene	2	1	5	25
cis-1,3-Dichloropropene	1	1	5	25
Dibromochloromethane	2	1	5	25
Dibromomethane	2	1	5	25
Dichlorodifluoromethane	5	2	5	50
Diethyl Ether**	5	5	5	250
Diisopropyl ether**	2	1	5	25
Ethylbenzene	2	1	5	25
Ethyl tertiary butyl ether**	2	1	5	25
Hexachlorobutadiene	2	1	5	50
Isopropylbenzene	2	1	5	25
Methyl-tert-butyl ether (MTBE)	2	1	5	25
Methylene Chloride	5	2	25	50
n-Butylbenzene	2	1	5	25
n-Propylbenzene	2	1	5	25
Naphthalene	5	1	5	50
sec-Butylbenzene	2	1	5	25
Styrene	2	1	5	25
tert-Butylbenzene	2	1	5	25
Tetrachloroethene	2	1	5	25

* Soil/Solid reporting limits are based on 100% dry weight. Actual sample reporting limits will vary based on sample moisture content.

** Analyte available only in limited methods.

Volatile Organics (GC/MS)

Analyte	Reporting Limit (µg/L) Aqueous	Reporting Limit (µg/L) Low Level Aqueous	Reporting Limit (µg/Kg) Low Level Soils/Solids *	Reporting Limit (µg/Kg) Medium Level Soils/Solids *
Tetrahydrofuran**	10	10	5	250
Tertiary amyl methyl ether**	2	1	5	25
Tertiary Butanol	20	20	100	2,500
Toluene	2	1	5	25
trans-1,3-Dichloropropene	1	1	5	25
trans-1,4-Dichloro-2-butene	2	2	5	50
Trichloroethene	2	1	5	25
Trichlorofluoromethane	2	1	5	50
Vinyl Acetate**	10	N/A	N/A	N/A
Vinyl Chloride	2	1	5	25
Xylene (o)	2	1	5	25
Xylene (m&p)	2	1	5	25

* Soil/Solid reporting limits are based on 100% dry weight. Actual sample reporting limits will vary based on sample moisture content.

** Analyte available only in limited methods.

Volatile Organics (GC/MS)
EPA Method 524.2

Analyte	Reporting Limit (µg/L) Aqueous
1,1,2-Tetrachloroethane	0.5
1,1,1-Trichloroethane	0.5
1,1,2,2-Tetrachloroethane	0.5
1,1,2-Trichloroethane	0.5
1,1-Dichloroethane	0.5
1,1-Dichloroethene	0.5
1,1-Dichloropropene	0.5
1,2,3-Trichlorobenzene	0.5
1,2,3-Trichloropropane	0.5
1,2,4-Trichlorobenzene	0.5
1,2,4-Trimethylbenzene	0.5
1,2-Dibromo-3-chloropropane	2
1,2-Dibromoethane	0.5
1,2-Dichlorobenzene	0.5
1,2-Dichloroethane	0.5
1,2-Dichloropropane	0.5
1,3,5-Trimethylbenzene	0.5
1,3-Dichlorobenzene	0.5
1,3-Dichloropropane	0.5
1,4-Dichlorobenzene	0.5
2,2-Dichloropropane	0.5
2-Chlorotoluene	0.5
4-Chlorotoluene	0.5
4-Isopropyltoluene	0.5
Acrylonitrile	0.5
Benzene	0.5
Bromobenzene	0.5
Bromochloromethane	0.5
Bromodichloromethane	0.5
Bromoform	0.5
Carbon disulfide	1
Carbon tetrachloride	0.5
Chlorobenzene	0.5
Chloroethane	0.5
Chloroform	0.5
Chloromethane	0.5

Volatile Organics (GC/MS)
EPA Method 524.2

Analyte	Reporting Limit (µg/L) Aqueous
cis-1,2-Dichloroethene	0.5
cis-1,3-Dichloropropene	0.5
Dibromochloromethane	0.5
Dibromomethane	0.5
Dichlorodifluoromethane	0.5
Ethylbenzene	0.5
Hexachlorobutadiene	0.5
Isopropylbenzene	0.5
m,p-Xylene	0.5
Methyl tert-butyl ether	0.5
Methylene chloride	0.5
n-Butylbenzene	0.5
n-Propylbenzene	0.5
Naphthalene	0.5
o-Xylene	0.5
sec-Butylbenzene	0.5
Styrene	0.5
tert-Butylbenzene	0.5
Tetrachloroethene	0.5
Toluene	0.5
trans-1,2-Dichloroethene	0.5
trans-1,3-Dichloropropene	0.5
Trichloroethene	0.5
Trichlorofluoromethane	0.5
Vinyl chloride	0.5
Acetone	10
2-Butanone	10
2-Hexanone	10
4-Methyl-2-pentanone	10
Tetrahydrofuran	5
Tertiary butanol	10
Diisopropylether	1
Diethyl ether	1

Semivolatile Organics (GC/MS)

Analyte	Reporting Limit (µg/L) Aqueous	Reporting Limit (µg/Kg) Soils/Solids *
1,2,4-Trichlorobenzene	10	250
1,2-Dichlorobenzene	10	250
1,3-Dichlorobenzene	10	250
1,4-Dichlorobenzene	10	250
2,4,5-Trichlorophenol	10	250
2,4,6-Trichlorophenol	10	250
2,4-Dichlorophenol	10	250
2,4-Dimethylphenol	10	250
2,4-Dinitrophenol	20	500
2,4-Dinitrotoluene	10	250
2,6-Dinitrotoluene	10	250
2-Chloronaphthalene	10	250
2-Chlorophenol	10	250
2-Methylnaphthalene	10	250
2-Methylphenol	10	250
2-Nitroaniline	20	500
2-Nitrophenol	10	250
3,3'-Dichlorobenzidine	10	250
3-Nitroaniline	20	500
4,6-Dinitro-2-Methylphenol	20	500
4-Bromophenylphenyl Ether	10	250
4-Chloro-3-Methylphenol	20	500
4-Chloroaniline	10	250
4-Chlorophenyl-Phenylether	10	250
4-Methylphenol	10	250
4-Nitroaniline	20	500
4-Nitrophenol	20	500
Acenaphthene	10	250
Acetophenone	10	250
Aniline	10	250
Acenaphthylene	10	250
Anthracene	10	250

* Soil/Solid reporting limits are based on 100% dry weight. Actual sample reporting limits will vary based on sample moisture content.

Semivolatile Organics (GC/MS)

Analyte	Reporting Limit (µg/L) Aqueous	Reporting Limit (µg/Kg) Soils/Solids *
Azobenzene	10	250
Benzidine	20	500
Benzo(a)Anthracene	10	250
Benzo(a)Pyrene	10	250
Benzo(b)Fluoranthene	10	250
Benzo(g,h,i)Perylene	10	250
Benzo(k)Fluoranthene	10	250
Benzoic Acid	20	500
Benzyl Alcohol	20	500
Bis(2-Chloroethoxy)Methane	10	250
Bis(2-Chloroethyl)Ether	10	250
Bis(2-Chloroisopropyl)Ether	10	250
Bis(2-Ethylhexyl)Phthalate	10	250
Butylbenzylphthalate	10	250
Carbazole	10	250
Chrysene	10	250
Di-n-Butylphthalate	10	250
Di-n-Octyl Phthalate	10	250
Dibenzo(a,h)Anthracene	10	250
Dibenzofuran	10	250
Diethylphthalate	10	250
Dimethyl Phthalate	10	250
Fluoranthene	10	250
Fluorene	10	250
Hexachlorobenzene	10	250
Hexachlorobutadiene	10	250
Hexachlorocyclopentadiene	10	250
Hexachloroethane	10	250
Indeno(1,2,3-c,d)Pyrene	10	250
Isophorone	10	250
N-Nitroso-Di-n-Propylamine	10	250
N-Nitrosodimethylamine**	20	500
N-Nitrosodiphenylamine	10	250
Naphthalene	10	250
Nitrobenzene	10	250

* Soil/Solid reporting limits are based on 100% dry weight. Actual sample reporting limits will vary based on sample moisture content.

** Analyte available only in limited methods.

Semivolatile Organics (GC/MS)

Analyte	Reporting Limit (µg/L) Aqueous	Reporting Limit (µg/Kg) Soils/Solids *
Pentachlorophenol	20	500
Phenanthrene	10	250
Phenol	10	250
Pyrene	10	250
Pyridine**	20	500

Polynuclear Aromatic Hydrocarbons (GC/MS – 8270)

Analyte	Reporting Limit (µg/L) Aqueous	Reporting Limit (µg/L) Aqueous 8270 SIM Only	Reporting Limit (µg/L) Soils/Solids* 8270 SIM Only
Naphthalene	10	0.1	10
2-Methylnaphthalene	10	0.1	10
Acenaphthylene	10	0.1	10
Acenaphthene	10	0.1	10
Fluorene	10	0.1	10
Phenanthrene	10	0.1	10
Anthracene	10	0.1	10
Fluoranthene	10	0.1	10
Pyrene	10	0.1	10
Benzo[a]anthracene	10	0.1	10
Chrysene	10	0.1	10
Benzo[b]fluoranthene	10	0.1	10
Benzo[k]fluoranthene	10	0.1	10
Benzo[a]pyrene	10	0.1	10
Dibenzo[a,h]anthracene	10	0.1	10
Benzo[g,h,i]perylene	10	0.1	10
Indeno[1,2,3-cd]pyrene	10	0.1	10

* Soil/Solid reporting limits are based on 100% dry weight. Actual sample reporting limits will vary based on sample moisture content.

** Analyte available only in limited methods.

Organochlorine Pesticides (GC/ECD)

Analyte	Reporting Limit (µg/L) Aqueous	Reporting Limit (µg/Kg) Soils/Solids *
4,4´-DDD	0.0128	1.6
4,4´-DDE	0.0128	1.6
4,4´-DDT	0.0128	1.6
Aldrin	0.0064	0.8
alpha-BHC	0.0064	0.8
alpha-Chlordane	0.0064	0.8
beta-BHC	0.0064	0.8
delta-BHC	0.0064	0.8
Dieldrin	0.0128	1.6
Endosulfan I	0.0064	0.8
Endosulfan II	0.0128	1.6
Endosulfan sulfate	0.0128	1.6
Endrin	0.0128	1.6
Endrin aldehyde	0.0128	1.6
Endrin ketone	0.0128	1.6
gamma-BHC	0.0064	0.8
gamma-Chlordane	0.0064	0.8
Heptachlor	0.0064	0.8
Heptachlor epoxide	0.0064	0.8
Methoxychlor	0.064	8
Technical Chlordane	0.2	25
Toxaphene	0.2	25

* Soil/Solid reporting limits are based on 100% dry weight. Actual sample reporting limits will vary based on sample moisture content.

Polychlorinated Biphenyls (GC/ECD)

Analyte	Reporting Limit (µg/L) Aqueous	Reporting Limit (µg/Kg) Soils/Solids *	Reporting Limit (µg/Wipe) Wipe	Reporting Limit (mg/Kg) Oils
PCB-1016	0.2	25	1.0	5
PCB-1211	0.2	25	1.0	5
PCB-1232	0.2	25	1.0	5
PCB-1242	0.2	25	1.0	5
PCB-1248	0.2	25	1.0	5
PCB-1254	0.2	25	1.0	5
PCB-1260	0.2	25	1.0	5
PCB-1262	0.2	25	1.0	5
PCB-1268	0.2	25	1.0	5

* Soil/Solid reporting limits are based on 100% dry weight. Actual sample reporting limits will vary based on sample moisture content.

Hydrocarbon Fingerprinting (GC/FID)

Analyte	Reporting Limit (mg/L) Aqueous	Reporting Limit (µg/Kg) Soils/Solids *
Gasoline	0.05	50
Kerosene	0.05	50
Mineral Spirits	0.05	50
Fuel Oil #2/Diesel	0.05	50
Motor Oil/Hydraulic Oil	0.1	100
Unidentified Hydrocarbons	0.2	100

DIESEL RANGE ORGANICS (GC/FID)

Analyte	Reporting Limit (mg/L) Aqueous	Reporting Limit (µg/Kg) Soils/Solids *
Fuel Oil #2/Diesel	0.05	50

DIESEL RANGE ORGANICS (GC/FID) Maine

Analyte	Reporting Limit (mg/L) Aqueous	Reporting Limit (mg/Kg) Soils/Solids *
Fuel Oil #2/Diesel	0.05	5

Extractable Total Petroleum Hydrocarbons (ETPH) (GC/FID) -Connecticut

Analyte	Reporting Limit (mg/L) Aqueous	Reporting Limit (µg/Kg) Soils/Solids *
Extractable TPH (C9 - C36)	0.10	50

* Soil/Solid reporting limits are based on 100% dry weight. Actual sample reporting limits will vary based on sample moisture content.

Hydrocarbon Fingerprinting (P&T/GCMS)

Analyte	Reporting Limit (mg/L) Aqueous	Reporting Limit (mg/Kg) Soils/Solids *
Gasoline	0.1	2.5
Mineral Spirits	0.1	1.2

GASOLINE RANGE ORGANICS (GC/FID) Maine

Analyte	Reporting Limit (mg/L) Aqueous	Reporting Limit (mg/Kg) Soils/Solids *
Gasoline	0.01	0.25

Volatile Petroleum Hydrocarbon (VPH) Analysis
MA-DEP September 2004 Method 1.1

Analyte	Reporting Limit (µg/L) Aqueous	Reporting Limit (mg/Kg) Soils/Solids *
C5-C8 Aliphatics	100	100
C9-C12 Aliphatics	100	100
C9-C10 Aromatics	100	100
Methyl-tert-butylether	1	2
Benzene	1	2
Toluene	1	2
Ethylbenzene	1	2
M,P- Xylene	1	2
o- Xylene	1	2
Naphthalene	2	2

* Soil/Solid reporting limits are based on 100% dry weight. Actual sample reporting limits will vary based on sample moisture content.

Extractable Petroleum Hydrocarbon (EPH) Analysis
MADEP September, 2004 Method 1.1

Test Parameter	Reporting Limit (µg/L) Aqueous	Reporting Limit (µg/L) Aqueous SIM Only**	Reporting Limit (mg/Kg) Soils/Solids *	Reporting Limit (mg/Kg) Soils/Solids * SIM Only**
C9-C18 Aliphatics	100	N/A	10	N/A
C19-C36 Aliphatics	100	N/A	10	N/A
C11-C22 Aromatics*	100	N/A	10	N/A
Acenaphthene	2	0.1	0.1	0.025
Acenaphthylene	2	0.1	0.1	0.025
Anthracene	2	0.1	0.1	0.025
Benzo(a)Anthracene	2	0.1	0.1	0.025
Benzo(a)Pyrene	2	0.1	0.1	0.025
Benzo(b)Fluoranthene	2	0.1	0.1	0.025
Benzo(g,h,i)Perylene	2	0.1	0.1	0.025
Benzo(k)Fluoranthene	2	0.1	0.1	0.025
Chrysene	2	0.1	0.1	0.025
Dibenzo(a,h)Anthracene	2	0.1	0.1	0.025
Fluoranthene	2	0.1	0.1	0.025
Fluorene	2	0.1	0.1	0.025
Indeno(1,2,3-cd)Pyrene	2	0.1	0.1	0.025
Naphthalene	2	0.1	0.1	0.025
Phenanthrene	2	0.1	0.1	0.025
Pyrene	2	0.1	0.1	0.025
2-Methylnaphthalene	2	0.1	0.1	0.025

N/A= Not Applicable

* Soil/Solid reporting limits are based on 100% dry weight. Actual sample reporting limits will vary based on sample moisture content.

** Analyte available only in limited methods.

Metal's Reporting Limits

Element	AQUEOUS 200.7 6010B/3010A ICP µg/L	SOIL 6010B/3050 ICP mg/kg *	SOIL 6010B/3051 ICP mg/kg *	AQUEOUS 200 Series 7000 Series /3010A GFAA µg/L	SOIL 7000 Series/ 3050/ 3051 GFAA mg/kg *	AQUEOUS 245.1/7470 Mercury µg/L	SOIL 7471 Mercury mg/kg *
Aluminum	200	25	25				
Antimony	20	5	5	5	1		
Arsenic	50	6.3	6.3	5 (2)**	1		
Barium	200	25	25				
Beryllium	4	0.63	0.63				
Boron	250	31	31				
Cadmium	4	0.5	0.5	2(1)**	0.25		
Calcium	2500	310	310				
Chromium	10	1.3	1.3				
Cobalt	50	6.3	6.3				
Copper	25	3.2	3.2				
Iron	100	13	13				
Lead	25 (12)**	6.3	6.3	5 (1)**	1		
Lithium	100	13	13				
Magnesium	2500	310	310				
Manganese	15	1.9	1.9				
Molybdenum	25	3.2	3.2				
Nickel	40	5	5				
Potassium	2500	310	310				
Selenium	80	15	15	5	1		
Silver	7	1.8	1.8	1	0.1		
Sodium	2500	310	310				
Strontium	10	1.3	1.3				
Thallium	50	6.3	6.3	2	1		
Tin	250	31	31				
Titanium	100	13	13				
Vanadium	50	6.3	6.3				
Zinc	20	5	5				
Mercury						0.2	0.05

* Soil/Solid reporting limits are based on 100% dry weight. Actual sample reporting limits will vary based on sample moisture content.

** These reporting limits are available for special projects or if requested by the client.

Wet Chemistry Reporting Limits

ANALYSES	METHOD NUMBER Aqueous	METHOD NUMBER Soil	REPORTING LIMIT Aqueous mg/L	REPORTING LIMIT ** Soil mg/Kg
Alkalinity	SM2320B	N/A	5	--
Alkalinity	310.2	N/A	10	--
Ammonia	SM4500-NH3, C	SM4500-NH3 M	1	50
BOD	SM-5210B	N/A	2	--
CBOD	SM-5210B	N/A	2	--
Bromide	300	9056	04	20
COD (low)	Hach 8000/5220D	N/A	20	--
COD (high)	Hach 8000/5220D	N/A	50	--
Chloride	SM 4500-Cl, C	9252A	5	250
Chloride	300	9056	0.5	25
Chlorine, Total Residual	SM 4500-Cl G	N/A	0.2	--
Cyanide, Total	SM 4500-CN C,E/9010/9014	9010B/9014	0.01	0.5
Cyanide, Amenable	SM 4500-CN C,E9010/9014	9010B/9014	0.01	0.5
Fluoride	340.2/4500 F C/300	9056	0.1	5
Flashpoint/Ignitability	1010	1010 M	200° F	200° F
Hardness	6010/SM 2340B*	N/A	33	--
Hexavalent Chromium	3500-CR D	N/A	0.01	--
Kjeldahl Nitrogen, Total	SM4500-NH3, C	SM4500-NH3 M	1	50
Nitrate	300	9056	0.2	10
Nitrite	300	9056	0.2	10
Nitrite	354.1	354.1 M	0.01	0.5
Oil & Grease, Grav.	413.1M/1664A	N/A	5	--
Oil & Grease, IR	413.2 M	5520C SM	0.5	35
Orthophosphate	300	9056	0.5	25
Orthophosphate	SM 4500-P E	SM 4500-P E M	0.01	0.5
Paint Filter Test	N/A	9095A	--	--
Petroleum Hydrocarbon, Total IR	418.1 M	5520C SM/418.1M	0.5	35
PH/Corrosivity	SM4500-H,B	9045C	--	--
Phosphorus	SM 4500-P E	365.2 M	0.01	0.5
Phenol	420.1	9065	0.05	2.5
Reactive Cyanide	SW-846 7.3.3.2	SW-846 7.3.3.2	20	20
Reactive Sulfide	SW-846 7.3.4.2	SW-846 7.3.4.2	100	100
Settleable Solids	160.5	N/A	0.10 mL/L/hr	--
Silica	4500-Si E M	N/A	1	--
Specific Conductivity	120.1	9050A M	1	1
Sulfate	ASTM D516-02	9030A	5	250

* Hardness by ICP

** Soil/Solid reporting limits are based on 100% dry weight. Actual sample reporting limits will vary based on sample moisture content.

Wet Chemistry Reporting Limits

ANALYSES	METHOD NUMBER Aqueous	METHOD NUMBER Soil	REPORTING LIMIT Aqueous mg/L	REPORTING LIMIT ** Soil mg/Kg
Sulfate	300	9056	1	50
Sulfide	376.1	N/A	1	--
Sulfite	377.1	N/A	2	--
Total Dissolved Solids	2540 C	N/A	10	--
Total Solids	160.3	2540G	10	--
Total Suspended Solids	2540 D	N/A	4	--
Turbidity	180.1	N/A	1	--

* Hardness by ICP

** Soil/Solid reporting limits are based on 100% dry weight. Actual sample reporting limits will vary based on sample moisture content.

15.5 Records Management

15.5.1 Permanent Records:

15.5.1.1 Permanent Records are identified as records that meet one or more of the following criteria:

- Are of significant value for demonstrating safe operation; for determining the cause of accidents or malfunctions; and for maintaining, reworking, repairing, or modifying structures, items, systems or equipment;
- Pertain to environment, hazardous systems, or material disposal (waste management and environmental monitoring);
- Provide required baseline data for in-service maintenance, monitoring, inspection, or reconstruction of facilities or equipment;
- Are required by local, state, or federal statutes;
- Are identified by the client as a quality-related document.

15.5.1.2 Permanent records shall be retained for the life of the activity.

15.5.2 Non-Permanent Records:

15.5.2.1 Non-permanent records are those that are required to be maintained for a set time period. The records provide objective evidence that an activity was performed in accordance with specified requirements that may not be designated in the lifetime records.

15.5.3 Storage:

15.5.3.1. Records shall be stored in a manner that precludes deterioration, larceny and vandalism. The QA Manager shall assure that all records are stored in a location constructed and maintained in a manner which minimizes the risk of damage or destruction from natural disasters, such as winds, floods, or fires; environmental conditions, such as high and low temperatures and humidity; and infestation of insects, mold or rodents. Prevention of damage to special records (e.g., radiographs, photographs, negatives, microfilm, and magnetic media) from excessive light, dust, stacking and electromagnetic fields shall be of prime consideration when placing these special records in long-term storage facilities.

15.5.3.2 All records (including those pertaining to calibration and test Equipment), certificates and reports shall be stored and held secure and in confidence to the client. AMRO shall retain these records for a minimum of 5 years.

15.5.3.3 Records needed for reference on a routine basis may be stored in office files. Official records of the projects that are not needed on a routine basis shall be retired and stored. These activities shall be documented and include a complete listing of all records (Attachments 33 and 34).

15.6 Records Transfer

15.6.1 In the event that AMRO Environmental Laboratories Corporation transfers ownership or goes out of business the following steps will be in effect:

15.6.1.1 The owners of AMRO will agree in writing, before the transfer of ownership takes place to be accountable and liable for analyses, data and reports generated up to the time of legal transfer of ownership.

15.6.1.2 The buyer must agree in writing to be accountable and liable for any analyses, data and reports generated after the legal transfer of ownership occurs.

15.6.1.3 All records and analyses performed pertaining to accreditation will be kept for a minimum of 10 years.

15.6.1.4 The owners of AMRO will send an official notification to all clients announcing either the change of ownership or going out of business. The letter of notification will be mailed at least thirty days in advance.

SECTION 16. CONFIDENTIALITY AND PROPRIETARY RIGHTS

AMRO has a strict policy in place for protecting a client's right to confidentiality and any proprietary information that AMRO may learn in the course of performing analyses for a client. Results for any analysis are only released to the client of record who has submitted the samples, authorized the testing or is responsible for the payment of the services rendered. Any request for information from any other party is refused until AMRO has obtained written permission from the client of record to release data to another party. In addition, AMRO personnel will not discuss the nature of a client's samples with anyone except the client of record. AMRO personnel are informed of this policy upon employment at AMRO. Any intentional infraction of this policy would be considered cause for immediate dismissal.

SECTION 17. AUDITS AND CERTIFICATIONS

17.1 System Audits

A system audit is an on-site review of the laboratory's quality assurance practices and operating procedures. AMRO has agreed to audits by various government agencies and clients when requested.

17.2 Performance Evaluation Audits

Performance audits provide a systematic check of the quality of the laboratory data and of the measurement systems. AMRO participates in blind laboratory performance evaluations for the analytes in Potable and Non-Potable Water as well as Solid and Hazardous Waste. These studies are obtained from the State of New York and other approved proficiency test providers twice per year. Results are evaluated and sent to appropriate regulatory agencies.

17.3 Internal Audits

Internal audits for each analysis include checking, verification and documentation of all aspects of each analysis. Internal audits are performed annually or as needed in the event an out-of-control situation are discovered. Corrective Action Report and Status (CARS) are initiated and completed as a result of any audit findings. Follow up of out-of-control situations is performed until the analysis is determined to be in-control. The QA Manager keeps internal audits on file.

The items checked include the following:

17.3.1 Initial Demonstration of Lab Performance

17.3.1.1 Method Detection Limit studies of each analyte must be reported annually for each instrument, column, matrix, and extraction method. They are verified for completeness, proper documentation and accuracy.

17.3.1.2 Precision and Accuracy in the laboratory is assessed initially by the analyses of a minimum of 4 replicate samples at a mid-level point of the expected range. The percent recoveries and Relative Standard Deviations (RSD) are evaluated and compared to method specifications or default limits where applicable. They are verified for completeness, proper documentation and accuracy

17.3.2 Initial Calibration – verify all criteria met per method requirements.

17.3.3 Continuing Calibration – verify all method criteria met.

17.3.4 Blanks – verify all analytes below the MDL check (approximately 2 time the MDL) or method specified criteria or flagged if not.

17.3.5 Laboratory Control Samples – verify all recoveries acceptable and that the correct limits are applied.

17.3.6 Matrix Spike/Matrix Spike Duplicates - verify all recoveries acceptable and that the correct limits are applied.

17.3.7 Duplicates – verify all RPDs within acceptance limits.

17.3.8 Surrogates - verify all recoveries acceptable and that the correct limits are applied.

17.3.9 Internal Standards - verify all recoveries acceptable and that the correct limits are applied.

17.3.10 Control Limits – verify that correct limits are in use.

17.3.11 Maintenance – verify that maintenance documented and frequency is correct.

17.3.12 Training – verify training is on file and current for each analyst for the analyses performed.

17.3.13 Logbooks – verify they are filled out correctly and completely.

17.4 External Audits

The State of New Hampshire audits AMRO every two years to NELAC July 2003 Standards. Certifying authorities and clients also conduct audits per their requirements. All areas of the laboratory participate in these audits. Any deviations observed during any audit are investigated and corrected as needed.

17.5 Data Integrity Audits

Data Integrity Audits are performed in conjunction with the Internal Audits. Selected samples and QC data are subjected to more in depth scrutiny which includes examining raw data and ensuring that any manual manipulation of the data was done appropriately. Approximately 5% of the data throughout the lab is reviewed in depth. If any problem is encountered during this audit an investigation is started to determine if there is an on-going problem or an isolated incident. Corrective Action Report and Status (CARS) are initiated and completed as a result of any audit findings. Any employee found to be manipulating data inappropriately is subject to disciplinary action including dismissal.

17.6 Certifications

AMRO is currently certified to perform analyses in the following states for the following categories:

State/Program	Category
Connecticut (PH-0758)	Drinking Water/Wastewater Soil
Maine (NH-012)	Drinking Water/Wastewater
Massachusetts (M-NH-012)	Drinking Water/Wastewater
New Hampshire (1001)	Drinking Water/Non-potable water/ Solid and Hazardous Waste
New Jersey (NH005)	Solid and Hazardous Waste
New York (11278)	Non-potable water/ Solid and Hazardous Waste
Pennsylvania (68-01257)	Non-potable water/ Solid and Hazardous Waste

A copy of each of the certificates and/or approved analytes lists is available upon request.

SECTION 18. RECORD RETENTION AND DATA ARCHIVING

18.1 Data Security and Archiving

Once the data is reported, a copy of the final report and invoice are kept on file at our laboratory for at least 3 months. After 3 months, reports may be moved to an offsite storage facility.

18.2 Forms

All Master Forms are stored under the qc directory. The QA/QC Manager controls these forms. All forms are identified by name, date and revision number. Edits are submitted to the QA/QC Manager, completed, reviewed by the appropriate section head and updated in the Master Control Logbook.

18.3 Logbooks

All Logbooks are inventoried by the QA/QC Manager. Only one logbook is opened for any specific purpose at a time. Edits to logbooks are made using the procedure indicated in 18.2.

18.4 SOP's

SOP's are controlled by the QA/QC Manager. They are identified by title, revision number and revision date. Control copies are distributed to the appropriate section heads. Non-control copies are available upon request from the QA/QC Manager. SOP's are considered proprietary and are provided to outside sources only if necessary. Distribution is tracked and documented with the master copy of each SOP.

18.5 Certificates

Original Certificates provided from state agencies are displayed in the front lobby area of the laboratory. They are updated as provided.

SECTION 19. REFERENCES

1. Code of Federal Regulations; (40 CFR) Part 136, Appendix A and Appendix B.

2. Method for Chemical Analysis of Water and Wastes; U.S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Cincinnati, OH, 1983; EPA-600/4/79-020.

3. Standard Methods for the Examination of Water and Wastewater; 19th Edition; American Public Health Association, Washington, DC, 1995.

4. Methods for the Determination of Metals in Environmental Samples; EPA-600/4-91-010, June 1991.

5. Methods for the Determination of Metals in Environmental Samples – Supplement I; EPA-600/R-94/111, May 1994.

6. Technical Notes on Drinking Water Methods, EPA/600/R94-173, October 1994.

7. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods; Third Edition and its Updates; U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response, Washington, DC, 1996; SW-846.

8. Good Automated Laboratory Practices, August 1995.

9. NELAC Quality Systems Manual, July, 2003.

10. EPA, "Methods for Determination of Organic Compounds in Drinking Water", Supplement III, August 1995.

11. Department of Defense Quality Systems Manual For Environmental Laboratories, Version 4.1, 4/22/2009.

12. Massachusetts Contingency Plan (MCP), September 10, 2004.

13. Method for Determining Diesel Range Organics-Maine, 4.1.25, 09/06/95.

14. Method for Determining Gasoline Range Organics-Maine, 4.1.17, 09/06/95.

15. MA Department of Environmental Protection 310CMR 42.08.

AMRO ENVIRONMENTAL LABORATORIES CORPORATION

ETHICS AND DATA INTEGRITY AGREEMENT

I. I,_____, state that I understand the high standards of integrity required of me with regard to the duties I perform and the data I report in connection with my employment at AMRO Environmental Laboratories Corporation.

II. I agree that in the performance of my duties at AMRO Environmental Laboratories Corporation

a. I shall not intentionally report data values that are not the actual values. obtained;

b. I shall not intentionally report the dates and times of data analyses that are not the actual dates and times of data analyses; and

c. I shall not intentionally represent another individual's work as my own.

III. I agree to inform AMRO Environmental Laboratories Corporation of any accidental reporting of non-authentic data by myself in a timely manner.

IV. I agree to inform AMRO Environmental Laboratories Corporation of any accidental or intentional reporting of non-authentic data by other employees.

V. I understand that disciplinary action and criminal penalties can result from unethical behavior. I understand that ethical behavior is a requirement of continued employment.

_____
(Signature)

_____
(Date)

AMRO Environmental Laboratories Corporation
111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

QUALIFICATION CARD

Trainee: _____ Signature: _____

Trainer: _____ Signature: _____

I. Knowledge Factors:

SOP Title: _____ Revision Number/Date: _____

1. Did the Trainee read and understand the above SOP? Yes☐ No☐ NA☐
2. Was the Trainee instructed on how to properly fill out the documentation? Yes☐ No☐ NA☐
3. Has the Trainee been instructed on the proper procedures for addressing potential problems? Yes☐ No☐ NA☐

II. Practical Factors:

1. Has the Trainee completed a Precision and Accuracy Study? Yes☐ No☐ NA☐
2. Has the Trainee completed an acceptable Performance Evaluation sample? Yes☐ No☐ NA☐
3. Did the Trainee completed an acceptable Laboratory Control Sample (LCS)? Yes☐ No☐ NA☐

Completion Date: _____ Trainer's Signature: _____

I_____have read, understood and follow the above method/SOP, which is in use at AMRO Laboratories for the analysis of samples under the National Environmental Laboratory Accreditation Program, have met the Demonstration of Capability.

Section Manager/ Supervisor: _____ Date: _____

QA Manager: _____ Date: _____

Preservation reagent requirements and volumes for bottle preparation.
1.0 ml disposable pipettes are used.

TYPE OF ANALYSIS	CONTAINER WATER	PRESERVATION WATER	CONTAINER SOIL/SEDIMENTS/ SLUDGES
524.2	2 x 40 mL VOA vials	10 drops (3 mg) Sodium Thiosulfate, sample, then 5 drops HCl to pH<2	-
524.2/w/ vinyl chloride	2 x 40 mL VOA vials	1 scoop (25 mg) ascorbic acid, sample, then 5 drops HCl to pH<2	-
624/8260	2 x 40 mL VOA vials	5 drops HCl to pH <2,	2x40 mL VOA vials with Methanol/ Teflon lid
624/8260 w/ Residual Chloride	2 x 40 mL VOA vials	10 drops (3 mg) Sodium Thiosulfate, sample then 5 drops HCl to pH <2,	–
TCLP/SPLP Volatiles	3 x 40 mL VOA vials	None	2 oz glass w/ Teflon lid
VPH 1.1	2 x 40 mL VOA vials	5 drops HCl to pH <2	2x40 mL VOA vials with Methanol/ Teflon lid
8015 GRO	2 x 40 mL VOA vials	5 drops HCl to pH <2	2x40 mL VOA vials with Methanol/ Teflon lid
504.1	3 x 40 mL VOA vials	10 drops (3 mg) Sodium Thiosulfate	-
608 Pest/PCB	2x1 liter amber glass **	None	-
8081/Pest./8082/PCB	2x1 liter amber glass **	None	4 oz glass jar
TCLP Pesticide	1 liter amber glass	None	8 oz glass jar
625/8270BNA/Acid/BN	2x1 liter amber glass **	None	4 oz glass jar
8270 PAH	2x1 liter amber glass **	None	4 oz glass jar
TCLP Semivolatiles	1 liter amber glass	None	8 oz glass jar
EPH 1.1	2x1 liter amber glass **	H2SO4 or HCl to pH <2; 3mL	4 oz amber glass jar *
TPH-GC/8015 DRO	2x1 liter amber glass **	H2SO4 or HCl to pH <2; 3mL	4 oz glass jar
ETPH- CT	2x1 liter amber glass**	None	250 ml widemouth glass jar with Teflon lined lid
Mercury	250 mL Poly *	1 pipettes (4 mL) HNO3 to pH<2	4 oz glass jar *
Metals except Mercury	250 mL Poly *	4 pipettes (3 mL) HNO3 to pH<2	4 oz glass jar *
TCLP/SPLP Metals	1 Liter Poly *	None	8 oz glass jar *

* = In some cases multiple analyses can be taken from the same jar. Consult the lab for further instructions.
** = Additional bottles needed for QC.

TYPE OF ANALYSIS	CONTAINER WATER	PRESERVATION WATER	CONTAINER SOIL/SEDIMENTS / SLUDGES
Hexavalent Chromium	500 mL Poly - NO ACID!	None	-
pH	100 mL Poly bottle	None	4 oz glass jar
Acidity/Alkalinity	250 mL Poly Bottle	None	-
Ammonia	500 mL Poly Bottle	1 mL H2SO4 to pH <2	4 oz glass jar
BOD and CBOD	1000 mL Poly or Glass jar	None	-
COD	100 mL Poly or glass jar	5 drops H2SO4 to pH <2	-
Color	100ml	None	-
Chloride	250 mL Poly Bottle	None	4 oz glass jar
Chlorine, Total Residual	250 mL Poly Bottle	None	8 oz glass jar
Cyanide, Total and Amenable.	250 mL amber glass jar	½ pipette (0.5 mL) NaOH to pH>12 & large scoop (0.5 grams) Ascorbic Acid	4 oz amber glass jar
Flash point/ Ignitability	250 mL glass jar/separate	None	8 oz glass jar/separate
Fluoride	250 mL Poly Bottle	None	-
Formaldehyde***	500 mL glass	None	-
Hardness	250 mL Poly or glass jar	1 pipette (4 mL) HNO3 to pH<2	4 oz glass jar
Total Kjeldahl Nitrogen	500 mL Poly Bottle	½ pipette (0.5 mL) H2SO4 to pH <2	4 oz glass jar
Nitrate	250 mL Poly bottle	None	4 oz glass jar
Nitrate/Nitrite	250 mL Poly Bottle	1 drop H2SO4 to pH <2	4 oz glass jar
Nitrite	250 mL Poly bottle	None	4 oz glass jar
Oil and Grease – Grav.	2x 1 Liter Glass jar **	1 pipette (4 mL) H2SO4 to pH<2	4 oz glass jar (IR only)
TPH –Grav.	2x 1 Liter Glass jar**	1 pipette (4 mL) H2SO4 to pH<2	4 oz glass jar
Total Organic Carbon***	40 mL VOA vial	5 drops HCl to pH <2	4 oz Glass jar
Orthophosphate	250 mL Poly Bottle	None	4 oz glass jar
Dissolved Oxygen	BOD bottle/1 Liter glass	None/1 mL H2SO4	-
Phenol	1 Liter Glass Bottle	1 mL H2SO4 to pH <2	4 oz glass jar
Total Phosphorus	250 mL Poly bottle	¼ pipette (0.25 mL) H2SO4 to pH<2	4 oz glass jar
Total Residue	250 mL Poly Bottle	None	4 oz glass jar
Filterable Residue	250 mL Poly Bottle	None	-
Non-Filterable Residue (TSS)	250 mL Poly Bottle	None	-
Settleable Residue	1 Liter Poly Bottle	None	-
Volatile Residue	500 mL Poly Bottle	None	4 oz glass jar
Silica	250 mL Poly Bottle	None	-
Specific Conductivity	250 mL Poly Bottle	None	4 oz glass jar
Sulfate	250 mL Poly bottle	None	4 oz glass jar
Sulfide	500 mL Poly bottle	4 drops 2N Zn acetate/ 100 mL & (1.0 mL) NaOH to pH>9	-

* = In some cases multiple analyses can be taken from the same jar. Consult the lab for further instructions.
** = Additional bottles needed for QC.
***= subcontracted

TYPE OF ANALYSIS	CONTAINER WATER	PRESERVATION WATER	CONTAINER SOIL/SEDIMENTS / SLUDGES
Sulfite	250 mL Poly Bottle	None	4 oz glass jar
Surfactants***	250 mL Poly Bottle	None	-
Turbidity	250 mL Poly bottle	None	-

* = In some cases multiple analyses can be taken from the same jar. Consult the lab for further instructions.
** = Additional bottles needed for QC.
***= subcontracted

AMRO TABLE OF CONTAINERS, PRESERVATIVES AND HOLDING TIMES

TYPE OF ANALYSIS	CONTAINER WATER	PRESERVATION WATER	CONTAINER SOIL/SEDIMENTS/ SLIUDGES	PRES SOIL	HOLDING TIME WATER/SOIL
624/8260/524.2/8021	2 - 40 mL VOA vials	HCl to pH <2, 4°C	2 x 40 mL VOA vials/Methanol w/ Teflon lid	4°C	14 Days/14 Days
TCLP/SPLP Volatiles	3 - 40 mL VOA vials	-	2 oz glass w/ Teflon lid		14 Days/14 Days
VPH 1.1	2 - 40 mL VOA vials	HCl to pH <2, 4°C	2 x 40 mL VOA vials/Methanol w/ Teflon lid	4°C	14 Days/28 Days
8015/GRO/GRO Maine	2 - 40 mL VOA vials	HCl to pH <2, 4°C	2 x 40 mL VOA vials/Methanol w/ Teflon lid	4°C	14 Days/14 Days
504.1	3 - 40 mL VOA vials	3 mg Na2S2O3	-	-	14 Days
608 Pest/PCB	2x1 liter amber glass **	pH 5 -9 , 4°C	-	-	7 Days
8081/Pest.	2x1 liter amber glass **	4°C	4 oz glass jar	4°C	7 Days/14 Days
8082/PCB	2x1 liter amber glass **	4°C	4 oz glass jar	4°C	7 Days/14 Days
TCLP Pesticide	1 liter amber glass	4°C	8 oz glass jar	4°C	7 Days/14 Days
625/8270BNA/Acid/BN	2x1 liter amber glass **	4°C	4 oz glass jar	4°C	7 Days/14 Days
8270 PAH	2x1 liter amber glass **	4°C	4 oz glass jar	4°C	7 Days/14 Days
TCLP Semivolatiles	1 liter amber glass	4°C	8 oz glass jar	4°C	14 Days/14 Days
EPH 1.1	2x1 liter amber glass **	H2SO4 or HCl to pH <2, 4°C	4 oz amber glass jar*	4°C	14 Days/7 Days
TPH-GC/8015B DRO/DRO Maine	2x1 liter amber glass **	H2SO4 or HCl to pH <2, 4°C	4 oz glass jar	4°C	7 Days/14 Days
ETPH -CT	2x1 liter amber glass **	4°C	250 mL widemouth glass jar with Teflon lined lid	4°C	7 Days/14 Days
Mercury/TCLP Mercury	250 mL Poly *	HNO3 to pH<2	4 oz glass jar *	4°C	28 Days
Metals except Mercury	500 mL Poly *	HNO3 to pH<2	4 oz glass jar *	-	180 Days
TCLP/SPLP Metals	1 Liter Poly *	4°C	8 oz glass jar *	4°C	180 Days
Hexavalent Chromium	500 mL Poly - NO ACID!	4°C	4 oz glass jar	4°C	24 hours / 30 days
pH	250 mL Poly bottle	(4°C)	4 oz glass jar	(4°C)	ASAP water/(soil)
Acidity/Alkalinity	250 mL Poly Bottle	4°C	-	-	14 Days
Ammonia	500 mL Poly Bottle	H2SO4 to pH <2, 4°C	4 oz glass jar	4°C	28 Days
BOD	1 Liter Poly or Glass jar	4°C	-	-	48 Hours
COD	120 mL Poly or glass jar	H2SO4 to pH <2, 4°C	-	-	28 days
Color	100ml	4°C	-	-	48 Hours
Chloride	250 mL Poly Bottle	-	4 oz glass jar	-	28 Days
Chlorine, Total Residual	250 mL Poly Bottle	(4°C)	8 oz glass jar	4°C	ASAP water/(soil)
Cyanide, Total and Amenable And Free	250 mL Poly or glass jar	NaOH to pH>12, Ascorbic Acid, 4°C	4 oz amber glass jar	4°C	14 Days
Flash point/Ignitability	8 oz glass jar/separate	4°C	8 oz glass jar/separate	4°C	None Specified
Fluoride (DW)	250 mL Poly Bottle	(4°C)	-	-	28 Days
Fluoride (WW)	1 Liter Poly Bottle	(4°C)	-	-	28 Days
Formaldehyde***	500 mL glass	4°C	-	-	72 hours
Hardness	250 mL Poly or glass jar	HNO3 to pH<2	4 oz glass jar	4°C	6 months
Total Kjeldahl Nitrogen	500 mL Poly Bottle	H2SO4 to pH <2, 4°C	4 oz glass jar	4°C	28 Days
Nitrate	250 mL Poly bottle	4°C	4 oz glass jar	4°C	48 Hours
Nitrate/Nitrite	250 mL Poly Bottle	H2SO4 to pH <2, 4°C	4 oz glass jar	4°C	28 Days
Nitrite	250 mL Poly bottle	4°C	4 oz glass jar	4°C	48 hours
Oil and Grease - Grav.	2x 1 Liter Glass jar **	H2SO4 to pH<2, 4°C	4 oz glass jar (IR only)	4°C	28 Days
TPH – Grav.	1 Liter Glass jar	H2SO4 to pH<2, 4°C	4 oz glass jar	4°C	28 Days
Total Organic Carbon***	40 mL VOA vial	H2SO4 to pH <2, 4°C	4 oz glass jar	4°C	28 Days
Orthophosphate	250 mL Poly Bottle	4°C	4 oz glass jar	4°C	48 hours
Dissolved Oxygen	BOD Bottle/1 liter glass jar	(4°C) / 1mL H2SO4	-	-	IMMEDIATELY/ 8 Hours
Phenol	1 Liter Glass Bottle	H2SO4 to pH <2, 4°C	4 oz glass jar	4°C	28 Days
Total Phosphorus	250 mL Poly bottle	H2SO4 to pH <2, 4°C	4 oz glass jar	4°C	28 Days
Total Residue (TS)	250 mL Poly Bottle	4°C	4 oz glass jar	4°C	7 Days/(7 Days)
Filterable Residue (TDS)	250 mL Poly Bottle	4°C	-	-	7 Days
Nonfilterable Residue (TSS)	250 mL Poly Bottle	4°C	-	-	7 Days
Settleable Residue	1 Liter Poly Bottle	4°C	-	-	48 Hours
Volatile Residue (TVS)	500 mL Poly Bottle	4°C	4 oz glass jar	4°C	7 Days
Silica	250 mL Poly Bottle	4°C	-	--	28 Days
Specific Conductivity	250 mL Poly Bottle	4°C	4 oz glass jar	4°C	28 Days
Sulfide	500 mL Poly bottle	4 drops 2N Zn acetate/100mL, NaOH (1.0mL) to pH>9, 4°C	-	-	7 Days
Sulfate	250 mL Poly bottle	4°C	4 oz glass jar	4°C	28 Days
Sulfite	250 mL Poly Bottle	4°C	4 oz glass jar	4°C	IMMEDIATELY
Surfactants ***	250 mL Poly Bottle	4°C	-	-	48 Hours
Turbidity	250 mL Poly Bottle	4°C	-	-	48 Hours

* = In some cases multiple analyses can be taken from the same jar. Consult the lab for further instructions.
** = Additional bottles needed for QC. ***= Subcontracted ( ) indicates AMRO internal criteria.

AMRO Environmental Laboratories Corp. Sample Acceptance Policy

This sample acceptance policy outlines the circumstances when samples shall be accepted or rejected by the Lab. Data from any samples which do not meet the following criteria will be flagged. An explanation of all flagged data will be in a case narrative included with the final report. This policy is available to sample collection personnel and includes, but is not limited to, the following areas of concern:

a) full, and complete documentation (Chain of Custody), which shall include the client's name, address, turnaround time, sample identification, the location, date and time of collection, container's description, requested analyses, collector's name, preservation type, sample type and any special remarks concerning the sample;

b) proper sample labeling to include unique identification using durable labels (water resistant) and the use of indelible ink. Special instructions for sampling Methanol and Sodium Bisulfate vials is provided, (see Sampling Instructions Memo)

c) Use of appropriate sample containers, with proper preservation, temperature of samples upon receipt, (see Table of containers, preservatives and holding times)

d) Adherence to specified holding times (see Table of containers, preservatives and holding times)

e) Adequate sample volume. Sufficient sample volume must be available to perform the necessary tests;

f) When samples are found to be unacceptable for any reason an email or fax will be sent to the client. The Sample Receiving Technician will list the problems with the samples and the client is requested to let AMRO know, by email or fax, what action should be taken with the samples and if the laboratory should continue with the analyses. The client must answer by email or sign and date this form with any further instructions to the laboratory and return to the laboratory.

g) AMRO can not proceed with any analyses until all issues are resolved and the laboratory receives proper written authorization.

AMRO Environmental Laboratories Corporation
111 Herrick Street
Merrimack, NH 03054

CHAIN-OF-CUSTODY RECORD

59407

Office: (603) 424-2022
Fax: (603) 429-8496
web: www.amrolabs.com

Project No.:	Project Name:	Project State:	Project Manager:	Samplers (Signature):	AMRO Project No.:

P.O.#:	Results Needed by:
QUOTE #:	Seal Intact? Yes No N/A

Sample ID.:	Date/Time Sampled	Matrix	Total # of Cont. & Size	Comp.	Grab	REQUESTED ANALYSES	Remarks
Preservative: CI-HCl, MeOH, N-HN03, S-H2SO4, Na-NaOH, O- Other							

Send Results To:

PRIORITY TURNAROUND TIME AUTHORIZATION
Before submitting samples for expedited TAT, you must *have a coded AUTHORIZATION NUMBER*
AUTHORIZATION No.: BY:

METALS 8 RCRA ☐ 13 PP ☐ 23 TAL ☐ 14 MCP ☐
Method: 6010 ☐ 200.7 ☐ Other Metals:
Dissolved Metals Field Filtered? YES ☐ NO ☐

PHONE #: FAX #:
E-mail:

MCP Presumptive Certainty Required? YES ☐ NO ☐

MCP Methods Needed: YES ☐ NO ☐

Required Reporting Limits: S-1 ☐ GW-1 ☐ S-2 ☐ GW-2 ☐ S-3 ☐ GW-3 ☐ Other:

Relinquished By:	Date/Time	Received By

AMRO report package level needed:

EDD required:

Please print clearly, legibly and completely. Samples can not be logged in and the turnaround time clock will not start until any ambiguities are resolved.

Samples arriving after 12:00 noon will be tracked and billed as received on the following day.

AMRO policy requires notification in writing to the laboratory in cases where the samples were collected from highly contaminated sites.

KNOWN SITE CONTAMINATION:

White: Lab Copy Yellow: Client Copy

SHEET OF

AMROCOC2004, Rev.3 08/18/04

AMRO Environmental Laboratories Corporation
111 Herrick Street
Merrimack, NH 03054

Project Number Assignment Log

AMRO Project Number	Date Received	Time Received	Client Name	Comment

AMRO Environmental
Laboratories Corporation

SAMPLE RECEIPT CHECKLIST

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

Client: _____ AMRO ID: _____
Project Name: _____ Date Rec.: _____
Ship via: (circle one) Fed Ex., UPS , AMRO Courier, Date Due: _____
Hand Del., Other Courier, Other:

Items to be Checked Upon Receipt	Yes	No	NA	Comments
1. Army Samples received in individual plastic bags?				
2. Custody Seals present?				
3. Custody Seals Intact?				
4. Air Bill included in folder if received?				
5. Is COC included with samples?				
6. Is COC signed and dated by client?				
7. Laboratory receipt temperature. TEMP =				
Samples rec. with ice___ ice packs___ neither____				
8. Were samples received the same day they were sampled?				
Is client temperature = or <6°C ?				
If no obtain authorization from the client for the analyses.				
Client authorization from: Date: Obtained by:				
9. Is the COC filled out correctly and completely?				
10. Does the info on the COC match the samples?				
11. Were samples rec. within holding time?				
12. Were all samples properly labeled?				
13. Were all samples properly preserved?				
14. Were proper sample containers used?				
15. Were all samples received intact? (none broken or leaking)				
16. Were VOA vials rec. with no air bubbles?				
17. Were the sample volumes sufficient for requested analysis?				
18. Were all samples received?				
19. VPH and VOA Soils only:				
Sampling Method VPH (circle one): M=Methanol, E=EnCore (air-tight container)				
Sampling Method VOA (circle one): M=Methanol, SB=Sodium Bisulfate, E=EnCore, B=Bulk				
If M or SB:				
Does preservative cover the soil?				
If NO then client must be faxed.				
Does preservation level come close to the fill line on the vial?				
If NO then client must be faxed.				
Were vials provided by AMRO?				
If NO then weights MUST be obtained from client				
Was dry weight aliquot provided?				
If NO then fax client and inform the VOA lab ASAP.				
20. Subcontracted Samples:				
What samples sent:				
Where sent:				
Date:				
Analysis:				
TAT:				
21. Information entered into:				
Internal Tracking Log?				
Dry Weight Log?				
Client Log?				
Composite Log?				
Filtration Log?				

Received By: Date: Logged in By: Date:
Labeled By: Date: Checked By: Date:

NA= Not Applicable

AMRO Environmental
Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

Please Circle if:
Sample= Soil
Sample= Waste

AMRO ID: ____________

Sample ID	Analysis	Volume Sample	Preserv. Listed	Initial pH*	Acceptable? Y or N	List Preserv. Added by AMRO	Solution ID # of Preserv.	Volume Preservative Added	Final adjusted pH	Final adjusted pH (after 16 or 24 hours)

** = if the laboratory preserves the drinking water sample (s) for EPA Method 200 series, sample (s) should be held at least 16 hours prior to analysis or 24 hours for water sample (s).*

pH Checked By: ____________ Date: ________ pH adjusted By: ____________ Date: ________

pH Checked By: ____________ Date: ________ pH adj.(16 or 24hrs)By: ____________ Date: ________

AMRO Environmental Laboratories Corporation
111 Herrick Street
Merrimack, NH 03054
Phone: 603-424-2022
Fax: 603-429-8496

DATE:_____

TO: _____

_____

RE: SAMPLES RECEIVED **AMRO #:** _____

DATE RECEIVED:_____ **CHAIN OF CUSTODY #:**_____

PROJECT NAME:_____

THE FOLLOWING SAMPLES WERE NOT RECEIVED IN ACCEPTABLE CONDITION AS PER THE ANALYTICAL METHOD (S) REQUESTED:

SAMPLE ID	PROBLEM

SIGNATURE OF SAMPLE TECHNICIAN: _____

IF YOU WISH US TO CONTINUE WITH THE REQUESTED ANALYSES FOR THIS/THESE SAMPLE (S), PLEASE SIGN, DATE AND FAX THIS FORM BACK TO US. WE WILL HOLD THIS/THESE SAMPLE (S) PENDING YOUR RESPONSE. THANK YOU.

_____	_____	_____
DATE	**COMPANY NAME**	**SIGNATURE PROJECT MANAGER**

AMRO Internal Chain of Custody Form

1201056

Client: AMRO Environmental Lab. Corp.
Date Received: 1/25/2012

Project Name: DI Water
Date Due: 2/1/2012

Sample ID	Stored	Bottles	Bottle Type	Test	MS	Comments	Date / Time Out	By	Date / Time In
1201056-01B		1	500PHNO3	200.9_AS	☐				
					☐				
1201056-01B		1	500PHNO3	200.9_PB	☐				
					☐				
1201056-01B		1	500PHNO3	200.9_SE	☐				
					☐				
1201056-01B		1	500PHNO3	200_PREP, 200.7	☐				
					☐				
1201056-01A		1	500PU	E120.1 COND	☐				
					☐				
1201056-01B		1	500PHNO3	HG_245.1 PREP, HG_245.1	☐				
					☐				
1201056-01A		1	500PU	SM4500 PH	☐				
					☐				
1201056-01A		1	500PU	SM4500-CL RES	☐				

Comments:

1201056

Incoming Notice Form

Client Name: _____

Project ID: _____

Contact Person: _____

Number samples to be rec.: _____

Matrix: _____

Analyses: _____

Expected Date to be Rec.: _____

Turn Around Time: _____

QC Deliverable Requirements: _____

Other Information:

Information Rec. by: _____ Date: _____

Date Samples Received: _____

AMRO Environmental Laboratories Corporation
111 Herrick Street
Merrimack, NH 03054
Phone: (603) 424-2022
Fax: (603) 429-8496

Customer/Contact

Project

Chain-of custody #

Fax Number Date

In response to customer requests and state regulations. AMRO is informing you that the following methods are being substituted with the GC/MS method which covers the same analyte list.

1. EPA Method 601 analyte list will be analyzed as EPA Method 624.
2. EPA Method 602 analyte list will be analyzed as EPA Method 624.
3. SW-846 Method 8010 analyte list will be analyzed as SW-846 Method 8260B.
4. SW-846 Method 8020 analyte list will be analyzed as SW-846 Method 8260B.
5. SW-846 Method 8021 analyte list will be analyzed as SW-846 Method 8260B
6. SW-846 Method 8240 analyte list will be analyzed as SW-846 Method 8260B.
7. SW-846 Method 8100PAH analyte list will be analyzed as SW-846 Method 8270CPAH.
8. SW-846 Method 8100TPH analyte list will be analyzed as SW-846 Method 8015BMod.

AMRO feels that the GC/MS provides more reliable and accurate data.

The price billed for the analysis is for the method requested on the chain-of-custody, not for the method that AMRO is using.

If you feel that the substitutions do not suit your purposes, please contact us to provide you with alternative services.

Please sign and return this fax if the substitution for your project is acceptable.

Signature Date:

AMRO EQUIPMENT/INSTRUMENT LIST

Instrument Name	Manufacturer's Name	Serial Number	Purchase Date	Date Placed In Service	Location	Condition
Ion Chromatography DX-120	Dionex Corporation	901099	9/26/2000	9/26/2000	Wet Chemistry	New
pH Meter	VWR Scientific	SympHony SB20	7/1/2001	7/1/2001	Wet Chemistry	New
Muffle Furnace F62700	Barnstead International	120031	5/28/2002	6/4/2002	Organic Extraction	New
Conductivity Meter	Fisher	022241	7/1/2002	7/5/2002	Wet Chemistry	New
3D Floor Shaker	Glas-Col	VS5504	5/20/2003	6/13/2003	Organic Extraction	New
Purge &Trap 6890 GC FID/PID (V6)	Agilent	VS10404045	2/17/2004	3/1/2004	VOA Section	New
Model 8000-DSE Autoclave	NAPCO	34002704	1/27/2005	2/4/2005	Micro Section	New
Swift Microscope	Swift	SM-80	1/20/1995	2/15/1995	Micro Section	Used
Vapodest 20 Distilling Unit	Gerhardt	VAP 003967	10/1/2003	10/9/2003	Wet Chemistry	New
Ion Chromatography ICS-2000	Dionex Corporation	5041158	5/11/2005	5/11/2005	Wet Chemistry	New
Colony Counter	Reichert	01004-1205	2/3/2006	2/3/2006	Micro Section	New
Isotemp Water Bath	Fisher	1597051107865.00	2/3/2006	2/3/2006	Micro Section	New
Microwave Digestion System	CEM	600122 Mars	3/15/2006	3/17/2006	Metals	New
pH Meter	Thermo Electron Corp.	10527	12/12/2006	12/12/2006	Wet Chemistry	New
Dell PowerEdge T610 Server	Dell		7/1/2008	7/1/2008	Computer Room	New
Tecator Digestion System 20 1015	Tecator	5244	10/1/2009	10/1/2009	Wet Chemistry	Used
Perkin Elmer AAnalyst600	Perkin Elmer	600S9120301	12/15/2009	1/5/2010	Metals	New

AMRO Environmental Laboratories Corporation
111 Herrick Street
Merrimack, NH 03054

CHEMICAL RECEIVING LOG

DATE REC.	AMRO ID	CHEMICAL	MFG.	LOT #	AMOUNT	STORAGE	EXP. DATE	DISP. DATE

AMRO Environmental Laboratories Corporation
111 Herrick Street
Merrimack, NH 03054

INORGANIC STANDARD LOG

Analysis	Prep. Date	Prep. By	Standard	AMRO ID ("A" Number)	Amount Used (mLs or g)	Final Vol. (mLs)	Reagent used/ ID Number	Final Conc. (mg/L)	Stardard/LCS ID ("S" Number)	Exp. Date	Storage

Mercury Standard Log

Storage: Hg Hood

Standard ID	Manufacturer	Lot No.	Expiration Date	Stock Conc.	Analyst
Hg Calib. Stock ID				5000 µg/L	
Hg ICV Stock ID				20,000 µg/L	
Hg Calib. Stock ID				5000 µg/L	
Hg ICV Stock ID				20,000 µg/L	
Hg Calib. Stock ID				5000 µg/L	
Hg ICV Stock ID				20,000 µg/L	
Hg Calib. Stock ID				5000 µg/L	
Hg ICV Stock ID				20,000 µg/L	
Hg Calib. Stock ID				5000 µg/L	
Hg ICV Stock ID				20,000 µg/L	
Hg Calib. Stock ID				5000 µg/L	
Hg ICV Stock ID				20,000 µg/L	
Hg Calib. Stock ID				5000 µg/L	
Hg ICV Stock ID				20,000 µg/L	
Hg Calib. Stock ID				5000 µg/L	
Hg ICV Stock ID				20,000 µg/L	
Hg Calib. Stock ID				5000 µg/L	
Hg ICV Stock ID				20,000 µg/L	
Hg Calib. Stock ID				5000 µg/L	
Hg ICV Stock ID				20,000 µg/L	
Hg Calib. Stock ID				5000 µg/L	
Hg ICV Stock ID				20,000 µg/L	
Hg Calib. Stock ID				5000 µg/L	
Hg ICV Stock ID				20,000 µg/L	
Hg Calib. Stock ID				5000 µg/L	
Hg ICV Stock ID				20,000 µg/L	
Hg Calib. Stock ID				5000 µg/L	
Hg ICV Stock ID				20,000 µg/L	
Hg Calib. Stock ID				5000 µg/L	
Hg ICV Stock ID				20,000 µg/L	

ICP Calibration Standard S1 = S1-mmddyy.

This standard is also the Continuing Calibration Verification Standard (CCV) = CV-mmddyy and the Initial Performance Check
(IPC) = IPC-mmddyy.

To a presoaked 1,000-ml volumetric flask, add 50 mL of HCL and 10 mL of HNO3. Then add 5.0 ml of AMRO CAL/CCV 1 (A02446), 5.0 ml of AMRO CAL/CCV 2 (A02447), and 5.0 mL of AMRO CAL/CCV 3 (A02448). Dilute to volume with DI and transfer to a polyethylene bottle for storage. This solution is stable for up to six months following preparation.

Date	Analyst	ID	Exp. Date	HNO3 ID	HCl ID

Daily Calibration Standard at 25.0µg/L = S25mmddyy.

To a 100-mL volumetric flask, add 2 mL of HCl and 2 mL of HNO3. Then pipette 0.50 mL of Intermediate Calibration Standard and dilute to volume. This standard is prepared weekly or daily for Army Corp work.

Prep Date	Analyst	ID	Expiration Date	INTCAL ID

AMRO Environmental Laboratories Corporation
111 Herrick Street
Merrimack, NH 03054

INORGANIC REAGENT LOG

Analysis	Prep. Date	Reagent	AMRO ID ("A" Number)	Amount Used (mLs or g)	Final Vol. (mLs)	Final Conc. (mg/L)	Reagent ID ("R" Number)	Exp. Date	Storage	Prep. By

STANDARD I.D. INDEX

Standard I.D.	Section of Log	Brief Description

AMRO Environmental Laboratories Corporation
111 Herrick Street
Merrimack, NH 03054

STANDARD LOG - STOCK SOLUTIONS
ORGANIC SECTION

Date Opened/Prep'd	Open/Prep'd by	Compound Name	Receipt/Stock ID	Source	Conc. or Purity	Amt g or µl	Final Vol. (ml)	Solvent ID/ number	Final Conc.	Units µg/µl or µg/ml	Solution ID	Storage Loc.	Exp. Date

NOTE: 1) AMRO Stock ID is "V" or "S", date prepared plus a letter suffix (110498B is the second stock prepared on 11/04/98).
2) Vials must be labeled with compound name, conc., and AMRO stock ID, and exp. date.

AMRO Environmental Laboratories Corporation
111 Herrick Street
Merrimack, NH 03054

STANDARD LOG - WORKING STANDARDS
ORGANIC SECTION

Date Opened/Prep'd	Open/Prep'd by	Compound Name	Receipt/Stock ID	Source	Conc. or Purity	Amt. (µl)	Final volume (ml)	Solvent ID/ number	Final Conc.	Units ng/µl or µg/ml	Sol'n ID	Storage Loc.	Exp. Date

Notes: 1) AMRO working Std. ID is "V" or "S", date prepped, letter suffix(110498C is the third working std prepared on 11/04/98)

2) Vials must be labeled with the compound name, conc., AMRO ID, and exp. Date

MDL (Method Detection Limit) Checklist
Start-up (yes / no), Start up new analyst? (yes or no), Start up new instrument? (yes or no)?
Start-up on a new instrument must be approved by QA Manager before client data is released.
Start-up on a new analyst must be approved by Section manager before analyzing independently.

***(Reviewer's)*Name:_____On: ___/___/___**
Information required on MDL data sheet (fill in appropriate information or verify completed):

Instrument ID:_____
Analysis Method #:_____
Matrix(Aqueous/Soil/Methanol):_____
Prep Method/Prepped by/ Prep date:_____/_____/_____
File Name(s):_____
Analyst name:_____
Analysis date(s) – must be analyzed within holding time_____
Analytes (circle one: full list/subset – ID subset)_____

Student t-test value used – must be correct for number of replicates used to calc. MDL. Formula for SD is "n-1"
t value 3.143 for 7 QC's / 2.998 for 8 QC's _____
Minimum 7 replicates – report all replicates unless documented assignable cause for not using data_____
All values in at least 3 significant figures _____
Data - with units – explain if not in proper units for the matrix_____
Mean – with units_____
Standard deviation _____
MDL – with units, must be in proper units for the matrix_____
Percent Recovery_____

Complete one: Method required concentration used per Sect. _____ of Method _____ or
MDL conc. = 1-5x est. MDL

The Laboratory Reporting Limit must be at least three times the MDL or greater

MDL meets method criteria per Sect._____ of Method _____ where applicable
Outliers? If yes, assignable cause(s)?_____
Math Spot Check(s) & Transcription (cite analyte(s) & file/ ID's):_____
(100% check required where spreadsheet is not used..)
Explanations/ support for anomalies/deviations:_____

Limitations of this MDL/ Plans for next MDL: _____

STORAGE: Orig. review and report sheets, copies of prep & analysis logs, & original raw data to instrument/Method MDL file.

Review of this MDL Study by Section Manager_____ on ___/___/___

Review of this MDL Study by QA Manager _____ on ___/___/___

P&A (Precision & Accuracy Checklist

Start-up (yes / no), Start up new analyst? (yes or no), Start up new instrument? (yes or no)?
Start-up on a new instrument must be approved by QA Manager before client data is released.
Start-up on a new analyst must be approved by Section manager before analyzing independently.

***(Reviewer's)*Name:_____On: ___/___/___**

Information required on P &A data sheet (fill in appropriate information or verify completed):

Instrument ID_____
Analysis Method #_____
Matrix(Aqueous/Soil/Methanol)_____
Prep Method/Prepped by/ Prep date_____/_____/_____
File Name(s)_____
Analyst name_____
Analysis date(s) – must be analyzed within holding time_____
Analytes (circle one: full list/subset – ID subset)_____

Minimum 4 replicates – report all replicates unless documented assignable cause for not using data_____
All values in at least 3 significant figures _____
Data - with units – explain if not in proper units for the matrix_____
Mean – with units_____
Standard deviation _____
MDL – with units, must be in proper units for the matrix_____
Percent Recovery_____
%RSD_____

Complete one: Method required concentration used per Sect. _____ of Method _____ or 10-50xMDL_____

Circle one: %Rec. meets method criteria per Sect._____ of Method _____ or meets Sensibility check
(ID ones out)

Circle one: SD(or %RSD) meets method criteria per Sect._____of Method _____ or sensibility check <50% RSD
*(ID ones out)*_____

Outliers? If yes, assignable cause(s)?_____

Math Spot Check(s) & Transcription (cite analyte(s) & file/ ID's):_____
(100% check required where spreadsheet is not used.)
Explanation of/support for Deviations/ Anomalies **&/or** qualifications for use:_____

STORAGE: originals to instrument/method P&A File; CC: Analyst(s) training file(s)
Review of this P&A Study by Section Manager _____ on ___/___/___

Review of this P&A Study by QA Manager _____ on ___/___/___

AMRO Environmental
Laboratories Corporation
111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

Corrective Actions Report and Status

Date Generated:

Finding ☐

CARS No.:

Recommendation ☐

Source No.:

Observation ☐

Description

Corrective Action

Responsible Person:

Scheduled Completion Date:

Status

Corrective Action Completed

Responsible Person:

Date:

Laboratory Director:

Date:

Quality Assurance:

Date:

AMRO Environmental
Laboratories Corporation
111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

Surveillance Report

Surveillance Leader: Surveillance No.:

Section: Surveillance Date:

Source No.:

Requirements or Activities to be verified	Compliance		Observations
	Yes	No	

Passed ☐

Failed ☐

Additional Surveillance Required Yes ☐ No ☐

Approvals

Quality Assurance: Date:

AMRO Environmental Laboratories Corporation
111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

Non-Conforming Data Report

NCD : Lab Order: : Client(s) : Section: Sample(s) Affected:	Date of Occurrence: Date Discovered: Discovered by:

Description of Non-Conforming Data

Resolution

Resolution Completed by: _____ Date: _____

Approvals

_____ Date: _____
Section Supervisor

_____ Date: _____
QA Manager

AMRO Environmental
Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

GC AND GC/MS DATA REVIEW CHECKLIST

LAB ORDER: _____ **CLIENT:** _____

Method:		**Sample(s) No.:**
Analysis:	**Matrix:**	**LIMS Batch ID:**
Date of Extraction/Preparation:		**Date of Analysis**

A. GENERAL

1.	Copy of Prep/Extraction Log?	Y	N	NA
2.	Copy of Instrument Run Log or Tune List?	Y	N	NA
3.	Copy of dry weight log present?	Y	N	NA
4.	Are all sample checked for preservation after VOA analysis?	Y	N	NA
5.	Are all VPH Soil sample received with mL Methanol/g soil 1:1 ±25% ?	Y	N	NA
6.	All samples met extraction and/or analysis holding time criteria?	Y	N	NA
7.	Did the Tune pass and DFTPP or BFB injected every 12 / 24 hours?	Y	N	NA
8.	Are the surrogate recoveries for each sample within the QC limits?	Y	N	NA
9.	Method Blank- contaminant free(<½RL)?	Y	N	NA
10.	Initial Calibration meets method criteria for all compounds reported?	Y	N	NA
11.	Continuing Calibration meets method criteria for all compounds reported?	Y	N	NA
12.	Are all reported results within calibration range?	Y	N	NA
13.	LCS % Recovery criteria met for all compounds?	Y	N	NA
14.	MS/MSD %R's and %RPD's are met for all compounds?	Y	N	NA
15.	%RPD criteria met between sample and duplicate?	Y	N	NA
16.	Samples checked for carry over from sample to sample due to target or nontarget overload?	Y	N	NA
17.	Were manual integrations performed properly?	Y	N	NA
18.	Are all data exported to LIMS, calculated and verified?	Y	N	NA

COMMENTS

Analyst (s) _____ DATE: _____

REVIEWER: _____ DATE OF REVIEW: _____

ICP DATA REVIEW CHECKLIST

LAB ORDER: _____ CLIENT: _____

Method:

Analysis:

A. GENERAL

1.	Copy of Digestion Log?	Y	N	NA
2.	Copy of ICP Checklist?	Y	N	NA
3.	Copy of LIMS Checklist?	Y	N	NA
4.	All samples met digestion and/or analysis holding time criteria?	Y	N	NA
5.	Initial Calibration Verification (ICV) meets method 6010 criteria: ±10%?	Y	N	NA
6.	Initial Calibration Verification (ICV) meets method 200.7 criteria: ±5%?	Y	N	NA
7.	Is the RL1 check QC at ±20%?	Y	N	NA
8.	Initial Calibration Blank (ICB) free of contamination?(<½RL)	Y	N	NA
9.	Continuing Calibration Verification(CCV) meets method 6010 criteria: ±10% ?	Y	N	NA
10.	Initial Performance Calibration(IPC) meets method 200.7 criteria: ±5% ?	Y	N	NA
11.	Continuing Calibration Blank(CCB) free of contamination?(<½RL)	Y	N	NA
12.	Are CCV and CCB analyzed after every 10 samples ?	Y	N	NA
13.	Is the Interference Check Solution %R between 80-120%?	Y	N	NA
14.	Was the serial dilution performed? If yes was %R= 90-110?	Y	N	NA
15.	Was post digestion performed? If yes was %R=75-125?	Y	N	NA
16.	Was the MSA performed?	Y	N	NA
17.	Method Blank- contaminant free(<½RL)?	Y	N	NA
18.	Are all reported results within linear range?	Y	N	NA
19.	LCS % Recovery criteria met for all compounds?	Y	N	NA
20.	MS/MSD %R's and %RPD's are met for all compounds?	Y	N	NA
21.	%RPD criteria met between sample and duplicate?	Y	N	NA
22.	Are all data exported to LIMS, calculated and verified?	Y	N	NA

COMMENTS

Analyst (s)_____ DATE: _____

REVIEWER: _____ DATE OF REVIEW: _____

GFAA and CVAA DATA REVIEW CHECKLIST

LAB ORDER: _____ CLIENT: _____

Method:

Analysis:

	A. GENERAL			
1.	Copy of Digestion Log?	Y	N	NA
2.	Copy of Instrument Run Log?	Y	N	NA
3.	All samples met digestion and/or analysis holding time criteria?	Y	N	NA
4.	Initial Calibration meets method criteria for GFAA, min. 3 std plus a blank? R >0.995	Y	N	NA
5.	Initial Calibration meets method criteria for CVAA, min. 5 std plus a blank? R >0.995	Y	N	NA
6.	Initial Calibration Verification (ICV) meets method criteria: ±10%?	Y	N	NA
7.	Is the RL1 check QC at ±20%?	Y	N	NA
8.	Initial Calibration Blank (ICB) free of contamination?(<½RL)	Y	N	NA
9.	Initial Performance Calibration(IPC) meets criteria: ±5% ?	Y	N	NA
10.	Continuing Calibration Verification(CCV) meets method criteria: ±10% ?	Y	N	NA
11.	Continuing Calibration Blank(CCB) free of contamination?(<½RL)	Y	N	NA
12.	Are CCV and CCB analyzed after every 10 samples ?	Y	N	NA
13.	Was post digestion performed? If yes was %R=85-115?	Y	N	NA
14.	Was the serial dilution performed? If yes was %R= 90-110?	Y	N	NA
15.	Method Blank- contaminant free(<½RL)?	Y	N	NA
16.	Are all reported results within calibration range?	Y	N	NA
17.	LCS % Recovery criteria met for all compounds?	Y	N	NA
18.	MS/MSD %R's and %RPD's are met for all compounds?	Y	N	NA
19.	%RPD criteria met between sample and duplicate?	Y	N	NA

COMMENTS

Analyst (s) _____ DATE: _____

REVIEWER: _____ DATE OF REVIEW: _____

WET CHEMISTRY DATA REVIEW CHECKLIST

LAB ORDER: _____ CLIENT: _____

Method:

Analysis:

	A. GENERAL			
1.	Copy of Digestion Log?	Y	N	NA
2.	Copy of Instrument Run Log?	Y	N	NA
3.	All samples met digestion and/or analysis holding time criteria?	Y	N	NA
4.	Initial Calibration meets method criteria?	Y	N	NA
5.	Initial Calibration Verification (ICV) meets method or laboratory criteria?	Y	N	NA
6.	Continuing Calibration Verification(CCV) meets method criteria?	Y	N	NA
7.	Continuing Calibration Verification analyzed after every 10 samples ?	Y	N	NA
8.	Method Blank- contaminant free (½RL)?	Y	N	NA
9.	Are all reported results within calibration range?	Y	N	NA
10.	LCS % Recovery criteria met for all compounds?	Y	N	NA
11.	MS/MSD %R's and %RPD's are met for all compounds?	Y	N	NA
12.	%RPD criteria met between sample and duplicate?	Y	N	NA

COMMENTS

Analyst (s) _____ DATE: _____

REVIEWER: _____ DATE OF REVIEW: _____

DATA REVIEW CHECKLIST

LAB ORDER: _____ CLIENT: _____

Section: VOA, VPH, SVO, EPH, GC, ICP, GFAA, CVAA, Gen. Chem.

Analysis:

A.	**GENERAL**			
1.	Is the QC checklist initialed by the Analyst(s) ?	Y	N	NA
2.	Are all forms present?	Y	N	NA
3.	Are the case narrative and log-book pages enclosed?	Y	N	NA
4.	Is the correct method used?	Y	N	NA
B.	**CASE NARRATIVE**			
1.	Does the case narrative contain problems as documented on the section checklist(s)?	Y	N	NA

OBSERVATIONS

DATA REVIEW CHECKLIST

LAB ORDER: _____ CLIENT: _____

OBSERVATIONS

RECOMMENDATIONS

OK AS IS ☐ OK WITH MODIFICATIONS (RESUBMIT) ☐ REJECT ☐ LAB MANAGER APPROVAL REQ'D ☐

REVIEWER: _____ DATE OF REVIEW: _____
REVIEWER: _____ DATE OF REVIEW: _____
REVIEWER: _____ DATE OF REVIEW: _____
QA Manager: _____ DATE OF REVIEW: _____

LAB. MANAGER'S APPROVAL

LAB MANGER: _____ DATE: _____

AMRO Report Packages

Level 1:

1. Cover Letter
2. Work Order Sample Summary
3. Dates Report
4. Chain-Of- Custody
5. Sample Receipt Checklist
6. LIMS Case Narrative (If Applicable)
7. State Certificate (If required)
8. Data Comment Page
9. Sample Results
10. Invoice

Level 2:

1. Cover Letter
2. Work Order Sample Summary
3. Dates Report
4. Chain-Of- Custody
5. Sample Receipt Checklist
6. State Certificate (If required)
7. Case Narrative
8. MCP Report (If Applicable)
9. Data Comment Page
10. Sample Results and Surrogates*
11. Method Blank (s)
12. Sample Matrix Spike/Matrix Spike Duplicate
13. Sample Duplicate (If Applicable)
14. Laboratory Control Sample
15. Invoice

Level 3:

1. Cover Letter
2. Work Order Sample Summary
3. Dates Report
4. Chain-Of- Custody
5. Sample Receipt Checklist
6. State Certificate (If required)
8. Case Narrative
9. MCP Report (If applicable)
10. Data Comment Page
11. Sample Results and Surrogates*
12. Method Blank (s) and Raw Data (Organic Only)
13. Sample Matrix Spike/Matrix Spike Duplicate
14. Sample Duplicate (If Applicable)
15. Laboratory Control Sample

* *Use flag if required by client (i.e. J, B, etc.)*

16. Initial and Continuing calibration Summaries
17. Internal Standard Summaries (GC/MS Only)
18. Raw Sample Data (If Required)
19. Miscellaneous Data:
    - 19.1 Dry Weight Sheet
    - 19.2 Extraction/Digestion logbook pages
20. Invoice

Level 4:

1. Cover Letter
2. Table Of Content
3. Work Order Sample Summary
4. Dates Report
5. Chain-Of- Custody
6. Sample Receipt Checklist
7. State Certificate (If required)
8. Case Narrative
9. MCP Report (If Applicable)
10. Data Comment Page
11. Sample Results and Surrogates*
12. Method Blank Summary
13. Method Blank (s) and Raw Data
14. Sample Matrix Spike/Matrix Spike Duplicate
15. Sample Duplicate (If Applicable)
16. Laboratory Control Sample
17. Tune (GC/MS Only)
18. T-List/Injection Log/ Sequence List
19. Initial and Continuing calibration Summaries
20. Internal Standard Summaries (GC/MS Only)
21. Serial Dilutions (Inorganic Only)
22. Interference Check Sample (Inorganic Only)
23. Raw Sample Data
24. Miscellaneous Data:
    - 24.1 Dry Weight Sheet
    - 24.2 Extraction/Digestion logbook pages
25. Invoice

* *Use flag if required by client (i.e. J, B, etc.)*

Level 4 NJ:

1. Cover Letter
2. Table Of Content
3. Work Order Sample Summary
4. Dates Report
5. Chain-Of-Custody
6. Sample Receipt Checklist
7. State Certificate (If required)
8. Case Narrative
9. Data Comment Page
10. Sample Results and Surrogates*
11. TIC Results after each sample results including method blank(s) (VOA and SVO Only)
12. Method Blank Summary
13. Method Blank (s) and Raw Data
14. Sample Matrix Spike/Matrix Spike Duplicate and Raw Data
15. Sample Duplicate (If Applicable) and Raw Data
16. Laboratory Control Sample and Raw Data
17. Tune (GC/MS Only)
18. T-List/Injection Log/ Sequence List (Organic Only)
19. Initial and Continuing calibration Summaries
20. Internal Standard Summaries (GC/MS Only)
21. Interference Check Sample (Inorganic Only)
22. Serial Dilutions (Inorganic Only)
23. Raw Sample Data
24. Miscellaneous Data:
    - 24.1 Dry Weight Sheet
    - 24.2 Extraction/Digestion logbook pages
    - 24.3 Analysis logbook pages
    - 24.4 Internal Chain-Of-Custody
25. Invoice

* *Use flag if required by client (i.e. J, B, etc.)*

Level 5: CLP/ CLP-like

1. Cover Letter
2. Table Of Content
3. Work Order Sample Summary
4. Dates Report
5. Chain-Of-Custody
6. Sample Receipt Checklist
7. State Certificate (If required)
8. Case Narrative
9. MCP Report (If Applicable)
10. Data Comment Page
11. Sample Results and Surrogates*
12. TIC Results after each sample results including method blank(s) (VOA and SVO Only)
13. Method Blank Summary
14. Method Blank (s) and Raw Data
15. Sample Matrix Spike/Matrix Spike Duplicate and Raw Data
16. Sample Duplicate (If Applicable) and Raw Data
17. Laboratory Control Sample and Raw Data
18. Tune (GC/MS Only) and Raw Data
19. T-List/Injection Log/ Sequence List
20. Initial and Continuing calibration Summaries and Raw Data
21. Internal Standard Summaries (GC/MS Only)
22. Pesticide Identification Summary for Single Component and Multicomponent analytes (Form 10)
23. Interference Check Sample (Inorganic Only)
24. Serial Dilutions (Inorganic Only)
25. Method Detection Limit (Inorganic Only)
26. Raw Sample Data
27. Miscellaneous Data:
    - 27.1 Dry Weight Sheet
    - 27.2 Extraction/Digestion logbook pages
    - 27.3 Analysis logbook pages
    - 27.4 Internal Chain-Of-Custody
28. Invoice

* *Use flag if required by client (i.e. J, B, etc.)*

Notes: All reports are paginated

STORAGE BOXES TRACKING LOG

BOX #	BOX CONTENTS	DATE SENT OUT	TAKEN BY	STORAGE LOCATION	COMMENTS

SIGN OUT STORAGE BOXES LOG

BOX #	ITEM/FOLDER	REQUESTED BY	DATE OUT	TAKEN BY	DATE BACK	STORAGE LOCATION	COMMENTS

AMRO Environmental Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

INTERIM CHANGE NOTIFICATION

SOP Number:	Revision Number:
SOP Tittle:	Revision Date:

Approvals

Section Supervisor/ Manager	Date:
Samir A. Naguib QA Manager	Date:

qc/qcmemos/Forms/ICN/Rev.0 06/01

AMRO Environmental Laboratories Corporation

111 Herrick Street, Merrimack, NH 03054
TEL: (603) 424-2022 • FAX: (603) 429-8496
www.amrolabs.com

TOTAL PETROLEUM HYDROCARBONS BY GAS CHROMATOGRAPHY

AND

DIESEL RANGE ORGANICS (DROs)

SW-846 Method 8015B Modified

Procedure Number: OL-2009

Revision No.: 5

Revision Date: 02/04/2010

Review Date: N/A

Prepared By: Kristin Albert Date: 2/4/10

Approved By: Sue Karam Date: 2/4/10
Organic Manager

Approved By: [illegible] Date: 2/4/10
Laboratory Director

Approved By: Paula Benham Date: 2/4/10
Quality Assurance Manager

Property of AMRO Environmental Laboratories Corporation

TABLE OF CONTENTS

		Page
1.0	SCOPE AND APPLICATION	3
2.0	METHOD SUMMARY	4
3.0	DEFINITIONS	4
4.0	SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE	5
5.0	POTENTIAL PROBLEMS AND INTERFERENCES	6
6.0	HEALTH AND SAFETY	7
7.0	INSTRUMENTS AND EQUIPMENT	8
8.0	INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR	8
9.0	REAGENTS AND STANDARDS	9
10.0	PROCEDURE	15
11.0	CALCULATIONS	24
12.0	QUALITY CONTROL	25
13.0	DATA REVIEW AND STORAGE	28
14.0	REFERENCES	29
Attachment 1	Standard I.D. Index	30
Attachment 2	Stock and Working Standards	31
Attachment 3	GC and GC/MS Data Review Checklist	32
Attachment 4	SW-846 Method 8015M Qualification Card	33
Attachment 5A-E	Chromatograms of Standards	34-38

1.0 SCOPE and APPLICATION

This method is used to analyze Total Petroleum Hydrocarbons with qualitative "fingerprint" identification, diesel range organics (DRO), the Connecticut DEP Extractable Total Petoleum Hydrocarbons (CT ETPH), and the Maine Health and Environmental Testing Method 4.1.25 (Maine DRO), and the Oklahoma Department of Environmental Quality's method for Diesel Range Organics Revision 4.1(OK DRO) from extracts of waters, solids, soils and sludges, for purposes of identification and quantification. In general diesel range organics cover the range of nC10-nC28 alkanes and covers a boiling point range of approximately 170°C to 430°C. AMRO extends this method to include lubricating oil range organics (LRO) up to C36+. The CT ETPH range extends from nC9 to nC36. The identification of specific fuel types may be accomplished but may be complicated by environmental processes such as evaporation, biodegradation, or when more than one fuel type is present.

1.1 This SOP is for Method 8015B Modified, used to determine the concentrations of various hydrocarbons present in extracts from solid, aqueous, and other matrices.

1.2 Analytes and Reporting Limits:

ANALYTE	REPORTING LIMIT Aqueous (µg/L) (1)	REPORTING LIMIT Soil (mg/kg) (2)
Diesel Range Organics	50	50
Diesel Fuel	50	50
Gasoline	50	50
Motor Oil	100	100
Kerosene	50	50
Mineral Spirits	50	50
Oklahoma DRO	100	10
Maine DRO	50	5
CT ETPH	100	50
Unidentified Hydrocarbons	200	100

Notes: 1. Aqueous based on 1000mL sample/1mL final volume.
2. Soil based on 20.0g/10mL final volume (Diesel Range Organics).
3. Soil based on 20.0g/20mL final volume (Fingerprint Analysis).
4. Soil Reporting Limits based on 100% dry weight.

2.0 METHOD SUMMARY

2.1 This method describes chromatographic procedures for the detection of various hydrocarbons using a Flame Ionization detector (FID). Prior to the use of this method, appropriate extraction procedures must be used. Refer to the following SOP's: OL-2003 (Separatory Funnel Liquid-Liquid Extraction, OL-2016 (Microscale Solvent Extraction (MSE) and OL-2004 (automated Soxhlet Extraction for Soil) for sample extraction. The identification of petroleum products is accomplished by comparison with reference oil standards, and quantitation of identified products using the appropriate calibration curve(s).

3.0 DEFINITIONS

3.1 **Diesel range organics:** All chromatographic material eluting from C-10 (decane) and C-28 (octacosane) inclusive.

3.2 **Fingerprint Analysis:** Analysis of samples for specific hydrocarbon products such as fuels and lubricating oils.

3.3 **Unknown Hydrocarbons** are defined as the collective concentration of all compounds eluting from n-nonane to n-hexatriacontane inclusive.

3.4 **Analytical Batch:** is defined as a group of field samples with similar matrices which are processed as a unit. For Quality Control purposes, if the number of samples in such a group is greater than 20, then each group of 20 samples or less are defined as separate analytical batches.

3.5 **Calibration Check Standard** or **Calibration Verification Standard (CCV)** is defined as a calibration standard used to periodically check the calibration state of an instrument. The calibration check standard is prepared from the same stock standard solution as calibration standards, and is generally one of the mid-level range calibration standard dilutions.

3.6 **Calibration Standards** are defined as a series of standard solutions prepared from dilutions of a stock standard solution, containing known concentrations of each analyte, surrogate or petroleum product of interest.

3.7 **Method Blank** is defined as an aliquot of reagent water or clean sand spiked with a surrogate standard. The laboratory method blank is treated exactly as a sample, exposed to all glassware, solvents, reagents, and equipment. A laboratory method blank is analyzed with every batch of samples, to

determine if method analytes or other interferences are present in the laboratory environment, reagents, or equipment.

3.8 **Surrogate Standards** are compounds spiked into all samples, blanks, and matrix spikes to monitor the efficiency of sample extraction, chromatographic, and calibration systems.

3.9 **Matrix Spike Samples** are separate aliquots of field samples spiked with #2 fuel oil to monitor the efficacy of sample extraction, chromatographic, and calibration systems.

3.10 **Laboratory Control Samples** are aliquots of analyte free water or soil spiked with #2 fuel oil to monitor the efficacy of sample extraction, chromatographic, and calibration systems. Maine and Oklahoma DRO methods also require an LCS/LCSD spike pair using the Diesel Component Standard spike of even carbon n-alkanes from nC10 to nC28.

3.11 **Unresolved Complex Mixture (UCM)** is the "hump" in the chromatogram caused by a complex mixture of unresolved hydrocarbon peaks.

4.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

4.1 Water samples are collected in 1L glass bottles. Samples to be analyzed by Maine DRO and OK DRO are preserved with 5 ml of 1:1 HCl (check sample pH when received, preserve any samples with pH >2 and note this fact on the sample receiving checklist). Soil, sludge and oil samples are collected in 8 oz. wide mouth jars or other suitable containers.

4.2 Extract must be stored under refrigeration in the dark and analyzed within 40 days of extraction.

4.3 Sample extracts are custody transferred from the Extraction analyst to the GC analyst via signature in the extraction logbook, or they are transferred to cold storage by the Extraction analyst. The extracts are either loaded directly on to GC instrument for analysis or they are stored at 4°C for future use. Extracts are kept for a minimum of two months after extraction and are then properly disposed of.

5.0 POTENTIAL PROBLEMS AND INTERFERENCES

5.1 The success of these methods frequently depends on the levels of interference rather than on instrumental limitations. If interferences prevent identification or detection of analytes, the analyst must evaluate the interferences and perform the proper corrective action.

5.2 Sources of interferences can be grouped into three categories:

5.2.1 Contaminated solvents, reagents, or glassware

5.2.1.1 Method Extraction Blanks and Instrument Blanks are used to determine possible contamination of solvents, reagents, glassware, and GC equipment.

5.2.1.2 If samples are found to be contaminated from the extraction process, scrupulous cleaning of the glassware and re-extraction of the samples may be required.

5.2.2 Contaminated carrier gas or GC equipment, i.e. columns, injection port liners, & syringes.

5.2.2.1 If the GC equipment is found to be the source of contamination, proper cleaning and solvent rinsing of affected parts may be required or replacement with new ones.

5.2.3 Most organic compounds will show some response on the FID. Naturally occurring long chain alcohols and fatty acids are frequently found in waste sludges that are analyzed for the presence of TPH's. These will respond as large tailing peaks that are not part of the TPH response.

5.2.4 Contamination by carryover can occur whenever high concentration and low concentration samples are analyzed in sequence. Whenever an unusually high sample is encountered, it should be followed by injection of solvent blanks until the system is demonstrated to be free of carryover.

5.2.5 Other sources of interferences could occur from phthalate esters which can be minimized by avoiding sample contact with any plastic materials Phthalates are easily leached from plastic materials during laboratory operations or even sampling including equipment rinsing.

6.0 HEALTH AND SAFETY

6.1 AMRO has a laboratory safety program in place that applies to all employees. There is a safety officer as well as employees with 40 hours of OSHA training. The air quality of the laboratory has been monitored and employees are sent for physicals. All employees receive fire and safety training upon employment.

6.2 Fire extinguishers are located in various areas of the lab. A lab evacuation plan is posted in every room, with a designated meeting place.

6.3 All new analysts receive training on the safe handling of samples, standards, the changing of gas cylinders, and the operation of instruments. In the lab, clean laboratory coats and gloves are worn when working with samples. Neat standards are made up in hoods. When gas tanks are replaced, the carrier with chain is used properly, and all gas tanks are chained in place.

6.4 Care is taken with glassware and syringes to prevent injury. Broken glass and syringes are promptly removed to broken glass containers. First aid kits are available throughout the lab. There are also eyewash stations and an emergency shower.

6.5 MSDS's are reviewed for each chemical used to ensure proper precautions are observed when handling chemicals.

6.6 Pollution prevention – The use of chemical exhaust hood are required when working with chemicals. They are specifically designed to minimize analyst exposure. The hood exhaust is monitored periodically to ensure environmental exposure is minimized.

6.7 Waste control – AMRO takes whatever steps possible to minimize waste. This includes volume reduction where appropriate. AMRO also properly segregates wastes according to contaminants and a commercial vendor is utilized for waste disposal.

7.0 INSTRUMENTS AND EQUIPMENT

7.1 Gas Chromatograph: Analytical system complete with gas chromatograph suitable for on column and split-splitless injections. The system includes all the required accessories such as syringes, analytical columns, gases, flame ionization detectors (FIDs) and a data system.

7.2 AMRO has one complete GC/FID system: GC-FING 1. It is a Hewlett Packard Model 5890 Series II gas chromatographs equipped with electronic pressure control (EPC) and a Model 7673 autosamplers. Helium is the carrier and auxiliary make up gas. UHP hydrogen and ultra zero air are the detector gases. The GC is equipped with the following analytical column.

7.2.1 HP-5ms capillary column, 30m x 0.32mm from Agilent or comparable

7.3 The data systems for all instruments are run by Enviroquant software which is used to acquire and process all data.

7.4 Volumetric flasks, 10-mL to 100-mL, for preparation of standards.

8.0 INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR

8.1 Daily Maintenance:

The following procedures are performed each day an instrument is used for analysis if, in the analyst's judgement, system performance requires them:

8.1.1 The GC septum and glass liner are removed and replaced if judged necessary by the analyst.

8.1.2 Column performance is monitored by checking the response factor of key compounds which indicate column degradation and/or column bleed. Clip two or more inches from the head of the column if necessary.

8.1.3 Check that gases have adequate supply to last until the following day. Change tanks if necessary.

8.1.4 Check data file space and quant space on the MS Chem Station system.

8.2 Weekly Maintenance, or as needed:

8.2.1 Clip column

8.2.2 Swab shell weldment with methylene chloride or other appropriate solvent.

8.2.3 Clean or replace inlet seal

9.0 REAGENTS AND STANDARDS

9.1 The following solvents are used for sample dilutions, preparation of standards or solvent rinsing of equipment:

9.1.1 Methylene chloride, Reagent Grade and Pesticide Residue Grade chemicals or equivalent.

9.1.2 Acetone, Reagent Grade and Pesticide Residue Grade chemicals or equivalent.

9.1.3 Methanol, Reagent Grade and Pesticide Residue Grade chemicals or equivalent.

9.2 Commercially prepared stock standard solutions and solutions prepared from pure reference materials are used in this analysis.

9.3 Stock calibration standards

	Concentration µg/ml	**Vendor**	**Catalog Number**
Diesel fuel	50,000	Restek	31259
o-Terphenyl	10,000	Restek	31097
Gasoline	50,000	Restek	30206
Motor Oil	50,000	Restek	31464
Kerosene	50,000	Restek	31257
Mineral Spirits	50,000	Restek	31261
DRO mix	2,000	Restek	31064
CT ETPH Mix	1,000	Restek	31614

9.4 Preparation of calibration standards.

Diesel Fuel, Kerosene, Mineral Spirits, Gasoline and Motor Oil are all prepared in methylene chloride as described below (all stock at 50,000 µg/ml)

Calibration Point (ng/µL)	Amount of Stock (µL)	Final Volume (mL)
50*	10	10
250	50	10
1000	200	10
2500	500	10
5000	200	2
10000	400	2
20000	800	2

* note this fuel oil #2 standard is also used as the resolution check mix for Maine DRO

The o-Terphenyl (Surrogate) calibration curve is prepared in methylene chloride as described below (Stock solution at 10,000 ug/ml).

Calibration Point (ng/(µL)	Amount Of Stock (µL)	Final Volume (mL)
2.0	2.0	10
10	10	10
25	25	10
50	50	10
100	100	10
150	150	10
250	250	10

9.5 The CT ETPH standard contains 15 n-alkanes ranging from C-9 to C-36 at 1000µg/mL each. This is used as a retention time marker for the range analytes. It is also used to prepare a calibration curve for methods using the response factors of a specified set of alkanes for quantitation. The Maine and OK DRO required Diesel Component Standard contains all the even carbon number normal alkanes (10 of them) from nC10 to nC28

9.5.1 Preparation of retention time marker standard. 100µL of the n-alkane stock is brought to 10 ml final volume with methylene chloride. Final concentration is 10 ng/µL for each alkane.

9.5.2 Preparation of n-alkane calibration curve.

Calibration point (ng/µL)	Conc. of stock (µg/mL)	Amount of stock (µL)	Final volume (mL)
1	1000	5	5.0
5*	1000	5	1.0
20	1000	20	1.0
50*	1000	50	1.0#
100	1000	100	1.0
200	1000	200	1.0
500*	1000	500	1.0
# 50 ng/µL standard also used as CCV	* minimum 3 points for ME and OK DRO		

9.6 Surrogate, matrix spike and second source standards.

	Concentration	Vendor	Catalog Number
Fuel Oil #2	neat	Rochette Oil	N/A
Diesel component mix	2,000 ug/mL	Restek	31064
n-Nonane	neat	Chem Service	F1099
o-Terphenyl	neat	Chem service	F1054

9.6.1 Preparation of standard mixes from neat material.

	Amount (g)	Final volume (mL)	Concentration (µg/mL)	Solvent
Fuel Oil #2	2.0	100	20,000	Acetone
n-Nonane	1.0	5.0	20,000	MeCl2
o-Terphenyl	0.25	5.0	50,000	Acetone

9.6.2 Preparation of second source, initial calibration verification working standards.

	Amount (µL)	**Final volume (mL) in methylene chloride**	**Concentration (µg/mlL**
Fuel Oil #2 (20,000 µg/ml)	250	10.0	500
n-Nonane (20,000 ug/mL)	12.5	5.0	50
o-Terphenyl (50,000 µg/ml)	10	10.0	50

9.6.3 Preparation of surrogate and matrix spike solutions.

The #2 fuel oil standard (see sec 9.6.1) prepared in acetone from neat material is used as is to spike laboratory control samples and matrix spike samples.

The o-terphenyl standard (see sec 9.6.1) prepared in acetone from neat material is diluted 5X with acetone to prepare the working solution with a final concentration of 1,000 µg/ml and 20ug/mL (for Maine DRO)

Diesel component spike mix (for Maine and OK DRO): Prepared from a certified solution containing the 10 alkanes listed in Table 1 of the Maine DRO Method 4.1.25 and Table 1 of the OK DRO method. The stock solution at 2,000ug/mL is dilulted in acetone to make a working solution at 50 ug/mL per component.

9.7 TRACKING OF ANALYTICAL STANDARDS

9.7.1 Chemical Receipt:

9.7.1.1 The receipt of all standards, neat compounds and reagents from commercial sources is documented in the Chemical Receiving Logbook by sample receiving personnel or designate. Each solution or compound is assigned a unique standard receipt ID number, the letter "A" and a four digit sequential number. The date received, source, lot number, expiration date and disposal date are recorded. The expiration dates are provided from the manufacturer and the disposal dates are completed by AMRO employees when standards are used up or disposed. Refer to SOP " Sample Management" GL-1006.

9.7.2 Standards Preparation: Standards are prepared as written in the respective SOPs. In order to assure the accuracy of standards the following general guidelines are used:

9.7.2.1 AMRO purchases pesticide residue grade solvents for organic standard preparation and organic sample extractions.

9.7.2.2 All stock standards that are purchased must include a certificate of analysis from the manufacturer.

9.7.3 Standard Tracking: It is important to be able to track all analytical standards back to their sources. The following procedure is used by AMRO personnel to accomplish this:

9.7.3.1 Organic Standard Tracking: The Organic Standards Tracking System consists of three logbooks. One Standard ID Index logbook (Attachment 1) , one for Stock Standards, and one for Working Standards (Attachment 2).

9.7.3.2 Stock Standard: Whenever a stock standard solution is opened or is prepared from a neat compound, this information is recorded in the Stock Standard Logbook section of the standard tracking log. The stock solution is assigned a new ID number consisting of the letter "V" or "S", the date of preparation plus a letter suffix starting with the letter "A". This ID along with the compound name, concentration and initials of the person making the stock are included on the label. Stock standards are good one year from the date prepared or the date provided by manufacturer, whichever is shorter. Example - The fourth volatile standard prepared on April 15, 1989 would have the

standard ID V041589D. This number will be recorded in the log book and written on the container.

9.7.3.3 Working Section: Whenever a working standard solution opened or is prepared, whether from AMRO stocks or commercially obtained stocks, the information is recorded in the Working Standard section of the standard tracking log. The solution is assigned a new ID number based on the section "V" or "S", the date it is prepared plus a letter suffix. This number along with a descriptive name, concentration (or conc. varied) and the initials of the person preparing the solution are included on the label. The expiration of working standards vary depending on the use. Standards should be used in accordance with method specifications and manufacturer's instructions.

9.7.3.4 Standard Storage: Standards and reagents are stored per method specifications and manufacturer's instructions. Semivolatile, Pesticide, PCB, Petroleum standards are stored in refrigerators at 4±2°C, freezers at minus 10 °C, and ambient temperature depending upon the method and manufacturer requirements.

9.7.3.5 Solvent Check Analysis

All extraction procedures are performed using pesticide residue grade solvents and the first method or procedural blank analysis is used when a new lot number is received to verify the absence of target analytes. Also, Before a new vendor's solvent is used for sample extraction a special check of the concentrated solvent (not a method blank) is required.

10.0 PROCEDURE

10.1 AMRO currently has one GC-FID instrument: FING 1.

10.2 GC Operating Conditions: all analysis:

10.2.1 Injection volume: 2 µL

10.2.2 FID Temperature: 320°C

10.2.3 Injection Port Temperature: 300°C

10.2.4 Initial Temperature: 50°C

10.2.5 Initial time: 2.0minutes

10.2.6 Rate 1: 35°C/minute

10.2.7 Final Temperature 1: 100°C

10.2.8 Final Time 1: hold 0.0 minutes

10.2.9 Rate 2: 25°C/minute

10.2.10 Final Temperature 2: 320°C

10.2.11 Final Time 2: hold 15.77 minutes

10.2.12 Total Run Time 28 min

10.3 Injection Run Log:

10.3.1 All injections must be recorded in the injection runlog created by the macro inject.mac and stored in the Excel/InjLogs directory on each instrument. The runlog must indicate the appropriate sample, standard, and the instrument. Each page in the hardcopy logbook must be signed by the analyst who is responsible for its accuracy.

10.4 Retention Time Windows:

10.4.1 Before establishing retention time windows, make sure that the chromatographic system is operating reliably and that the system conditions have been optimized for the target analytes and surrogates in the sample matrix to be analyzed.

10.4.2 Make three injections of all single and all multi-component analytes over the course of a 72-hour period. Serial injections or injections over a period of less than 72 hours may result in retention time windows that are too tight.

10.4.3 Record the retention times for all single analytes and three to five major peaks for multi-component analytes. Calculate the mean and standard deviation of the three absolute retention times of each single analyte and those peaks.

10.4.4 If the standard deviation of the retention times for a target compound is 0.000, then the laboratory uses a default standard of 0.01 minutes. Recording retention times to three decimal places rather than two should minimize the instances in which the standard deviation is calculated as 0.000.

10.4.5 The width of the retention time window for the single analytes, each major constituent in multi-component analytes and surrogates is defined as ±3 times the standard deviation of the mean absolute retention time established during a 72-hour period. Determination of the retention time windows for the DRO range marker analytes and surrogates are required . If the default standard deviation is employed, ½ the width of the window will be 0.07 minutes.

10.4.6 The absolute retention time windows must be calculated for each analyte and surrogate on each chromatographic column and instrument. New retention time windows must be established when a new GC column is installed.

10.4.7 Establish the center of the window for each analyte and surrogate by using the absolute retention time for each analyte and surrogate from the calibration verification standard at the beginning of the analytical shift. For samples run during the same shift as an initial calibration, use the retention time of the mid-point standard of the initial calibration.

10.4.8 If the daily CCV falls outside the window, the analyst will evaluate the instrument and will recalibrate if necessary. For samples run during the same analytical shift as the Initial Calibration, use the RT of the midpoint standard. However, the experience of the GC analyst should weigh heavily in the interpretation of the chromatograms. The analyst may therefore qualify an analyte as present outside the RT window by using pattern recognition.

10.5 Initial Calibration

10.5.1 A minimum of a five point curve is used for the initial calibration curve (*three points minimum for Maine DRO Method 4.1.25 and the Oklahoma DRO method Rev.4.1*). The following components and their corresponding concentrations are listed in the reagent section of this document. The response factor (RF) for each component is calculated.

$$\frac{\text{Area of component}}{\text{ng injected}} = \text{RF}$$

10.5.2 The average RF is calculated by averaging the RF's from each calibration Level. The %RSD must be less than or equal to 20%. Any curve that is over 20% must be evaluated using linear regression. The criteria for linear regression is the coefficient of determination must be 0.99 or greater. If this criteria cannot be met a quadratic equation must be used. The criteria is a coefficient of determination of 0.99 or greater. If none of these criteria are met the instrument must be recalibrated. A 6th point must be added to use a quadratic regression. Do not force the origin, and do not use (0,0) as a calibration point.

10.5.3 The response factors for the Connecticut EPTH method are calculated by summing the areas of the 15 components listed in the CT ETPH Mix and dividing by the total amount injected for each calibration level.

10.5.4 The response factors for the Maine DRO method 4.1.25 and OK DRO Rev.4.1 are calculated by summing the integrated area, baseline to baseline, of the 10 alkane components in the Diesel Component Mix and dividing this area by the total amount injected for each calibration level.

10.6 Continuing Calibration Verification (CCV)

10.6.1 Baseline subtraction is performed at the instrument level by electronic subtraction of a stored "blank run". This "column compensation data" needs to be updated periodically as column bleed and length change. Do not update the column compensation to compensate for an elevated baseline due to contamination of the GC system with high boiling material. This will result in a negative baseline once the system has cleared itself of this material.

10.6.2 Updating the column compensation data.

10.6.2.1 Close the data acquisition software (Chemstation) for the instrument.

10.6.2.2 On the GC keypad press col comp 1 (or 2) and enter.

10.6.2.3 The GC will go through the normal EPC and oven program.

10.6.2.4 Check the result by running a solvent blank.

10.6.3 Verify calibration at the start of each analytical sequence by injecting a #2 fuel oil standard at 2500 ng/ul and an o-terphenyl standard at 50 ng/ul. The #2 fuel oil standard response must be ± 15% of the true value, the o-terphenyl standard response must be ± 15% of the true value. A closing or continuing standard is required every 12 hours and is evaluated by the same criteria. The closing CCV concentration should not be the same as the initial CCV. If two or more initial CCVs fail in a row, then after corrective action to fix the problem, two passing CCVs in succession must be analyzed to demonstrate calibration verification before continuing with sample analyses.

10.6.4 Verify calibration for the CT ETPH method at the start of each analytical sequence containing CT ETPH samples by injecting the n-alkane CCV mix and o-terphenyl standard (50ug/mL). If the response is within 30% of the true value then the calibration is verified and CT ETPH samples can be analyzed. A passing continuing or closing standard is required every 12 hours. A discrimination check must be performed on the CCV at the beginning of each sequence and pass the requirement that the RFs for each alkane must be within 20% of the average response factor. This discrimination check requirement does not apply to the closing CCV.

10.6.5 Verify calibration for the Maine DRO method and OK DRO methods at the start of each sequences containing Maine or OK DRO samples by injecting the n-alkane CCV mix and o-terphenyl standard (50ug/mL). If the response is within 20% of the true value then the calibration is verified and Maine DRO / OK DRO samples can be analyzed. A passing continuing standard is required every 20 samples and at the end of each sequence. A resolution check should be performed at the beginning and end of each analytical batch if Maine DRO samples are present in the queue. Pristane should resolve from n-C17 and phytane should resolve from n-C18 in the resolution check mix (50ug/mL fuel oil #2 standard). The peaks are considered resolved

when the smallest peak height to valley difference is greater than 60% of the smaller peak height. If this criteria is not met then all the associated data must be rerun or flagged. The recovery of the resolution check standard should be between 60% and 140%.

10.6.6 The verification of calibration curves for other products such as gasoline, kerosene, and mineral spirits is only done at the start of an analytical sequence. The standard response must be ± 15% of the true value. A closing CCV is required only for fuel oil#2 and o-terphenyl because fuel oil #2 is representative of all analyte fuel types. Samples can be analyzed for all these products for 24 hours as long as the #2 fuel and o-terphenyl CCV's continue to pass.

10.6.7 Retention time marker standard (sec 9.5.1). This standard is run before and after each analytical sequence but need not be injected within the 12 hour window. If a #2 fuel oil standard and an o-terphenyl standard are serving as continuing calibration standards (marking the end of one analytical sequence and the start of another) the retention time marker standard may be run either before or after the continuing calibration standards. The n-alkane CCV can also serve as the retention time marker.

10.6.8 An instrument blank is run after the opening or continuing standards. This may be an extraction blank or a methylene chloride blank. The o-terphenyl standard can also serve as the instrument blank.

10.6.9 If the standard analyzed after a group of samples exhibits high response (over the applicable limit), and the analyte was not detected in the samples, it is acceptable to report ND results without qualification. If Department of Defense (DOD) samples are present in the queue then two terminal CCVs must be analyzed at the end of the sequence to demonstrate a consistent high bias. In contrast, if the response in the standard is low (below the applicable limit), the sample must be reanalyzed.

10.6.10 Note the OK DRO method requires an instrument or method blank analysis after every 10 samples to check for target analyte carryover.

10.7 Data Interpretation

10.7.1 Begin to examine the sample chromatograms. Check the baseline integration and compare it to the baseline for the sample blank. The baseline should be about the same as the sample blank. In the case of poor chromatography or matrix interferences, this baseline may be difficult to determine. The technical judgement and experience of the analyst must be used in making accurate baseline determinations. Baseline determinations must be verified by a supervisor or data reviewer to confirm analyst interpretation of the baseline. In some cases adjustment to the GC may be required.

10.7.2 Locate the Surrogate Standard peak (OTP) and quantify it. The computer will automatically calculate the recovery. If the % recovery of OTP in the sample is off by more than the current limits, re-extraction may be necessary. The analyst may re-analyze the samples to determine if a bad injection was made.

10.7.3 Check to determine if the surrogate is identified correctly by matching retention times with the daily standard. If any interferences are observed associated with the surrogate the data should be flagged and noted in the narrative. The analyst should consult a supervisor if retention time shifts occur.

10.8 Petroleum Product Identification in 'Fingerprint Analysis'

10.8.1 Use a current hard copy of the daily standard to compare to the samples for identification purposes. Look for the presence of a gaussian shaped window of un-resolved peaks in the chromatogram, the presence of such an envelope is indicative of a possible petroleum product and should be examined for a positive match with reference materials.

10.8.2 Light-weight products such as gasoline, kerosene, jet fuel or mineral spirits may not show any un-resolved hydrocarbon window at low concentrations. If there is a group(s) of early eluting peaks in the sample chromatogram check them against the reference standards for the aforementioned products for retention time matches. Please note that these low boiling point products are particularly susceptible to weathering effects, so differences in the relative amounts of the peaks should be expected. Samples showing a reasonable degree of match with the reference material patterns should be quantitated as the matching petroleum product with the notation that it is weathered. If

there is no identifiable match to a calibrated petroleum product then report the results as an unidentified hydrocarbon (nC9-nC36 range).

10.8.3 Gasoline is more appropriately analyzed by purge and trap (8015B GRO Mod) and should be reported as an estimated value by this method.

10.8.4 To identify which petroleum product is present in an extract, a detailed evaluation must be made. Listed below is guidance information to use in identifying components.

10.8.4.1 Shape, width and elution time of the UCM 'hump'.

10.8.4.2 Range and relative ratios of n-alkane components.

10.8.5 Characteristics of typical petroleum products:

10.8.5.1 Unleaded Gasoline - Asymmetrical, C8-C12 no unresolved area

10.8.5.2 Mineral Spirits - symmetrical, C8 - C14

10.8.5.3 Kerosene - symmetrical, C8-C18

10.8.5.4 Fuel Oil #2 - symmetrical, C9 - C24

10.8.5.5 Motor Oil - symmetrical, C18 - C36+

10.8.6 Sample chromatograms that do match any of the calibration standards are quantitated as 'unknown hydrocarbons' using the #2 fuel oil response factor. Integration is done by projecting a horizontal baseline from nC-9 to nC-36.

10.8.7 Sample chromatograms that are to be reported as Diesel Range Organics (DRO) are Integrated by projecting a horizontal baseline from C-10 to C-28. These samples are quantitated using a response factor generated by integrating the #2 fuel oil curve using the same criteria, or in the case of Maine and OK DRO analyses using the Diesel Component Standard response factor.

10.8.8 Sample chromatograms that are to be reported as CT ETPH are integrated by projecting a horizontal baseline from nC9 to nC36 and quantified using the initial calibration specified in Sec.10.5.3.

10.8.9 Sample chromatograms that are to be reported as Maine DRO or OK DRO are integrated by projecting a horizontal baseline from nC10 to nC28 and quantified using the initial calibration specified in Sec. 10.5.4. Note the individual calibrated n-alkanes in the DRO window should also be reported for OK DRO.

10.8.10 Note the presence of any extraneous peaks in the sample that are not present in the reference standards used for qualitative identification. Report the possible presence of gasoline or significant UCM area outside the DRO window for Maine DRO reports.

10.8.11 Note additional evidence of weathering, including degradation of low boiling point components and degradation of the low boiling point end of the unresolved complex mixture.

10.8.12 All sample responses must fall within the calibration range. Re-analysis at a dilution must occur if the sample response exceeds the maximum calibration range.

10.8.13 Identification based on the guidelines in ASTM Method 3328 is recommended. Four possible levels of identification are given.

10.8.13.1 MATCH - This level of identification indicates an exact or near exact match between the sample and reference standard Indicate the name of the component.(i.e. "Fuel Oil #2", conc. = 500 mg/kg, reporting limit (50 mg/kg.).

10.8.13.2 PROBABLE MATCH - This indicates a nearly exact match, with the exception of small differences that can be specifically attributed to the presence of extraneous components or moderate weathering effects. Indicate the name of the component same as above but flag that the sample is weathered.

10.8.13.3 INDETERMINATE - This level indicates that the sample is too different from any reference standard to make a definitive identification. Include a carbon range and quantify as an unknown hydrocarbon against a known standard in the same range. Indicate unidentified hydrocarbon, concentration, and reporting limit with a flag on the results to indicate what the result was quantitated as.

10.8.13.4 MISMATCH - This level of identification should only be used when a client has submitted a possible source standard for comparison with the sample and the source does not match the sample. Use this level in conjunction with one of the other 3 levels of identification for both the sample and the suspected source.

10.8.13.5 If there is no indication of the presence of a petroleum product report "No Petroleum Product Detected" (N.D.) and the reporting limit. All samples and blanks that are reported as ND are integrated either as diesel range organics or as unidentified hydrocarbons (C-9 to C-36). This is done to confirm the response is below the reporting limit.

10.8.13.6 The integration of compounds for standards and samples should be performed to be in the same manner as the initial calibration integration. Cases where the initial calibration is in question should be investigated to ensure it is not related to poor maintenance, damaged or defective column, or other issues which should be solved before further analysis.

10.8.13.7 The initial calibration curve must be printed and stored with the calibration records to document passing the required QC criteria.

10.8.14 Each sample analysis must be bracketed with an acceptable continuing calibration check CCV's (each 12-hr. shift or interspersed every 20 samples, whichever comes first). DOD samples will be analyzed at intervals of no greater than 10 injections between CCV's.

11.0 CALCULATIONS

11.1 Necessary calculations and formulas can be found throughout the text as applicable to each section.

11.2 Average Response Factor Calibration. Use the following equation to calculate the concentration of analytes in aqueous samples:

$$\text{Concentration (mg/L)} = \frac{(As)\,(Vf)\,(Df)}{(Rfa)\,(Vs)\,(Vi)}$$

Where:
As = Area counts for the analyte in the sample.
Vs = Initial volume of the sample extracted in mL.
Vf = Final volume of sample extract in mL.
Df = Dilution factor.
Vi = Volume of extract injected in ul. The injection volume for samples and standards must be the same
Rfa = Average response factor from the initial calibration curve (area per ng injected).

11.3 Average Response Factor Calibration. Use the following equation to Calculate the concentration of analytes in non aqueous samples:

$$\text{Concentration (mg/KG)} = \frac{(As)\,(Vf)\,(Df)}{(Rfa)\,[(W)(\%S)]\,(Vi)}$$

Where:
As = Area counts for the analyte in the sample.
W = Initial weight of the sample in grams.
%S = Percent solids expressed in decibel form (91% = 0.91). If not applicable set at 1.0.
Vf = Final volume of sample extract in mL.
Df = Dilution factor.
Vi = Volume of extract injected in ul. The injection volume for samples and standards must be the same
Rfa = Average response factor from the initial calibration curve (area per ng injected).

12.0 QUALITY CONTROL

12.1 Initial Demonstration of Proficiency:

12.1.1 The ability of AMRO to produce accurate and precise data is demonstrated per instrument/per analyst for each method. It consists of a Method Detection Limit Study (MDL) and Precision and Accuracy Study (P&A) for each instrument and each matrix on an annual basis. The laboratory demonstrates initial proficiency with each combination of sample preparation and determinative methods that it utilizes by generating data of acceptable precision and accuracy for a reference sample containing the target analytes in a clean matrix. The reference samples are prepared from a spiking solution containing each analyte of interest at a concentration that is 10-50 times the MDL for each analyte in that matrix, or at the routine concentration of LCS's (Laboratory Control Samples). P & A Studies are required to be updated annually by evaluating a minimum of 4 LCS's.

12.2 Method Detection Limit (MDL) Study:

12.2.1 The method detection limit is defined in 40 CFR 136 Appendix B. The purpose of an MDL is to establish the minimum concentration of each analyte greater than zero that can be reported with 99% confidence. An MDL study consists of at least 7 replicates of spiked deionized water (ideally standard set at ½ RL or lower), which are extracted and analyzed as normal samples. The standard deviation of the results of these analyses is multiplied by the appropriate student T-test value and the resulting value is deemed the method detection limit for that specific analyte.

12.2.2 MDL studies of each analyte must be reported annually for each instrument, column, matrix, and extraction method. To ensure that reasonable MDL values are determined, an MDL check sample is analyzed by spiking an interference free matrix with all target analytes at about two times the determined MDL. The MDL check sample is taken through the same process as the MDL. If any of the target analytes are not detected, the MDL study is modified and repeated until the MDL check sample is detectable. The MDL check will be analyzed quarterly and after major instrument maintenance or changes in the instrumentation or instrumental conditions to verify sensitivity of the method.

12.3 Precision &Accuracy:

12.3.1 Accuracy is a measure of the degree to which the analytical result approaches the "true" value of the concentration of the analyte being determined. Precision in the laboratory is determined by the comparison of duplicates, where duplicate samples result from an original sample that has been split for identical analyses. Precision and Accuracy in the laboratory is assessed initially by the analyses of a minimum of 4 replicate samples at a mid-level point of the expected range. The percent recoveries and Relative Standard Deviations (RSD) are evaluated and compared to method specifications or default limits where applicable.

12.3.2 Accuracy is also assessed by the regular analysis of known standards such as the Laboratory Control Samples (LCS), and matrix and analytical spikes. Accuracy within the laboratory is expressed in terms of percent recovery.

12.3.3 The precision of data is regularly evaluated by determining the relative percent difference (RPD) of duplicate (replicate) analyses.

12.4 Method Blanks are prepared at a frequency of one for every batch of up to 20 samples of the same matrix, prepared at the same time, by the same procedures. When sample extracts are subjected to cleanup procedures, the associated method blank must also be subjected to the same procedures.

12.4.1 The results for the method blank should be < the RL for all analytes and ½ the RL if DoD project samples are in the batch. If the method blank results do not meet the acceptance criteria, then corrective action is taken to locate and reduce the source of the contamination and the associated sample extracts are reanalyzed or re-extracted if necessary.

12.5 Matrix spike (MS) and Matrix Spike Duplicate (MSD) are prepared at a frequency of one for every batch of up to 20 samples of the same matrix, prepared at the same time, by the same procedures.

12.5.1 Samples must be selected for spiking at random and rotated among clients and sites from batch to batch. In some cases, the client may specify which sample is to used for MS/MSD; if not , the laboratory shall pick a representative sample based on the following:

12.5.1.1 MS/MSD shall not be performed on Trip Blank, Rinsate Blank or Field Blank.

12.5.1.2 Adequate sample weight/volume.

12.5.1.3 Client requested QC deliverables.

12.6 Laboratory Control Samples_are prepared at a frequency of one for everybatch of up to 20 samples of the same matrix, prepared at the same time, by the same procedures. The LCS consists of an aliquot of clean matrix similar to the sample matrix and of the same weight or volume. The LCS is spiked with the same compounds at the same concentrations as the MS and MSD. When the results of the MS and MSD analysis indicates a potential problem due to the sample matrix itself, the LCS results are used to verify that the lab can perform the analysis in a clean matrix. Note the OK DRO method requires an LCSD per batch and a maximum batch size of 10 samples.

12.7 Analysis of the MS, MSD, and LCS require the same procedures employed for the original sample and the concentration of each analyte spiked is calculated.

12.8 Calculation of Recovery: Accuracy is estimated from the recovery of spiked analytes from the matrix of interest. The recovery of each spiked analyte is calculated using the following formula:

$$\text{Recovery} = \%R = \frac{Cs - Cu}{Cn} \times 100\%$$

Where:

Cs = Measured concentration of the spike sample aliquot

Cu = Measured concentration of the unspike sample aliquot (use 0 for LCS)

Cn= Nominal (theoretical) concentration increase that results from spiking the sample, or the nominal concentration of the spike aliquot (for LCS).

12.9 Calculation of Precision: Precision is estimated from the relative percent difference (RPD) of the concentrations (not the recoveries) measured for the MS/MSD. To calculated the RPD, use the following formula:

$$RPD = \frac{|Conc.\ 1 - Conc.\ 2|}{((Conc.\ 1 + Conc.\ 2)/\ 2)} \times 100$$

Where:
Conc. 1 = Measured concentration of the first sample aliquot
Conc. 2 = Measured concentration of the second sample aliquot

12.10 Unless specifically excepted below, all recoveries control limits for surrogates, matrix spikes and laboratory control sample control are based on the laboratory control charts. The control charts are updated annually.

12.11 For all batches containing DOD project samples the default acceptance criteria for LCS recoveries is 60% to 140%.

12.12 Maine DRO LCS and MS spike recovery contorl limits are 60% to 140% and the RPD for LCS/LCSD or MS/MSD results should be less than 20%.

12.13 OK DRO LCS/LCSD pairs must demonstrate accuracy and precision within 20% for waters and 40% for soils.

12.14 If the surrogate recovery for a Maine DRO sample is less than 50% then repeat the analysis and flag the results if it fails this criteria in the rerun.

13.0 DATA REVIEW AND STORAGE

13.1 All cross-outs must be a single line and should be initialed and dated. Analyst review is documented on the GC and GC/MS Data Review Checklist (Attachment 3).

14.0 REFERENCES

14.1 40 CFR Part 136 Appendix B, 1984.

14.2 USEPA Office of Solid and Hazardous Waste - SW-846 Method Chapter 1, Rev. 1 7/92.

14.3 Method 8000B Revision 2, December 1996. SW846, Update III, USEPA.

14.4 Method 8015B Revision 2, December 1996. SW846, Update III, USEPA.

14.5 Shell for Analytical Chemistry Requirements, Version EM 200-1-3, 02/01/01.

14.6 Separatory Funnel, Liquid-Liquid Extraction, OL-2003.

14.7 Microscale Solvent Extraction (MSE), OL-2016.

14.8 Automated Soxhlet Extraction for Soil, OL-2004.

14.9 Department of Defense Quality Systems Manual For Environmental Laboratories, Version 3, January 2006.

14.10 Method For Determining Diesel Range Organics, Maine, Method 4.1.25, 09/06/95.

14.11 Analysis of Extractable Total Petroleum Hydrocarbons (ETPH) using Methylene Chloride Gas Chromatograph/Flame Ionization Detection , CT DEP , March 1999

14.12 Oklahoma Department of Environmental Quality, Methods 8000/8100 (modified) Diesel Range Organics, Revision 4.1, 10/22/97

Attachment 1

AMRO Environmental Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

STANDARD I.D. INDEX

Standard I.D.	Standard Logbook (Stock or Working)	Brief Description

qc/qcmemos/forms/organicstdindex Rev. 2 05/00

Attachment 2

AMRO Environmental Laboratories Corporation
111 Herrick Street
Merrimack, NH 03054

STANDARD LOG - STOCK SOLUTIONS
ORGANIC SECTION

Date Opened/Prep'd	Opened/Prep'd by	Compound Name	Receipt/Stock ID	Source	Conc. or Purity	Amt (g) or (µl)	Final Vol. (ml)	Solvent ID/ number	Final Conc.	Units ug/ml or ug/ml	Solution ID	Storage Loc.	Exp. Date

Notes: 1) AMRO stock Std. ID is "V" or "S", date prepped, letter suffix(110498B is the second stock std prepared on 11/04/98)

2) Vials must be labeled with the compound name, conc., AMRO stock ID, and exp. Date

qc/qcmanuals/forms/organicstock Rev. 4 05/00

AMRO Environmental Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-03054

STANDARD LOG - WORKING STANDARDS
ORGANIC SECTION

Date Opened/Prep'd	Prep'd/Verified by	Compound Name	Receipt/Stock ID	Source	Conc. or Purity	Amt. (ml)	Final volume (ml)	Solvent ID/ number	Final Conc.	Units ug/ml or ug/ml	Sol'n ID	Storage Loc.	Exp. Date

Notes: 1) AMRO working Std. ID is "V" or "S", date prepped, letter suffix(110498C is the third working std prepared on 11/04/98)

2) Vials must be labeled with the compound name, conc., AMRO ID, and exp. Date

qc/qcmanuals/forms/organicwork Rev. 3 08/11/01

Attachment 3

AMRO Environmental
Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

GC AND GC/MS DATA REVIEW CHECKLIST

LAB ORDER: _____ CLIENT: _____

Method: | Sample(s) No.:

Analysis: | Matrix:

A. GENERAL

1.	Copy of Prep/Extraction Log?	Y	N	NA
2.	Copy of Instrument Run Log or Tune List?	Y	N	NA
3.	Copy of dry weight log present?	Y	N	NA
4.	Are all sample checked for preservation after VOA analysis?	Y	N	NA
5.	All samples met extraction and/or analysis holding time criteria?	Y	N	NA
6.	Did the Tune pass and DFTPP or BFB injected every 12 hours?	Y	N	NA
7.	Are the surrogate recoveries for each sample within the QC limits?	Y	N	NA
8.	Method Blank - contaminant free(< ½ RL)?	Y	N	NA
9.	Initial Calibration meets method criteria for all compounds reported?	Y	N	NA
10.	Continuing Calibration meets method criteria for all compounds reported?	Y	N	NA
11.	Are all reported results within calibration range?	Y	N	NA
12.	LCS % Recovery criteria met for all compounds?	Y	N	NA
13.	MS/MSD %R's and %RPD's are met for all compounds?	Y	N	NA
14.	%RPD criteria met between sample and duplicate?	Y	N	NA
15.	Samples checked for carry over from sample to sample due to target or nontarget overload?	Y	N	NA
16.	Are all data exported to LIMS, calculated and verified?	Y	N	NA

COMMENTS:

Analyst (s) _____ DATE: _____

REVIEWER _____ DATE OF REVIEW: _____

qc/qcmemos/Forms/gcmschecklist Rev. 2 08/13/01

Attachment 4

AMRO Environmental
Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

QUALIFICATION CARD FOR TPH/DRO SW-846 METHOD 8015Mod.

Trainee: _____ Signature: _____

Trainer: _____ Signature: _____

I. Knowledge Factors:

SOP Title: _____ Revision Number/Date: _____

1. Did the Trainee read and understand the above SOP? Yes ☐ No ☐ NA ☐
2. Was the Trainee instructed on how to properly fill out the documentation? Yes ☐ No ☐ NA ☐
3. Has the Trainee been instructed on the proper procedures for addressing potential problems? Yes ☐ No ☐ NA ☐

II. Practical Factors:

1. Has the Trainee completed a Precision and Accuracy Study? Yes ☐ No ☐ NA ☐
2. Has the Trainee completed an acceptable Performance Evaluation sample? Yes ☐ No ☐ NA ☐
3. Did the Trainee completed an acceptable Laboratory Control Sample (LCS)? or PT study* Yes ☐ No ☐ NA ☐
4. Has the Trainee performed manual integration as indicated in the SOP? Yes ☐ No ☐ NA ☐

Completion Date: _____ Trainer's Signature: _____

I _____ have read, understood and follow the above method/SOP, which is in use at AMRO Laboratories for the analysis of samples under the National Environmental Laboratory Accreditation Program, have met the Demonstration of Capability.

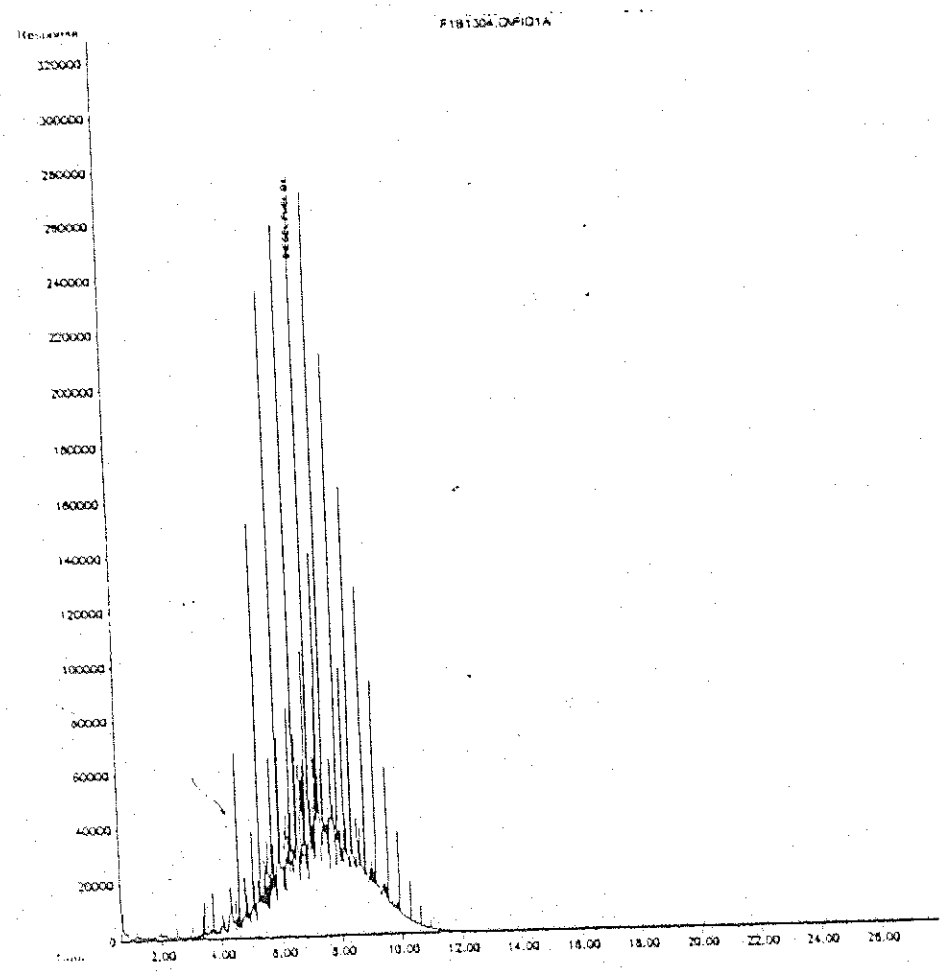
Section Manager/ Supervisor: _____ Date: _____

QA Manager: _____ Date: _____

qc/qcmemos/forms/TPH/DRO8015Mod.qualcard Rev. 0 08/13/01

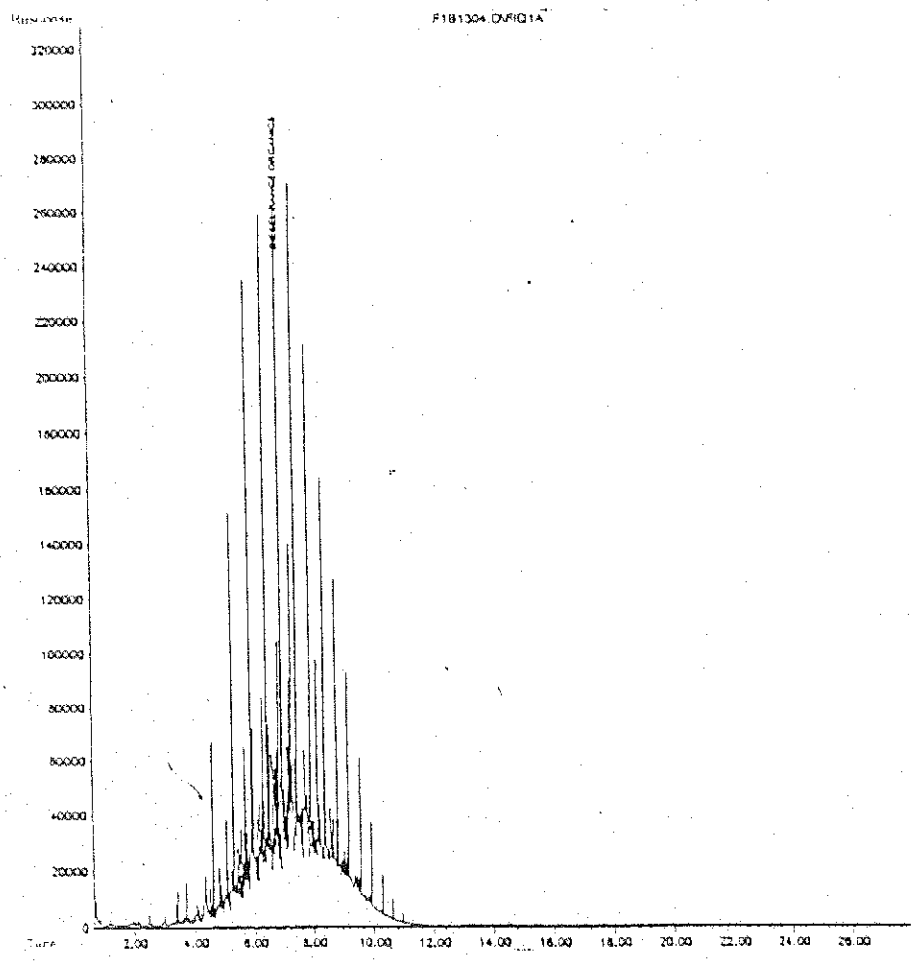
Attachment 5A

```
File        : C:\HPCHEM\1\DATA\082703\F1B1304.D
Operator    : KD
Acquired    : 27 Aug 2003   2:18 pm using AcqMethod FING1_32.M
Instrument  :   Fing1
Sample Name: [#2 FUEL OIL 2500 NG/UL] DF-1 (FING_S)
Misc Info   : S0701031
Vial Number: 6
```



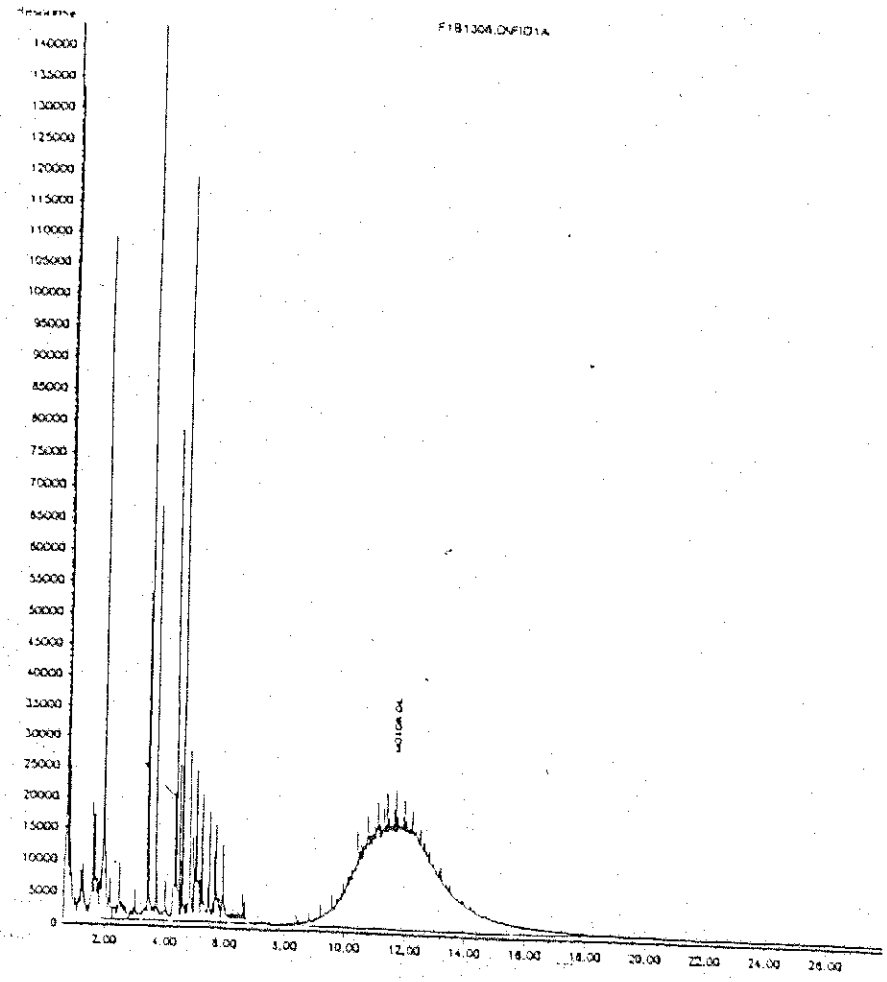
Attachment 5B

```
File        : C:\HPCHEM\1\DATA\082703\F1B1304.D
Operator    : KD
Acquired    : 27 Aug 2003   2:18 pm using AcqMethod FING1_32.M
Instrument  :   Fing1
Sample Name: (#2 FUEL OIL 2500 NG/UL) DF=1 (FING_S)
Misc Info   : S0701031
Vial Number: 6
```



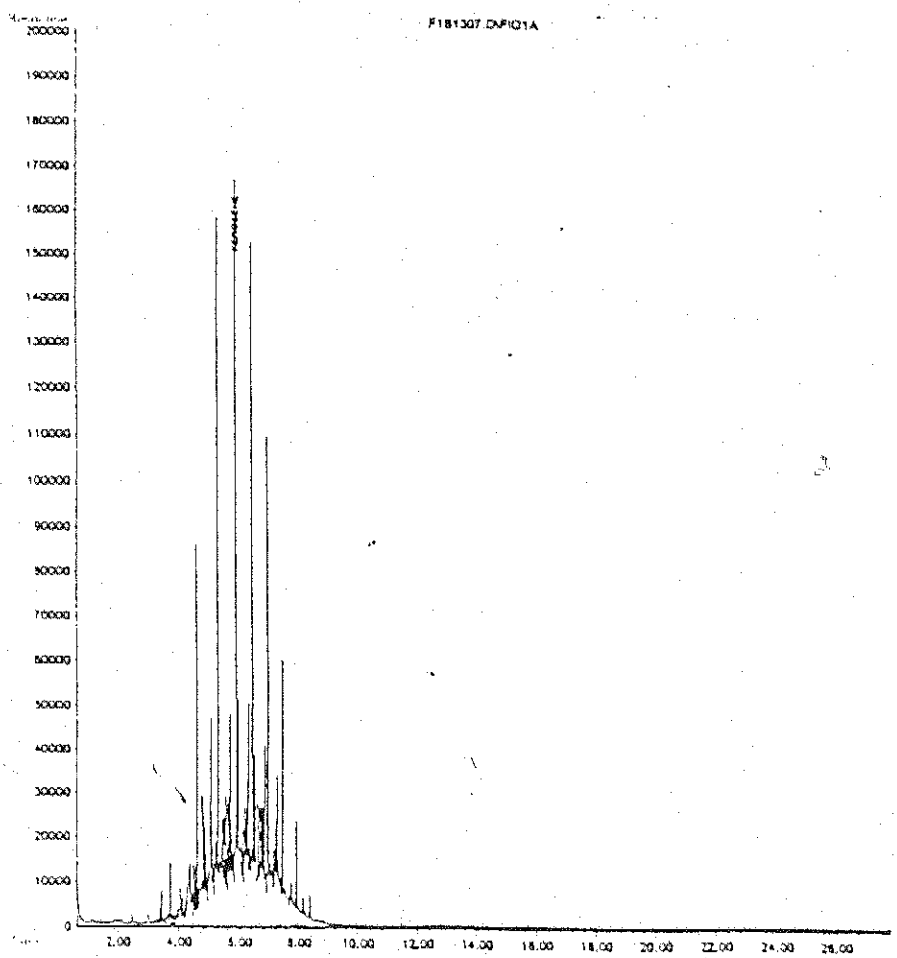
Attachment 5C

```
File        : C:\HPCHEM\1\DATA\082703\F1B1306.D
Operator    : KD
Acquired    : 27 Aug 2003   3:31 pm using AcqMethod FING1_32.M
Instrument  :   Fing1
Sample Name: (GASOLINE/MOTOR OIL 1000 NG/UL) DF-1 (FING_S)
Misc Info   : S070103K
Vial Number: 8
```



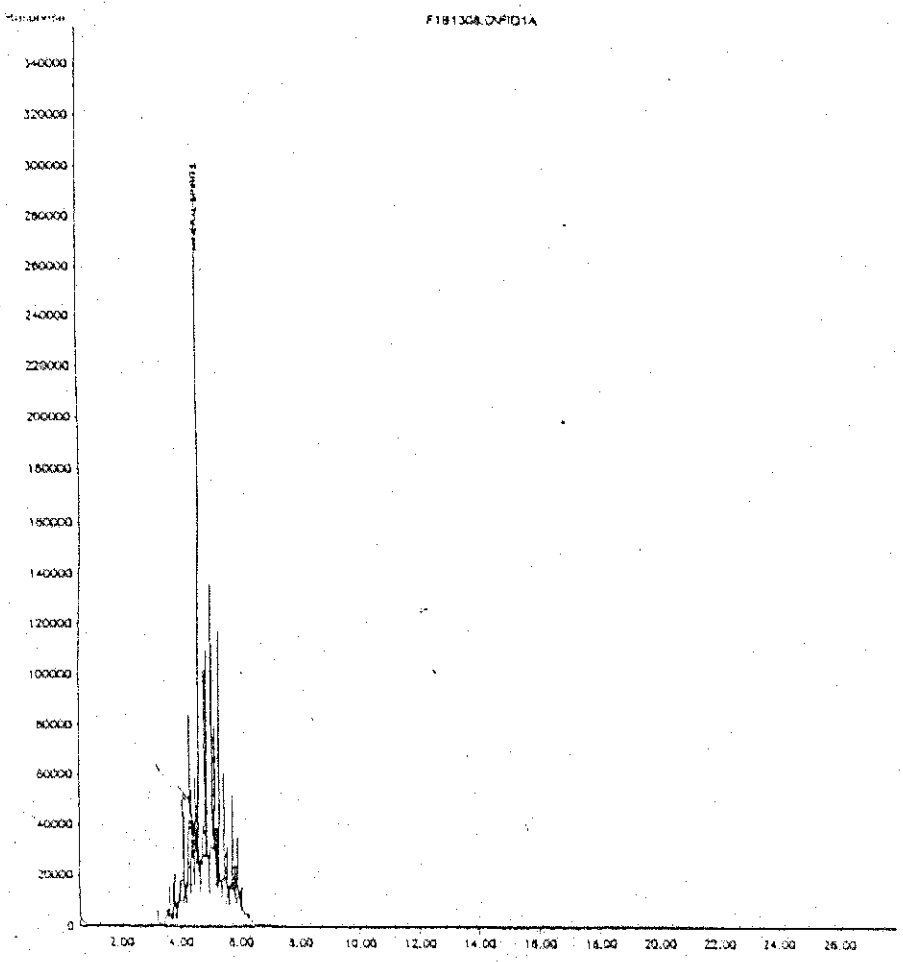
Attachment 5D

```
File        : C:\HPCHEM\1\DATA\082703\F181307.D
Operator    : KD
Acquired    : 27 Aug 2003   4:08 pm using AcqMethod FING1_32.M
Instrument  :   Fing1
Sample Name: (KEROSENE 1000 NG/UL) DF=1 (FING_S)
Misc Info   : S070103L
Vial Number: 9
```



Attachment 5E

```
File        : C:\HPCHEM\1\DATA\082703\F181308.D
Operator    : KD
Acquired    : 27 Aug 2003   4:44 pm using AcqMethod FING1_32.M
Instrument  :   Fing1
Sample Name: (MINERAL SPIRITS 1000 NG/UL) DF=1 (FING_S)
Misc Info   : S070103M
Vial Number: 10
```



AMRO Environmental Laboratories Corporation

111 Herrick Street, Merrimack, NH 03054
TEL: (603) 424-2022 • FAX: (603) 429-8496
www.amrolabs.com

SEMIVOLATILE ORGANIC COMPOUNDS BY GAS CHROMATOGRAPH/MASS SPECTROMETRY

By

SW-846 METHOD 8270C

Procedure Number: OL-2008

Revision No.: 8

Revised Date: 02/02/2010

Review Date: N/A

Prepared By: _____ Date: 2/3/10

Approved By: _____ Date: 2/4/10
Organic Manager

Approved By: _____ Date: 2/3/10
Laboratory Director

Approved By: Paula Bentam Date: 2/3/10
Quality Assurance Manager

TABLE OF CONTENTS

		Page
1.0	SCOPE AND APPLICATION	2
2.0	METHOD SUMMARY	5
3.0	DEFINITIONS	5
4.0	SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE	6
5.0	POTENTIAL PROBLEMS AND INTERFERENCES	6
6.0	HEALTH AND SAFETY	6
7.0	INSTRUMENTS AND EQUIPMENT	7
8.0	REAGENTS AND STANDARDS	8
9.0	GC/MS PROCEDURE	18
10.0	INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR	28
11.0	CALCULATIONS	29
12.0	QUALITY CONTROL	30
13.0	DATA REVIEW AND STORAGE	34
14.0	REFERENCES	36
Attachment 1A,B,C	Internal Standards with Corresponding target and surrogates Assigned for Quantitation	38
Attachment 2	Surrogate Recovery Control Limits	41
Attachment 3A,B,C	DoD LCS and MS Control Limits for Water Matrix	42
Attachment 4A,B,C	DoD LCS and MS Control Limits for Soil Matrix	45
Attachment 5	Instrument Operating Conditions	48
Attachment 6	GC and GC/MS Data Review Checklist	49
Attachment 7	SW-846 Method 8270C Qualification Card	50

1.0 SCOPE and APPLICATION

1.1 This Standard Operating Procedure (SOP) describes the analysis of semivolatile organic compounds in Methylene Chloride extracts prepared from many types of solid waste matrices, soils, and water samples. The compounds analyzed by AMRO and their typical reporting limits are listed in Table 1.

Table 1

Compound Name	CAS number	Reporting Limits	
		Water (µg/L)	Soil (mg/kg)
1,2,4-TRICHLOROBENZENE	120-82-1	10	0.25
1,2-Dichlorobenzene	95-50-1	10	0.25
1,2-Diphenylhydrazine (as Azobenzene)	122-66-7	10	0.25
1,3-Dichlorobenzene	541-73-1	10	0.25
1,4-Dichlorobenzene	106-46-7	10	0.25
2,4,5-Trichlorophenol	95-95-4	10	0.25
2,4,6-Trichlorophenol	88-06-2	10	0.25
2,4-Dichlorophenol	120-83-2	10	0.25
2,4-Dimethylphenol	105-67-9	10	0.25
2,4-Dinitrophenol	121-14-2	20	0.5
2,4-Dinitrotoluene	606-20-2	10	0.25
2,6-Dinitrotoluene	53-96-3	10	0.25
2-Chloronaphthalene	321-60-8	10	0.25
2-Chlorophenol	95-57-8	10	0.25
2-Methylnaphthalene	95-48-7	10	0.25
2-Methylphenol	91-59-8	10	0.25
2-Nitroaniline	88-75-5	20	0.5
2-Nitrophenol	119-93-7	10	0.25
3,3'-Dichlorobenzidine	56-49-5	10	0.25
3-Nitroaniline	534-52-1	20	0.5
4,6-Dinitro-2-Methylphenol	92-67-1	20	0.5
4-Bromophenylphenyl Ether	101-55-3	10	0.25
4-Chloro-3-Methylphenol	59-50-7	20	0.5
4-Chloroaniline	106-47-8	10	0.25
4-Chlorophenyl-Phenylether	7005-72-3	10	0.25
4-Methylphenol	106-44-5	10	0.25
4-Nitroaniline	57-97-6	20	0.5
4-Nitrophenol	3855-82-1	20	0.5
Acenaphthene	83-32-9	10	0.25
Acenaphthylene	208-96-8	10	0.25
Acetophenone	98-86-2	10	0.25

Table 1 (cont)

Compound Name	CAS number	Reporting Limits Water (µg/L)	Reporting Limits Soil (mg/kg)
ANILINE	120-12-7	10	0.25
Anthracene	140-57-8	10	0.25
Benz(a)Anthracene	56-55-3	10	0.25
Benzidine	92-87-5	20	0.5
Benzo(a)Pyrene	50-32-8	10	0.25
Benzo(b)Fluoranthene	205-99-2	10	0.25
Benzo(g,h,i)Perylene	191-24-2	10	0.25
Benzo(k)Fluoranthene	207-08-9	10	0.25
Benzoic Acid	65-85-0	20	0.5
Benzyl Alcohol	100-51-6	20	0.5
Bis(2-Chloroethoxy)Methane	111-91-1	10	0.25
Bis(2-Chloroethyl)Ether	111-44-4	10	0.25
Bis(2-Chloroisopropyl)Ether	108-60-1	10	0.25
Bis(2-Ethylhexyl)Phthalate	117-81-7	10	0.25
Butylbenzylphthalate	85-68-7	10	0.25
Carbazole	86-74-8	10	0.25
Chrysene	218-01-9	10	0.25
Dibenzo(a,h)Anthracene	53-70-3	10	0.25
Dibenzofuran	132-64-9	10	0.25
Diethylphthalate	84-66-2	10	0.25
Dimethyl Phthalate	131-11-3	10	0.25
Di-n-Butylphthalate	84-74-2	10	0.25
Di-n-Octyl Phthalate	117-84-0	10	0.25
Fluoranthene	62-50-0	10	0.25
Fluorene	206-44-0	10	0.25
Hexachlorobenzene	118-74-1	10	0.25
Hexachlorobutadiene	87-68-3	10	0.25
Hexachlorocyclopentadiene	77-47-4	10	0.25
Hexachloroethane	67-72-1	10	0.25
Indeno(1,2,3-c,d)Pyrene	193-39-5	10	0.25
Isophorone	78-59-1	10	0.25
Naphthalene	621-64-7	10	0.25
Nitrobenzene	62-75-9	10	0.25
N-Nitrosodimethylamine	86-30-6	20	0.5
N-Nitroso-di-n-propylamine	91-20-3	10	0.25

Table 1 (cont)

Compound Name	CAS number	Reporting Limits	
		Water (µg/L)	Soil (mg/kg)
N-Nitrosodiphenylamine	98-95-3	10	0.25
Pentachlorophenol	87-86-5	20	0.5
Phenanthrene	85-01-8	10	0.25
Phenol	108-95-2	10	0.25
Pyrene	129-00-0	10	0.25
Pyridine	110-86-1	20	0.5

2.0 SUMMARY OF METHOD

2.1 Soil and solid samples are prepared by SW-846 Method 3541, Automated Sohxlet Extraction. Water samples are prepared by SW-846 Method 3510, Separatory Funnel Extraction.

2.2 The semivolatile compounds are introduced into the GC/MS by injecting the sample extract into a gas chromatograph (GC) with a narrow-bore fused-silica capillary column. The GC column is temperature-programmed to separate the analytes, which are then detected with a mass spectrometer (MS) connected to the gas chromatograph.

2.3 Analytes eluted from the capillary column are introduced into the mass spectrometer via a direct connection. Identification of target analytes is accomplished by comparing their mass spectra with the electron impact spectra of authentic standards. Quantitation is accomplished by comparing the response of a major (quantitation) ion relative to an internal standard using a calibration curve with a minimum of five contiguous data points.

3.0 DEFINITIONS

3.1 **Method Blank:** An aliquot of reagent water, which is carried through the entire analytical procedure with the samples, its purpose is to determine whether contamination is present during the analysis. A method blank is analyzed 1 for every analytical batch of samples.

3.2 **Laboratory Control Sample:** An aliquot of reagent water which known quantities of the method analyte are added in the laboratory. The LCS is analyzed exactly like a sample, and its purpose is to determine the degree to which the analytical result approaches the "true value" of the concentration of the analyte being determined. The percentage recovery is calculated in order to assess the efficiency of the analysis. One (1) LCS is analyzed for every analytical batch of samples.

3.3 **Matrix Spike:** A specific aliquot of sample into which a known amount of analyte is added. The analytical spike is analyzed with the sample batch and the percent recovery is calculated in order to assess the matrix effect on the analytical system.

3.4 **Batch:** A group of 20 or fewer samples extracted (prepared) at the same time, in the same location, using the same method. Associated with each batch is a set of QC samples, including: Duplicate Samples, Matrix Spike(MS), Matrix Spike Duplicate (MSD), Laboratory Control Sample (LCS), and a Method Blank.

4.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

4.1 Store the sample extracts at 4°C ±2°C, protected from light, in sealed vials (e.g. screw-cap vials or crimp-capped vials) equipped with unpierced PTFE-lined septa. Analysis: 40 days after extraction.

5.0 POTENTIAL PROBLEMS AND INTERFERENCES

5.1 Contamination by carryover can occur whenever high-concentration and low-concentration samples are sequentially analyzed. To reduce carryover, the sample syringe is rinsed with solvent between sample injections. Whenever an unusually concentrated sample is encountered, the analysis immediately following it is evaluated for cross-contamination.

5.2 The following compound specific problems are noteworthy.

5.2.1 Benzidine may be subject to oxidative losses during solvent concentration and its chromatographic behavior is poor.

5.2.2 Hexachlorocyclopentadiene is subject to thermal decomposition in the inlet of the gas chromatograph, chemical reaction in acetone solution, and photochemical decomposition.

5.2.3 N-nitrosodimethylamine and Pyridine elute very early and become more difficult to separate from the solvent front as the column is shortened through maintenance clipping.

5.2.4 N-nitrosodiphenylamine decomposes in the gas chromatographic inlet and cannot be separated from diphenylamine.

5.2.3 Pentachlorophenol, 2,4-dinitrophenol, 4-nitrophenol, benzoic acid, 4,6-dinitro-2-methylphenol, 4-chloro-3-methylphenol, 2-nitroaniline, 3-nitroaniline, 4-chloroaniline, and benzyl alcohol are subject to erratic chromatographic behavior, especially if the GC system is contaminated with high boiling material.

6.0 HEALTH AND SAFETY

6.1 AMRO has a laboratory safety program in place that applies to all employees. There is a safety officer as well as employees with 40 hours of OSHA training. The air quality of the laboratory has been monitored and employees are sent for physicals. All employees receive fire and safety training upon employment.

6.2 Fire extinguishers are located in various areas of the lab. A lab evacuation plan is posted in every room, with a designated meeting place.

6.3 All new analysts receive training on the safe handling of samples, standards, the changing of gas cylinders, and the operation of instruments. In the lab, clean laboratory coats and gloves are worn when working with samples. Neat standards are made up in hoods. When gas tanks are replaced, the carrier with chain is used properly, and all gas tanks are chained in place. Soap is used to check for any leaks.

6.4 Care is taken with glassware and syringes to prevent injury. Broken glass and syringes are promptly removed to broken glass containers. First aid kits are available throughout the lab. There are also eyewash stations and an emergency shower.

6.5 MSDS's are reviewed for each chemical used to ensure proper precautions are observed when handling chemicals.

6.6 Pollution prevention: The use of chemical exhaust hood are required when working with chemicals. They are specifically designed to minimize analyst exposure. The hood exhaust is monitored periodically to ensure environmental exposure is minimized.

6.7 Waste control, AMRO takes whatever steps possible to minimize waste. This includes volume reduction where appropriate. AMRO also properly segregates wastes according to contaminants and a commercial vendor is utilized for waste disposal.

7.0 INSTRUMENTS AND EQUIPMENT

7.1 Gas Chromatograph/Mass Spectrometer Systems

7.1.1 Hewlett-Packard (HP) Model 5890 Series II (SV-2, SV-3) -temperature-programmable gas chromatographs equipped with Electronic Pressure Control (EPC), splitless injection, capillary-direct interface, and Model 7673 Autosampler/Injector. Hewlett-Packard (HP) Model 6890 (SV-4) - temperature-programmable gas chromatograph equipped with Electronic Pressure Control (EPC), split injection, capillary-direct Interface and Model 7683 Autosampler/injector.

7.1.2 Column - 30 m x 0.25 mm ID, 0.25 um film thickness 5% phenyl methyl silicone-coated fused-silica capillary column (J&W Scientific DB-5MS, Catalog No. 122-5532 or equivalent).

7.1.3 Hewlett-Packard (HP) Model 5972 Mass Selective Detector (MSD) , SV-2 and SV-3. Hewlett-Packard (HP) Model 5973 Mass Selective Detector (MSD) SV-4. Note SV-2 and SV-3 are backup instruments only for the SW-846 Method 8270 and do not routinely perform full BNA analyses.

7.1.4 Hewlett-Packard Chemstation PC Data system - Computer system interfaced to the GC/MSD.

The following system identifiers have the listed software versions:

SV-2	G1034C	Version C.02.05
SV-3	G1701AA	Version A.03.00
SV-4	G1701BA	Version B.00.00

The system allows the continuous acquisition and storage on machine-readable media of all mass spectra obtained throughout the duration of the chromatographic program. The computer has software that can search any GC/MS data file for ions of a specific mass and that can plot such ion abundances versus time or scan number. This type of plot is defined as an Extracted Ion Current Profile (EICP). The software allows integrating the abundances in any EICP between specified time or scan-number limits. The most recent version of the EPA/NIST Mass Spectral Library is also available.

7.2 Syringe - 10 µL, 25µl - 1.0 mL varying sizes

7.3 Volumetric flasks: Class A - Appropriate sizes with ground-glass stoppers.

7.4 Bottles - 1.5 to 2.0mL amber and clear glass with polytetrafluoroethylene (PTFE)-lined screw caps or crimp tops for standard storage.

7.5 5.0mL amber vials with PFTE-lined screw caps.

7.6 Compressed Helium - Ultra High Purity (UHP) grade.

8.0 REAGENTS AND STANDARDS

8.1 The stock standard solutions are purchased from commercial suppliers as certified solutions. Transfer the stock standard solutions into 2mL amber vials with PTFE-lined screw caps using a pasteur pipet. Label vial with content information, standard ID and expiration date. Store, protected from light, at $4^{o}C \pm 2^{o}C$. Stock standard solutions must be replaced after one year from the opening date of the vial, or on the manufacturer expiration date, whichever is shorter.

8.1.1 Stock Calibration Standards

Restek:

Semivolatiles Calibration Standards
Contain1mL of each of the following products at:
8270 Mega Mix (Catalog No.: 31850) 500-1000 µg/ml
Benzoic Acid Mix (Catalog No.: 31879) 2000 µg/ml
Benzidines Mix (Catalog No.: 31852) 2000 µg/ml
Custom Acetophenone (2,000 µg/ml) Catalog No. 558859

8.1.2 Calibration Standards: Second Source Verification Standards

Ultra Scientific, Inc.:

Pyridines Mixture	2000 µg/ml	Catalog No. US-120AN
Benzidines Mixture	2000 µg/ml	Catalog No. US-105N
SVOA Mix 1	1000 µg/ml	Catalog No. SVM-8270
SVOA Mix 2	1000 µg/ml	Catalog No. SVM-8271

8.1.3 Surrogate Solutions: The surrogates are Phenol-d_6, 2-Fluorophenol, 2,4,6-Tribromophenol, Nitrobenzene-d_5, 2-Fluorobiphenyl, and p-Terphenyl-d_{14}.

Restek, Inc.:

Base/Neutral Surrogates, 5,000 µg/mL (Catalog No. 31086)
Nitrobenzene-d5
Fluorobiphenyl
P-Terphenyl-d14

Acid Surrogates, 10,000µg/mL (Catalog No. 31063)
Phenol-d5
2-Fluorophenol
2,4,6-Tribromophenol

8.1.4 Internal Standard Solutions: The internal standards are 1,4-Dichlorobenzene-d_4, Naphthalene-d_8, Acenaphthene-d_{10}, Phenanthrene-d_{10}, Chrysene-d_{12}, and Perylene-d_{12}. Restek Catalog No.: 31206 is purchased and used as is directly from manufacturer.

8.1.4.1 The solution contains each compound at a concentration of 2,000 ng/µL. Each 1mL sample extract undergoing analysis should be spiked with 20µL of the internal standard solution, resulting in a concentration of 40ng/ µL of each internal standard. Store at 4°C±2°C when not in use.

8.1.5 GC/MS Tuning Standard: A mix of Decafluorotriphenylphosphine (DFTPP), Pentachlorophenol, Benzidine, and DDT is commercially available stock solution from Restek, Catalog No.: 31615 (1,000µg/mL).

8.1.6 Laboratory Control Sample spike stock solutions: Restek

Mega Mix	500-100 µg/ml	Catalog No.: 31850
Benzidines Mix	2000 µg/ml	Catalog No: 31852
Benzoic acid	2000 µg/ml	Catalog No.: 31879
CAL Mix 1	2000 µg/ml	Catalog No.: 31618
Custom Acetophenone	2000 µg/ml	Catalog No.: 558859

8.2 Intermediate Solutions

8.2.1 Preparation of Intermediate Calibration stock at 250µg/ml Using Primary Source Standards

Prepare each individual commercial calibration stock solutions according to the manufacturers instructions. Transfer each of the calibration stock solutions into 1.5mL amber vials with teflon lined screw caps using pasteur pipets. Label each vial with contents, standard ID and expiration date. Clean a 5mL volumetric flask and stopper with methylene chloride. Do not add any methylene chloride to the flask until all solutions have been added. Using a clean 500µl syringe, transfer 625µl of each 2,000 µg/mL calibration stock solution and 1250µl of the Mega Mix calibration stock solution (500-1000 µg/ml) into the volumetric flask. Rinse the syringe between each aliquot with clean methylene chloride and replace the stopper. Using a clean syringe, transfer 250µl of the Base Neutral Surrogate (5,000 µg/mL) to the volumetric flask and replace the stopper. Using a clean syringe, transfer 125µl of the acid surrogate (10,000 µg/mL) to the volumetric flask and replace the stopper. Using clean methylene chloride carefully bring the meniscus to the mark on the flask. Use extreme caution to ensure proper volume. Transfer contents of the volumetric to a clean 5mL amber vial with a PFTE-lined screw cap using a pasteur pipet. Label vial with contents, standard ID and expiration date. Using a Sharpee, mark the meniscus with a line to ensure no evaporation has taken place when not in use, store protected from light at 10°C-20°C.

8.2.2 Preparation of Intermediate Calibration Standard Stock at 250µg/mL - Secondary Source Verification

Prepare each individual commercial calibration stock solutions according to the manufactures instructions. Transfer each of the calibration stock solutions into 1.5mL amber vials with teflon lined screw caps using pasteur pipets. Label each vial with contents, standard ID and expiration date. Clean a 5mL volumetric flask and stopper with methylene chloride. Do not add any methylene chloride to the flask until all solutions have been added. Using a clean syringe, transfer 625µl of each 2,000 µg/mL calibration stock solution and 1250µl of each 1000 µg/mL calibration stock solution into the volumetric flask. Rinse the syringe between each aliquot with clean methylene chloride and replace the stopper. Using a clean syringe, transfer 250µl of the Base Neutral Surrogate (5,000 µg/mL) to the volumetric flask and replace the stopper. Using a clean syringe, transfer 125µl of the acid surrogate (10,000 µg/mL) to the volumetric flask and replace the stopper. Using clean methylene chloride carefully bring the meniscus to the mark on the flask. Use extreme caution to ensure proper volume. Transfer contents of the volumetric to a clean 5mL amber vial with a PFTE-lined screw cap using a pasteur pipet. Label vial with contents, standard ID and expiration date. Using a Sharpee mark the meniscus with a line to ensure no evaporation has taken place. When not using, store protected from light at -10 to -20C.

8.3 Working Standard Solution

8.3.1 Calibration standards - Eight calibration standards are prepared at eight different concentrations using the 250µg/mL intermediate standard, including 5.0, 10, 20, 50, 80, 120, 160 and 250µg/mL. Each point is prepared in a 1.5mL amber vial with a solid teflon-lined screw cap. Label each point with standard ID, concentration, expiration date and initials. Using a Sharpee mark the meniscus with a line to ensure no evaporation when not in use.

8.3.1.1 All working calibration standards are stored at -10 to -20°C and are freshly prepared if the calibration verification standard indicates a problem. The CCV working standard is stored at 4 ±2 °C.

8.3.1.2 A eight point curve is prepared by diluting the above stock with clean methylene chloride according to the chart below:

Calibration Point	Amt. of stock (µL)	Final Volume	Amt. of Internal Std
250ng/µl	500	0.5mL	10µl
160ng/µl	640	1.0mL	20µl
120ng/µl	480	1.0mL	20µl
80ng/µl also CCV	320	1.0mL	20µl
50ng/µl	200	1.0mL	20µl
20ng/µl	80	1.0mL	20µl
10ng/µl	40	1.0mL	20µl
5.0ng/µl	20	1.0mL	20µl

8.3.1.3 Low limit check standard.

A 1.0ng/µl standard is analyzed to check the lower limit of the system. This point is not used in the calibration curve.

8.3.2 Secondary Source Working Stock Calibration point using 225µg/mL Intermediate Calibration Stock

A single point 80µg/mL is prepared by diluting the secondary source stock with clean methylene chloride. Fill a clean 2mL volumetric frask with 500µl of clean methylene chloride. Using a clean 1mL syringe, transfer 640µl of the above stock into the 2mL volumetric and carefully bring to volume. Add 40µl of semivolatile internal standard to the volumetric and transfer to a clean 5mL amber screw cap vial, label with standard ID, concentration and expiration date. Using a Sharpee, mark the meniscus with a line to ensure proper volume.

8.3.3 Surrogate Standard Check: Dilute the working surrogate standard solution by a factor of two in methylene chloride. Inject this into the GC/MS to determine recovery of surrogate standards. Recovery of all surrogates must be between 95 - 110 % of true value before use in samples.

True values of the surrogates are as follows:

Base/Neutral Surrogates	50µg/mL on column
Nitrobenzene-d5	
Fluorobiphenyl	
p-Terphenyl-d14	
Acid Surrogates	75 µg/mL on column
Phenol-d5	
2-Fluorphenol	
2,4,6-Tribromophenol	

8.3.4 Laboratory Control Sample spike working solution:

Prepare each individual commercial LCS stock solutions according to the manufactures instructions. Transfer each of the calibration stock solutions into 1.5mL amber vials with teflon lined screw caps using pasteur pipets. Label each vial with contents, standard ID and expiration date. Clean a 10mL volumetric flask and stopper with methylene chloride. Do not add any methanol to the flask until all solutions have been added. Using a clean 500µL syringe, transfer 1.0mL of the CLP mix, 250µL of the phenols mix, 500µL of the benzidines mix, 200uL of the NNDMA stock, 500µL of the benzoic acid stock, 500µL of the benzyl alcohol stock, and 500uL of the pyridine stock into the volumetric flask. Rinse the syringe between each aliquot with clean

methylene chloride and replace the stopper. Using clean methanol carefully bring the meniscus to the mark on the flask. Use extreme caution to ensure proper volume. Transfer contents of the volumetric to a clean 5mL amber vial with a PFTE-lined screw cap using a pasteur pipet. Label vial with contents, standard ID and expiration date. Using a Sharpee mark the meniscus with a line to ensure no evaporation has taken place. When not using, store protected from light at -10 to -20°C.

8.3.5 GC/MS tuning standard:

Containing decafluorotriphenylphosphine (DFTPP), pentachlorophenol, benzidine, and DDT is prepared by diluting the stock solution with methylene chloride to form a solution containing 50 ng/µL. Clean a 2mL volumetric flask and stopper with methylene chloride. Add a small amount of clean methylene chloride to the flask and replace the stopper. Using a clean syringe transfer 100µL of DFTPP stock into the 2mL volumetric flask. Using clean methylene chloride slowly bring meniscus up to the mark on the volumetric flask. Transfer the contents of volumetric flask to a clean 5 mL amber PFTE-lined screw cap vial. Label vial with concentration, standard ID and expiration date. Using a Sharpee, mark the meniscus with a line to ensure no evaporation has occurred when not in use. Store at 4°C±2°C (per vendors recommendation) when not in use.

8.3.6 Matrix Spike Check:

Dilute the working matrix spike standard solution by a factor of two in Methylene Chloride. Inject this into the GC/MS to determine recovery of matrix spike compounds. Recovery of all matrix spike compounds must be between 95 -110 % of true value before use in samples. True values of the spiking solution are as follows:

BASE/NEUTRAL SPIKES	µg/mL on column
1,4-Dichlorobenzene	50
n-Nitroso-di-N-propylamine	50
1,2,4-Trichlorobenzene	50
Acenaphthene	50
2,4-Dinitrotoluene	50
Pyrene	50

ACID SPIKES	µg/mL on column
Phenol	75
2-Chlorophenol	75
4-Chloro-3-Methylphenol	75
4-Nitrophenol	75
Pentachlorophenol	75

8.3.6.1 Some projects may require the spiking of the specific compounds of interest. When this occurs, the matrix and LCS spiking standards should be prepared in methanol, with each compound present at a concentration appropriate for the project.

8.4 Acetone, pesticide residue quality or equivalent.

8.5 Hexane, pesticide residue quality or equivalent.

8.6 Methanol, pesticide residue quality or equivalent.

8.7 Methylene chloride, pesticide residue quality or equivalent.

8.8 TRACKING OF ANALYTICAL STANDARDS

8.8.1 Chemical Receipt

The receipt of all standards, neat compounds and reagents from commercial sources is documented in the Chemical Receiving Logbook by sample receiving personnel or designate. Each solution or compound is assigned a unique standard receipt ID number, the letter "A" and a four digit sequential number. The date received, source, lot number, expiration date and disposal date are recorded.

8.9 Standards Preparation:

Standards are prepared as written in the respective SOPs. In order to assure the accuracy of standards the following general guidelines are used:

8.9.1 AMRO purchases pesticide residue grade solvents and purge and trap grade Methanol for organic standard preparation and organic sample extractions.

8.9.2 ACS reagent grade chemicals are used when the method warrants.

8.9.3 Any stock standards that are purchased are accompanied by a certificate of analysis from the manufacturer.

8.9.4 Class A volumetric glassware is used to prepare standards.

8.10 Standard Tracking:

It is important to be able to track all analytical standards back to their sources. The following procedure is used by AMRO personnel to accomplish this:

8.10.1 Standards, neat compounds and reagents from commercial sources is documented in the Chemical Receiving Logbook by sample receiving personnel or designate. Each solution or compound is assigned a unique standard receipt ID number, which consists of the letter "A" and a four digit sequential number. The date received, source, lot number, expiration date and disposal date are recorded. The expiration dates are provided from the manufacturer and the disposal dates are completed by AMRO employees when standards are used up or disposed. Refer to the Certificate of Analysis Logbook for standard concentration information. The Certificates are kept on file in the GC/MS department.

8.10.2 Standards Preparation

Standards are prepared as written in the respective SOPs. In order to assure the accuracy of standards the following general guidelines are used:

AMRO purchases pesticide residue grade solvents and purge and trap grade Methanol for organic standard preparation and organic sample extractions.

Any stock standards that are purchased are accompanied by a certificate of analysis from the manufacturer.

Class A volumetric glassware is used to prepare standards.

8.10.3 Organic Standards:The Organic Standards Tracking Log consists of three sections, an Index, a Stock section and a Working section. Stock Standards are defined as any solution that requires a dilution or addition to multiple solutions and are used to make Working Standards. Working Standards are defined as anything that is added directly to a sample or analyzed directly on an instrument.

8.10.3.1 The ID index assures that no two standards are assigned the same ID number. The Index requires the Standard ID, the section of the Standard Log (Stock or Working) the Standard information is located, and a brief description of the standard.

8.10.3.2 Stock Section: Whenever a stock standard solution is opened or prepared, this information is recorded in the Stock Standard Logbook section of the standard tracking log.

8.10.3.2.1 Date prepared and Prepared by are the first two items to be completed. The next is the compound name, which should be the name of the solution being used. Do not use vendor catalog numbers alone.

8.10.3.2.2 The Receipt/Stock ID is the ID of the solution being used. This can be the "A" number or a Stock ID number.
The Source of the solution is the manufacturer.
The concentration or purity of the solution is the next item.

8.10.3.2.3 The amount in grams (g) or microliters (μL) of the solution used and the final volume of the solution made is documented. The final concentration of the new solution and the units is recorded.

The stock solution is assigned a new ID number consisting of the letter "S" for semivolatile, the date of preparation plus a letter suffix starting with the letter "A". This ID along with the compound name, concentration and initials of the person making the stock are included on the label. Example - The fourth semivolatile standard prepared on April 15, 1989 would have the standard ID S041589D. This number will be recorded in the logbook and written on the container along with expiration date and analyst initials.
The storage location is recorded in the logbook.
The expiration date is the last item recorded. Stock standards are good one year from the date opened or the date provided by manufacturer, whichever is shorter. The analyst must verify that 1 year from the date opened is within the manufacturers expiration date window. If it is not, then the manufacturer's expiration date must be used for the AMRO expiration date.

8.10.4 Working Section - Whenever a working standard solution opened or is prepared, whether from AMRO stocks or commercially obtained stocks, the information is recorded in the Working Standard section of the standard tracking log.

- Date opened/prepared and Opened/Prepared by are the first two items to be completed.

The next is the compound name, which should be the name of the solution being used. Do not use vendor catalog numbers alone.
The Receipt/Stock ID is the ID of the solution being used. This can be the "A" number or a Stock ID number. If a stock ID number was previously assigned, use the stock ID number rather than the "A" number for traceability.
The Source of the solution is the manufacturer.
The concentration or purity of the solution is the next item.
The amount in microliters (uL) of the solution used and the final volume of the solution made is documented.
The final concentration of the new solution and the units is recorded.
The stock solution is assigned a new ID number consisting of the letter "S" for semivolatile, the date of preparation plus a letter suffix starting with the letter "A". This ID along with the compound name, concentration and initials of the person making the stock are included on the label. Example - The fourth semivolatile standard prepared on April 15, 1989 would have the standard ID S041589D. This number will be recorded in the logbook and written on the container along with expiration date and analyst initials.
The storage location is recorded in the logbook.
The expiration date is the last item recorded. Working standards are good one year from the date opened or the oldest date prepared of any compound stock standard or the date provided by manufacturer, whichever is shorter. The daily CCV standards are good for one week only. The analyst must verify that 1 year from the date opened is within the manufacturers expiration date window. If it is not than the manufacturer date must be used for the expiration date.

8.11 Standard Storage - Standards and reagents are stored per method specifications or manufacturer's instructions. Semivolatile standards are stored in refrigerators at 4 +/- 2°C, or in freezers at below minus 10 °C, and/or ambient temperature depending upon the method and manufacturer requirements.

8.12 Solvent Check Analysis

All extraction procedures are performed using pesticide residue grade solvents and a method or procedural blank analysis is performed when a new lot number is received to verify the absence of target analytes.

9.0 PROCEDURE

9.1 Sample Preparation

9.1.1 All Samples are normally prepared by one of the following Methods prior to GC/MS analysis

Matrix	SW-846 Methods	AMRO SOP
Water	3510	OL-2003
Soil/Solids	3541	OL-2004
Waste	See supervisor	

9.1.2 Sample extracts are prepared by adding 2µl of internal standard solution per 100µl of extract (or diluted extract) that is dispensed into a 2mL crimp vial.

9.1.3 AMRO does not routinely perform any cleanups of extracts for semivolatile analyses, however if significant non-target analyte interference exists for aniline and aniline derivatives, or phthalate esters, or nitrosamines, or nitroaromatics and cyclic ketones, or haloethers, or chlorinated hydrocarbons, then the Florisil cleanup (OL-2018, SW-846 Method 3620B) may be used to remove interferences.

9.2 GC/MS Conditions

Attachment 7 contains the specific instrument operating conditions. These parameters are contained in method file *BNAmmdd.m;* where mm = the month, and dd=the day of calibration, or any similar format incorporating the date of calibration. Method calibration files should be archived with the data files at the time of back-up on the file server

9.3 Hardware Tuning - The GC/MS system must be hardware-tuned using a 50 ng injection of DFTPP. Analyses must not begin until the tuning criteria are met.

9.3.1 Under the HP ChemStation drop down menu item, select Tune. In the drop down menu select Autofind DFTPP to screen or printer. This macro selects the peak apex plus or minus one scan average mass spectrum and does an automatic background correction. Alternately, the whole peak average spectrum and a single scan background correction may be evaluated. Another alternative is the use of a single passing scan near

the TIC peak apex after the background scan correction. All background correction scans must be before the DFTPP peak but not more than 20 scans before the DFTPP apex. In either case, a hard copy showing the passing spectrum and passing criteria must be printed, dated and initialed by the analyst.

9.3.2 Use the DFTPP mass intensity criteria as tuning acceptance criteria.

MASS	ION ABUNDANCE CRITERIA 8270
51	30-60 % of mass 198
69	present
68	< 2% of mass 69
70	< 2% of mass 69
127	40-60 % of mass 198
197	< 1% of mass 198
198	Base peak, 100% relative abundance
199	5-9 % of mass 198
275	10-30 % of mass 198
365	> 1% of mass 198
441	Present but less than mass 443
442	> 40% of mass 198,
443	17-23 % of mass 442

NOTE: All subsequent standards, sample, MS/MSDs, and blanks associated with a DFTPP analysis must use the identical mass spectrometer instrument conditions.

9.4 Initial Calibration

9.4.1 Using the HP 7673 autosampler, inject 1µl of each calibration standard (containing internal standards). Seven calibration levels are injected: 5.0 ng/µl, 10 ng/µl, 20 ng/µl, 50 ng/µl, 80 ng/µl, 120 ng/µl, and 160 ng/µl. An injection volume of 1µl is used for all standards and sample extracts. A set of at least 5 calibration standards is required. The default quantitation ions and association of target analytes and internal standards is listed in Attachments 1A, 1B, and 1C.

The data system software calculates relative response factors (RRFs) for each target analyte relative to one of the internal standards as follows:

$$RRF = \frac{A_s \times C_{is}}{A_{is} \times C_s}$$

where:

A_s = Peak area of the analyte's quantitation ion
A_{is} = Peak area of the internal standard's quantitation ion
C_s = Mass of analyte injected in nanograms (ng)
C_{is} = Mass of internal standard injected in nanograms (ng)

9.4.2 System performance check compounds (SPCCs)

9.4.2.1 System Performance Check Compounds (SPCCs) are: N-nitroso-d-n-propylamine; hexachlorocyclopentadiene; 2,4-dinitrophenol; and 4-nitrophenol. The minimum acceptable average RRF for these compounds is 0.050 in the initial calibration curve. If the minimum response factors are not met, the system must be evaluated, and corrective action must be taken before sample analysis begins. Possible problems include standard mixture degradation, injection port inlet contamination, contamination at the front end of the analytical column, and active sites in the column or chromatographic system. This check must be met before sample analysis begins.

9.4.3 Calibration check compounds (CCCs) are as follows:

Base/Neutral Fraction	Acid Fraction
Acenaphthene	4-Chloro-3-Methylphenol
1,4-Dichlorobenzene	2,4-Dichlorophenol
Hexachlorobutadiene	2-Nitrophenol
N-Nitrosodiphenylamine	Phenol
Di-n-octyl phthalate	Pentachlorophenol
Fluoranthene	2,4,6-Trichlorophenol
Benzo(a)pyrene	

9.4.3.1 The data system calculates the mean response factor and the relative standard deviation (RSD) of the response factors for each target analyte. The RSD should be less than or equal to 15% for each target analyte. However, the RSD for each individual CCC must be less than or equal to 30%.

$$RSD = \frac{SD}{RF} * 100$$

Where: SD = Standard Deviation
RF = Relative Response Factor

9.4.3.2 If the RSD of any CCC is greater than 30%, then the chromatographic system is too reactive for analysis to begin. Evaluate possible causes of the problems, perform additional maintenance which may include replacing the injector liner, clipping 2 to 3 inches off the front of the capillary, or replacing the capillary column, then repeat the calibration procedure.

9.4.4 Evaluation of retention times - The relative retention time (RRT) of each target analyte in each calibration standard must agree within 0.06 RRT units.

9.4.5 Linearity of target analytes - If the RSD of any target analyte is 15% or less, then the relative response factor is assumed to be constant over the calibration range, and the average relative response factor can be used for quantitation.

9.4.5.1 If the RSD of any target analyte is greater than 15%, linear regression or quadratic equation may be used but the Coefficient of Determination (COD) (r^2) must be greater than 0.99 for the calibration to be valid for the analyte.

9.4.5.2 Several compounds may not exhibit sufficient response at the lower calibration levels due to their chemical properties. These compounds are indicated in Table 1 by a Reporting Limit of 20 ug/L in water. If the %RSD criteria cannot be met for any of these compounds with all seven data points then up to the two lowest points (i.e. the 5.0 and 10 ug/ml calibration points) may be excluded from the calibration curve to meet the criteria. If the criteria cannot be met in this manner then further investigation into the problem must be initiated. If there is a subset of compounds to be reported, then the curve may be used for those which meet the criteria; e.g PAHs only.

9.4.6 A second source initial calibration verification standard (ICV) is analyzed after the initial calibration. All analytes must be within 25% of the expected value.

9.5 GC/MS calibration verification - Calibration verification consists of five evaluation steps that are performed prior to sample extract analysis at the beginning of each 12 hour shift.

9.5.1 Prior to the analysis of samples or calibration standards, inject 50 ng of the tune standard into the GC/MS system. The resultant mass spectrum for DFTPP must meet the criteria given in section 9.3.2 before sample analysis begins. Using the Enviroquant "Tailing" macro in QEDIT, evaluate and

hardcopy the tailing factor for pentachlorophenol and benzidine. See Section 9.5.2.3 for the formula used. The tailing factors must be less than 5 and 3, respectively. Evaluate the DDT degradation using the following formula: ((DDD+DDE) / (DDT+DDD+DDE))*100 = %degradation. DDT degradation must be less than 20%. These criteria must be demonstrated before each 12-hour shift during which samples are analyzed.

9.5.2 The initial calibration for each compound of interest is verified once every 12 hours prior to sample analysis, using the introduction technique and conditions used for samples. This is accomplished by analyzing the 80 ng/µl calibration standard and verifying that the following criteria are met. All analytical queues containing USACE project samples must be followed by a closing CCV. CCV criteria do not apply to the closing standard and the results do not need to be reported, but the data must be available to USACE inspection if requested.

9.5.2.1 System performance check compounds (SPCCs) - A system performance check must be made during every 12-hour analytical shift. Each SPCC in the calibration verification standard must meet a minimum response factor of 0.050. This is the same check that is applied during the initial calibration.

If the minimum response factors are not met, the system must be evaluated, and corrective action must be taken before sample analysis begins. Possible problems include standard mixture degradation, injection port inlet contamination, contamination at the front end of the analytical column, and active sites in the column or chromatographic system. This check must be met before sample analysis begins.

9.5.2.2 Calibration check compounds (CCCs) - After the system performance check is met, the CCCs listed in Section 7.4.3 are used to check the validity of the initial calibration. Use percent difference when performing the average response factor model calibration. Use percent drift when calibrating using a regression or quadratic fit model. If the percent difference or drift for each CCC is less than or equal to 20%, then the initial calibration is assumed to be valid. If the criterion is not met (i.e., greater than 20% difference or drift) for any one CCC, then corrective action must be taken prior to the analysis of samples. If the CCCs are not included in the list of analytes for a project, then all analytes which will be reported must meet the 20% difference or drift criterion. Problems similar to those listed under SPCCs could affect the CCCs. If the problem cannot be corrected by other measures, a new initial

calibration must be generated. The CCC criteria must be met before sample analysis begins.

9.5.2.3 Peak tailing will be evaluated by using the Enviroquant "Tailing" macro in QEDIT for each tune mix standard run and printed. Tailing factor is calcluated by the software and must be <5 for Pentachlorophenol and <3 for Benzidine. The formula is as follows:

$$\text{Peak Tailing} = \frac{B*C}{A*B}$$

9.5.3 A method or solvent blank must be analyzed after the calibration standard, or at any other time during the anlytical shift, to ensure that the total system (introduction device, transfer lines and GC/MS system) is free of contaminants. If the sample extracts in the 12 hour analysis shift are being analyzed solely for dilution of target analytes exceeding calibration range, and the method blank analyzed with the sample extract was previously demonstrated to be free of contaminants, then a method or solvent blank is not required to be analyzed with the reanalysis for dilution. See the following for method blank performance criteria.

9.5.3.1 Less than half of the Reporting Limit for the matrix for the specific analyte.

9.5.3.2 Less than a level specified in a quality assurance project plan specific to the associated samples.

9.5.3.3 Less than the MDL check sample concentration for all batches containing USACE project samples. See Section 9.1.1.

If the method blank exceeds these criteria then an investigation will be initiated.

9.5.4 Internal standard retention time - The retention times of the internal standards in the calibration verification standard must be evaluated immediately after data acquisition. If the retention time for any internal standard changes by more than 30 seconds from that in the mid-point standard level of the most recent initial calibration sequence, then the chromatographic system must be inspected for malfunctions and corrections must made, as required. When corrections are made, reanalysis of samples analyzed while the system was malfunctioning is required. AMRO also evaluates all samples and batch QC against the daily CCV using the same

criteria. The decision to re-analyze samples due to internal standards falling outside of the windows is based on analysts' judgement of data impact.

- If examination of the total ion chromatogram shows no evidence of matrix interference or elevated baseline, the extract should be reanalyzed to determine if there is some other matrix effect behavior or that the added internal standard solution is no longer acceptable for use. If reanalysis exhibits the same behavior then the analyst will report the data and indicate the problem on the Data Review Checklist with some assessment of data impact.

- If examination of the total ion chromatogram shows evidence of matrix interference or elevated baseline, the analyst should evaluate whether a dilution is warranted due to peak distortion. If there are no chromatographic anomalies, the data is reported as is since the internal standard is designed to allow for some matrix effects or inlet discrimination.

9.5.5 Internal standard response - if the EICP area for any of the internal standards in the calibration verification standard changes by a factor of two (-50% to +100%) from that in the mid-point standard level of the most recent initial calibration sequence, the mass spectrometer must be inspected for malfunctions and corrections must made, as required. When corrections are made, reanalysis of sample analyzed while the system was malfunctioning is required. AMRO also evaluates all samples and batch QC against the daily CCV using the same criteria. The decision to re-analyze samples due to internal standards falling outside of the windows are based on analysts' judgement of data impact.

- If examination of the total ion chromatogram shows no evidence of matrix interference or elevated baseline, the extract should be reanalyzed to determine if there is some other matrix effect behavior or that the added internal standard solution is no longer acceptable for use. If reanalysis exhibits the same behavior then the analyst will report the data and indicate the problem on the Data Review Checklist report with some assessment of data impact.

- If examination of the total ion chromatogram shows evidence of matrix interference or elevated baseline, the analyst should evaluate whether a dilution is warranted due to peak distortion. If there are no chromatographic anomalies, the data is reported as is since the internal standard is designed to allow for some matrix effects or inlet discrimination.

9.6 GC/MS analysis of samples

9.6.1 Allow the sample extract to warm to room temperature. Add 2 µL of the internal standard per 100 µL of concentrated sample extract or diluted extract obtained from sample preparation.

9.6.2 Inject a 1µL aliquot of the sample extract into the GC/MS system, using the same operating conditions that were used for the calibration.

9.6.3 If the response for any quantitation ion exceeds the initial calibration range of the GC/MS system, the sample extract must be diluted and reanalyzed.

9.6.4 Monitor internal standard retention times and responses (area counts) in all samples, spikes, blanks, and standards to effectively check drifting method performance, poor injection execution, and anticipate the need for system inspection and/or maintenance.

9.6.5 The use of Selected Ion Monitoring (SIM) is acceptable for applications requiring detection limits below the normal range of electron impact mass spectrometry. However, SIM provides a lesser degree of confidence in compound identification.

9.7 Qualitative analysis

9.7.1 The qualitative identification of compounds determined by this method is based on retention time and on comparison of the sample mass spectrum, after background correction, with characteristic ions in a reference mass spectrum. The reference mass spectrum must be generated by using the conditions of this method. The characteristic ions from the reference mass spectrum are defined as the three ions of greatest relative intensity, or any ions over 30% relative intensity, if less than three such ions occur in the reference spectrum. Compounds are identified when the following criteria are met.

9.7.1.1 The intensities of the characteristic ions of a compound must maximize in the same scan or within one scan of each other. Selection of a peak by the HP data system target compound search routine where the search is based on the presence of a target chromatographic peak containing ions specific for the target compound at a compound-specific retention time will be accepted as meeting this criterion.

9.7.1.2 The RRT of the sample component is within +/- 0.06 RRT units of the RRT of the standard component.

9.7.1.3 The relative intensities of the characteristic ions agree within 30% of the relative intensities of these ions in the reference spectrum. (Example: For an ion with an abundance of 50% in the reference spectrum, the corresponding abundance in a sample spectrum can range between 20% and 80%).

Isometric pairs are resolved >90% to baseline except in the case of Benzo(b)fluoranthene and Benzo(k)fluoranthene. In this case, manual integration is performed by drawing parallel to the baseline and then stopping at the baseline point where the valley between the two isomers is deepest. This integration is performed on all calibration standards. Samples are integrated in the same way as the standards.

9.7.1.4 Identification is hampered when sample components are not resolved chromatographically and produce mass spectra containing ions contributed by more than one analyte. When gas chromatographic peaks obviously represent more than one sample component, i.e. a broadened peak with shoulder(s) or a valley between two or more maxima, appropriate selection of analyte spectra and background spectra is important.

9.7.1.5 Examination of extracted ion current profiles of appropriate ions can aid in the selection of spectra and in qualitative identification of compounds. When analytes co-elute (i.e. only one chromatographic peak is apparent), the identification criteria may be met, but each analyte spectrum will contain extraneous ions contributed by the co-eluting compound.

9.8 Quantitative analysis

9.8.1 Once a compound has been identified, the quantitation of that compound will be based on the integrated abundance of the primary characteristic ion from the EICP.

9.8.2 Isomeric pairs will be reported as individual compounds by performing integration in the same manner that the standards were integrated.

9.8.3 The integration of compounds for standards and samples should be performed to be in the same manner as the initial calibration integration. Cases where the initial calibration is in question should be investigated to

ensure it is not related to poor maintenance, damaged or defective column, or other issues which should be solved before further analysis.

9.8.4 The following must be checked for each compound present in standards and samples to ensure proper integration has been performed.

9.8.4.1 The peak shape of the calibration compound must be maintained for standards and samples. This should take into account any shouldering, peak tailing, and peak co-elution.

9.8.4.2 The retention time windows for each compound of the calibration must be applied to standards and samples. If there is a retention time shift confirmed by comparison of the Internal Standards and Surrogates then pattern recognition can be utilized for identification of multi-component analytes or known isomer relative retention time patterns, e.g., benzo(b) and benzo(k) fluoranthene, dibenz(a,h)anthracene and indeno(1,2,3,cd)pyrene. If the retention time shifts are serious enough to cause potential false negatives or quantitation errors for many compounds, then re-calbration is required.

9.8.4.3 The baseline integration techniques for each compound of the calibration must be maintained for the standards and the samples. This should take into account elevated baselines, column compensation corrections and negative peaks in samples.

9.8.4.4 Make sure that positive identification of compounds has been established thru EICP's. Pay special attention to the isomer pairs commonly misidentified by the data system, i.e. phenanthrene + anthracene, benzo(a)anthracene +chrysene, benzo(b)fluroanthene + benzo(k)fluoranthene, indeno(1,2,3,cd)pyrene + dibenz(a,h)anthracene, the trichlorophenol isomers, the dichlorobenzene isomers, the dueterated dichlorobenzene isomers, the methylphenol isomers, and benzyl alcohol.

9.8.4.5 Ensure any positive results are within the lower and upper levels of the calibration curve and above the reporting limits for each compound.

9.8.4.6 If there are any cases where the integration of a compound is questionable after ensuring the above steps have been followed then consult another qualified analyst. Chromatograms should be printed out in these cases, dated and initialed by the analyst and the qualified consultant.

10.0 INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR

Instrument maintenance and repair records are maintained to document satisfactory instrument performance. The operator is generally responsible to see that records are well kept. Records of major maintenance and repair are kept in the instrument maintenance log per instrument. Routine maintenance procedures such as changing the GC septum need only be recorded in the instrument analysis log.

10.1 Daily maintenance procedures:

10.1.1 The following procedures are performed each day an instrument is used for analysis.

10.1.1.1 The GC septum and glass liner are removed and replaced if judged necessary by the analyst.

10.1.1.2 Column performance is monitored by checking the response factor of key compounds which indicate column degradation and/or column bleed. Clip two or more inches from the head of the column if necessary.

10.1.1.3 Check that gases have adequate supply to last until the following day. Change tanks if necessary.

10.1.1.4 Check for sufficient data file space on the data system hardrive.

10.2 Weekly maintenance procedures:

10.2.1 Clip column at the inlet end.

10.2.2 Swab shell weldment with methylene chloride or other appropriate solvent.

10.2.3 Clean or replace gold seal.

10.3 Six month maintenance procedure:

10.3.1 Six month maintenance procedure. Every six months the vacuum pump oil and the adsorbent trap packing should be changed.

10.4 Maintenance "As needed":
The following service should be performed when system performance Indicates:

10.4.1 Clean the analyzer source. This will become necessary if a high background becomes apparent which is not attributable to column degradation or the system cannot meet DFTPP criteria.

10.4.2 Replace the electron multiplier when the maximum gain no longer provides the required sensitivity.

10.4.3 Replace the ion source filament as needed.

11.0 CALCULATIONS

11.1 Sample results are calculated automatically using a Microsoft EXCEL spreadsheet macro called *calcmul2*. The macro requires that specific information be included in the Sample and Miscellaneous fields in the HP Chemstation quantitation report. Provided that the information has been entered correctly, the results are provided as direct read-out in units of ug/liter for water samples and mg/kg for soil samples. The information and format of the sample information is as follows:

Sample : [AMRO ID#] DF= {8270-SX}
Misc : Matrix FV= Samp= S= X

Where: [AMRO ID#] = AMRO # in square brackets
DF = dilution factor
{8270-SX} = LIMS test code in curly brackets
FV = Final volume of sample extract in mLs
Samp = sample weight in grams for soils, sample volume in mLs for water
S = Dry weight % (i.e. % Solids)
X = Extraction date of sample

Example follows for a soil sample:

Sample : [20152-03] DF=1 {8270_SX}

Misc : Soil FV=1ML SAMP=20.10G S=94.5 X083198

12.0 QUALITY CONTROL

12.1 Initial Demonstration of Lab Performance

The ability of AMRO to produce accurate and precise data is demonstrated per instrument/per analyst for each method. This information was entered on an Excel® spreadsheet and is kept on file with the QC department along with the associated chromatograms and quantitation output pages. It consists of a Method Detection Limit Study (MDL) and Precision and Accuracy Study (P&A) for each instrument and each matrix on an annual basis.

12.1.1 The method detection limit is defined in 40 CFR 136 Appendix B. The MDL is determined annually by the analysis of a minimum of seven replicate samples, all containing an analyte(s) of the same low-level concentration. These replicate samples are put through all the preparation steps that a sample is put through. The standard deviation of the results of these analyses is multiplied by the appropriate student T-test value and the resulting value is deemed the method detection limit for that specific analyte.

This is performed annually for each method, each instrument and each matrix analyzed by AMRO. Quarterly preparation and analysis of MDL check samples are performed and the results compared to the USACE and Navy requirements. MDL check sample concentrations should be about twice the target analyte MDL values. MDL values must be less than about 1/3 of the RL value for each analyte.

12.1.2 Precision &Accuracy

Accuracy is a measure of the degree to which the analytical result approaches the "true" value of the concentration of the analyte being determined. Precision in the laboratory is determined by the comparison of duplicates, where duplicate samples result from an original sample that has been split for identical analyses. Precision and Accuracy in the laboratory is assessed initially by the analyses of a minimum of 4 replicate samples at a mid-level point of the expected range. The percent recoveries and Relative Standard Deviations (RSD) are evaluated and compared to method specifications or default limits where applicable.

Accuracy is also assessed by the regular analysis of known standards such as the Laboratory Control Samples (LCS), and matrix and analytical spikes. Accuracy within the laboratory is expressed in terms of percent recovery.

The precision of data is regularly evaluated by determining the relative percent difference (RPD) of duplicate (replicate) analyses.

12.2 The GC/MS system must be tuned to meet the DFTPP criteria listed in Section 9.3.2.

12.3 There must be an initial calibration of the GC/MS system as described in Section 9.4.

12.4 The GC/MS system must meet the calibration verification acceptance criteria in Section 9.5, each 12 hours.

12.5 Sample Quality Control for Preparation and Analysis - The laboratory analyzes QC samples for every analytical batch of up to 20 samples or each day, whichever is more frequent. QC samples include a method blank, matrix spike, matrix spike duplicate, and a laboratory control sample (LCS) in each analytical batch and the addition of surrogates to each field sample and QC sample.

12.5.1 Method blanks are evaluated for every extraction batch. See Section 9.5.3 for method blank performance criteria.

12.5.2 Full list Matrix spike (MS)/matrix spike duplicate (MSD) pairs are prepared with every extraction batch if sufficient sample was provided. The MS/MSD are evaluated for % Recovery and Relative Percent Difference (RPD). Quality Control limits are updated annually for the water and soil matrices (non-soil solid samples follow the rules for soil samples). Note the special USACE acceptance criteria limits for the LCS apply to all USACE or Navy project sample matrix spikes by default.

12.5.2.1 If all analytes are within QC limits then accuracy and precision objectives have been met for the matrix.

12.5.2.2 If any analyte exceeds QC limits then an investigation of possible causes begins. This may include, but is not limited to, the following:

12.5.2.2.1 Review of the preparation worksheet to see if any problems were encountered by the technicians during sample preparation such as emulsions, unusually high or low initial pH, observations or descriptions of a

strange physical appearance of the sample, extract losses during handling, etc;

12.5.2.2.2 review of the chain-of-custody to see if any descriptions or notations were provided by client;

12.5.2.2.3

12.5.2.2.4 previous knowledge of the history of the particular matrix;

12.5.2.2.5 evaluation of the total ion chromatogram (TIC) for interferences in the region of interest.

12.5.3. A Full List Laboratory Control Sample (LCS) is included with each extraction batch. If sufficient sample was not provided for an MS/MSD, then a LCS Duplicate is also extracted. The LCS consists of an aliquot of a clean (control) matrix similar to the sample matrix and of the same weight or volume. The LCS is spiked with a full analyte list at the same relative concentrations (acid and base) as the matrix spike. When the results of the matrix spike analyses indicate a potential problem due to the sample matrix itself, the LCS results are evaluated to verify that the laboratory extraction systems are in control. Note the special default USACE acceptance criteria limits for LCS samples are described in the Attachments 3A, 3B, 3C and 4A, 4B, and 4C and these apply to all USACE and Navy project sample LCS reports. Note that 3 Sporadic Marginal Exceedances of the criteria below are allowed for each full list LCS.

12.5.4 Surrogate recoveries - The laboratory must evaluate surrogate recovery data from individual samples versus the surrogate control limits developed by the laboratory. The same evaluation criteria for sections 12.5.2.1 through 12.5.2.3 are applied to the surrogates.

12.5.3 Special surrogate recovery limits apply to all USACE and Navy project samples and associated QC samples. These limits are listed in Attachment 2 and the USACE test codes: Note that Sporadic Marginal Exceedances of surrogate recoveries is not allowed. All surrogate failures must be discussed in the narrative and results flagged. Samples must be re-extracted and re-analyzed if sufficient volume remains.

12.5.4 Samples must be selected for spiking at random and rotated among clients and sites from batch to batch. In some cases, the client may specify which sample is to used for MS/MSD; if not , the laboratory shall pick a representative sample based on the following:

A. MS/MSD shall not be performed on Trip Blank, Rinsate Blank or Field Blank.
B. Adequate sample weight/volume.
C. Client requested QC deliverables.

12.6 The following additional Quality Control criteria should be met for all Massachusetts Contingency Plan (MCP) projects where MCP methods are requested:

12.6.1 MS/MSD: Must contain all target compounds. Recoveries should be between 40-140% for base-neutral targets and between 30-130% for acids. RPDs should be≤20% for waters and ≤30% for soils. Document exceedance in narrative with laboratory statistical control limits if recoveries are *within* AMRO statistical limits.

12.6.2 LCS- Must contain all target compounds.Recoveries must be between 40-140% for base-neutral targets and between 30-130% for acids. Re-extract if >20% of all analytes fall outside the criteria or if >15% or either fraction fall outside the criteria. Document exceedance in narrative with laboratory statistical control limits if recoveries are *within* AMRO statistical limits.

12.6.3 Surrogates- Recoveries must be between 30-130% for all surrogates in soils. Recoveries must be between 30-130% for all base-neutral surrogates in water and between 15-110% for acids in water. Document exceedance in narrative with laboratory statistical control limits if recoveries are *within* AMRO statistical limits.

12.7 USACOE and Navy Projects:

12.7.1 For all project submitted from the USACOE and Navy follow the specific requirements as indicated in Attachment 2, 3A, 3B, 3C, 4A, 4B, 4C. LCS failure occurs if: (1) a project specific analyte exceeds the control limits; or (2) if more than the allowable number of Sporadic Marginal Exceedances occur; or (3) if any single analyte exceeds the SME limits. Corrective action must be applied to all analytes that exceed the primary control limits used as acceptance criteria. If the problem appears to be isolated to the LCS then a new LCS may be prepared and run with the original batch reruns. If the problem appears to affect all the samples in the batch, indicated by similar problems in the surrogates and matrix spikes, then the entire batch must be reprepared and reanalyzed. If the new LCS has similar problems then all the associated data must be flagged in the results and discussed in the

narrative. If the new LCS passes, report both LCS results and discuss the problem analytes in the narrative.

13.0 DATA REVIEW AND STORAGE

AMRO's goal for completeness is 100%. The following data calculating, reviewing and reporting procedures are followed to obtain that goal.

13.1 Data Review - performed by the analyst:

When an analysis of a sample is complete, the analysis for that sample should be checked and the data calculated as soon as possible to identify any problems while still within the holding time for the analysis. The following steps should be taken to ensure that a good analysis has been obtained.

13.1.1 Check that all calibration analyses associated with the sample meet criteria to ensure acceptance criteria is met.

13.1.2 Check the internal standard areas. They should be -50 to +200% in comparison to the I.S. areas in the Initial Calibration standard.

13.1.3 Compare the surrogate recoveries to the AMRO limits. The default SVO surrogate recovery limits are as follows and are used until in house limits are generated.

13.1.4 Check the LCS to be sure the results are inside the limits, as well as the matrix spike and matrix spike duplicate results.

13.1.5 Check the analyzed times to be sure the tuning requirements are met.

13.1.6 Check that no compounds exceed the calibration range. If there are, these samples must be reanalyzed at a dilution.

13.1.7 Check the chromatography (good peak shape, baseline not noisy, good sensitivity).

13.1.8 Check the analysis for carryover or contamination. If any carryover is evident, these samples must be reanalyzed.

13.1.9 Check that the amount of sample analyzed is correctly recorded in the chromatogram header.

13.1.10 Check spectrum, area, and retention time of any positive hit on the quant output page.

13.1.11 Perform the final calculations on any positively identified compound in µg/L, taking into account dilution factors, etc.

13.1.12 Check the chromatogram for very large peaks not picked up by quant. If any are present, check the spectrum to be sure it is not a target compound that is over the calibration range or outside the normal retention time window. If not a target compound, make a note on the chromatogram that the peak is an unknown and use the library to identify if possible.

13.1.13 Check to see if there are any other analyses of the sample. If so, check to see if the data agrees.

13.1.14 Any problems discovered during this preliminary data check will necessitate re-analysis unless the lab manager authorizes use of the data in writing with an explanation of why the data is being used.

13.1.15 All calculations should be written in black ballpoint pen ink. All cross-outs should be a single line and should be initialed. The person performing these data calculations and checks should sign and date the bottom of the quant page.

13.2 Data Review - performed by the department supervisor or designate.

When all samples for a given project have been analyzed and the results have been calculated, the project goes through the following data review procedure:

13.2.1 The reviewer reads over all associated paperwork to become familiar with the requirements of the project.

13.2.2 The project is checked for completeness.

13.2.3 Data sheets are checked for accuracy.

13.2.4 The data calculations are spot-checked. If any problems are encountered then the whole package should be checked.

13.2.5 The QC data sheets are checked. Any problems encountered by the reviewer are brought to the attention of the lab manager.

13.2.6 All cross-outs must be a single line and should be initialed and dated. Analyst review is documented on the GC and GC/MS Data Review Checklist (Attachment 8).

13.3 Data Reporting

Many report options are available to clients of AMRO. It is AMRO policy to discuss with all clients their reporting requirements soon after receipt of the samples. The cover letter for the data reports will address any quality control problems, either with the condition of the samples upon receipt or with the analyses, or contain a statement that no quality control problems were encountered. The letter will also contain a statement that it is an integral part of the data report.

13.4 Data Archival

13.4.1 GC/MS Data Files:
All raw GC/MS data files are archived through the Network and are backed up on a tape drive through the server.

13.4.2 Data Reports:

Final data and QC reports are input into Excel and spreadsheet files. Template files exist on the Network for final data reports, daily QC check reports, sample spike reports, initial precision and accuracy data, wastewater method accuracy data, surrogate recovery data, and MDL data. When data is input template files are renamed as follows:

Data reports: XXX#####

Where X 's are the first three characters of the AMRO client code and #'s are the AMRO project and sample number.

14.0 REFERENCES

14.1 USEPA Office of Solid and Hazardous Waste - SW-846 Method Chapter 1, Rev. 1 7/92.

14.2 USEPA Method 3500. Physical and Chemical Methods for the Determination of Soild/Hazardous Waste, SW 846, Update III, Revision 2, 12/96

14.3 USEPA Method 8000B. Physical and Chemical Methods for the Determination of Soild/Hazardous Waste, SW 846, Update III, Revision 2, 12/96.

14.4 USEPA Method 8270C. Physical and Chemical Methods for the Determination of Soild/Hazardous Waste, SW 846, Update III, Revision 3, 12/96.

14.5 40 CFR Part 136 Appendix B, 1984

14.6 USACE Shell for Analytical Chemistry Requirements, EM 200-1-3, Feb 01, 2001.

14.7 Massachusetts Department of Environmental Protection, Massachusetts Contingency Plan (MCP) Method BWSC – CAM IIB , Revision 3, May 22, 2003.

14.8 USEPA Superfund Contract Laboratory Program Statement of Work for Organics Analysis OLM04.2 , May 1999.

14.9 Department of Defense Quality Systems Manual For Environmental Laboratories, Final Version 3, January 2006.

Attachment 1A

Semi-Volatile Internal Standards With Corresponding Target Compounds and Surrogates Assigned For Quantitation

	Compound	Quant ion	Qual #1	Qual #2	Qual#3
Internal Standard	1,4-DICHLOROBENZENE-d4	152	115		
	N-NITROSODIMETHYLAMINE	74	42		
	PYRIDINE	79	52	50	73
Surrogate	2-FLUOROPHENOL	112	64		
Surrogate	PHENOL-d5	99	42	71	
	PHENOL	94	65	66	
	ANILINE	93	65	66	
	bis (2-CHLOROETHYL) ETHER	93	63	95	
	2-CHLOROPHENOL	128	64	130	
	1,3-DICHLOROBENZENE	146	148	113	
	1,4-DICHLOROBENZENE	146	148	113	
	BENZYL ALCOHOL	108	79	77	
	2-METHYLPHENOL	108	107		
	1,2-DICHLOROBENZENE	146	148	113	
	bis(2-CHLOROISOPROPYL) ETHER	45	77		
	ACETOPHENONE	105	77	120	51
	4-METHYLPHENOL	108	107		
	n-NITROSO-DI-N-PROPYLAMINE	70	42	130	
	HEXACHLOROETHANE	117	201	199	
Internal Standard	NAPHTHALENE-d8	136	68		
Surrogate	NITROBENZENE-d5	82	128	54	
	NITROBENZENE	77	123	65	
	ISOPH0RONE	82	138		
	2,4-DIMETHYLPHENOL	107	121	122	
	BENZOIC ACID	122	105	77	
	2-NITROPHENOL	139	65	109	
	bis(2-CHLOROETHOXY) METHANE	93	95	123	
	2,4-DICHLOROPHENOL	162	164	98	
	1,2,4-TRICHLOROBENZENE	180	182	145	
	NAPHTHALENE	128	129	127	
	4-CHLOROANILINE	127	129		
	HEXACHLOROBUTADIENE	225	223	227	
	4-CHLORO-3-METHYLPHENOL	107	144	142	
	2-METHYLNAPHTHALENE	142	141		

Attachment 1B

Semi-Volatile Internal Standards With Corresponding Target Compounds and Surrogates Assigned For Quantitation

	Compound	Quant ion	Qual #1	Qual #2	Qual#3
Internal Standard	ACENAPHTHENE-d10	164	162	160	
	HEXACHLOROCYCLOPENTADIENE	237	235	272	
	2,4,6-TRICHLOROPHENOL	196	198	200	
	2,4,5-TRICHLOROPHENOL	196	198	200	
Surrogate	2-FLUOROBIPHENYL	172	171		
	2-CHLORONAPHTHALENE	162	164	127	
	2-NITROANILINE	65	92	138	
	DIMETHYLPHTHALATE	163	194	164	
	2,6-DINITROTOLUENE	165	89	121	
	ACENAPHTHYLENE	152	151	153	
	3-NITROANILINE	138	108	92	
	4-NITROPHENOL	109	139	65	
	2,4-DINITROPHENOL	184	63	154	
	ACENAPHTHENE	153	152	154	
	2,4-DINITROTOLUENE	165	63	182	
	DIBENZOFURAN	168	139		
	DIETHYLPHTHALATE	149	177	150	
	4-CHLOROPHENYL-PHENYLETHER	204	206	141	
	FLUORENE	166	165	167	
	4-NITROANILINE	138	92	108	
Internal Standard	PHENANTHRENE-d10	188	94		
	4,6-DINITRO-2-METHYLPHENOL	198	51	121	
	n-NITROSODIPHENYLAMINE	169	168	167	
	AZOBENZENE	77	51	182	
Surrogate	2,4,6-TRIBROMOPHENOL	330	332	141	
	4-BROMOPHENYL-PHENYL-ETHER	248	250	141	
	HEXACHLOROBENZENE	284	142	249	
	PENTACHLOROPHENOL	266	264	268	
	PHENANTHRENE	178	179	176	
	ANTHRACENE	178	179	176	
	CARBAZOLE	167	166	139	
	DI-N-BUTYL-PHTHALATE	149	150	104	
	FLUORANTHENE	202	101		

Attachment 1C

Semi-Volatile Internal Standards With Corresponding Target Compounds and Surrogates Assigned For Quantitation

	Compound	Quant ion	Qual #1	Qual #2	Qual#3
Internal Standard	CHRYSENE-d12	240	120	236	
	BENZIDINE	184	185	92	
	PYRENE	202	101	100	
Surrogate	TERPHENYL-d14	244	122	212	
	BUTYLBENYLPHTHALATE	149	91	206	
	BIS(2-ETHYLHEXYL)PHTHALATE	149	167	279	
	3,3'-DICHLOROBENZIDINE	252	254	126	
	BENZO(A)ANTHRACENE	228	229	226	
	CHRYSENE	228	226	229	
	DI-N-OCTYL PHTHALATE	149	150		
Internal Standard	PERYLENE-d12	264	260	265	
	BENZO(B)FLUORANTHENE	252	253	125	
	BENZO(K)FLUORANTHENE	252	253	125	
	BENZO(A)PYRENE	252	126	253	
	DIBENZO(A,H,)ANTHRACENE	278	139	279	
	INDENO[1,2,3-CD]PYRENE	276	138		
	BENZO[G,H,I]PERYLENE	276	138	277	

Attachment 2

SURROGATE RECOVERY CONTROL LIMITS FOR USACOE AND NAVY PROJECTS

	8270C Water		8270C Solid	
Analyte	**Lower**	**Upper**	**Lower**	**Upper**
	Control Limit	**Control Limit**	**Control Limit**	**Control Limit**
2-Fluorobiphenyl	50	110	45	105
Terphenyl-d14	50	135	30	125
2,4,6-Tribromophenol	40	125	35	125
2-Fluorophenol	20	110	35	105
Phenol-d5/d6	10	115	40	100
Nitrobenzene-d5	40	110	35	100

Attachment 3A

LCS and MS Control Limits For Semi-volatile Organic Compounds SW-846 Method 8270C
Water Matrix

Analyte	Lower Control Limit	Upper Control Limit	Lower ME	Upper ME
1,2,4-Trichlorobenzene	35	105	25	120
1,2-Dichlorobenzene	35	100	20	115
1,2-Diphenylhydrazine (as Azobenzene)	55	115	45	120
1,3-Dichlorobenzene	30	100	20	110
1,4-Dichlorobenzene	30	100	20	110
2,4,5-Trichlorophenol	50	110	40	120
2,4,6-Trichlorophenol	50	115	40	125
2,4-Dichlorophenol	50	105	40	115
2,4-Dimethylphenol	30	110	15	125
2,4-Dinitrophenol	15	140	10	160
2,4-Dinitrotoluene	50	120	40	130
2,6-Dinitrotoluene	50	115	35	130
2-Chloronaphthalene	50	105	40	115
2-Chlorophenol	35	105	25	115
2-Methylnaphthalene	45	105	35	115
2-Methylphenol	40	110	25	120
2-Nitroaniline	50	115	35	125
2-Nitrophenol	40	115	25	125
3,3´-Dichlorobenzidine	20	110	10	125
3,3´-Dimethylbenzidine	20	150		
3-Nitroaniline	20	125	10	145
4,6-Dinitro-2-methylphenol	40	130	25	145
4-Bromophenyl phenyl ether	50	115	40	125
4-Chloro-3-methylphenol	45	110	35	120
4-Chloroaniline	15	110	10	125
4-Chlorophenyl phenyl ether	50	110	40	120
4-Methylphenol	30	110	20	125
4-Nitroaniline	35	120	20	130
4-Nitrophenol[3]	*0*	*125*	*0*	*145*
Acenaphthene	45	110	35	120
Acenaphthylene	50	105	40	115
Acetophenone	45	135		
Aniline*	10	150		

Notes:

1. All **bold** analytes do not have DoD QSM acceptance criteria and "Shell" criteria are used.
2. **Bold*** analytes are designated Poor Performing Analytes (PPA) in the "Shell"
3. PPA DoD Table D-2 analytes are designated poor performers in the DoD QSM.

Attachment 3B

LCS and MS Control Limits For Semi-volatile Organic Compounds SW-846 Method 8270C Water Matrix

Analyte	Lower Control Limit	Upper Control Limit	Lower ME	Upper ME
Anthracene	55	110	45	120
Benz(a)anthracene	55	110	45	120
Benzidine*	10	150		
Benzo(a)pyrene	55	110	45	120
Benzo(b)fluoranthene	45	120	35	130
Benzo(g,h,i)perylene	40	125	25	135
Benzo(k)fluoranthene	45	125	30	135
Benzoic acid[3]	*0*	*125*	*0*	*150*
Benzyl alcohol	30	110	15	125
Bis(2-chloroethoxy)methane	45	105	35	115
Bis(2-chloroethyl)ether	35	110	25	120
Bis(2-chloroisopropyl)ether	25	130	10	150
Bis(2-ethylhexyl)phthalate	40	125	30	140
Butyl benzyl phthalate	45	115	35	130
Carbazole	50	115	35	130
Chrysene	55	110	45	120
Dibenz(a,h)anthracene	40	125	30	140
Dibenzofuran	55	105	45	115
Diethyl phthalate	40	120	30	130
Dimethyl phthalate	25	125	10	145
Di-n-butyl phthalate	55	115	45	125
Di-n-octyl phthalate	35	135	20	155
Fluoranthene	55	115	45	125
Fluorene	50	110	40	120
Hexachlorobenzene	50	110	40	120
Hexachlorobutadiene	25	105	15	115

Notes:

1. All **bold** analytes do not have DoD QSM acceptance criteria and "Shell" criteria are used.
2. **Bold*** analytes are designated Poor Performing Analytes (PPA) in the "Shell"
3. PPA DoD Table D-2 analytes are designated poor performers in the DoD QSM. Batch acceptance should not be evaluated based on these control limits.

Attachment 3C

LCS and MS Control Limits For Semi-volatile Organic Compounds SW-846 Method 8270C Water Matrix

Analyte	Lower Control Limit	Upper Control Limit	Lower ME	Upper ME
Hexachlorocyclopentadiene	20	150		
Hexachloroethane	30	95	15	105
Indeno(1,2,3-cd)pyrene	45	125	30	140
Isophorone	50	110	40	125
Naphthalene	40	100	30	115
Nitrobenzene	45	110	35	120
N-Nitrosodimethylamine	25	110	10	125
N-Nitrosodi-n-propylamine	35	130	20	145
N-Nitrosodiphenylamine	50	110	35	120
Pentachlorophenol	40	115	25	130
Phenanthrene	50	115	40	130
Phenol[3]	0	115	0	135
Pyrene	50	130	35	140
Pyridine	NA	NA		

Notes:

1. All **bold** analytes do not have DoD QSM acceptance criteria and "Shell" criteria are used.
2. **Bold*** analytes are designated Poor Performing Analytes (PPA) in the "Shell"
3. PPA DoD Table D-2 analytes are designated poor performers in the DoD QSM.

Attachment 4A

LCS and MS Control Limits For Semi-volatile Organic Compounds SW-846 Method 8270C Soil Matrix

Analyte	Lower Control Limit	Upper Control Limit	Lower ME	Upper ME
1,2,4-Trichlorobenzene	45	110	30	120
1,2-Dichlorobenzene	45	95	35	105
1,2-Diphenylhydrazine (as Azobenzene)	45	135		
1,3-Dichlorobenzene	40	100	30	110
1,4-Dichlorobenzene	35	105	25	115
2,4,5-Trichlorophenol	50	110	40	120
2,4,6-Trichlorophenol	45	110	30	120
2,4-Dichlorophenol	45	110	35	120
2,4-Dimethylphenol	30	105	20	115
2,4-Dinitrophenol	15	130	10	150
2,4-Dinitrotoluene	50	115	35	130
2,6-Dinitrotoluene	50	110	35	125
2-Chloronaphthalene	45	105	35	115
2-Chlorophenol	145	105	35	115
2-Methylnaphthalene	45	105	35	115
2-Methylphenol	40	105	30	115
2-Nitroaniline	45	120	30	130
2-Nitrophenol	40	110	30	120
3,3'-Dichlorobenzidine[3]	10	130	0	145
3-Nitroaniline	25	110	15	125
4,6-Dinitro-2-methylphenol	30	135	10	155
4-Bromophenyl phenyl ether	45	115	35	130
4-Chloro-3-methylphenol	45	115	35	125
4-Chloroaniline[3]	10	95	0	110
4-Chlorophenyl phenyl ether	45	110	35	120
4-Methylphenol	40	105	30	120
4-Nitroaniline	35	115	20	125
4-Nitrophenol	15	140	10	160
Acenaphthene	45	110	35	120
Acenaphthylene	45	105	35	115
Acetophenone	45	135		
Aniline	10	150		

Notes:

1. All **bold** analytes do not have DoD QSM acceptance criteria and "Shell" criteria are used.
2. **Bold*** analytes are designated Poor Performing Analytes (PPA) in the "Shell"
3. PPA DoD Table D-2 analytes are designated poor performers in the DoD QSM.

Attachment 4B

LCS and MS Control Limits For Semi-volatile Organic Compounds SW-846 Method 8270C Soil Matrix

Analyte	Lower Control Limit	Upper Control Limit	Lower ME	Upper ME
Anthracene	55	105	45	115
Benz(a)anthracene	50	110	40	120
Benzidine	10	150		
Benzo(a)pyrene	50	110	40	120
Benzo(b)fluoranthene	45	115	35	125
Benzo(g,h,i)perylene	40	125	25	140
Benzo(k)fluoranthene	45	125	30	135
Benzoic acid[3]	0	110	0	130
Benzyl alcohol	20	125	10	140
Bis(2-chloroethoxy)methane	45	110	30	120
Bis(2-chloroethyl)ether	40	105	25	115
Bis(2-chloroisopropyl)ether	20	115	10	130
Bis(2-ethylhexyl)phthalate	45	125	35	140
Butyl benzyl phthalate	50	125	35	135
Carbazole	45	115	30	130
Chrysene	55	110	45	120
Dibenz(a,h)anthracene	40	125	25	140
Dibenzofuran	50	105	40	110
Diethyl phthalate	50	115	40	125
Dimethyl phthalate	50	110	40	120
Di-n-butyl phthalate	55	110	45	120
Di-n-octyl phthalate	40	130	25	145
Fluoranthene	55	115	45	125
Fluorene	50	110	40	115
Hexachlorobenzene	45	120	35	130
Hexachlorobutadiene	40	115	25	130

Notes:

1. All **bold** analytes do not have DoD QSM acceptance criteria and "Shell" criteria are used.
2. **Bold*** analytes are designated Poor Performing Analytes (PPA) in the "Shell"
3. PPA DoD Table D-2 analytes are designated poor performers in the DoD QSM.

Attachment 4C

LCS and MS Control Limits For Semi-volatile Organic Compounds SW-846 Method 8270C
Soil Matrix

Analyte	Lower Control Limit	Upper Control Limit	Lower ME	Upper ME
Hexachlorocyclopentadiene	NA	NA		
Hexachloroethane	35	110	20	120
Indeno(1,2,3-cd)pyrene	40	120	35	135
Isophorone	45	110	30	125
Naphthalene	40	105	30	120
Nitrobenzene	40	115	30	125
N-Nitrosodimethylamine	20	115	10	130
N-Nitrosodi-n-propylamine	40	115	30	125
N-Nitrosodiphenylamine	50	115	40	125
Pentachlorophenol	25	120	10	135
Phenanthrene	50	110	40	120
Phenol	40	100	30	110
Pyrene	45	125	35	135
Pyridine	NA	NA		

Notes:

1. All **bold** analytes do not have DoD QSM acceptance criteria and "Shell" criteria are used.
2. **Bold*** analytes are designated Poor Performing Analytes (PPA) in the "Shell".
3. PPA DoD Table D-2 analytes are designated poor performers in the DoD QSM.

Attachment 5

INSTRUMENT CONTROL PARAMETERS

Sample Inlet: GC
Injection Source: GC ALS
Mass Spectrometer: Enabled

HP GC Injector

Front Injector:
No parameters specified

Back Injector:

Sample Washes	1
Sample Pumps	3
Injection Volume	1.0 microliters
Syringe Size	10.0 microliters
On Column	Off
Nanoliter Adapter	Off
PostInj Solvent A Washes	1
PostInj Solvent B Washes	1
Viscosity Delay	0 seconds
Plunger Speed	Fast

HP5890 Temperature Parameters

Zone Temperatures:	State	Setpoint
Inlet A:	Off	50 C
Inlet B:	On	280 C
Detector A:	Off	50 C
Detector B:	On	280 C
Auxiliary:	Off	50 C

Oven Parameters:

Oven Equib Time:	0.20 minutes
Oven Max:	325 C
Oven State:	On
Cryo State:	Off
Cryo Blast:	Off
Ambient:	25 C

Oven Program:

Initial Temperature:	50 C
Initial Time:	1.50 minutes

d: BNASV1.M Mon Jul 21 12:56:29 2003 Page: 1

	Valve 1: Off	Valve 2: Off	Valve 3: Off	Valve 4: Off
19405 Valves:				
	Valve 5: Off	Valve 6: Off	Valve 7: Off	Valve 8: Off
19405 Relays:				
	Relay 1: Off	Relay 2: Off	Relay 3: Off	Relay 4: Off

HP5890 Detector Information

Detector	Type	State
A	---	Off
B	---	Off

HP5890 Signal Information

Not saving signal data.

Signal	Source	Peak Width	Data Rate	Start Data	Stop Data
1	Testplot	0.053	5.000	0.00	1.00
2	Testplot	0.053	5.000	0.00	1.00

MS ACQUISITION PARAMETERS

General Information

Tune File	: dftpp.u
Acquisition Mode	: Scan

MS Information

Solvent Delay	: 1.00 min
EM Absolute	: False
EM Offset	: 0
Resulting EM Voltage	: 2317.6

[Scan Parameters]

Low Mass	: 35
High Mass	: 500
Threshold	: 500
Sample #	: 2 A/D Samples 4

END OF MS ACQUISITION PARAMETERS

END OF INSTRUMENT CONTROL PARAMETERS

Level	Rate (C/minute)	Final Temperature (C)	Final Time (minutes)
1	10.0	100	0.00
2(A)	15.0	240	0.00
3(B)	8.0	320	1.50

Next Run Time: 24.00 minutes

HP5890 Inlet Pressure Programs

GC Pressure Units: psi

Inlet A:

Constant Flow:	Off
Constant Flow Pressure:	0.0 psi
Constant Flow Temperature:	50 C
Initial Pressure:	0.0 psi
Initial Time:	650.00 minutes

Level	Rate (psi/minute)	Final Pressure (psi)	Final Time (minutes)
1	0.00	0.0	0.00
2(A)	0.00	0.0	0.00
3(B)	0.00	0.0	0.00

Total Program Time: 650.00 minutes

Column Length:	30.00 m
Column Diameter:	0.530 mm
Gas:	He
Vacuum Compensation:	Off

Inlet B:

Constant Flow:	Off
Constant Flow Pressure:	0.0 psi
Constant Flow Temperature:	50 C
Initial Pressure:	7.7 psi
Initial Time:	0.00 minutes

Level	Rate (psi/minute)	Final Pressure (psi)	Final Time (minutes)
1	99.00	50.0	0.15
2(A)	99.00	7.7	0.00
3(B)	0.00	0.0	0.00

Total Program Time: 1.00 minutes

Column Length:	30.00 m
Column Diameter:	0.250 mm
Gas:	He
Vacuum Compensation:	On

HP5890 Packed Column Flow Control

Inlet A not used to control packed column flow.

Inlet B not used to control packed column flow.

HP5890 Purge Valve Settings

Inlet Purge	Init Value	On Time	Off Time	Splitless Injection
A	Off	0.00	0.00	No
B	Off	0.52	0.00	Yes

HP5890 Valve and Relay Information

Initial Setpoints:
5890 Valves:

Method: BNASV1.M Mon Jul 21 12:56:29 2003 Page: 2

Attachment 6

AMRO Environmental
Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

GC AND GC/MS DATA REVIEW CHECKLIST

LAB ORDER: _____ CLIENT: _____

Method: | Sample(s) No.:

Analysis: | Matrix:

A.	GENERAL			
1.	Copy of Prep/Extraction Log?	Y	N	NA
2.	Copy of Instrument Run Log or Tune List?	Y	N	NA
3.	Copy of dry weight log present?	Y	N	NA
4.	Are all sample checked for preservation after VOA analysis?	Y	N	NA
5.	All samples met extraction and/or analysis holding time criteria?	Y	N	NA
6.	Did the Tune pass and DFTPP or BFB injected every 12 hours?	Y	N	NA
7.	Are the surrogate recoveries for each sample within the QC limits?	Y	N	NA
8.	Method Blank- contaminant free(< ½RL)?	Y	N	NA
9.	Initial Calibration meets method criteria for all compounds reported?	Y	N	NA
10.	Continuing Calibration meets method criteria for all compounds reported?	Y	N	NA
11.	Are all reported results within calibration range?	Y	N	NA
12.	LCS % Recovery criteria met for all compounds?	Y	N	NA
13.	MS/MSD %R's and %RPD's are met for all compounds?	Y	N	NA
14.	%RPD criteria met between sample and duplicate?	Y	N	NA
15.	Samples checked for carry over from sample to sample due to target or nontarget overload?	Y	N	NA
16	Are all data exported to LIMS, calculated and verified?	Y	N	NA

COMMENTS

Analyst (s) _____ DATE: _____

REVIEWER: _____ DATE OF REVIEW: _____

qc/qcmemos/Forms/gcmschecklist Rev. 2 08/13/01

Attachment 7

AMRO Environmental
Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

QUALIFICATION CARD FOR SW-846 METHOD 8270C

Trainee: _____ Signature: _____

Trainer: _____ Signature: _____

I. Knowledge Factors:

SOP Title: _____ Revision Number/Date: _____

1. Did the Trainee read and understand the above SOP? Yes ☐ No ☐ NA ☐
2. Was the Trainee instructed on how to properly fill out the documentation? Yes ☐ No ☐ NA ☐
3. Has the Trainee been instructed on the proper procedures for addressing potential problems? Yes ☐ No ☐ NA ☐

II. Practical Factors:

1. Has the Trainee completed a Precision and Accuracy Study? Yes ☐ No ☐ NA ☐
2. Has the Trainee completed an acceptable Performance Evaluation sample? Yes ☐ No ☐ NA ☐
3. Did the Trainee completed an acceptable Laboratory Control Sample (LCS)? or PT study Yes ☐ No ☐ NA ☐
4. Has the Trainee performed manual integration as indicated in the SOP? Yes ☐ No ☐ NA ☐

Completion Date: _____ Trainer's Signature: _____

I _____ have read, understood and follow the above method/SOP, which is in use at AMRO Laboratories for the analysis of samples under the National Environmental Laboratory Accreditation Program, have met the Demonstration of Capability.

Section Manager/ Supervisor: _____ Date: _____

QA Manager: _____ Date: _____

qc/qcmemos/forms/8270Cqualcard Rev. 0 08/24/01

AMRO Environmental Laboratories Corporation

111 Herrick Street, Merrimack, NH 03054
TEL: (603) 424-2022 • FAX: (603) 429-8496
www.amrolabs.com

POLYCHLORINATED BIPHENYLS (PCB's) BY GAS CHROMATOGRAPHY

SW-846 Method 8082

Procedure Number: OL-2006

Revision No.: 10

Revision Date: 03/07/13

Review Data: N/A

Prepared By: Kristen Morin Date: 3/18/13

Approved By: Sue Karam Date: 3/18/13
Organic Manager

Approved By: [illegible] Date: 3/18/13
Laboratory Director

Approved By: [illegible] Date: 3/18/13
Quality Assurance Manager

Property of AMRO Environmental Laboratories Corporation

TABLE OF CONTENTS

		Page
1.0	SCOPE AND APPLICATION	3
2.0	METHOD SUMMARY	3
3.0	DEFINITIONS	3
4.0	SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE	4
5.0	POTENTIAL PROBLEMS AND INTERFERENCES	4
6.0	HEALTH AND SAFETY	5
7.0	INSTRUMENTS AND EQUIPMENT	6
8.0	INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR	7
9.0	REAGENTS AND STANDARDS	7
10.0	PROCEDURE	11
11.0	CALCULATIONS	22
12.0	QUALITY CONTROL	22
13.0	DATA REVIEW AND STORAGE	27
14.0	REFERENCES	27

1.0 SCOPE and APPLICATION

1.1 This SOP is for Method 8082 to determine the concentrations of various Polychlorinated Biphenyls (PCBs) in extracts from solid, aqueous, and other matrices.

1.2 Analytes and Reporting Limits:

ANALYTE	RL (Reporting Limit)*			
	Aqueous (µg/L)	Soil (µg/kg)	Oil (mg/kg)	Wipes (µg/wipe)
+PCB-1016	0.20	25	5.0	1.0
+PCB-1221	0.20	25	5.0	1.0
+PCB-1232	0.20	25	5.0	1.0
+PCB-1242	0.20	25	5.0	1.0
+PCB-1248	0.20	25	5.0	1.0
+PCB-1254	0.20	25	5.0	1.0
+PCB-1260	0.20	25	5.0	1.0

+= Designates multi-component analytes.
* = Aqueous based on 1000mL sample /4mL final volume
Soil based on 20.00g/10mL final volume
Oil based on 0.10g/10mL final volume
Wipe based on 10mL final volume per wipe

2.0 METHOD SUMMARY

2.1 This method describes chromatographic procedures for the detection of specific PCB's at ppb (µg/L and µg/kg) levels. Prior to the use of this method, appropriate extraction procedures must be used. Please refer to OL-2003 and OL-2004 for sample extraction. An aliquot of the sample extract is injected into a gas chromatograph (GC) equipped with dual columns and dual electron capture detectors (ECD). This allows for quantitation and confirmation to occur at the same time.

3.0 DEFINITIONS

3.1 **Multi-component Analyte and Single component Analyte:** Throughout this SOP, the terms "single component and multi-component analyte" are used. Multi-component analyte chromatograms contain a pattern of many peaks for one target analyte while a single component analyte chromatogram contains only a single peak for each target analyte.

3.2 **Aroclor:** Aroclor is the trade name for mixtures containing PCB's. Since each Aroclor is a mixture, they must be described as multi-component analytes. Aroclors may contain compounds in addition to PCB's, but the terms "PCB" and "Aroclor" are commonly used interchangeably. The names of the Aroclor mixtures such as 1260 refer to the 12-member biphenyl ring and the percent Chlorination by weight with the exception of 1016. Aroclor 1260 is a mixture of isomers composed of 12-member (carbon) biphenyl rings with 60% chlorination by weight. Chromatograms of Aroclors contain a pattern of multiple peaks due to different PCB compounds called congeners.

4.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

4.1 Extract must be stored under refrigeration in the dark and analyzed within 40 days of extraction.

4.2 Sample extracts are custody transferred from the Extraction analyst to the GC analyst via signature in the extraction logbook, or the sample extracts are transferred to cold storage by the Extraction analyst. The extracts are either loaded directly on to GC instrument for analysis or they are stored at 4°C for future use. Extracts are kept for a minimum of two months after extraction and are then properly disposed of.

5.0 POTENTIAL PROBLEMS AND INTERFERENCES

5.1 The success of these methods frequently depends on the levels of interference rather than on instrumental limitations. If sample or matrix interference's prevent identification or detection of analytes, the analyst must evaluate the interference's and perform the proper corrective action.

5.2 Sources of interference's can be grouped into three categories:

5.2.1 Contaminated solvents, reagents, or glassware

5.2.1.1 Method Extraction Blanks and Instrument Blanks are used to determine possible contamination of solvents, reagents, glassware, and GC equipment.

5.2.1.2 If contamination is found from the extraction process, review of methodology, scrupulous cleaning of the glassware, and re-extraction of the samples may be required.

5.2.2 Contaminated carrier gas or GC equipment, i.e. columns, injection port liners, detectors and syringes.

5.2.2.1 If the GC equipment is found to be the source of contamination, proper cleaning and solvent rinsing of affected parts may be required or replacement with new ones.

5.2.3 Compounds extracted from the sample matrix to which the detectors respond.

5.2.3.1 If sample matrix is determined to be the cause of interference in the extract, the analyst should evaluate whether extract cleanup procedures are needed. All PCB extracts are sulfuric acid cleaned prior to analysis. Additional cleanups may be needed.

5.2.3.2 Such interference may include the presence of elemental sulfur, which results in broad peaks that interfere with the detection target compounds. (Analyst should refer to SOP OL-2020 for sulfur removal.).

5.2.3.3 Other sources of interference could occur from phthalate esters, which can be minimized by avoiding sample contact with any plastic materials. Phthalates are easily leached from plastic materials during laboratory operations or even sampling including equipment rinsing.

6.0 HEALTH AND SAFETY

6.1 AMRO has a laboratory safety program in place that applies to all employees. There is a safety officer as well as employees with 40 hours of OSHA training. The air quality of the laboratory and the extraction hood velocities are monitored. All employees receive fire and safety training upon employment.

6.2 Fire extinguishers are located in various areas of the lab. A lab evacuation plan is posted in every room, with a designated meeting place. Fire drills are held on an annual basis or "as needed" with building or personnel changes.

6.3 All new analysts receive training on the safe handling of samples, standards, the changing of gas cylinders, and the operation of instruments. In the lab, clean laboratory coats and gloves are worn when working with samples. Neat standards are made up in hoods. When gas tanks are replaced, the carrier with chain is used properly, and all gas tanks are chained in place.

6.4 Care is taken with glassware and syringes to prevent injury. Broken glass and syringes are promptly removed to broken glass containers. First aid kits are available throughout the lab. There are also eyewash stations and an emergency shower.

6.5 Material Safety Data Sheets (MSDS's) are reviewed for each chemical used to ensure proper precautions are observed when handling chemicals.

6.6 Pollution prevention – The use of chemical exhaust hood are required when working with chemicals. They are specifically designed to minimize analyst exposure. The hood exhaust is monitored periodically to ensure environmental exposure is minimized.

6.7 Waste control – AMRO takes whatever steps possible to minimize waste. This includes sample and solvent volume minimization where appropriate. There is a Waste Coordinator officer designated with 40 hours of OSHA training. AMRO also properly segregates wastes based upon waste characterization (i.e. flammability, chlorination, acidity, etc.) and a commercial vendor is utilized for waste disposal.

7.0 INSTRUMENTS AND EQUIPMENT

7.1 Gas Chromatograph: Analytical system complete with gas chromatograph suitable for on column and split-splitless injections. The system includes all the required accessories such as syringes/autosampler systems, analytical columns, gases, electron capture detectors (ECDs) and a data system.

7.2 AMRO has two complete GC/ECD systems: GC-ELVIS and GC-TRENT. Both are Hewlett Packard Model 5890s capable of dual column analysis. Helium is the carrier gas and P5 (95% Argon/5% Methane) is the auxiliary make-up gas. Each GC is equipped with one of two equivalent capillary column pairs, either:

7.2.1 ELVIS:
RXI-50 (Restek), 30m x 0.53mm I.D. 0.83µmdf
RTX50 (Restek), 30m x 0.53mm I.D. 1.5µmdf

or

7.2.2 TRENT:
RTX-CL PesticideII (Restek), 30m x 0.32mmID, 0.25µmdf.
RTX-CL PesticideI (Restek), 30m x 0.32mmID, 0.5µmdf

7.3 The data systems for all instruments are Hewlett-Packard Chemstation-Enviroquant software which is used to acquire and process all GC-ECD data.

GC Elvis is the primary PCB analysis instrument. GC Trent is a back-up instrument for PCB analysis but not used routinely.

7.4 Volumetric flasks, 10 and 25mL, and Gas-Tight syringes for preparation of standards.

8.0 INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR

8.1 Daily Maintenance:

The following procedures are performed each day an instrument is used for analysis if in the analyst's judgement, system performance requires them:

8.1.1 Column performance is monitored by checking the response factor of key compounds, which indicates column degradation, column bleed, or appropriate peak resolution. Clip two or more inches from the head of the column if necessary.

8.1.2 Check that carrier and make-up gases have adequate supply sufficient for the analytical sequence. Visual inspection of color indicating inline gas filters (hydrocarbon and moisture). Change tanks if necessary.

8.1.3 Check to ensure the hard drive memory capacity is sufficient for data acquisition using the HP Chemstation-EnviroQuant software.

8.2 Weekly Maintenance, or as needed:

8.2.1 Clipping column

8.2.2 Swab inlet weldment and injection port with hexane or other appropriate solvent(s).

8.2.3 Clean or replace single taper injection liners and glass wool, gold inlet seal, ferrules, and septa.

9.0 REAGENTS AND STANDARDS

9.1 The following solvents are used for sample dilutions, preparation of standards or solvent rinsing of equipment:

9.1.1 Hexane, Reagent Grade and Pesticide Residue Grade chemicals or equivalent.

9.1.2 Acetone, Reagent Grade and Pesticide Residue Grade chemicals or equivalent.

9.1.3 Methanol, Reagent Grade and Pesticide Residue Grade chemicals or equivalent.

9.2 Commercially prepared stock standard solutions that are certified by the manufacturer are used in this analysis. All PCBs standards are purchased from Restek (e.g. cat. #32039 for 1000µg/mL Aroclor 1660) or an equivalent vendor. Second source standards can be purchased from another supplier or can be a different lot number than used to calibrate. Calibration standards for the special Aroclors 1262 and 1268 can be purchased from Ultra Scientific or Restek. The source of the surrogate, LCS, and MS/MSD spike solutions used in sample preparation is Restek.

9.3 Working standard solutions are made from stock standard solutions. All multi-component PCBs are purchased individually and surrogates are then added. Serial dilutions are made to create a seven point curve for "AR1660 (a mixture of PCB 1016 and PCB 1260). The remaining PCBs only require a single point analysis at the midpoint of the AR1660 curve, to be used to create a response factor appropriate for the individual Aroclor. Note for DoD projects all reportable quantitation of non-AR1660 PCBs must be preceded by at least a five point initial calibration so bracketing standards must be prepared as needed. All standards are brought to final volume with Hexane.

Calibration Stds	Vol. Of Stock	Final Vol.	Concentration (µg/mL)
AR1660*/TCX/DCB	0.05mL (2.0µg/mL)	2mL	0.05/0.001
AR1660*/TCX/DCB	0.1mL (2.0µg/mL)	2mL	0.10/0.002
AR1660*/TCX/DCB	0.2mL (2.0µg/mL)	2mL	0.20/0.004
AR1660*/TCX/DCB	0.4mL (2.0µg/mL)	2mL	0.40/0.008
AR1660*/TCX/DCB	0.6mL (2.0µg/mL)	2mL	0.60/0.012
AR1660*/TCX/DCB	0.8mL (2.0µg/mL)	2mL	0.80/0.016
AR1660*/TCX/DCB	1.0mL	2mL	1.00/0.02

	(2.0µg/mL)	
AR1660*/TCX/DCB	0.05mL (1660 stock) 25mL 5µL TCX/DCB Stock	2.00/0.04
AR1221/TCX/DCB	25µL of Stock 25mL 2.5 µL of TXC/DCB Stock	1.0/0.02
AR1232/TCX/DCB	25 µL of Stock 25mL 2.5 µL of TCX/DCB Stock	1.0/0.02
AR1242/TCX/DCB	25 µL of Stock 25mL 2.5 µL of TCX/DCB Stock	1.0/0.02
AR1248/TCX/DCB	25 µL of Stock 25mL 2.5 µL of TCX/DCB Stock	1.0/0.02
AR1254/TCX/DCB	25 µL of Stock 25mL 2.5 µL of TCX/DCB Stock	1.0/0.02

*Please note AR1660 contains both AR1016 & AR1260.

9.4 TRACKING OF ANALYTICAL STANDARDS

9.4.1 Chemical Receipt:

The receipt of all standards, neat compounds and reagents from commercial sources is documented in the Chemical Receiving Logbook by sample receiving personnel or designate. Each solution or compound is assigned a unique standard receipt ID number, the letter "A" and a 5 digit sequential number. The date received, source, lot number, expiration date and disposal date are recorded. The expiration dates are provided from the manufacturer and the disposal dates are completed by AMRO employees when standards are used up or disposed. Refer to SOP " Sample Management" GL-1006.

9.4.2 Standards Preparation:

Standards are prepared as written in the respective SOPs. In order to assure the accuracy of standards the following general guidelines are used:

9.4.2.1 AMRO purchases pesticide residue grade solvents and purge and trap grade Methanol for organic standard preparation and organic sample extractions.

9.4.2.2 All stock standards that are purchased must include a certificate of analysis from the manufacturer.

9.5.3 Standard Tracking:

It is important to be able to track all analytical standards back to their sources. The following procedure is used by AMRO personnel to accomplish this:

9.5.3.1 Organic Standard Tracking: The Organic Standards Tracking System consists of three logbooks. One Standard ID Index logbook, one for Stock Standards, and one for Working Standards.

9.5.3.2 Stock Standard: Whenever a stock standard solution is opened or is prepared from a neat compound, this information is recorded in the Stock Standard Logbook section of the standard tracking log. The standard chemical receipt I.D. is used for the stock solution. This ID along with the compound name, concentration and initials of the person making the stock are included on the label. Stock standards are good one year from the date prepared or the date provided by manufacturer, whichever is shorter. Example - The fourth volatile standard prepared on April 15, 1989 would have the standard ID V041589D. This number will be recorded in the logbook and written on the container.

9.5.3.3 Working Section: Whenever a working standard solution opened or is prepared, whether from AMRO stocks or commercially obtained stocks, the information is recorded in the Working Standard section of the standard tracking log. The solution is assigned a new ID number based on the section "V" or "S", the date it is prepared plus a letter suffix. This number along with a descriptive name, concentration (or conc. varied) and the initials of the person preparing the solution are included on the label. The expiration of working standards vary depending on the use. Standards should be used in accordance with method specifications and manufacturer's instructions. Stock standards must be replaced no more than one year after opening or sooner if routine QC tests indicates a problem. Working standard expiration dates are derived from

the assigned stock solution's expiration date or sooner if routine QC tests indicates a problem.

9.5.3.4 Standard Storage: Standards and reagents are stored per method specifications and manufacturer's instructions. Semivolatile, Pesticide, PCB, Petroleum standards are stored in refrigerators at 4±2°C, freezers at minus 10 °C, and ambient temperature depending upon the method and manufacturer requirements.

9.5.3.5 Solvent Check Analysis

All extraction procedures are performed using pesticide residue grade solvents. The first method blank is used to verify the absence of target analytes when a new lot number is received. Also, Before a new vendor's solvent is used for sample extraction a special check of the concentrated solvent (not a method blank) is suggested.

10.0 PROCEDURE

10.1 AMRO currently has two GC instruments: TRENT and ELVIS.

10.2 GC Operating Conditions:

PCB ANALYSIS (using Sec.7.2.1 columns on GC Elvis)
Injection volume: 1 µL
ECD Temperature: 310°C
Injection Port Temperature: 280°C
Initial Temperature: 150°C
Initial time: 0.5minutes
Rate: 1: 12°C/minute
Final Temperature 1: 270°C
Final Time hold: 15 minutes
Total Run Time: 25.5 min

* A signed hard copy of this acquisition method is stored in the Instrument run logbook.

10.3 Injection port maintenance:

10.3.1 Due to the low concentrations injected in this method, every attempt must be made to ensure that the analyte path in the GC is free from sites of absorption or activity by performing injection port maintenance. Such maintenance may include replacing septa, inlet

liners, and the inlet seal. All maintenance must be recorded in the maintenance logbook.

10.4 Injection Runlog:

10.4.1 All injections are recorded with the EnviroQuant software and a signed hard copy of the sequence list (brief and full listing) is stored in the Instrument logbook.

10.5 Dual Column Analysis:

10.5.1 This method uses the dual column/dual detector approach. It involves the use of two 30m X 0.53mm ID fused- silica open tubular columns of different polarities, thus different selectivities towards the target compounds. The columns are connected to two separate injection ports with dual auto sampling towers. Each column is then connected to its individual ECD detector.

10.6 Retention Time Windows (sections 10.6.1 through 10.6.5 refer to a setting up new instrument and determining analyte RT and elution orders):

10.6.1 Before establishing retention time windows, make sure that the chromatographic system is operating reliably and that the system conditions have been optimized for the target analytes and surrogates in the sample matrix to be analyzed.

10.6.2 Make three injections of all single and all multi-component analytes over the course of a 72-hour period. Serial injections or injections over a period of less than 72 hours may result in retention time windows that are too tight.

10.6.3 Record the retention times for all single analytes and three to five major peaks for multi-component analytes. Calculate the mean and standard deviation of the three absolute retention times of each single analyte and those peaks.

10.6.4 If the standard deviation of the retention times for a target compound is 0.000, then the laboratory uses a default standard of 0.01 minutes. Recording retention times to three decimal places rather than two should minimize the instances in which the standard deviation is calculated as 0.000.

10.6.5 The width of the retention time window for the single analytes, each major constituent in multi-component analytes and surrogates is defined as ±3 times the standard deviation of the mean absolute

retention time established during a 72-hour period. If the default standard deviation is employed, ½ the width of the window will be 0.07 minutes.

10.6.6 The absolute retention time windows must be calculated for each analyte and surrogate on each chromatographic column and instrument. New retention time windows and/or analyte elution order must be established when a new GC column is installed.

10.6.7 Establish the center of the window for each analyte and surrogate by using the absolute retention time for each analyte and surrogate from the calibration verification standard at the beginning of the analytical shift. For samples run during the same shift as an initial calibration, use the retention time of the mid-point standard of the initial calibration.

10.6.8 If the daily CCV falls outside the window, the analyst will evaluate the instrument and will recalibrate if necessary. For samples run during the same analytical shift as the Initial Calibration, use the RT of the midpoint standard. However, the experience of the GC analyst should weigh heavily in the interpretation of the chromatograms. The analyst may therefore qualify an analyte as present outside the RT window by using pattern recognition.

10.7 Initial Calibration:

10.7.1 Must contain a minimum 5-point curve of AR1660 (this is a mixture of Aroclors 1016 and 1260) to establish linearity for PCBs over the range of quanitifed Aroclors, along with the midpoint standards for the remaining 1221, 1232, 1242, 1248, 1254 Aroclors. These midpoints are to be used for pattern recognition and one-point calibration (the standards are used to determine the response factor appropriate for each individual Aroclor). The %RSD of the 1660 curve must be ≤20%. See Section 10.9.1 for action when the %RSD exceeds 20%. Note for DoD projects all reportable quantitation of Aroclors that are <u>not</u> 1016 or 1260 must be preceded by at least a five point initial calibration. Bracketing standards must be prepared as needed and the sample re-run after the special initial calibration.

10.7.2 A minimum of 3 peaks must be chosen for quantitation but preferably 5 peaks should be used especially with 1016 and 1260. The chosen peaks should be within 25% of the height of the largest Aroclor peak and/or represent a unique peak height ratio. Peak selection should include at least one peak that is unique to each Aroclor.

10.7.3 When reporting PCBs two processes are used: qualitative and quantitative. The first is qualitative, which is done matching the unknown sample to the Aroclor standards evaluated during the initial calibration. In this case the pattern in the sample is compared to patterns of the standards. If a match is found, it is determined at what concentration the Aroclor is in the unknown, or its quantitative value. Three to five of the major peaks in the Aroclor pattern are chosen to measure the concentration of the positive hit. Of the seven commercial Aroclors on the 8082 target list, 1016, 1242, and 1232 have similar major peaks, the difference being the ratio of these peaks to one another. Although the same peaks may be used to quantitate a PCB hit, the same average response factors are not used. These are derived from that additional Aroclor's initial calibration.

10.8 Calibration Techniques:

There are two calibration techniques used by AMRO acceptable for quantitation: average response factor calibration and linear regression calibration curve. This is the order of preference:

10.8.1 The Average Response Factor Calibration:

10.8.1.1 Calculate the response factor of each compound using the equation:

$$\text{Response Factor (RF)} = \frac{\text{Peak Area of analyte}}{\text{Conc. of Analyte in standard}}$$

10.8.1.2 Calculate the Average of the Response Factors (Rfa) and the Standard Deviation (STD). Using the Rfa and STD, calculate the percent relative standard deviation (%RSD). When the RSD of Analytes are less than 20%, linearity through the origin can be assumed.

$$\%\ \text{RSD} = \frac{\text{Standard Deviation}}{\text{Average Response factor}} \times 100\%$$

10.8.1.3 Providing the % RSD for each analyte is less than 20%, the Average Response Factor (Rfa) can be using to calculate the sample results. If the %RSD is greater than 20% then a Linear Calibration Curve may be used providing the acceptance criteria is met.

10.8.2 Linear Calibration Curve:

10.8.2.1 In order to use this technique, the data system must plot and evaluate a calibration curve by calculating the correlation coefficient against the first order equation:

$$Y = mX + b$$

10.8.2.2 The software option Linear Regression must be selected and the computer will evaluate the calibration based on the above equation. Forcing the origin of the linear regression is not acceptable. The acceptance criteria for this equation is the coefficient of determination must be at least 0.990 and documented with a signed/dated graphics plot stored with the calibration.

10.8.2.3 Dropping of standard point should be performed ONLY on either the high or the low standard. Any point dropping should be documented for the reason of dropping on the initial calibration form. The analyst must sign and date the initial calibration form and will be reviewed by the appropriate data reviewer. The curve must be printed for visual verification and stored with the calibration records.

10.8.2.3.1 If the %RSD is greater than 20% and the coefficient of determination is less than 0.99 even after the adjustments in 10.8.2.3 are made , then the instrument must be re-calibrated.

10.9 Continuing Calibration Verification (CCV)

10.9.1 Verify calibration each 12 hour shift by injecting CCV's (Continuing Calibration Verification sample, a midpoint concentration standard) prior to any sample analysis. A CCV must also be injected at intervals not less than once every 20 samples, including QC (MB, LCS, MS, etc) (or at the end of a 12 hour interval, whichever comes first). DoD samples will be analyzed at intervals of no greater than 10 field samples between CCV's.

10.9.2 A12-hour sequence begins with the injection of the first CCV. The shift ends after the completion of the analysis of the last sample or standard that can be injected within 12-hours of the beginning of the sequence. A closing standard **MUST** be injected at the end of the 12-hour window. However, in

continuous analysis, the closing CCV of one shift may also serve as the CCV of the next 12-hour shift.

10.9.3 The CCV Standard response must be within ± 15% of the initial calibration curve. If the percent Difference (%D) of an analyte peak is > 15%, but the average %D for all the analyte peaks within any one Aroclor is within 15%, then the calibration has been verified.

$$\% \text{ Drift} = \frac{\text{Calculated Concentration - Theoretical Conc.}}{\text{Theoretical conc.}} \times 100\%$$

$$\text{Ave. \%Drift per Aroclor} = \frac{\text{\%Drift of Each Analyte Peak}}{\text{Total \# of Analyte Peaks}}$$

No sample results can be reported associated with a verified CCV > 15% for that analyte unless it is qualified as estimated. Reanalysis is recommended in these cases. If a CCV fails and correction action fails to produce a passing CCV, i.e. two CCVs fail in a row, then a new initial calibration is required *or* two consecutive CCVs must pass the method criteria described above in order for sample analysis to proceed.

10.9.4 CCV retention times must be compared to the RT windows established vs. starting CCV (RT updated and verified) of the analytical sequence.

10.9.4.1 If any analyte is outside the window, the chromatographic system must either be adjusted so re-analysis of the CCV falls within RT windows, or a new initial calibration must be performed and new retention time windows established.

10.9.4.2 Subsequent CCV retention times should be compared to the initial CCV of the 12-hour shift.

10.9.5 If the standard analyzed after a group of samples exhibits high response (>15%), and the analyte was not detected in the samples, it is acceptable to report ND results without qualification. The high bias must be demonstrated by one or both terminal CCVs. In contrast, if the response in the standard is low (by 15%), the sample must be reanalyzed.

10.10 Data Interpretation

10.10.1 The integration of compounds for standards and samples should be performed to be in the same manner as the initial calibration integration. Cases where the initial calibration is in question should be investigated to ensure it is not related to poor maintenance, damaged or defective column, or other issues which should be solved before further analysis.
The following must be checked for each compound present in standards and samples to ensure proper integration has been performed:

10.10.1.1 The peak shape of the calibration compound must be maintained for standards and samples. This should take into account any shouldering, peak tailing, and peak co-elution. See Sec.10.11.2.1 for specific information associated with PCBs.

10.10.1.2 The retention time windows for each compound of the calibration must be applied to standards and samples. If there is a retention time shift confirmed by comparison of the Continuing Calibration Standards and Surrogates then pattern recognition can be utilized for identification of multi-component analytes only. Otherwise re-calibration is required. Generally re-calibration is required whenever the column is significantly shortened during maintenance.

10.10.1.3 The baseline integration techniques for each compound of the calibration must be consistent for the standards and the samples. This should take into account elevated baselines, coelution, peak shape ands peak splitting, and negative peaks in samples.

10.10.1.4 Make sure that positive identification and confirmation of compounds has been established. This is done using comparison between two columns.

10.10.1.5 Ensure any positive results are within the lower and upper levels of the calibration curve and above the reporting limits for each compound.

10.11.2 Data interpretation consists of two steps, qualitative interpretation and quantitative interpretation. Qualitative interpretation involves identifying the analytes that are present. Analytes are identified and confirmed according to their retention times on two different columns. Quantitative interpretation involves determining the concentrations of the analytes that are present. All analytes are calculated by using the initial calibration curve:

10.11.2.1 Qualitative Analysis:

10.11.2.1.1 Qualitative interpretation involves identifying the analytes that are present. Analytes are identified and confirmed according to their retention times on two different columns which is done matching the unknown sample to the Aroclor standards evaluated during the initial calibration. In this case the pattern in the sample is compared to patterns of the standards. If a match is found, it is determined at what concentration the Aroclor is in the unknown, or its quantitative value. Quantitative interpretation involves determining the concentrations of the analytes that are present. All analytes are calculated by using the initial calibration curve. Three to five of the major peaks in the Aroclor pattern are chosen to measure the concentration of the positive hit. Of the seven commercial Aroclors on the 8082 target list, 1016, 1242, and 1232 have similar major peaks, the difference being the ratio of these peaks to one another. Although the same peaks are used to quantitate a PCB hit, the same average response factors are not used.

10.11.2.1.2 The first step in evaluating the data is qualitative analysis. Tentative identification of an analyte occurs when a peak from a sample falls within the established daily RT window for a specific target analyte. Confirmation is required on a second GC column of different characteristics. For multi-component analytes (Aroclors), identifications is based upon pattern recognition,

but retention time windows are used to supplement this process.

10.11.2.1.3 Pattern recognition of multi-component analytes. Each multi-component analyte shows a distinctive chromatographic pattern which is used to identify that compound in a sample. To determine if a multi-component analyte is present, compare the sample chromatogram to the initial calibration standard. If the multi-component analyte is present in the sample, the relative response of the peaks in the standard should be similar in selected peak height ratios in standards. In addition, most major peaks observed in the standard should also appear in the sample. Be aware that degradation can alter the appearance and peak ratios of an Aroclor pattern. All Aroclors are mixes of congeners and may vary with the original manufacturer's raw materials.

10.11.2.1.4 When dual column analysis is being performed, the results for at least one column must meet the calibration acceptance criteria. The other column may be used for qualitative verification. Use of the designated qualitative verification column for quantitation is only acceptable if the initial and terminal CCVs on the verification column are in control and interference is suspected on the primary quantitation column. The maximum RPD between the final concentrations generated from the two columns is 40%. For DoD samples both columns must meet the acceptance criteria.

10.11.2.1.5 If compound identification is precluded due to interference, cleanup of the extract may be warranted. Refer to method 3600 for cleanup procedures. Analyst judgement must consider options available vs. expected improvement in chromatography.

10.11.2.2 Quantitative Analysis:

The second step in evaluating data is quantitative analysis. This step can only take place after the qualitative techniques in Section 10.11.2.1 have been used to confirm a positive result. For all multi-component analytes, a minimum of three distinct peaks must be used for quantitative analysis.

10.11.2.2.1 Sample results are quantitated from the initial calibration based on the three techniques discussed in Section 10.9, following this order of preference.

10.11.2.2.2 Average Response Factor Calibration. Use the following equation to calculate the concentration of analytes:

$$\text{Concentration } (\mu g/L) = \frac{(Ax)\,(Vf)\,(Df)}{(Rfa)\,(Vi)}$$

Where:
Ax = Area counts for the analyte in the sample.
Vi = Initial volume of the sample extracted in mL.
Vf = Final volume of sample extract in mL.
Df = Dilution factor.
Rfa = Average response factor from the initial calibration curve.

10.11.2.2.3 Linear Fit Calibration. Use the following equation to calculate the concentration of analytes:

$$\text{Concentration } (\mu g/L) = \frac{([m]\,[Ax] + b)\,(Vf)\,(Df)}{(Vi)}$$

Where:
([m] [Ax] + b) = Concentration of analyte in sample extract, calculated by data system or integrator (ug/L).
Vi = Initial volume of sample extracted in mL.
Vf = Final volume of sample extract in mL
Df = Dilution factor.

The curve must be printed and stored with the calibration records to document visual evaluation.

10.11.3 To quantitate multi-component analytes, discern at least three to five distinctive, unobstructed, peaks in the sample chromatogram that correspond to characteristic peaks in the standard chromatogram used for initial calibration. The data system will calculate the average concentration of the selected characteristic peaks. The average response factors of the characteristic peaks or the calibration curve is used to calculate sample concentrations. Alternatively, the total area from each curve standard can be used to produce a linear or quadratic calibration curve.

10.11.4 Each sample analysis must be bracketed with an acceptable Initial Calibration, CCV's (each 12-hr. shift or interspersed every 20 samples, whichever comes first). DoD samples will be analyzed at intervals of no greater than 10 field samples between CCV's.

10.11.5 When a CCV fails to meet acceptance criteria, all the samples injected after the last acceptable CCV must be re-injected.

10.11.6 All sample responses must fall within the calibration range. Re-analysis at a dilution must occur if the sample response exceeds the calibration range.

10.11.7 Sample results are confirmed by using two dissimilar columns. The column used for reporting results depends upon acceptable daily quality control including CCVs, MS, MSD, and LCS criteria being met. In general, report data from the column with the best overall QC data. This is the designated quantitation column and should be indicated on the Data Review Checklist in the project folder and marked on the CCV Summary Form. For DoD samples both columns must be in control. Report the higher of two confirmed results unless overlapping peaks are causing erroneously high results, then report the non-affected result and document in the case narrative.

10.11.8 For DoD samples any sample which is not confirmed must be reported with a "Q" flag.

10.11.9 When sample results are confirmed , the difference between the two columns is measured by calculating the Relative Percent Difference (RPD) between the two concentrations:

$$RPD = \frac{|R1-R2|}{((R1+R2)/2)} \times 100\%$$

*R1 & R2 are the results on 2 columns.

This data is calculated by the macro PCB_RT.mac when the information is required in a data deliverables package.

If the result from one column is significantly higher than the other column result, check the chromatogram for overlapping peaks causing erroneously high results. If no overlapping peaks are noted, examine the baseline parameters established during integration. If no abnormalities are noted, report the result from the designated primary quantitation column (except as noted in section 10.11.7 for DoD samples). If the results from the designated quantitation column appear to be in error due to interference's, and the CCV data is acceptable from the designated qualitative confirmation column, then use the confirmation column result for reporting. If the RPD exceeds 40% and the difference is not clearly attributable to matrix interference then report the RPD criteria exceedance in the case narrative and flag the result with a "J".

11.0 CALCULATIONS

11.1 All necessary calculations and formulas can be found throughout the text as applicable to each section.

12.0 QUALITY CONTROL

12.1 Initial Demonstration of Proficiency:

12.1.1 The ability of AMRO to produce accurate and precise data is demonstrated per instrument/per analyst for each method. It consists of a Method Detection Limit Study (MDL) and Precision and Accuracy Study (P&A) for each instrument and each matrix. The laboratory demonstrates initial proficiency with each combination of sample preparation and determinative methods that it utilizes by generating data of acceptable precision and accuracy for a reference sample containing the target analytes in a clean matrix. The reference samples are prepared from a spiking solution containing each analyte of interest at a concentration that is 10-50 times the MDL for each analyte in that matrix, or at the routine concentration of LCS's (Laboratory Control Samples). P & A Studies are required to be reviewed annually by evaluating a minimum of 4 LCS's and corrective action taken if necessary.

12.2 MDL and LOQ/LOD Studies:

12.2.1 The method detection limit (MDL) is defined in 40 CFR 136 Appendix B. The purpose of an MDL is to establish the minimum concentration of each analyte greater than zero that can be reported with 99% confidence. An MDL study consists of at least 7 replicates of spiked deionized water (ideally standard set at RL or lower), which are extracted and analyzed as normal samples. The standard deviation of the results of these analyses is multiplied by the appropriate student T-test value. The resulting value is deemed the method detection limit for that specific analyte.

MDL studies of each analyte must be reported initially for each instrument, column, matrix, and extraction method. To ensure that reasonable MDL values are determined, an MDL check sample may be analyzed by spiking an interference free matrix with all target analytes at about two times the determined MDL. The MDL check sample is taken through the same process as the MDL. If any of the target analytes are not detected, or the characteristic Aroclor peak pattern cannot be identified, then the MDL study is modified and repeated until the MDL check sample is detectable. The MDL check is recommended on a quarterly basis and after major instrument maintenance or changes in the instrumentation or instrumental conditions to verify sensitivity of the method.

12.2.2 LOQ/LOD

The LOD (limit of detection) is an estimate of the lowest amount of an analyte that can be detected. This estimate would be derived from MDL studies and calibration curves (the low-level standards).

To determine the LOQ (limit of quantation), low level standards are prepped and analyzed as normal samples. The level should be at one to two times the reporting limit. The percent recoveries are calculated and criteria established for expected recoveries. For 8082 analysis, the LOQ/LOD is spiked into blank water/soil, brought through the normal extraction and cleanup process, and then analyzed. The acceptance criteria will be 50-150%. The LOQ studies must be done annually.

12.3 Precision &Accuracy:

12.3.1 Accuracy is a measure of the degree to which the analytical result approaches the "true" value of the concentration of the analyte being determined. Precision in the laboratory is determined by the

comparison of duplicates, where duplicate samples result from an original sample that has been split for identical analyses. Precision and Accuracy in the laboratory is assessed initially by the analyses of a minimum of 4 replicate samples at a mid-level point of the expected calibration range. The percent recoveries and Relative Standard Deviations (RSD) are evaluated and compared to method specifications or default limits where applicable.

12.3.2 Accuracy is also assessed by the regular analysis of known standards such as the Laboratory Control Samples (LCS), and matrix and analytical spikes. Accuracy within the laboratory is expressed in terms of percent recovery.

12.3.3 The precision of data is regularly evaluated by determining the relative percent difference (RPD) of duplicate (replicate) analyses.

12.4 Method Blanks are prepared at a frequency of one for every batch of up to 20 samples of the same matrix, prepared at the same time, by the same procedures. When sample extracts are subjected to cleanup procedures, the associated method blank must also be subjected to the same procedures.

12.4.1 The results for the method blank should be < RL for all analytes for all sample batches and < ½ RL for batches containing DoD project samples (DoD samples can have common lab contaminants up to the RL). If the method blank results do not meet these acceptance criteria, then corrective action is taken to locate and reduce the source of the contamination and the associated sample extracts are reanalyzed or re-extracted if necessary. If all the samples in the batch are non-detects then re-extraction is not necessary. If insufficient sample volume remains for re-extraction then all the samples will be reported with the appropriate data qualifiers.

12.5 Matrix spike (MS) and Matrix Spike Duplicate (MSD) are prepared at a frequency of one for every batch of up to 20 samples of the same matrix, prepared at the same time, by the same procedures (unless otherwise specified, i.e. MCP requires an LCS/LCSD).

12.5.1 Samples must be selected for spiking at random and rotated among clients and sites from batch to batch. In some cases, the client may specify which sample is to used for MS/MSD; if not , the laboratory shall pick a representative sample based on the following:

A. MS/MSD shall not be performed on Trip Blank, Rinsate Blank or Field Blank.
B. Adequate sample weight/volume.

C. Client requested QC deliverables.

12.6 Laboratory Control Samples are prepared at a frequency of one for every batch of up to 20 samples of the same matrix, prepared at the same time, by the same procedures. The LCS consists of an aliquot of clean matrix similar to the sample matrix and of the same weight or volume. The LCS is spiked with the same compounds at the same concentrations as the MS and MSD. When the results of the MS and MSD analysis indicates a potential problem due to the sample matrix itself, the LCS results are used to verify that the lab can perform the analysis in a clean matrix.

12.7 Analysis of the MS, MSD, and LCS require the same procedures employed for the original sample and the concentration of each analyte spiked is calculated.

12.8 Calculation of Recovery:

Accuracy is estimated from the recovery of spiked analytes from a sample matrix. The recovery of each spiked analyte is calculated using the following formula:

$$\text{Recovery} = \%R = \frac{Cs - Cu}{Cn} \times 100\%$$

Where:
Cs = Measured concentration of the spike sample aliquot
Cu = Measured concentration of the unspiked sample aliquot (use 0 for LCS)
Cn= Nominal (theoretical) concentration increase that results from spiking the sample, or the nominal concentration of the spike aliquot (for LCS).

12.9 Calculation of Precision:

Precision is estimated from the relative percent difference (RPD) of the concentrations (not the recoveries) measured for the MS/MSD. To calculated the RPD, use the following formula:

$$RPD = \frac{|\text{Conc. 1} - \text{Conc. 2}|}{((\text{Conc. 1} + \text{Conc. 2})/2)} \times 100$$

Where:
Conc. 1 = Measured concentration of the first sample aliquot
Conc. 2 = Measured concentration of the second sample aliquot

12.10 All recoveries control limits for surrogates, matrix spikes and laboratory control sample control are based on the laboratory control charts. The control charts are updated annually.

12.11 The following additional Quality Control rules should be followed for all Massachusetts Contingency Plan (MCP) projects where MCP CAM methods are specifically requested:

12.11.1 MS/MSD: %REC's should be between 40-140%. RPD's should be <50% for all Aroclors.

12.11.2 LCS/LCSD: %REC's must be between 40-140%.

12.11.3 Surrogates: %REC's must be between 30-150% for both surrogates on both columns.

12.11.4 Confirmation: All QC parameters must meet on both columns. Report the higher of the two columns results unless the highest result is attributable to interference.

12.11.5 Reporting: Report both sets if one is extracted inside the holding time and other outside the holding time. Provide chromatograms if the Quality Control problems are attributed to matrix effects. Report any exceedances of the above requirements in the narrative. Note if recoveries are outside the CAM acceptance criteria but inside AMRO's statistical control limits.

12.12 The following special default batch QC acceptance limit criteria apply to all DOD project samples unless superceded by a project specific QAPP, :

12.12.4 The LCS recovery acceptance limits are as follows:
Soils: AR1016= 25-145%, AR1260= 30-145%
Waters: AR1016= 40-140%, AR1260= 60-130%.

12.12.5 The MS/ MSD recovery acceptance limits are the same as for the LCS.

12.12.6 The maximum RPD allowed for MS/MSD pairs is 30%.

12.12.7 Surrogate recovery for Decachlorobiphenyl in water samples is 40-135%. Surrogate recovery for Decachlorobiphenyl in solid samples is 60-125%.

12.12.8 Corrective action must be taken if the MB or LCS surrogates or LCS target analyte spike recoveries are outside the acceptance criteria. If

reanalysis does not fix the problem, or investigation does not prove the problem is confined to the MB and/or LCS, then re-extraction of the entire batch may be necessary. All data associated with failed MB or LCS QC must be flagged in the case narrative.

13.0 DATA REVIEW AND STORAGE

13.1 All cross-outs must be a single line and should be initialed and dated. Analyst review is documented on the GC and GC/MS Data Review Checklist.

14.0 REFERENCES

14.1 40 CFR Part 136 Appendix B, 1984.

14.2 USEPA Office of Solid and Hazardous Waste - SW-846 Method Chapter 1, Rev. 1 7/92.

14.3 Method 8000B Revision 2, December 1996. SW846, Update III, USEPA.

14.4 Method 8082 Revision 1, December 1996. SW846, Update III, USEPA.

14.5 Shell for Analytical Chemistry Requirements, Version EM 200-1-3, 02/01/01.

14.6 OL-2003, Separatory Funnel Liquid-Liquid Extraction.

14.7 OL-2004, Automated Soxhlet Extraction.

14.8 OL-2019, Sulfur Cleanup.

14.9 Massachusetts Department of Environmental Protection, WSC-CAM V-A Method, Revision 1, July 1, 2010

AMRO Environmental Laboratories Corporation

111 Herrick Street, Merrimack, NH 03054
TEL: (603) 424-2022 • FAX: (603) 429-8496
www.amrolabs.com

ORGANOCHLORINE PESTICIDES BY GAS CHROMATOGRAPHY

SW-846 Method 8081A

Procedure Number: OL-2005

Revision No.: 9

Revision Date: 03/04/13

Review Date: n/a

Prepared By: Kristen Morin Date: 3/18/13

Approved By: Sue Karam Date: 3/18/13
Organic Manager

Approved By: [illegible] Date: 3-18-13
Laboratory Director

Approved By: [illegible] Date: 3-18-13
Quality Assurance Manager

Property of AMRO Environmental Laboratories Corporation

TABLE OF CONTENTS

		Page
1.0	SCOPE AND APPLICATION	3
2.0	METHOD SUMMARY	3
3.0	DEFINITIONS	4
4.0	SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE	4
5.0	POTENTIAL PROBLEMS AND INTERFERENCE'S	4
6.0	HEALTH AND SAFETY	5
7.0	INSTRUMENTS AND EQUIPMENT	6
8.0	INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR	7
9.0	REAGENTS AND STANDARDS	8
10.0	PROCEDURE	13
11.0	CALCULATIONS	25
12.0	QUALITY CONTROL	25
13.0	DATA REVIEW AND STORAGE	29
14.0	REFERENCES	30
	Attachment 1 DoD requirements for Method 8081	31

1.0 SCOPE and APPLICATION

1.1 This SOP is for Method 8081A to determine the concentrations of various Organochlorine Pesticides in extracts from solid, aqueous, and other matrices.

1.2 Analytes and Reporting Limits:

ANALYTE	RL (Reporting Limit) Aqueous * (µg/L)	Soil ** (µg/kg)
Aldrin	0.0064	0.80
Alpha-BHC	0.0064	0.80
Beta-BHC	0.0064	0.80
Delta-BHC	0.0064	0.80
Gamma-BHC	0.0064	0.80
Alpha-Chlordane	0.0064	0.80
Gamma-Chlordane	0.0064	0.80
4,4'-DDD	0.0128	1.6
4,4'-DDE	0.0128	1.6
4,4'-DDT	0.0128	1.6
Dieldrin	0.0128	1.6
Endosulfan I	0.0064	0.80
Endosulfan II	0.0128	1.6
Endosulfan Sulfate	0.0128	1.6
Endrin	0.0128	1.6
Endrin Aldehyde	0.0128	1.6
Endrin Ketone	0.0128	1.6
Heptachlor	0.0064	0.80
Heptachlor Epoxide	0.0064	0.80
Methoxychlor	0.064	8.0
+Technical Chlordane	0.20	25
+Toxaphene	0.20	25

+ Designates multi-component analytes.
* Nominal value where aqueous initial volume 1000mL, final volume 4mL
** Nominal value where soil initial mass 20g, final volume 10mL, and 0%moisture.

2.0 METHOD SUMMARY

2.1 This method describes chromatographic procedures for the detection of specific organochlorine pesticides at ppb (µg/L and µg/kg) levels. Prior to the use of this method, appropriate extraction procedures must be used. Please refer to OL-2003 "Separatory Funnel Liquid-Liquid Extraction" and OL-2004, "Automated Soxhlet Extraction" for sample extraction. An aliquot of the sample extract is injected into a gas chromatograph (GC) equipped with dual columns and dual electron capture detectors (ECD). This allows for quantitation and confirmation to occur at the same time.

3.0 DEFINITIONS

3.1 Multi-component Analyte and Single component Analyte: Throughout this SOP, the terms "single component and multi-component analyte" are used. Multi-component analyte chromatograms contain a pattern of many peaks for one target analyte while a single component analyte chromatogram contains only a single peak for each target analyte.

4.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

4.1 Extract must be stored under refrigeration in the dark and analyzed within 40 days of extraction.

4.2 Sample extracts are custody transferred from the Extraction analyst to the GC analyst via signature in the extraction logbook, or the Extraction analyst transfers them to cold storage. The extracts are either loaded directly on to GC instrument for analysis or they are stored at 4°C for future use. Extracts are kept for a minimum of two months after extraction and are then properly disposed of.

5.0 POTENTIAL PROBLEMS AND INTERFERENCE'S

5.1 The success of these methods frequently depends on the levels of interference rather than on instrumental limitations. If interferences prevent identification or detection of analytes, the analyst must evaluate the interferences and perform the proper corrective action.

5.2 Sources of interference's can be grouped into three categories:

5.2.1 Contaminated solvents, reagents, or glassware

5.2.1.1 Method Extraction Blanks and Instrument Blanks are used to determine possible contamination of solvents, reagents, glassware, and GC equipment.

5.2.1.2 Any blank value > ½ of the Reporting Limit (RL) is suspect. Sample values above the reporting limit must be evaluated for lab contamination.

5.2.1.3 If samples are found to be contaminated from the extraction process, scrupulous cleaning of the glassware and re-extraction of the samples may be required.

5.2.2 Contaminated carrier gas or GC equipment, i.e. columns, injection port liners, detectors, and syringes.

5.2.2.1 If the GC equipment is found to be the source of contamination, proper cleaning and solvent rinsing of affected parts may be required or replacement with new ones.

5.2.3 Compounds extracted from the sample matrix to which the detectors respond.

5.2.3.1 If sample matrix is determined to be the cause of interferences in the extract, the analyst should evaluate whether extract cleanup procedures should be employed.

5.2.3.2 Such interferences may include the presence of elemental sulfur, which results in broad peaks that interfere with the detection compounds and breakdown of certain pesticides. (The analyst should refer to SOP OL-2019 for sulfur removal).

5.2.3.3 Matrix interference's such as oxygen and sulfur containing compounds, elemental sulfur, and undetected hydrocarbons which cause retention time shifting or ECD response suppression. Some of these interferences may be removed by Florisil cleanup (The analyst should refer to SOP OL-2018 for the Florisil procedure).

5.2.3.4 Other sources of interferences could occur from phthalate esters, which can be minimized by avoiding sample contact with any plastic materials. Phthalates are easily leached from plastic materials during laboratory operations or even sampling including equipment rinsing.

6.0 HEALTH AND SAFETY

6.1 AMRO has a laboratory safety program in place that applies to all employees. There is a safety officer as well as employees with 40 hours of OSHA training. The air quality of the laboratory and the extraction hood velocities are monitored. All employees receive fire and safety training upon employment.

6.2 Fire extinguishers are located in various areas of the lab. A lab evacuation plan is posted in every room, with a designated meeting place. Fire drills are held on an annual basis or "as needed" with building or personnel changes.

6.3 All new analysts receive training on the safe handling of samples, standards, the changing of gas cylinders, and the operation of instruments. In the lab,

clean laboratory coats and gloves are worn when working with samples. Neat standards are made up in hoods. When gas tanks are replaced, the carrier with chain is used properly, and all gas tanks are chained in place.

6.4 Care is taken with glassware and syringes to prevent injury. Broken glass and syringes are promptly removed to broken glass containers. First aid kits are available throughout the lab. There are also eyewash stations and an emergency shower.

6.5 Material Safety Data Sheets (MSDS's) are reviewed for each chemical used to ensure proper precautions are observed when handling chemicals.

6.6 Pollution prevention – The use of chemical exhaust hood are required when working with chemicals. They are specifically designed to minimize analyst exposure. The hood exhaust is monitored periodically to ensure environmental exposure is minimized.

6.7 Waste control – AMRO takes whatever steps possible to minimize waste. This includes sample and solvent volume minimization where appropriate. There is a Waste Coordinator officer designated with 40 hours of OSHA training. AMRO also properly segregates wastes based upon waste characterization (i.e. flammability, chlorination, acidity, etc.) and a commercial vendor is utilized for waste disposal.

7.0 INSTRUMENTS AND EQUIPMENT

7.1 Gas Chromatograph: Analytical system complete with gas chromatograph suitable for on column and split-splitless injections. The system includes all the required accessories such as syringes/autosampler systems, analytical columns, gases, electron capture detectors (ECDs) and a data system.

7.2 AMRO has two complete GC/ECD systems: GC-Trent (7.2.1) and GC-Priscilla (7.2.2). All are Hewlett Packard Model 5890s capable of dual column analysis. Helium is the carrier gas and P5 (95% Argon/5% Methane) is the auxiliary make-up gas. GC-Priscilla is the primary Pesticide analysis instrument and uses column configuration (7.2.2). Each GC is equipped with one of two equivalent capillary column pairs, either:

7.2.1 RXI-50 (Restek), 30m x 0.53mm I.D. 0.83µmdf
RTX50 (Restek), 30m x 0.53mm I.D. 1.5µmdf

7.2.2 J&W Scientific DB-608, 30m x 0.45mmID, 0.7µmdf
Agilent DB-1701, 30m x 0.45mmID, 0.85µmdf

7.3 The data systems for all instruments are Hewlett-Packard Chemstation-EnviroQuant software which is used to acquire and process all GC-ECD data.

7.4 Volumetric flasks, 10 and 25mL, and Gas-Tight syringes for preparation of standards.

8.0 INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR

8.1 Daily maintenance:

The following procedures are performed each day an instrument is used for analysis if in the analyst's judgement, system performance requires them:

8.1.1 The GC septum and glass liner are removed and replaced if judged necessary by the analyst.

8.1.2 Column performance is monitored by checking the response factor of key compounds, which indicate column degradation, column bleed, or appropriate peak resolution. Clip two or more inches from the head of the column if necessary.

8.1.3 Check that carrier and make-up gases have adequate supply sufficient for the analytical sequence. Visual inspection of color indicating inline gas filters (hydrocarbon and moisture). Change tanks if necessary.

8.1.4 Check to ensure the hard drive memory capacity is sufficient for data acquisition using the HP Chemstation-EnviroQuant software.

8.2 Weekly Maintenance, or as needed:

8.2.1 Clipping column

8.2.2 Swab inlet weldment and injection port with hexane or other appropriate solvent(s).

8.2.3 Clean or replace single taper injection liner and glass wool, gold inlet seal, ferrules, and septa.

9.0 REAGENTS AND STANDARDS

9.1 The following solvents are used for sample dilutions, preparation of standards or solvent rinsing of equipment:

9.1.1 Hexane, Reagent Grade and Pesticide Residue Grade chemicals or equivalent.

9.1.2 Acetone, Reagent Grade and Pesticide Residue Grade chemicals or equivalent.

9.1.3 Methanol, Reagent Grade and Pesticide Residue Grade chemicals or equivalent.

9.2 Commercially prepared stock standard solutions that are certified by the manufacturer are used in this analysis. All Pesticide standards are purchased from Restek or an equivalent vendor. Second source standards are purchased from Ultra or are a different lot number than that used to calibrate.

9.3 All single component pesticide compounds can be found in Pesticide Standard Mixture A (Ind. A) and Pesticide Standard Mixture B (Ind. B). Both Ind. A & B contain surrogates Tetrachloro-m-xylene (TCX) and Decachlorobiphenyl (DCB) so no additional surrogates need to be added. **Table 1** below lists the analytes and concentrations in the stock mixes:

Table 1

Ind. A	Concentration µg/mL
alpha-BHC	8.0
gamma-BHC (Lindane)	8.0
4,4'-DDD	16
4,4'-DDT	16
Dieldrin	16
Endosulfan I	8.0
Endrin	16
Heptachlor	8.0
Methoxychlor	80

Ind. B	Concentration µg/mL
Hexachlorobenzene	8.0
Aldrin	8.0
beta-BHC	8.0
delta-BHC	8.0
alpha-chlordane	8.0
gamma-chlordane	8.0
4,4'-DDE	16
Endosulfan II	16
Endosulfan Sulfate	16
Endrin Aldehyde	16
Endrin Ketone	16
Heptachlor Epoxide	8.0

9.4 Working Calibration Standards: Seven serial dilutions are then made from the stock standards as specified in the Table 2 below for the calibration curve

9.4.1 Single component pesticide calibration standards and concentration:
NOTE: Methoxychlor is 10 times the lowest target concentration in each standard.
NOTE: To meet the analyte list requirements of the MADEP CAM V B Method, hexachlorobenzene (HCB) is added from a stock of 8ug/mL to the L7B standard and then is carried in all the serial dilutions of the L7B mix.

Table 2			
Calibration Std's	**Vol. Of Stock**	**Final Vol.**	**Concentration***
IndA Level 1 (L1A)	1.25mL Level 7	25mL	2×10^{-4}
IndB Level 1 (L1B)	1.25mL Level 7	25mL	2×10^{-4}
IndA Level 2 (L2A)	2.5mL Level 7	25mL	4×10^{-4}
IndB Level 2 (L2B)	2.5mL Level 7	25mL	4×10^{-4}
IndA Level 3 (L3A)	3.75mL Level 7	25mL	6×10^{-4}
IndB Level 3 (L3B)	3.75mL Level 7	25mL	6×10^{-4}
IndA Level 4 (L4A)	20mL Level 7	100mL	8×10^{-4}
IndB Level 4 (L4B)	20mL Level 7	100mL	8×10^{-4}
IndA Level 5 (L5A)	6.25mL Level 7	25mL	1×10^{-3}
IndB Level 5 (L5B)	6.25mL Level 7	25mL	1×10^{-3}
IndA Level 6 (L6A)	12.5mL Level 7	25mL	2×10^{-3}
IndB Level 6 (L6B)	12.5mL Level 7	25mL	2×10^{-3}
IndA Level 7 (L7A)	1.0mL stock A mix	250mL	4×10^{-3}
IndB Level 7 (L7B)	1.0 mL stock B mix plus 0.008mL of HCB stock	250mL	4×10^{-3}

* true concentrations = multiplier times stock solution concentrations in Table 1

9.4.2 All multi-component pesticides are purchased individually and surrogates are then added. Serial dilutions are made from 1,000µg/mL stock to create five point curves for Toxaphene and Technical Chlordane when a multi-point calibration is required.

Multi-component pesticide calibration standards and concentration

Calibration Std's	Vol. Of Stock	Final Vol.	Concentration (µg/mL)
Toxaphene Level 4	50µL	50mL	1.0
Tech. Chlordane Level 4	50µL	50mL	1.0

9.4.3 Initial Calibration Verification Standard: 2.5mL of Matrix Spike Solution (0.20µg/mL) is brought to 25mL final volume with Hexane for a final concentration of 0.020µg/mL.

9.5 TRACKING OF ANALYTICAL STANDARDS

9.5.1 Chemical Receipt:

The receipt of all standards, neat compounds and reagents from commercial sources is documented in the Chemical Receiving Logbook by sample receiving personnel or designate. Each solution or compound is assigned a unique standard receipt ID number, the letter "A" and a five digit sequential number. The date received, source, lot number, expiration date and disposal date are recorded. The expiration dates are provided from the manufacturer and the disposal dates are completed by AMRO employees when standards are used up or disposed. Refer to the laboratory SOP "Sample Management" GL-1006.

9.5.2 Standards Preparation:

Standards are prepared as written in the respective SOPs. In order to assure the accuracy of standards the following general guidelines are used:

9.5.2.1 AMRO purchases pesticide residue grade solvents and purge and trap grade Methanol for organic standard preparation and organic sample extractions.

9.5.2.2 Any stock standards that are purchased are accompanied by a certificate of analysis from the manufacturer.

9.5.3 Standard Tracking:

It is important to be able to track all analytical standards back to their sources. The following procedure is used by AMRO personnel to accomplish this:

9.5.3.1 Organic Standard Tracking: The Organic Standards Tracking System consists of three logbooks. One logbook for The ID index logbook one for Stock Standards and one for Working Standards.

9.5.3.1 Stock Standard: Whenever a stock standard solution is opened or is prepared from a neat compound, this information is recorded in the Stock Standard Logbook section of the standard tracking log. The standard chemical receipt I.D. is used for the stock solution. This ID along with the compound name, concentration and initials of the person making the stock are included on the label. Stock standards are good one year from the date prepared or the date provided by manufacturer, whichever is shorter. Example - The fourth volatile standard prepared on April 15, 1989 would have the standard ID V041589D. This number will be recorded in the logbook and written on the container.

9.5.3.2 Working Section: Whenever a working standard solution opened or is prepared, whether from AMRO stocks or commercially obtained stocks, the information is recorded in the Working Standard section of the standard tracking log. The solution is assigned a new ID number based on the section "V" or "S", the date it is prepared plus a letter suffix. This number along with a descriptive name, concentration (or conc. varied) and the initials of the person preparing the solution are included on the label. The expiration of working standards vary depending on the use. Standards should be used in accordance with method specifications and manufacturer's instructions. Stock standards must be replaced no more than one year after opening or sooner if routine QC tests indicates a problem. Working standard expiration dates are derived from the assigned stock solution's expiration date or sooner if routine QC tests indicates a problem.

9.5.3.3 Standard Storage: Standards and reagents are stored per method specifications and manufacturer's instructions. Semivolatile, Pesticide, PCB, Petroleum standards are stored in

refrigerators at 4±2°C, freezers at minus 10 °C, and ambient temperature depending upon the method and manufacturer requirements.

9.5.3.4 Solvent Check Analysis

All extraction procedures are performed using pesticide residue grade solvents and the first method blank analysis is used when a new lot number is received to verify the absence of target analytes. Also, Before a new vendor's solvent is used for sample extraction a special check of the concentrated solvent (not a method blank) is suggested.

10.0 PROCEDURE

10.1 AMRO currently has two GC instruments: TRENT and PRISCILLA.

10.2 GC Operating Conditions for PRISCILLA:

PESTICIDE ANALYSIS
Injection volume: 2 µL
ECD Temperatures: 300°C
Injection Port Temperature: 150°C
Initial Temperature: 150°C
Initial time: 0.5minutes
Rate 1: 15°C/minute
Final Temperature: 280°C
Final Time: 6 minutes
Run Time: 15.17 minutes

* A signed hard copy of this acquisition method is stored in the Instrument run logbook.

10.3 Injection port maintenance:

10.3.1 Due to the low concentrations injected in this method, every attempt must be made to ensure that the analyte path in the GC is free from sites of absorption or activity by performing injection port maintenance. Routine daily maintenance may include replacing septa, inlet liners, cleaning the injection port and clipping the injector end of the guard column. All non-routine maintenance such as column replacement or detector replacement must be recorded in the maintenance logbook.

10.4 Column Priming:

10.4.1 Because of the low concentration of pesticide standards injected on a GC/ECD, column absorption may be a problem. The GC column may be primed or deactivated by injecting 1.0 µL of a high standard solution.

10.5 Injection Run Log:

10.5.1 All injections are recorded with the EnviroQuant software and a signed hard copy of the sequence list is stored in the Instrument logbook.

10.6 Dual Column Analysis:

10.6.1 This method uses the dual column/dual detector approach. It involves the use of two 30m X 0.45mm ID fused- silica open tubular columns of different polarities, thus different selection towards the target compounds. The columns are connected by a "Y" connector to a guard column, which is connected to one injection port with one auto-sampling tower. Both columns are then connected to two different ECD detectors. (A guard column maybe used at the analysts documented discretion.)

10.7 Retention Time Windows (sections 10.7.1 through 10.7.5 refer to a setting up new instrument and determining analyte RT and elution orders):

10.7.1 Before establishing retention time windows, make sure that the chromatographic system is operating reliably and that the system conditions have been optimized for the target analytes and surrogates in the sample matrix to be analyzed.

10.7.2 Make three injections of all single and all multi-component analytes over the course of a 72-hour period. Serial injections or injections over a period of less than 72 hours may result in retention time windows that are too tight.

10.7.3 Record the retention times for all single analytes and three to five major peaks for multi-component analytes. Calculate the mean and standard deviation of the three absolute retention times of each single analyte and those peaks.

10.7.4 If the standard deviation of the retention times for a target compound is 0.000, then the laboratory uses a default standard of 0.01 minutes. Recording retention times to three decimal places rather than two should minimize the instances in which the standard deviation is calculated as 0.000.

10.7.5 The width of the retention time window for the single analytes, each major constituent in multi-component analytes and surrogates is defined as ±3 times the standard deviation of the mean absolute retention time established during a 72-hour period. If the default standard deviation is employed, the width of the window will be 0.03 minutes.

10.7.6 The absolute retention time windows must be calculated for each analyte and surrogate on each chromatographic column and instrument. New retention time windows and/or analyte elution order must be established when a new GC column is installed.

10.7.7 Establish the center of the window for each analyte and surrogate by using the absolute retention time for each analyte and surrogate from the calibration verification standard at the beginning of the analytical shift. For samples run during the same shift as an initial calibration, use the retention time of the mid-point standard of the initial calibration.

10.7.8 If the daily CCV falls outside the window, the analyst will evaluate the instrument and will recalibrate if necessary. For samples run during the same analytical shift as the Initial Calibration, use the RT of the midpoint standard. However, the experience of the GC analyst should weigh heavily in the interpretation of the chromatograms. The analyst may therefore qualify an analyte as present outside the RT window by using pattern recognition.

10.8 Initial Calibration:

10.8.1 The initial calibration curve must contain a minimum 5-point curve for all surrogates and analytes of interest with %RSD's less than 20%. Normally 7 standard levels are used for the single pesticides as indicated in 9.5.1.

10.8.2 The analysis of the multi-component analytes chlordane and toxaphene employs a single point calibration at the midpoint of the expected calibration range of each multi-component analyte. It is included with the initial calibration of the single component analytes and is used for pattern recognition and RTs. If the analytes are detected in the sample,

and the sample is from a DoD project, then a 5 point curve needs to be analyzed and the sample should be reanalyzed against this curve.

10.8.3 A second source mid-point standard is injected and compared to the initial calibration curve. The recovery of each analyte must be ±15% of the true value.

10.8.4 In reporting multi-component analytes, two processes are used: qualitative and quantitative. The first is qualitative, which is done matching the unknown sample to the multi-component standards evaluated during the initial calibration. In this case the pattern in the sample is compared to patterns of the standards. If a match is found, it is determined at what concentration the multi-component analyte is in the unknown, or its quantitative value. Three to five of the major peaks in the multi-component analyte pattern are chosen to measure the concentration of the positive hit.

10.9 Calibration Techniques:

There are two calibration techniques used by AMRO acceptable for quantitation: average response factor calibration and linear regression calibration curve. This is the order of preference:

10.9.1 The Average Response Factor Calibration:

10.9.1.1 Calculate the response factor of each compound using the equation:

$$\text{Response Factor (RF)} = \frac{\text{Peak Area of analyte}}{\text{Conc. of Analyte in standard}}$$

10.9.1.2 Calculate the Average of the Response Factors (Rfa) and the Standard Deviation (STD). Using the Rfa and STD, calculate the percent relative standard deviation (%RSD). When the RSD of Analytes are less than 20%, linearity through the origin can be assumed.

$$\%\ \text{RSD} = \frac{\text{Standard Deviation}}{\text{Average Response factor}} \times 100\%$$

10.9.1.3 Providing the % RSD for each analyte is less than 20%, the Average Response Factor (Rfa) can be using to calculate the sample results. If the %RSD is greater than 20% then a Linear Calibration Curve may be used providing the acceptance criteria is met.

10.9.2 Linear Calibration Curve:

10.9.2.1 In order to use this technique, the data system must plot and evaluate a calibration curve by calculating the correlation coefficient against the first order equation:

$$Y = mX + b$$

10.9.2.2 The software option "Curve Fit" must be selected and the computer will evaluate the calibration based on the above equation. The acceptance criteria for this equation is the coefficient of determination must be at least 0.990 and documented with a signed/dated graphics plot stored with the calibration.

10.9.2.3 Dropping of standard point should be performed ONLY on either the high or the low standard. Any point dropping should be documented for the reason of dropping on the initial calibration form. The analyst must sign and date the initial calibration form and will be reviewed by the appropriate data reviewer. The curve must be printed for visual verification and stored with the calibration records.

10.9.3 If the %RSD is greater than 20% and the correlation coefficient is less than 0.99, the instrument must be re-calibrated.

10.10 Continuing Calibration Verification (CCV)

10.10.1 Verify calibration each 12 hour shift by injecting CCV's (Continuing Calibration Verification sample, a midpoint concentration standard) prior to any sample analysis. A CCV must also be injected at intervals not less than once every 20 samples including QC (or at the end of a 12 hour interval, whichever comes first). For DoD samples the CCV must be analyzed after every 10 field samples and at the end of the analysis sequence.

10.10.2 A12-hour sequence begins with the injection of the first CCV. The shift ends after the completion of the analysis of the last sample or standard that can be injected within 12-hours of the beginning of the sequence. A closing standard **MUST** be injected at the end of the 12-hour window. However, in

continuous analysis, the closing CCV of one shift may also serve as the CCV of the next 12-hour shift.

10.10.3 The CCV Standard response must be within ± 15% of the expected value based on the initial calibration curve. If the percent Drift (%D) of any analyte is > 15%, but the average %Drift for all the analytes are within 15% and the %D for an individual analyte < 25%, then the calibration has been verified.

$$\% \text{ Drift} = \frac{\text{Calculated Concentration - Theoretical Conc.}}{\text{Theoretical conc.}} \times 100\%$$

$$\text{Ave. \%Drift} = \frac{\text{\%Drift of Each Analyte}}{\text{Total \# of Analytes}}$$

No sample results can be reported associated with a verified CCV > ±15% drift for that analyte unless it is qualified in the associated narrative report. Reanalysis is required in these cases. If a CCV fails and correction action fails to produce a passing CCV, i.e. two CCVs fail in a row, then a new initial calibration is required *or* two consecutive CCVs must pass the method criteria described above in order for sample analysis to proceed.

For DoD samples all analytes must be within ± 20% of the expected value from the Initial Calibration.

10.10.4 CCV retention times must be compared to the RT windows established vs. starting CCV (RT updated and verified) of the analytical sequence.

10.10.4.1 If any analyte is outside the window, the chromatographic system must either be adjusted so re-analysis of the CCV falls within RT windows, or the data system method copy can be updated to adjust the RT window position, otherwise a new initial calibration must be performed and new retention time windows established.

10.10.4.2 Subsequent ongoing CCV retention times should be compared to the initial CCV of the 12-hour shift. Any shifts outside the initial CCV verified windows must be investigated for

possible reanalysis of the samples in the analytical sequence.

10.10.5 If the standard analyzed after a group of samples exhibits high response (>15%), and the analyte was not detected in the specific samples analyzed during the analytical shift, then the extracts for those samples do not need to be reanalyzed, as the verification standard has demonstrated that the analyte would have been detected were it present. A second terminal CCV should be performed for all queues containing DOD project samples to demonstrate the consistency of bias, if any, in the terminal CCV result. If the response in the terminal CCV standard is low (by >15%), the sample must be re-injected in a separate analytical queue after preventive maintenance to correct the instrument problem causing the terminal QC failure. If all samples were analyzed twice in separate analytical queues with the same failing results on the closing CCV, then the laboratory will submit the initial sample results and the reanalysis of the samples will be indicated in the laboratory case narrative with the indication of which compounds failed the closing CCVs.

10.10.6 The initial daily CCV standards should include a PEM (pesticide evaluation mixture) which is used to determine the breakdown of Endrin and DDT. This standard should be analyzed *before* samples are analyzed, every 12-hour shift. Breakdown should be less than 15% for each compound. Results of the macro BREAKDWN.mac must be included with the raw data with analyst initials and date.

$$\% \text{ DDT Breakdown} = \frac{\text{Sum of DDE \& DDD areas} \times 100\%}{\text{Sum of DDT,DDE,DDD areas}}$$

$$\% \text{ Endrin Breakdown} = \frac{\text{Sum of Endrin Aldehyde + Endrin Ketone Areas} \times 100\%}{\text{Sum of Endrin, End. Aldehyde, + Endrin Ketone Areas}}$$

10.11 Data Interpretation

10.11.1 The integration of compounds for standards and samples should be performed to be in the same manner as the initial calibration integration. Cases where the initial calibration is in question should be investigated to ensure it is not related to poor maintenance, damaged or defective column, or other issues which should be solved before further analysis.

The following must be checked for each compound present in standards and samples to ensure proper integration has been performed.

10.11.2 The peak shape of the calibration compound must be maintained for standards and samples. This should take into account any shouldering, peak tailing and peak co-elution. The following pesticide pairs may nearly co-elute, although when the columns are new the resolution should be sufficient to quantify them adequately if both are present in a standard or sample: heptachlor and delta-BHC; gamma-BHC and beta-BHC; 4,4'-DDE and dieldrin; endosulfan sulfate and 4,4'-DDT; endosulfan I and DDE (column 1); alpha-chlordane and endosulfan I (column 2). These analytes are in different standard mixes to allow for proper evaluation in the standards. Analyst experience is an important tool in differentiating co-eluting analytes.

10.11.3 The retention time windows for each compound of the daily initial calibration verification must be applied to standards and samples. If there is a retention time shift confirmed by comparison of the Continuing Calibration Standards and Surrogates then pattern recognition can be utilized for identification of multi-component analytes only. Otherwise re-calibration is required.

10.11.4 The baseline integration technique for each compound of the calibration must be maintained for the standards and the samples. This should take into account elevated baselines, column compensation corrections, and negative peaks in samples. The preferred integration of multicomponent analytes should be baseline-baseline along a common baseline established by the beginning and end of the pattern. Use of valley-valley integration for toxaphene or technical chlordane should be avoided.

10.11.5 Make sure that positive identification of compounds has been established. This is done using comparison between two columns and evaluating the presence, shape, and position of the peaks within the RT windows. The peak apex of the target peak should be very near the center of the window, which is marked with a "+" in the data system display. Some slight shifting due the matrix effects may occur but the shift should be in the same direction on both columns, usually to later RTs. Qdelete the unconfirmed and false positive hits.

10.11.6 Ensure any positive results are within the lower and upper levels of the calibration curve and above the reporting limits for each compound.

10.11.7 Data interpretation consists of two steps, qualitative interpretation and quantitative interpretation. Qualitative interpretation involves identifying the analytes that are present. Analytes are identified and confirmed according to their retention times on two different columns. Quantitative interpretation involves determining the concentrations of the analytes that are present. All analytes are calculated by using the initial calibration curve:

10.11.7.1 Qualitative Analysis:

10.11.7.1.1 The first step in evaluating the data is qualitative analysis. Tentative identification of an analyte occurs when a peak from a sample falls within the established daily RT window for a specific target analyte. Confirmation is required on a second GC column of different characteristics.. For multi-component analytes (Toxaphene, Technical Chlordane), identifications are based mostly on pattern recognition, but retention time windows are used to supplement this process.

10.11.7.1.2 Pattern recognition of multi-component analytes. Each multi-component analyte shows a distinctive chromatographic pattern, which is used to identify that compound in a sample. To determine if a multi-component analyte is present, compare the sample chromatogram to the initial calibration standard. If the multi-component analyte is present in the sample, the relative response of the peaks in the standard should be similar to the response of the corresponding peaks in the sample. In addition, most major peaks observed in the standard should also appear in the sample. Be aware that degradation can alter the appearance of a sample pattern, making it harder to recognize.

10.11.7.1.3 When dual column analysis is being performed, the results for at least one column

must meet the calibration acceptance criteria. The other column may be used for qualitative verification. Use of the designated qualitative verification column for quantitation is only acceptable if the initial and terminal CCVs on the verification column are in control and interference is suspected on the primary quantitation column. For DoD samples both columns must meet the acceptance criteria.

10.11.7.2 Quantitative Analysis:

10.11.7.2.1 The second step in evaluating data is quantitative analysis. This step can only take place after the qualitative techniques in Section 10.11.7.1 have been used to confirm a positive result. For all multi-component analytes, a minimum of three distinct peaks must be used for quantitative analysis.

10.11.7.2.2 Sample results are quantitated from the initial calibration based on the three techniques discussed in Section 10.9, following this order of preference.

10.11.7.2.3 Average Response Factor Calibration. Use the following equation to calculate the concentration of analytes:

$$\text{Concentration (ug/L)} = \frac{(Ax)\,(Vf)\,(Df)}{(Rfa)\,(Vi)}$$

Where:
Ax = Area counts for the analyte in the sample.
Vi = Initial volume of the sample extracted in mL.
Vf = Final volume of sample extract in mL.
Df = Dilution factor.
Rfa = Average response factor from the initial calibration curve.

10.11.7.2.4 Linear Fit Calibration. Use the following equation to calculate the concentration of analytes:

$$\text{Concentration (ug/L)} = \frac{([m]\,[Ax] + b)\,(Vf)\,(Df)}{(Vi)}$$

Where:
([m] [Ax] + b) = Concentration of analyte in sample extract, calculated by data system or integrator (ug/L).
Vi = Initial volume of sample extracted in mL.
Vf = Final volume of sample extract in mL
Df = Dilution factor.

The curve must be printed and stored with the calibration records to document visual evaluation.

10.11.7.2.5 If it is determined that Toxaphene and/or Technical Chlordane are present, a valid calibration curve for that analyte must be performed before quantitation of that analyte can proceed if multi point calibration is required. The sample must then be re-analyzed and quantitated against the curve.

10.11.8 To quantitate multi-component analytes, discern at least three to five distinctive, unobstructed, peaks in the sample chromatogram that correspond to peaks in the standard chromatogram. Total the area of these peaks in the sample. For each standard used in the curve, total the area of the corresponding peaks. If the average response factor calibration technique is being used, calculate standard response factors for each curve standard from the total area. Then from the standard response factors calculate an average response factor. Alternatively, the total area from each curve standard can be used to produce a linear or quadratic calibration curve. Finally, the average response factor or the calibration curve is used to calculate sample concentrations.

10.11.9 Each sample analysis must be bracketed with an acceptable Initial Calibration, CCV's (each 12-hr. shift or interspersed every 20 samples including QC, whichever comes first). DoD samples will be analyzed at intervals of no greater than 10 field samples between CCV's.

10.11.10 When a CCV fails to meet acceptance criteria, all the samples injected after the last acceptable CCV must be reinjected.

10.11.11 All sample responses must fall within the calibration range. Re-analysis at a dilution must occur if the sample response exceeds the calibration range.

10.11.12 Sample results are confirmed by using two dissimilar columns. The column used for reporting results depends upon acceptable daily quality control including CCVs, MS, MSD, and LCS criteria being met. In general, report data from the column with the best overall QC data. This is the designated-quantitation column and should be indicated on the Data Review Checklist in the project folder and marked on the CCV Summary Form. For DoD samples both columns must be in control. Report the higher of two confirmed results unless overlapping peaks are causing erroneously high results, then report the non-affected result and document in the case narrative.

10.11.13 For DoD samples any sample which is not confirmed must be reported with a "Q" flag.

10.11.14 When sample results are confirmed , the difference between the two columns is measured by calculating the Relative Percent Difference (RPD) between the two results:

$$RPD = \frac{|R1-R2|}{((R1+R2)/2)} \times 100\%$$

Where R1 & R2 are the results on 2 columns.

If the result from one column is significantly higher than the other, check the chromatogram for overlapping peaks which may cause erroneously high results. If no overlapping peaks are noted, examine the baseline parameters established during integration. If no abnormalities are noted, report the result from the designated primary quantitation column (except as noted in section 10.11.12 for DOD samples). If the results from the designated quantitation column appear to be in error due to interference's, and the CCV data is acceptable from the designated qualitative confirmation column, then use the confirmation column result for reporting. If the RPD exceeds 40% and the difference is not clearly attributable to matrix interference then report the RPD criteria outlier in the case narrative and flag the result with a "J".

11.0 CALCULATIONS

11.1 All necessary calculations and formulas can be found throughout the text as applicable to each section.

12.0 QUALITY CONTROL

12.1 Initial Demonstration of Proficiency:

12.1.1 The ability of AMRO to produce accurate and precise data is demonstrated per instrument/per analyst for each method. It consists of a Method Detection Limit Study (MDL) and Precision and Accuracy Study (P&A) for each instrument and each matrix. The laboratory demonstrates initial proficiency with each combination of sample preparation and determinative methods that it utilizes by generating data of acceptable precision and accuracy for a reference sample containing the target analytes in a clean matrix. The reference samples are prepared from a spiking solution containing each analyte of interest at a concentration that is 10-50 times the MDL for each analyte in that matrix, or at the routine concentration of LCS's (Laboratory Control Samples). P & A Studies are required to be reviewed annually by evaluating a minimum of 4 LCS's and corrective action taken if necessary.

12.2 MDL and LOQ/LOD Studies:

12.2.1 The method detection limit (MDL) is defined in 40 CFR 136 Appendix B. The purpose of an MDL is to establish the minimum concentration of each analyte greater than zero that can be reported with 99% confidence. An MDL study consists of at least 7 replicates of spiked soil/deionized water (ideally standard set at ½ RL or lower), which are extracted and analyzed as normal samples. The standard deviation of the results of these analyses is multiplied by the appropriate student T-test value. The resulting value is deemed the method detection limit for that specific analyte.

MDL studies of each analyte must be reported initially for each instrument, column, matrix, and extraction method. To ensure that reasonable MDL values are determined, an MDL check sample may be analyzed by spiking an interference free matrix with all target analytes at about two times the determined MDL. The MDL check sample is taken through the same process as the MDL. If any of the target analytes are not detected, or the characteristic Aroclor peak

pattern cannot be identified, then the MDL study is modified and repeated until the MDL check sample is detectable. The MDL check is recommended on a quarterly basis and after major instrument maintenance or changes in the instrumentation or instrumental conditions to verify sensitivity of the method.

12.2.2 LOQ/LOD

The LOD (limit of detection) is an estimate of the lowest amount of an analyte that can be detected. This estimate would be derived from MDL studies and calibration curves (the low-level standards).

To determine the LOQ (limit of quantation), low level standards are prepped and analyzed as normal samples. The level should be at one to two times the reporting limit. The percent recoveries are calculated and criteria established for expected recoveries. For 8081 analysis, the LOQ/LOD is spiked into blank water/soil, brought through the normal extraction and cleanup process, and then analyzed. The acceptance criteria will be 50-150%. The LOQ studies are be done annually.

12.3 Precision &Accuracy:

12.3.1 Accuracy is a measure of the degree to which the analytical result approaches the "true" value of the concentration of the analyte being determined. Precision in the laboratory is determined by the comparison of duplicates, where duplicate samples result from an original sample that has been split for identical analyses. Precision and Accuracy in the laboratory is assessed initially by the analyses of a minimum of 4 replicate samples at a mid-level point of the expected range. The percent recoveries and Relative Standard Deviations (RSD) are evaluated and compared to method specifications or default limits where applicable.

12.3.2 Accuracy is also assessed by the regular analysis of known standards such as the Laboratory Control Samples (LCS), and matrix and analytical spikes. Accuracy within the laboratory is expressed in terms of percent recovery.

12.3.3 The precision of data is regularly evaluated by determining the relative percent difference (RPD) of duplicate (replicate) analyses.

12.4 Method Blanks are prepared at a frequency of one for every batch of up to 20 samples of the same matrix, prepared at the same time, by the same procedures. When sample extracts are subjected to cleanup procedures, the associated method blank must also be subjected to the same procedures.

12.4.1 The results for the method blank should be < RL for all analytes for all sample batches and < ½ RL for batches containing DoD project samples (DoD samples can have common lab contaminants up to the RL). If the method blank results do not meet these acceptance criteria, then corrective action is taken to locate and reduce the source of the contamination and the associated sample extracts are reanalyzed or re-extracted if necessary. If all the samples in the batch are non-detects then re-extraction is not necessary. If insufficient sample volume remains for re-extraction then all the samples will be reported with the appropriate data qualifiers.

12.5 Matrix spike (MS) and Matrix Spike Duplicate (MSD) are prepared at a frequency of one for every batch of up to 20 samples of the same matrix, prepared at the same time, by the same procedures (unless otherwise specified).

12.5.1 Samples must be selected for spiking at random and rotated among clients and sites from batch to batch. In some cases, the client may specify which sample is to used for MS/MSD; if not , the laboratory shall pick a representative sample based on the following:

A. MS/MSD shall not be performed on Trip Blank, Rinsate Blank or Field Blank.
B. Adequate sample weight/volume.
C. Client requested QC deliverables.

12.6 Laboratory Control Samples are prepared at a frequency of one for every batch of up to 20 samples of the same matrix, prepared at the same time, by the same procedures. The LCS consists of an aliquot of clean matrix similar to the sample matrix and of the same weight or volume. The LCS is spiked with the same compounds at the same concentrations as the MS and MSD. When the results of the MS and MSD analysis indicates a potential problem due to the sample matrix itself, the LCS results are used to verify that the lab can perform the analysis in a clean matrix.

12.7 Analysis of the MS, MSD, and LCS require the same procedures employed for the original sample and the concentration of each analyte spiked is calculated.

12.8 <u>Calculation of Recovery:</u>
Accuracy is estimated from the recovery of spiked analytes from the matrix of interest. The recovery of each spiked analyte is calculated using the following formula:

$$\text{Recovery} = \%R = \frac{Cs - Cu}{Cn} \times 100\%$$

Where:
Cs = Measured concentration of the spike sample aliquot
Cu = Measured concentration of the unspiked sample aliquot (use 0 for LCS)
Cn= Nominal (theoretical) concentration increase that results from spiking the sample, or the nominal concentration of the spike aliquot (for LCS).

12.9 Calculation of Precision:
Precision is estimated from the relative percent difference (RPD) of the concentrations (not the recoveries) measured for the MS/MSD. To calculated the RPD, use the following formula:

$$RPD = \frac{|\text{Conc. 1} - \text{Conc. 2}|}{((\text{Conc. 1} + \text{Conc. 2})/2)} \times 100$$

Where:
Conc. 1 = Measured concentration of the first sample aliquot
Conc. 2 = Measured concentration of the second sample aliquot

12.10 All recoveries control limits for surrogates, matrix spikes and laboratory control sample control are based on the laboratory control charts unless specifically excepted below. The control charts are updated annually.

12.11 The following additional Quality Control criteria apply for all Massachusetts Contingency Plan (MCP) projects where the CAM Method V B is requested:

12.11.1 MS/MSD: Must contain all target compounds. %REC's should be between 30-150%. RPD's should be <30% for soils, <20% for waters.

12.11.2 LCS/LCSD: %REC's must be between 40-140%.

12.11.3 Surrogates: %REC's must be between 30-150% for both surrogates on both columns.

12.11.4 Confirmation: All QC parameters must meet on both columns. Report the higher of the two columns results unless the highest result is attributable to interference.

12.11.5 Reporting: Report both sets if one is extracted inside the holding time and other outside the holding time. Provide chromatograms if the Quality Control problems are attributed to matrix effects. Report all exceedances of the above criteria in the narrative and

indicate if the recoveries ,although out side the acceptance criteria, are inside the AMRO statistical control limits.

12.12 The following special default batch QC acceptance limit criteria apply to all DOD project samples unless superceded by a project specific QAPP.

12.12.1 The LCS recovery acceptance limits for water and soil are found in Attachment 1. One target sporadic marginal failure for full list spikes is allowed outside these limits. The marginal exceedance limits are also found in Attachment 1.

12.12.2 The MS/ MSD recovery acceptance limit rules are the same as for the LCS.

12.12.3 The maximum RPD allowed for MS/MSD pairs is 30%.

12.12.4 The surrogate recovery limit for TCMX is 25-140% for water samples and 70-125% for solid samples. The surrogate recovery limit for Decachlorobiphenyl is 30-135% for water samples and 55-130% for solid samples.

12.12.5 Corrective action must be taken if the MB or LCS surrogates or LCS target analyte spike recoveries are outside the acceptance criteria. If reanalysis does not fix the problem, or investigation does not prove the problem is confined to the MB and/or LCS, then re-extraction of the entire batch may be necessary. All data associated with failed MB or LCS QC must be "Q" flagged.

13.0 DATA REVIEW AND STORAGE

13.1 All cross-outs must be a single line and should be initialed and dated. Analyst data review is documented on the GC and GC/MS Data Review Checklist.

14.0 REFERENCES

14.1 40 CFR Part 136 Appendix B, 1984.

14.2 USEPA Office of Solid and Hazardous Waste - SW-846 Method Chapter 1, Rev. 1 7/92.

14.3 Method 8000B Revision 2, December 1996. SW846, Update III, USEPA.

14.4 Method 8081A Revision 1, December 1996. SW846, Update III, USEPA.

14.5 Shell for Analytical Chemistry Requirements, Version EM 200-1-3, 02/01/01.

14.6 OL-2003, Separatory Funnel Liquid-Liquid Extraction.

14.7 OL-2004, Automated Soxhlet Extraction.

14.8 OL-2018, Florisil Cleanup.

14.9 OL-2019, Sulfur Cleanup.

14.10 Massachusetts Department of Environmental Protection, WSC CAM V B , Revision 1, July 1, 2010.

14.11 Department of Defense Quality Systems Manual for Environmental Laboratories, Final Version 3, January 2006

Attachment 1

TABLE D-14. LCS CONTROL LIMITS FOR ORGANOCHLORINE PESTICIDES SW-846 METHOD 8081 WATER MATRIX[24]

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
4,4'-DDD	88	20	25	150	10	170
4,4'-DDE	87	18	35	140	15	160
4,4'-DDT	92	15	45	140	30	155
Aldrin	83	19	25	140	10	155
alpha-BHC	94	11	60	130	50	140
alpha-Chlordane	93	10	65	125	55	135
beta-BHC	96	10	65	125	55	135
delta-BHC	91	15	45	135	30	150
Dieldrin	95	11	60	130	50	140
Endosulfan I[25]	80	10	50	110	40	120
Endosulfan II	79	17	30	130	10	150
Endosulfan sulfate	96	14	55	135	40	150
Endrin	95	13	55	135	45	145
Endrin aldehyde	96	14	55	135	40	150
Endrin ketone	102	8	75	125	70	135
gamma-BHC	82	18	25	135	10	155
gamma-Chlordane	94	11	60	125	50	135
Heptachlor	87	15	40	130	30	145
Heptachlor epoxide	96	11	60	130	50	140
Methoxychlor	103	16	55	150	40	165

TABLE D-15. LCS CONTROL LIMITS FOR ORGANOCHLORINE PESTICIDES SW-846 METHOD 8081 SOLID MATRIX[26]

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
4,4'-DDD	81	18	30	135	10	155
4,4'-DDE	97	10	70	125	60	135
4,4'-DDT	92	16	45	140	30	155
Aldrin	93	16	45	140	30	155
alpha-BHC	93	10	60	125	50	135
alpha-Chlordane	92	10	65	120	55	130
beta-BHC	95	11	60	125	50	135
delta-BHC	94	12	55	130	45	145
Dieldrin	96	10	65	125	55	135
Endosulfan I	74	20	15	135	10	155
Endosulfan II	89	17	35	140	20	160
Endosulfan sulfate	99	12	60	135	50	145
Endrin	97	12	60	135	50	145
Endrin aldehyde	92	18	35	145	20	165
Endrin ketone	100	11	65	135	55	145
gamma-BHC	91	11	60	125	50	135
gamma-Chlordane	96	10	65	125	55	135
Heptachlor	96	15	50	140	35	155
Heptachlor epoxide	98	11	65	130	55	140
Methoxychlor	100	14	55	145	45	155

[24] A number of sporadic marginal exceedances of the control limits are allowed, depending on the number of analytes spiked in the LCS. Refer to section D.2 and Table D-1 for guidance on the appropriate application of control and ME limits. LCS control limits are not available for Hexachlorobenzene and Toxaphene, although those compounds do appear on the target analyte list for method 8081 (Table C-8 in Appendix DoD-C). Sufficient data to perform statistically significant analyses were not received for those analytes during the LCS study. Additional limits for surrogate compounds can be found in section D.6.

[25] Provisional limits – outlier analyses during the LCS study resulted in LCS-CLs generated with data from fewer than four laboratories. Limits may be adjusted in the future as additional data becomes available.

[26] A number of sporadic marginal exceedances of the control limits are allowed, depending on the number of analytes spiked in the LCS. Refer to section D.2 and Table D-1 for guidance on the appropriate application of control and ME limits. LCS control limits are not available for Hexachlorobenzene, Hexachlorocyclopentadiene, and Toxaphene, although these compounds do appear on the target analyte list for method 8081 (Table C-8 in Appendix DoD-C). Sufficient data were not received for those analytes during the LCS study to perform statistically significant analyses. Additional limits for surrogate compounds can be found in section D.6.

AMRO Environmental Laboratories Corporation

111 Herrick Street, Merrimack, NH 03054
TEL: (603) 424-2022 • FAX: (603) 429-8496
www.amrolabs.com

AUTOMATED SOXHLET EXTRACTION
EPA Method 3541

Procedure Number: OL-2004

Revision No.: 6

Revision Date: 12/23/2009

Review Date: N/A

Prepared By: Kristen Albert Date: 12/23/09

Approved By: Kristen Albert Date: 1/21/10
Extraction Section Supervisor

Approved By: [illegible] Date: 1/21/10
Laboratory Director

Approved By: Paula Benham Date: 1/21/10
Quality Assurance Manager

Property of AMRO Environmental Laboratories Corporation

TABLE OF CONTENTS

		Page
1.0	SCOPE AND APPLICATION	3
2.0	METHOD SUMMARY	3
3.0	SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE	3
4.0	POTENTIAL PROBLEMS AND INTERFERENCES	4
5.0	HEALTH AND SAFETY	5
6.0	INSTRUMENTS AND EQUIPMENT	5
7.0	REAGENTS AND STANDARDS	6
8.0	PROCEDURE	13
9.0	CALCULATIONS	21
10.0	QUALITY CONTROL	22
11.0	DATA REVIEW AND STORAGE	23
12.0	REFERENCES	23
	Attachment 1 Semivolatile Organic Extraction Worksheet	24
	Attachment 2 Pesticides/PCBs Extraction Worksheet	25
	Attachment 3 EPH Extraction Worksheet	26
	Attachment 4 Automated Soxhlet Extraction Qualification Card	27
	Attachment 5 Extraction Information Summary	28
	Attachment 6 Preparation of Surrogates, Matrix Spike and Internal Standards	29
	Attachment 7 Surrogate and Spike Checks	30
	Attachment 8 Dilution Chart	31
	Attachment 9 DRO/TPH-GCFID Extraction Worksheet	32

1.0 SCOPE and APPLICATION

1.1 This Standard Operating Procedure describes the extraction of organic analytes from soil, sediment, sludges, and waste solids.

2.0 METHOD SUMMARY

2.1 20 grams of sample is weighed, dried, and recorded in the appropriate prep logbook. The surrogates and spikes for the type of test to be run are added with the corresponding solvents and placed on the automated soxhlet unit.

2.2 This procedure uses 20 grams of sample to a 2mL final volume for EPH, 10mL for PCB/Pest and DRO, and 1mL for BNAs. Nominal default reporting limits are predicated on these values and assume 100% solids. The solvent volume is increased from 70mL to 140mL to cover the sample per method requirements.

2.3 Sample aliquots are measured prior to the addition of the drying agent. Samples are not ground but mixed to a homogeneous consistency.

2.4 Extraction temperatures are based on the boiling point of the solvents used plus 80°C. Manufacturer and method recommends 100 to 120°C above the solvent boiling point. Precision and Accuracy studies performed by the laboratory have produced acceptable results using the lower temperature.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

3.1 It is not necessary for samples to be chemically preserved. They should be collected in 8-ounce glass sealable container and shipped in a cooler with cold packs, temperature 4°C. upon arrival at the laboratory, the soil samples must be refrigerated at 4°C.

3.2 Sample extraction must occur within 14 days of sampling for all, counting time from the date of sampling to the date the extraction begins. Store extracts at 4°C, separate from standards and samples.

4.0 POTENTIAL PROBLEMS AND INTERFERENCES

4.1 Water leaks, low or empty air tank, incorrect solvent amounts added, incorrect surrogate or spike added, contaminated glass wool, dirty glassware, wrong program selection may all cause problems.

4.2 Interferences by phthalate esters or other plasticizers introduced in sampling, login, or preparation can pose a major problem.

4.2.1 Avoid plastic/vinyl gloves. Use gloves made from nitrile, Viton, or similar solvent resistant polymers without plasticizers.

4.2.2 Avoid allowing the samples, pipettes, solvent bottles, and solvent pump tubing, or other apparatus or materials to contact plastics (unless PTFE coated) or contaminated surfaces.

4.3 Clean glassware immediately after use by rinsing with the last solvent used, then setting glassware in hot soapy water until washing steps can occur.

4.4 Follow the glassware cleaning SOP. Note that soap residue left on glassware may result in high (basic) pH on glassware surfaces, which may cause degradation of analytes including Aldrin, Heptachlor, most organophosphorus pesticides, and acid fraction SVOCs.

4.5 When the volume of solvent is reduced below 1mL during extract concentration, semivolatile analytes may be lost. Document problem and cause in extractions log, then notify supervisor or analyst. Attempt re-extraction ASAP.

4.6 Any observations associated with samples such as precipitate formation, non-homogeneous samples, clay samples, loss of sample, double spiking, etc. MUST be noted in the extraction logbook. This information is vital to the evaluation of the data.

5.0 HEALTH AND SAFETY

5.1 AMRO places a high value on laboratory safety. The air quality of the laboratory has been monitored. Fire extinguishers are located in various areas of the lab. The laboratory evacuation plan is posted in every room, with a designated meeting place.

5.2 All new analysts receive training on the safe handling of samples, standards, the changing of gas cylinders, and the operation of instruments. In the lab, clean lab coats and gloves are worn when working with samples. Neat standards are made up in hoods. When gas tanks are replaced, the carrier with chain is used properly, and all gas tanks are chained in place. A leak detector is used to check for any gas leaks.

5.3 Care is taken with glassware and syringes to prevent injury. Broken glass and syringes are promptly removed to broken glass containers. First aid kits are available throughout the lab. There are also eye-wash stations and an emergency shower.

5.4 MSDS's are reviewed for each chemical used to ensure proper precautions are observed when handling chemicals.

5.5 Pollution prevention – The use of chemical exhaust hood are required when working with chemicals. They are specifically designed to minimize analyst exposure. The hood exhaust is monitored periodically to ensure environmental exposure is minimized.

6.0 INSTRUMENTS AND EQUIPMENT

6.1 Soxtherm Automated Extraction System

6.1.1 Control Box-	Unit A # 473338	Unit B # 480015
	Unit C # 480019	Unit D # 480019
6.1.2 Soxtherm-	Unit A # 473343	Unit B # 480005
	Unit C # 480007	Unit D # 480009

6.2 Balance, analytical

6.3 Syringes: 100µL, 500µL and 1000µL, and 5 mL.

6.4 Micropipette: Finnpipette Fixed volume pipettors: 500µL and 1000µL

6.5 Graduated Cylinder: 100mL

6.6 Spatula

6.7 Extraction cups: Glass, 180 mL

6.8 Clips for thimbles

6.9 Boiling chips- Solvent-extracted, approximately 10/40 mesh (silicon carbide, PTFE ,or equivalent).

6.10 Vials-2mL, 5mL, 10 mL glass with PTFE-lined screw-caps or crimp tops.

6.11 Turbovap II Concentrator

6.11.1 200ml Turbovap Tubes

6.11.2 10mL graduated cylinder

6.11.3 5ml Syringe

6.11.4 500µL Syringe

6.11.5 1.0ml Syringe

6.12 Glass wool Pyrex WV-34552-01 purchased from Cole-Palmer. Baked at 200° C for four hours.

7.0 REAGENTS AND STANDARDS

7.1 Compressed air

7.2 Methylene Chloride, pesticide grade – for rinsing, EPH extractions and BNA, PAH, DRO.

7.3 Acetone, pesticide grade – for BNA and PAH extractions with Methylene Chloride.

7.4 Hexane, Pesticide Grade – for solvent exchange of EPH1.1, PCB, Pest and extraction of PCB and Pesticides with Acetone.

7.5 DI water – AMRO reagent water – Deionized and activated carbon cleaned water from a Culligan System that is checked monthly for Residual Chlorine, Conductivity, Heterotrophic Plate count, pH, Arsenic, Barium, Cadmium, Chromium, Copper, Iron, Lead, Nickel, Selenium, Silver, Zinc and Mercury. Resistivity and pH are monitored daily. Instrument and Procedural Blanks are also used to monitor contaminant levels through out the laboratory.

7.6 Nitrogen – UHP Ultra High Purity – Maine Oxy.

7.7 Methanol, pesticide grade.

7.8 Diatomaceous Earth

7.9 Sodium sulfate: Baker, anhydrous, reagent grade, heated at 400°C for 4 hours, cooled, and stored in a glass bottle.

7.10 Stock standard solutions: Stock standards should be stored in Teflon sealed crimp or screw-cap vials at 4 degrees Celsius and should be protected from the light. Stock standards should also be checked frequently for signs of degradation.

7.10.1 TPH-GCFID Surrogate stock solution -O-terphenyl at 10,000µg/mL from Restek # 31097.

7.10.2 TPH-GCFID Matrix Spike stock solution - used for LCS and Spikes - fuel oil #2, pure, obtained from Rochette Oil Co. This is a different lot number from the Calibration Stock Standard.

7.10.3 BNA LCS Stock Solution Components

8270 Mega Mix - 500-1000µg/mL obtained from Restek #31850
8270 Benzidines - 2000µg/mL obtained from Restek #31852
Custom Acetophenone - 2000µg/mL obtained from Restek #558859
8270 Cal. Mix # 1 - 2000µg/mL obtained from Restek #31618
Benzoic Acid - 2000µg/mL obtained from Restek #31879

7.10.4 BN/A Surrogate in Tinted Methanol 100:150µg/Ml obtained from Environmental Express (#M0014)

7.10.5 BN Matrix Spike Mix - 5000µg/mL obtained from Restek (#31074)

7.10.6 Acid Matrix Spike Mix - 7500µg/mL obtained from Restek (#31075)

7.10.7 TCLP BN Matrix Spike – 2,000µg/mL obtained from Restek (#31028)

7.10.8 TCLP Acid Matrix Spike – 2,000µg/mL obtained from Restek (#31027)

7.10.9 EPH Surrogate – 4,000µg/mL obtained from Restek #31479

7.10.10 EPH Matrix Spike - 1,000µg/mL Aliphatic Hydrocarbon obtained from Restek #21459, 1,000µg/mL Aromatic Hydrocarbon obtained from Restek # 31458.

7.10.11 EPH Fractionation surrogate 4,000µg/mL obtained from Restek # 31480

7.10.12 Pesticide/PCB Surrogate – 200µg/mL obtained from Restek #32000

7.10.13 Pest Full List Matrix Spike: 2000µg/mL organochlorine Pest Mix A&B obtained from Restek #32415, 1000µg/mL Hexachlorobenzene obtained from Restek # 32231

7.10.14 PCB Spike - Aroclor 1016/1260 Mix - 1,000µg/mL obtained from Restek # 32039.

7.10.15 BNA or PAH Internal Standard – 2,000µg/mL obtained from Restek # 31206.

7.10.16 EPH Internal Standard : 5 -alpha-Androstane - 2,000µg/mL obtained from Restek # 31065

7.11 Working standards:

7.11.1 Working TPH-GCFID (OTP) surrogate standard - 1000µL of surrogate standard is brought to a 10mL final volume in acetone. Final concentration is 1,000 ng/µL.

7.11.2 TPH-GCFID Matrix Spike working standard - 1gram of neat fuel oil brought to 100 mL final volume with acetone. Final concentration is 10,000 ng/µL.

7.11.3 BNA Full list Matrix Spike:
8270 Mega Mix - 1,000µl
8270 Benzidines - 500µl
Custom Acetophenone - 500µl
8270 Cal. Mix # 1 - 250µl
Benzoic Acid - 250µl
10mL final volume in Methanol.

Final concentrations are as follows:
8270 Mega Mix - 50-100µg/ml
8270 Benzidines - 100µg/ml
Custom Acetophenone - 100µg/ml
8270 Cal. Mix # 1 - 50µg/ml
Benzoic Acid - 50µg/ml

7.11.4 BN and Acid Surrogate – Prepared by Environmental Express; 30mL 100:150 BN:A Surrogate in Tinted Methanol. See 7.10.4

7.11.5 BN Matrix Spike Mix - 500µL of Stock to 25mL with Methanol for a final concentration of 100ng/µL.

7.11.6 Acid Matrix Spike Mix - 500µL of Stock to 25mL with Methanol for a final concentration of 15ng/µL.

7.11.7 TCLP BNA Matrix Spike – 500µL of the stock TCLP BN and Acid Matrix Spike solutions to 10mL with methanol for a final concentration of 100µg/mL for each analyte.

7.11.8 EPH Surrogate – 1mL of stock to 100mL with Acetone for a final concentration of 40ng/µL.

7.11.9 EPH Matrix Spike – 1,250µL of EPH Aliphatic Hydrocarbon and 1,250µL of EPH Aromatic Hydrocarbon to 25mL with Acetone for a final concentration of 50ng/µL.

7.11.10 Pesticide/PCB Surrogate – 400µL of stock to a final volume of 250mL with Acetone for a final concentration of 0.32ng/µL.

7.11.11 Pesticide Full List Spike – 10µL of Organochlorine mix and 20µL of Hexahlorobenzene to 50mL final volume with Acetone for a final concentration 0.4ng/µL.

7.11.12 PCB Matrix Spike – 1mL of Aroclor 1660 mix (1016/1260) stock to 100 mL final volume with Acetone for a final concentration of 10ng/µL.

7.11.13 BNA or PAH Internal Standard – 2000ug/mL obtained from Restek #31206

7.11.14 PAH-SIM Internal Standard Solution – 100uL of the BNA/PAH IS Stock to 1mL final volume with methylene chloride for a final concentration of 200ug/mL for each analyte.

7.11.15 EPH Internal Standard – 2000ug/mL of 5-alpha-androstane in methylene chloride obtained from Restek #31065

7.11.16 EPH Fractionation Surrogate Spike Solution – 4000ug/mL obtained from Restek #31480

See Table below for surrogate and spike mix concentrations and volumes.

Table of Surrogate and Matrix Spikes for Soils

Method #'s	Based in	Solution	Concentration	Amount
8270	Methanol	BNA Tinted Surrogate	100 and 150ng/µL	500µL in all samples
	Methanol	BNA Full List	100 and 150 ng/µL	500µL in LCS, MS, MSD
8270-PAH SIM	Methanol	BNA surrogate	100 and 150ng/µL	50µL in all samples
	Methanol	BNA Full List	100 and 150ng/µL	50µL in LCS, MS, MSD
8270 PAH	Methanol	BNA Tinted surrogate	100 and 150ng/µL	500µL in all samples

	Methanol	BNA Full List	100 and 150ng/µL	500µL in LCS, MS, MSD
EPH	Acetone	EPH surrogate	40ng/µL	1.0mL in all samples
EPH	Acetone	EPH Matrix Spike	50ng/µL	1.0mL in LCS, MS
Pesticide	Acetone	PCB/Pest surrogate	0.32µg/mL	500µL in all samples
Pesticide	Acetone	Pest Full List	0.4ug/mL	500µL LCS, MS, MSD
PCB	Acetone	PCB/Pest surrogate	0.32µg/L	500µL in all samples
PCB	Acetone	PCB spike	10µg/mL	1.0mL in LCS, MS, MSD
DRO/TPH-GCFID	Acetone	OTP	1,000µg/mL	100µL in all samples
DRO/TPH-GCFID	Acetone	#2 Fuel Oil	10,000µg/mL	400µL in LCS, MS

Note: Surrogate and spike amounts are based on the assumption of nominal final volume for the extract. If it is known a different final volume will be required see the section supervisor for instructions before proceeding.

7.12 Tracking of Reagents and Standards

It is important to be able to track all analytical reagents and standards back to their sources. The following procedures are used by AMRO personnel to accomplish this:

7.12.1 Standards, neat compounds and reagents from commercial sources is documented in the Chemical Receiving Logbook by sample receiving personnel or designate. Each solution or compound is assigned a unique standard receipt ID number, the letter "A" and a five digit sequential number. The date received, source, lot number, expiration date and disposal date are recorded. The expiration dates are provided from the manufacturer and the disposal dates are completed by AMRO employees when standards are used up or disposed. Refer to the Certificate of Analysis Logbook for standard concentration information.

7.12.2 Tracking of Reagents and Standards

It is important to be able to track all analytical reagents and standards back to their sources. The following procedures are used by AMRO personnel to accomplish this:

7.12.2.1 Standards, neat compounds and reagents from commercial sources is documented in the Chemical Receiving Logbook by sample

receiving personnel or designate. Each solution or compound is assigned a unique standard receipt ID number, which consists of the letter "A" and a five digit sequential number. The date received, source, lot number, expiration date and disposal date are recorded. The expiration dates are provided from the manufacturer and the disposal dates are completed by AMRO employees when standards are used up or disposed. Refer to the Certificate of Analysis Logbook for standard concentration information. The Certificates are kept on file in the QA/QC department. They are in numerical order and grouped as Organic Standards, Inorganic Standards and Solvents.

7.12.2.2 Standards Preparation: -

Standards are prepared as written in the respective SOPs. In order to assure the accuracy of standards the following general guidelines are used:

- AMRO purchases pesticide residue grade solvents and purge and trap grade Methanol for organic standard preparation and organic sample extractions.
- Any stock standards that are purchased are accompanied by a certificate of analysis from the manufacturer.
- Class A volumetric glassware is used to prepare standards.

7.12.2.3 Organic Standards - The Organic Standards Tracking Log System consists of three books, an Index Logbook, a Stock Standards Logbook and a Working Standards Logbook. Stock Standards are defined as any solution that requires a dilution or addition to multiple solutions and are used to make Working Standards. Working Standards are defined as anything that is added directly to a sample or analyzed directly on an instrument.

- The ID index assures that no two standards are assigned the same ID number. The Index requires the Standard ID, the section of the Standard Log (Stock or Working) the Standard information is located, and a brief description of the standard.

- Stock Standards Logbook - Whenever a stock standard solution is opened or prepared, this information is recorded in the Stock Standard Logbook .

  - Date prepared and Prepared by are the first two items to be completed.

- The next is the compound name, which should be the name of the solution being used. Do not use vendor catalog numbers alone.
- The Receipt/Stock ID is the ID of the solution being used. This can be the "A" number or a Stock ID number.
- The Source of the solution is the manufacturer.
- The concentration or purity of the solution is the next item.
- The amount in grams (g) or microliters (μL) of the solution used and the final volume of the solution made is documented.
- The Solvent ID is documented for traceability.
- The final concentration of the new solution and the units is recorded.

- The stock solution is assigned a new ID number consisting of the letter "S" for semivolatile, the date of preparation plus a letter suffix starting with the letter "A". This ID along with the compound name, concentration and initials of the person making the stock are included on the label. Example - The fourth semivolatile standard prepared on April 15, 1989 would have the standard ID S041589D. This number will be recorded in the logbook and written on the container along with expiration date and analyst initials.
- The storage location is recorded in the logbook.
- The expiration date is the last item recorded. Stock standards are good one year from the date opened or the date provided by manufacturer, whichever is shorter. The analyst must verify that 1 year from the date opened is within the manufacturers expiration date window. If it is not, then the manufacturer's expiration date must be used for the AMRO expiration date.

- Working Standards Logbook: Whenever a working standard solution opened or is prepared, whether from AMRO stocks or commercially obtained stocks, the information is recorded in the Working Standard Log.
  - Date opened/prepared and Opened/Prepared by are the first two items to be completed.
  - The next is the compound name, which should be the name of the solution being used. Do not use vendor catalog numbers alone.
  - The Receipt/Stock ID is the ID of the solution being used. This can be the "A" number or a Stock ID number. If a stock ID number was previously assigned, use the stock ID number rather than the "A" number for traceability.
  - The Source of the solution is the manufacturer.
  - The concentration or purity of the solution is the next item.

- The amount in microliters (μL) of the solution used and the final volume of the solution made is documented.
- The final concentration of the new solution and the units is recorded.
- The solvent ID is recorded for traceability.
- The stock solution is assigned a new ID number consisting of the letter "S" for semivolatile, the date of preparation plus a letter suffix starting with the letter "A". This ID along with the compound name, concentration and initials of the person making the stock are included on the label. Example - The fourth semivolatile standard prepared on April 15, 1989 would have the standard ID S041589D. This number will be recorded in the logbook and written on the container along with expiration date and analyst initials.
- The storage location is recorded in the logbook.
- The expiration date is the last item recorded. Working standards are good one year from the date opened or the oldest date prepared of any compound stock standard or the date provided by manufacturer, whichever is shorter. The analyst must verify that 1 year from the date opened is within the manufacturers expiration date window. If it is not than the manufacturer date must be used for the expiration date.

7.12.3 Standard Storage:

Standards and reagents are stored per method specifications and manufacturer's instructions. Semivolatile, DRO, Pesticide, PCB, Petroleum standards are stored in refrigerators at 4±2°C, in freezers at minus 10°C, and/or ambient temperature depending upon the method and manufacturer requirements.

7.12.4 Solvent Check Analysis:

All extraction procedures are performed using pesticide residue grade solvents and a method or procedural blank analysis is performed when a new lot number is received to verify the absence of target analytes.

8.0 PROCEDURE

8.1 All glassware is air-dried, oven dried, or dried with Acetone, then rinsed twice with Methylene Chloride. (See Glassware Washing SOP GL-1009.)

8.2 Boiling Stones are added to soxhlet beakers and glass wool is placed in each thimble to block the holes in thimble.

8.3 Weigh 20.00g of homogenized sample (remove foreign matter e.g. twigs and

leaves before weighing) into cleaned and rinsed beaker which has been labeled with the sample # and record exact mass in corresponding logbook. Refer to Homogenization SOP for proper procedures for sample homogenization. Take care when homogenizing samples. If mixed too much or too vigorously, target analytes may be lost. If samples cannot be homogenized it must be noted in the extraction log. Take a representative aliquot of the sample. This procedure uses approximately 20 grams of sample to a 2mL final volume for EPH, 10mL for PCB/Pest, DRO and 1mL for BNAs.

8.3.1 One sample per 20 should be chosen for a Matrix Spike (MS) and Matrix Spike Duplicate (MSD), for non-MCP requirements.

8.3.2 Approximately 20g are weighed out into each of 3 beakers and labeled sample number, sample number MS, and sample number MSD.

8.3.3 Method Blank and Laboratory Control Sample (LCS) are also weighed (20g each) and recorded in logbook.

8.3.4 If lack of sample volume or amount limits the ability to extract a matrix spike, or matrix spike duplicate, perform an LCSD instead. Notify the section head or appropriate analyst for further instructions. Samples that have MCP requirements do not need an MS/MSD, rather an LCS and LCSD, unless otherwise specified by client.

8.4 Drying agent (Anhydrous Sodium Sulfate or Diatomaceous Earth for Pest/PCB only) is mixed with samples until free flowing powder consistency is obtained. Avoid excessive and/or vigorous mixing as target analytes may be lost. Sample aliquots are measured prior to the addition of the drying agent. Samples are not ground but mixed to a homogeneous consistency.

8.4.1 For Pesticides/PCB's **ONLY**, diatomaceous earth may be used as the drying agent (Reference Method 3545).

8.5 Samples are transferred to extraction thimbles using metal spatulas. Spatulas are rinsed with Methylene Chloride between samples.

8.6 Surrogates and spikes are added. (See Surrogates/Spikes Table, Section 7.14).

8.7 Add respective solvents to extraction beakers which have been labeled with the sample #: The solvent volume is increased from the 70mL indicated in the method to 140mL due to the increased sample used for this procedure. The method requires the samples to be covered with solvent.

<u>Extraction Solvents/ Volume:</u>

8.7.1 PCB/Pesticides-70mL Hexane and 70mL Acetone
8.7.2 BNA- 70mL Methylene Chloride (CH_2Cl_2) and 70mL Acetone

8.7.3 EPH/ DRO - 140mL Methylene Chloride(CH_2Cl_2)

8.8 Beakers with thimbles containing sample, surrogate, spike (where applicable), and solvent are placed on instrument and program is selected and started. (See Programs, Section 8.9)

8.9 Programs:

8.9.1 Programs used depend on solvent/test being performed. Maximum temperature switch is set on 200°C, shutdown will occur if it is exceeded. Extraction temperatures are based on the boiling point of the solvents used plus 80°C. Manufacturer and method recommends 100 to 120°C above the solvent boiling point. Precision and Accuracy studies performed by the laboratory have produced acceptable results using the lower temperature.

8.9.2 PCB/Pesticides and BNA
Extraction temperature 140 degrees Celsius
Boiling time 1 hour
Solvent reduction A- 5×15mL
Extraction time - 1 hour
Solvent reduction B - 2 ×15mL
Cooling 30 minutes

8.9.3 EPH and DRO
Extraction temperature 110 degrees Celsius
Boiling time 1 hour
Solvent reduction A - 5×15mL
Extraction time- 1 hour
Solvent reduction B - 2×15mL
Cooling - 30 minutes

8.9.4 If final reduction of extracts is <20mL, notify department manager or supervisor to adjust program to ensure samples do not go dry (<1mL) during soxhlet extraction.

8.10 Collection of Extract

8.10.1 When all but 20-50mL of solvent have been concentrated, open the system and remove the cups.

8.10.2 Transfer the contents of the cups to 200mL turbovap tubes, which have been labeled with the sample ID #. Rinse the cups using the proper solvent (see 8.12.1) and add the rinsates to the glass tubes. Concentrate the extracts to 1mL - 10mL (see 8.12). Transfer a portion to a GC vial and store at 4° C until analyses are performed.

8.11 Shut down

8.11.1 Turn off instrument and water.

8.11.2 Ensure all condensers are free of solvent.

8.12 Concentration - Extract is ready to be concentrated using Turbovap Concentration Technique.

8.12.1 Samples are removed from Soxhlet apparatus and rinsed (<5mL) through thimble and on exterior of thimble with respective solvent:

Analysis	Solvent
EPH, DRO BN ONLY , PAH ONLY and Full BNA 8270 HSL,	Methylene Chloride
Pesticide/PCB PCB only	Hexane

8.12.2 After solvent is no longer dripping through soil, thimble may be removed and soil sample may be discarded in solid waste container for waste contaminated with Methylene Chloride/Hexane.

8.12.3 Turbovap concentrator tubes must be cleaned thoroughly with soap and water, rinsed with tap water and then further rinsed with deionized water. Tubes must be oven dried before use. After tubes are certain to be clean and dried, all tubes for any test are rinsed with Methylene Chloride and solvent discarded into waste solvent container.

8.12.4 Each tube must be clearly marked with sample number, test and extraction date before transfer of sample from Soxhlet beaker/Erlenmeyer flask to Turbovap tube. **Double check the match of all labels each time before transferring the sample or solvent to prevent mix-ups.**

8.12.5 Sodium Sulfate (NaSo4) may be used to remove water from sample extracts, to prevent water from being transferred into tube. Funnels are prepared for transfer of sample into tube. Funnels must be cleaned and dried as described above. A piece of silane treated glass wool should be placed in stem of funnel to allow flow of liquid but not allow Sodium Sulfate to get through wool and into tube. Sodium Sulfate (Na_2So_4) is used to remove water from sample extracts, to prevent water

from being transferred into tube. Once Sodium Sulfate is placed in funnel (approximately 1 inch deep), Sodium Sulfate is rinsed (~10mL) with methylene chloride for all tests. For Pesticides/PCB or PCB only test, funnel is further rinsed with hexane (~10mL).

8.12.6 Sample may be poured through sodium sulfate prepared funnel into tube. After contents of beaker are poured, beaker is rinsed 2 times (<5mL each) with respective solvent as described in step 1, and then poured into tube. If, as in the case of water extraction, entire volume of flask does not fit into tube, fill tube to "fill line" and keep funnel with respective flasks until the volume of sample is concentrated enough to fit rest of sample into tube.

8.12.7 Place tubes with extracts into warmed Turbovap bath (water should be ~ 41°C). Be certain nitrogen gas pressure is at 0psi before placing tubes in bath. The higher the volume of liquid in tube, the lower the gas pressure should be. A full tube should be ~5 to 7psi. Pressure of gas can be increased as volume in tube decreases, however pressure should never exceed 18psi. Pay close attention to be sure that gas pressure isn't so high that sample is splashing out of the tube against the glass top, and that the solvent liquid is in a controlled spinning motion (vortex).

8.12.8 Once liquid reaches the desired volume in tube, the Turbovap tube is removed from bath carefully, so as to not get water in other samples. The internal wall of the tube must be rinsed several times with appropriate solvent during the operation. During evaporation, the tube must be positioned to avoid water condensation (i.e. the solvent level should be below the level the water bath). The extract must not be allowed to become dry or concentrate significantly below 0.8mL to avoid analyte loss.

8.13 **SOLVENT EXCHANGE:** The extract must not be allowed to become dry or concentrate significantly below 0.8mL to avoid analyte loss. Appropriate solvents as described below:

8.13.1 BNA: Is exchanged <u>twice</u> with DCM, to remove the acetone, which can degrade some of the analytes with time, by aldol condensation. The level to initiate the exchange is between one and three ml. The volume to add is 20-30 ml. Final volume is 1ml.

8.13.2 PCB/PESTICIDE: Is exchanged twice with hexane to remove the acetone, which reacts exothermically or explosively with the H2SO4 cleanup. The level to initiate the exchange is between two and five ml. The volume to add is 20-30 ml. Final volume is 10ml.

8.13.3 EPH1.1: Is exchanged three times with hexane to remove all traces of polar solvent (DCM), which will cause breakthrough at the fractionation step and invalidate the test. The level to initiate the exchange is between one and four ml. The volume to add each time is 20-30 ml. Final volume is 2 ml.

8.13.4 DRO: Do not need solvent exchange. They can be directly concentrated to final volume (10 mL).

8.13.5 Solvents used for rinsing extract and bringing to final volume:

BNA: DCM.
EPH: Hexane
Pest/PCB: Hexane
DRO : DCM

After rinsing step is complete, extracts can be concentrated to final volumes. If the extract evaporation rate slows down significantly during concentration and the extract becomes viscous, **DO NOT CONTINUE TO CONCENTRATE THE SAMPLE.** Ask the supervisor to examine the extract and dilute it to a higher volume if appropriate.

CAUTION: When the volume of solvent is reduced below 1mL, semivolatile analytes may be lost.

CAUTION: If sample will not concentrate to its optimal final volume to nearest whole number with addition of clean solvent with respect to test type, a note must be recorded into logbook about said sample and analyst must be notified. See 8.14 for final volumes.

8.14 All 1.0 mL final volumes are to be measured using a class A "TC" volumetric flask and are placed in a 2.0 mL screw top vial. If final volume of extract is less than desired final volume, volume may be achieved through use of clean solvent as described below.

8.15 All 2.0mL and 10.0 mL final volumes are measured by comparison to the proper reference vial, matching up the meniscus.

NOTE: Reference vials are made each time a new lot of vials are received. Using a syringe, 2 mL of Hexane are transferred into a 5 mL screw top

vial and the meniscus is marked with a permanent marker. For 10 mL vials, a syringe is used to transfer 10 mL of solvent to a 12 mL vial. A DCM and Hexane 10 mL reference vial are made [DRO (DCM) and Pest/PCB (Hexane)]. A record is kept of the new vial lot numbers and the date of preparation.

8.16 Final volume caution: Because acetone absorbs water, and DCM and Hexane do not, some times water will appear in the final volumes of BNA, or P/P samples. BNA may be dried through a small pasteur pipette containing a small quantity of Na2SO4 directly into the volumetric flask. In the case of PCB (or pest) samples, either carefully draw the water from the bottom with a pipette, or draw the hexane from the top, or both. Water will react exothermically with H2SO4, and alter the true volume.

8.16.1 BN only (8270 PAH), BNA (8270 HSL): Final volume (see 8.14)- store 1.0mL in screw cap vial. If volume is not less than 0.75mL, clean Methylene Chloride can be used to bring final volume to 1.0mL. If volume is <0.75mL, volume may be brought up to 1.0mL with clean Methylene Chloride and a note must be written in logbook about the lowest volume reached during concentration.

8.16.2 EPH1.1: Final volume(see 8.15)- 2.0ml in 5.0mL screw cap vial. If final volume is <2.0mL, clean hexane may be used to bring final volume to2.0mL.

8.16.3 Pesticide/PCB &PCB soil: Final volume(see 8.15)- store 10.0mL in 19X65 (12mL) vial. Clean hexane can be added to bring final volume to 10.0mL. A note must be recorded in logbook if volume before hexane addition <3.0mL.

8.16.4 DRO: Final volume (see 8.15)- 10mL in 19X65 (12mL) vial. Clean DCM can be used to bring to final volume.

8.17 The final volumes vary from the method requirements of 1-2mL final volumes. This procedure uses 20g of sample to a 2mL final volume for EPH, 10mL for PCB/Pest, DRO and 1mL for BNAs. This is done in order to achieve nominal reporting limits for the given parameters.

8.18 All final volumes must be recorded in respective logbooks along with initials and date. Once entire batch for day is complete, a photocopy of the page is given to analyst and samples are signed over to analyst. If analyst is not present, samples are placed in refrigerator and copy of batch placed on analyst desk.

8.19 Acid wash the PCB portion of the extract using 2mL of concentrated Sulfuric Acid. If the sample is lightly colored use 2mL of acid, if the sample is darkly

colored use 2 mL of acid and then repeat the cleanup if the hexane layer is colored or turbid until the acid layer is waxy white.

8.20 Preparation of Samples for Analysis

8.20.1 PAH/BNA Samples:

8.20.1.1 Using a clean 500µL syringe rinsed with Methylene Chloride take 300µL of the extract and place into a prelabeled crimp top vial. Double check the label match before transfer.

8.20.1.2 Add 6µL of BNA Internal Standard Solution (I.S.) to the extract and crimp vial with cap. Make sure to check the level of BNA I.S. to be sure the solution has not evaporated. Minimize the amount of time when the I.S. vial is open to reduce evaporation.

8.20.1.3 Mark the level of the I.S. when all extracts are prepared.

8.20.1.4 Make sure all crimp vials caps will not twist and are legibly and properly labeled.

8.20.2 EPH Samples:

8.20.2.1 Add 10µL of fractionation surrogate per 2.0mL final volume of EPH sample and thoroughly mix the sample. The fractionation surrogate is much less dense than the extract and will not mix well unless shaken.

8.20.2.2 Fractionate the sample (see SOP OL-2026)

8.20.2.3 Using a clean 500µL syringe rinsed with Methylene Chloride take 300µL of the extract and place into a crimp top vial.

8.20.2.4 Add 3µL of EPH Internal Standard Solution (I.S.) to the extract and crimp vial with cap. Make sure to check the level of EPH I.S. to be sure the solution has not evaporated. Minimize the amount of time when the I.S. vial is open to reduce evaporation.

8.20.2.5 Mark the meniscus levels of the I.S. and fractionation surrogate when all extracts are prepared.

8.20.2.6 Make sure all crimp vials are properly labeled.

8.20.3 PCB Samples:

8.20.3.1 After acid washing (see SOP OL-2019) and copper cleanup (see SOP OL-2020), use Pasteur pipettes to place approximately 1mL of each extract from the top solvent layer into properly labeled crimp top vials. If the top layer appears cloudy allow it to settle longer or centrifuge the supernatant.

CAUTION: Transferring any sulfuric acid into the autosampler vial will destroy the GC column and damage the detector if the sample is injected. Be very careful that ONLY the clear hexane layer is transferred to the crimp top vial.

8.20.3.2 Crimp the tops of the vials and mark the meniscus level on each vial.

8.20.4 Pesticide Samples:

8.20.4.1 After Florisil cleanup (see SOP OL-2018) and copper cleanup (see SOP OL-2020) use Pasteur pipettes to place approximately 1mL of each extract from the top of the extract into properly labeled crimp top vials.

8.20.4.2 Crimp the tops of the vials and mark the meniscus level on each vial.

8.20.5 DRO samples:

8.20.5.1 Use Pasteur pipettes to transfer approx. 1mL of extract into properly labeled crimp top vials.

8.20.5.2 Crimp the tops of the vials and mark meniscus level.

9.0 CALCULATIONS

Not Applicable

10.0 QUALITY CONTROL

10.1 The Method Blank (MB), Laboratory Control Sample (LCS), Matrix Spike (MS) and Matrix Spike Duplicate (MSD) must be rotated at various location between the soxtherm units.

10.2 One Method Blank (MB) must be extracted with each batch of samples. The method blank is used to determine if the extraction procedure was successful and if there is any contamination associated with the extraction.

10.3 The surrogate is used to determine the efficiency of the extraction and must be added to each sample, blank, LCS, MS/MSD, and sample duplicate prior to extraction.

10.4 The MS/MSD is used to determine the effects of the matrix on the analytes of interest in the analysis. They are extracted with every twenty samples.

10.5 In some cases, the client may specify which sample is to used for MS/MSD; if not, the laboratory shall pick a representative sample based on the following:

A. MS/MSD shall **NOT** be performed on Rinsate Blank or Field Blank. Watch for client sample IDs containing codes like FB, EB, RB, etc. that might indicate a field blank sample.
B. Adequate sample weight.
C. Client requested QC deliverables.

10.6 If there is not adequate sample to have a Matrix Spike, then a Laboratory Control Sample (LCS) and Laboratory Control Sample Duplicate (LCSD) are extracted and analyst/department manger is notified.

10.7 The LCS is used to evaluate the laboratory performance in a clean matrix. The LCS confirms the extraction/analysis was properly performed when matrix effects cause the MS/MSD recoveries to be unacceptable. The acceptable LCS proves the extraction did not affect the recovery of the analytes, therefore it is extremely important to be careful when extracting, concentrating, and transferring the LCS.

Failure of the LCS may necessitate re-extraction of the entire batch.

10.8 In case of concentration <1mL, analytes may be lost. Contact the supervisor or initiate re-extraction before holding time has expired. In any case, documentation of the lowest extract volume in the prep logbook is required.

10.9 Be sure to enter all pertinent data in the extraction logbook. Carefully document any problems or unusual conditions in the comment section. This information is necessary for a non-conformance summary if QC sample or surrogate recovery problems occur.

11.0 DATA REVIEW AND STORAGE

11.1 All related preparation information and observations will be noted in the appropriate extraction worksheet.

11.2 All cross-outs must be a single line and should be initialed and dated.

12.0 REFERENCES

12.1 USEPA SW846-Update III, Rev 0, Dec. 1994, Automated Soxhlet Extraction Method 3541

12.2 USEPA SW846-Update III, Rev.2, Dec. 1996, Organic Extraction and Sample Preparation Method 3500B

Attachment 1

AMRO Environmental Laboratories Corporation

SEMIVOLATILE ORGANIC EXTRACTION WORKSHEET

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

Concentration Method: Turbovap; K-D (Circle One)

…/Rev. No.: OL-2003; 5	Matrix : Water	No./Rev. No.: OL-2004; 5	Matrix : Soil/Sludge Other Matrix:
…CTION DATE	______	SURR. AMT.:	______
…YST(s)	______	MS AMT.:	______
…DY Released by	______	SURROGATE/ SPIKE WITNESS	______
…d By	______	INTERNAL STANDARD ID	______
…CTION SOLVENT LOT #	______	LIMS BATCH ID:	______
…HED BY			

*SW-846 Method 3520C: Initial extraction pH <2 and Secondary extraction pH>11; EPA 625: Initial extraction pH >11 and Secondary extraction pH <2

…b Sample Number	Sample Amount Used (mL or g)	Sample pH	Initial Extraction pH	Secondary Extraction pH*	Conc. Date & Analyst	Final Volume (mL)	Int. Std. Added By/Date	Comments (Ext Appearance and Color)

Surrogate Spike		Matrix Spike		
Solution ID	Spiking compounds and Concentration(ug/mL)	Solution ID	Spiking compounds and Concentration (ug/mL)	Water Bath Temperature
				Sulfuric Acid Lot Number
				Sodium Hydroxide Lot Number

qc/qcinomes/forms/svoextwsheet Rev. 12/12/04/03

Attachment 2

RO Environmental
oratories Corporation

PESTICIDES/PCBs EXTRACTION WORKSHEET

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

Concentration Method: Turbovap; K-D (Circle One)

No./Rev. No.: OL-2003;5 Matrix: Water SOP No./Rev. No.: OL-2004;5 Matrix: Soil/Sludge Other Matrix:

ACTION DATE		SURR. AMT.	
LYST(s)		MS AMT.	
TODY Released by		SURROGATE/	
ved By		SPIKE WITNESS	
RACTION SOLVENT(s) / LOT #s		LIMS BATCH ID	
HANGE SOLVENT / LOT #		*REVIEWED BY:*	

Lab Sample Number	Sample Amount Used (mL or g)	Sample pH *	Adjusted pH *	Solvent Added (mL)	Conc. Date & Analyst	Final Volume (mL)	Cu Clean up: Date/ Init	H2SO4Clean up: Date/Init	Comments (Ext Appearance and Color)

Surrogate Spike		Matrix Spike		
Solution ID	Spiking compounds and Concentration(µg/mL)	Solution ID	Spiking compounds and Concentration (µg/mL)	Water Bath Temperature:
				Ultrasonic Tuning Date/By

* Adjust pH if not between 5 and 9

qc/qcmemos/forms/pestpcbexlog Rev. 12/23/04

Attachment 3

AMRO Environmental
Laboratories Corporation

EXTRACTABLE PETROLEUM HYDROCARBONS (EPH) EXTRACTION WORKSHEET

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

Concentration Method: Turbovap; K-D

SOP No./Rev. No.: OL-2003   Matrix: Water   SOP No./Rev. No.: OL-2004   Matrix: Soil/Sludge   Other Matrix:

EXTRACTION DATE ______
ANALYST(s) ______
CUSTODY/Released by ______
Received By ______
EXTRACTION SOLVENT / LOT #: ______
LIMS BATCH ID: ______

SURR. AMT.: ______
MS AMT.: ______
SURROGATE/
SPIKE WITNESS: ______
INTERNAL STANDARD ID: ______
FRACTIONATION STANDARD ID: ______

Lab Sample Number	Sample Amount Used (mL or g)	Sample pH	Extraction pH <2	Conc. Date & Analyst	Final Volume (mL)	Fractionation Added By/Date	Int. Std. Added By/ Date	Comments (Ext. Appearance and color)
MB								

Surrogate Spike		Matrix Spike		Water Bath Temperature
Solution ID	Spiking Compounds and Conc. (µg/ml)	Solution ID	Spiking Compounds and Conc. (µg/ml)	

REVIEWED BY: ______

[illegible] Rev. [illegible]

Attachment 4

AMRO Environmental
Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

QUALIFICATION CARD FOR AUTOMATED SOXHLET EXTRACTION

Trainee: _____ Signature: _____

Trainer: _____ Signature: _____

I. Knowledge Factors:

SOP Title: _____ Revision Number/Date: _____

1. Did the Trainee read and understand the above SOP? Yes ☐ No ☐ NA ☐
2. Was the Trainee instructed on how to properly fill out the documentation? Yes ☐ No ☐ NA ☐
3. Has the Trainee been instructed on the proper procedures for addressing potential problems? Yes ☐ No ☐ NA ☐

II. Practical Factors:

1. Has the Trainee completed a Precision and Accuracy Study? Yes ☐ No ☐ NA ☐
2. Has the Trainee completed an acceptable Performance Evaluation sample? Yes ☐ No ☐ NA ☐
3. Did the Trainee completed an acceptable Laboratory Control Sample (LCS)? Yes ☐ No ☐ NA ☐
4. Has the Trainee performed manual integration as indicated in the SOP? Yes ☐ No ☐ NA ☐

Completion Date: _____ Trainer's Signature: _____

I _____ have read, understood and follow the above method/SOP, which is in use at AMRO Laboratories for the analysis of samples under the National Environmental Laboratory Accreditation Program, have met the Demonstration of Capability.

Section Manager/ Supervisor: _____ Date: _____

QA Manager: _____ Date: _____

qc/qcmemos/forms/qualcardAutosoxhletex Rev. 0 11/00

Attachment 5

EXTRACTION INFORMATION SUMMARY

Analysis	QC	Matrix	Drying Agent	Type of Surr.	Surr. Amt.	Type of Spike	Spike Amt	Acid / Base First	Extraction Solvent	Solvent Amt.(ml)	Final Vol
8270 PAH SIM	MB, LCS	A	N / A	BN:A Tinted	50µL	BN:A Full List Spike	50µL	N / A	CH2CL2	3 x 60mL	1mL
	MS, MSD	S	Sodium Sulfate	Surrogate				N / A	CH2CL2/Acetone	70 / 70	
8270 PAH ONLY	MB, LCS	A	N / A	BN:A Tinted	500µL	BN:A Full List Spike	500µL	N / A	CH2CL2	3x60mL	1mL
	MS, MSD	S	Sodium Sulfate	Surrogate				N / A	CH2CL2/Acetone	70 / 70	
8270	MB, LCS	A	N / A	BN:A Tinted	500µL	BN:A Full List Spike	500µL	1.H2SO4 2.NaOH	CH2CL2	6x60mL	1mL
	MS, MSD	S	Sodium Sulfate	Surrogate				N / A	CH2CL2/Acetone	70 / 70	
625	MB, LCS	A	N / A	BN:A Tinted	500µL	BN:A Full List Spike	500µL	1.NaOH 2.H2SO4	CH2CL2	6x60mL	1mL
	MS, MSD	S	Sodium Sulfate	Surrogate				N / A	CH2CL2/Acetone	N/A	
BNA TCLP	MB,LCS, MS,MSD	S	N / A	BNA TintedSurrogate	500µL	BN:A TCLP Spike	500µL	1.H2SO4 2.NaOH	CH2CL2	6X60mL	1mL
EPH Rev. 1.1	MB,LCS,LCSD,	A	N/A	EPH	1000µL	EPH Matrix Spike =	1000µL	HCL to controls	CH2CL2	3x60mL	2mL
	LCSD	S	Sodium Sulfate	Surrogate		LCS+LCSD		N/A	CH2CL2	140mL	2mL
PCB ONLY	MB, LCS	A	N / A	PEST/PCB	200µL	PCB Matrix Spike=	400µL	N / A	CH2CL2	3x60mL	4mL
	MS, MSD	S	Sodium Sulfate	Surrogate	500µL	LCS + MS + MSD	1000µL	N / A	Hexane/Acetone	70 / 70	10mL
Pest ONLY	MB, LCS	A	N / A	PEST/PCB	200µL	Full List Spike	200µL	N / A	CH2CL2	3x60mL	4mL
	MS, MSD	S	Sodium Sulfate	Surrogate	500µL	LCS + MS + MSD	500µL	N / A	Hexane/Acetone	70 / 70	10mL
PEST/ PCB	P/P MB,PCB LCS, Pest LCS,	A	N / A	PEST /	200µL	Pest Full List Spike= Pest LCS,MS,MSD	200µL Pest 400µLPCB	N / A	CH2CL2	3x60mL	4mL
	PCB MS&MSD, Pest MS&MSD	S	Sodium Sulfate	PCB Surrogate	500µL	PCB spike=PCB LCS, MS,MSD	500µL Pest 1000µL PCB	N / A	Hexane/Acetone	70 / 70	10mL
PEST TCLP	MB, LCS, MS, MSD	S	N / A	Pest/PCB Surrogate	200µL	PEST TCLP Matrix Spike	200µL	N / A	CH2CL2	3x60mL	4mL
PCB OIL	MB,MS & MSD	OIL	N / A	P/P Surr.	500µL	PCB Spike	1000µL	N / A	Hexane	9.5/8.5mL	10mL
PCB Wipes	MB,LCS, MS,MSD	Wipe	N / A	P/P Surr.	1000µL	PCB Spike	2000µL	N / A	Hexane	19/17mL	20mL
Fing	MB,LCS,	A	N / A	O-terphenyl	100µL	#2 Fuel Oil Matrix	200µL	N / A	CH2CL2	3x60mL	1mL
	MS,MSD	S	Sodium Sulfate	Surrogate 1000ng/µL	100µL	Spike 10000 ng/µL	400µL	N / A	CH2CL2	20mL	20mL
DRO	MB,LCS,	A	N / A	O-terphenyl	100µL	#2 Fuel Oil Matrix	200µL	N / A	CH2CL2	3x60mL	1mL
	MS,MSD	S	Sodium Sulfate	Surrogate 1000ng/µl	100µL	Spike 10000 ng/µL	400µL	N / A	CH2CL2	140mL	10mL
MEDRO	MB,LCS,LCSD,	A	N / A	O-terphenyl	1000µL	LCS=DRO MS 50	1000µL/	N / A	CH2CL2	3x60mL	1mL
	LCS II	S	Sodium Sulfate	Surrogate 20ng/µL	1000µL	LCS II=#2 Fuel Oil MS	100µL	N / A	CH2CL2	140mL	1mL
ETPH	MB,LCS,	A	N / A	O-terphenyl	100µL	#2 Fuel Oil Matrix	200µL	N / A	CH2CL2	3x60mL	1mL
	MS,MSD	S	Sodium Sulfate	Surrogate 500ng/µL	100µL	Spike 10000 ng/µL	200µL	N / A	CH2CL2	140mL	5mL

qc/qcmemos/forms/extractionlist2009 Rev7 09/11/2009

Property of AMRO Environmental Laboratories Corporation

Attachment 6

PREPARATION OF SURROGATES, MATRIX SPIKES AND INTERNAL STANTARDS

Surrogate/Spike name	Compound name	Compound Amount (µL)	Solvent type	Final Volume *
BNA FULL LIST SPIKE Attachment 12	8270 Mega Mix	1000µL	METHANOL	10mL
	BENZIDINES	500µL		
	ACETOPHENONE	500µL		
	BENZOIC ACID	500µL		
	8270 Cal Mix	250µL		
	BENZOIC ACID	250µL		
TCLP BNA SPIKE Attachment 13	TCLP BN SPIKE MIX	250µL	METHANOL	5mL
	TCLP ACID SPIKE MIX	250µL		
EPH SURROGATE Attachment 14	EPH SURROGATE MIX	1000µL	ACETONE	100mL
EPH SPIKE Attachment 14	ALIPHATIC	1250µL	ACETONE	25mL
	AROMATIC	1250µL	ACETONE	25mL
PEST/PCB SURROGATE Attachment 15	PEST/PCB SURROGATE MIX	400µL	ACETONE	250mL
PEST SPIKE	ORGANOCHLORINE MIX	10µL	ACETONE	50mL
	HEXACHLOROBENZENE	20µL	ACETONE	50mL
PCB SPIKE	AROCLOR 1016/1260 Mix	1000uL	ACETONE	100mL
TCLP PEST SPIKE Attachment 16	TCLP PEST SPIKE MIX	10µL	ACETONE	50mL
BNA IS Attachment 17	SEMIVOLATILE INTERNAL STANDARD	ALL	NOT APLLICABLE	ALL
EPH IS	5-ALPHA ANDROSTANE	ALL	NOT APPLICABLE	ALL
EPH FRACTIONATION SURROGATE Attachment 18	CUSTOM FRACTIONATION SURROGATE	ALL	NOT APPLICABLE	ALL
SIM IS	BNA IS	100µL	METHYLENE CHLORIDE	1000µL
DRO/TPH-GCFID SURROGATE Attachment 19	O-TERPHENYL	1000µL	ACETONE	10mL
DRO/TPH-GCFID MATRIX SPIKE Attachment 19	#2 FUEL OIL	1g	ACETONE	100mL

*Amount is subject to change- check with analyst before making it up.
EPH Spike needs to be warmed up before use due to crystalization at room temperautre.

Attachment 7

SURROGATE AND SPIKE CHECKS

SOLUTION	DILUTION	SOLVENT
QQ PAH SURROGATE	5X	CH2CL2
QQ PAH MARTIX SPIKE	5X	CH2CL2
QQ PCB SURROGATE	10X	HEXANE
QQ PCB MATRIX SPIKE	5X	HEXANE
EPH SURROGATE	5X	CH2CL2
EPH MATRIX SPIKE	5X	CH2CL2
BNA SURROGATE	2X	CH2CL2
BN MATRIX SPIKE	2X	CH2CL2
ACID MARTIX SPIKE	2X	CH2CL2
BNA FULL LIST SPIKE	2X	CH2CL2
BNA TCLP SPIKE	2X	CH2CL2
PEST/PCB SURROGATE	20X	HEXANE
PCB MATRIX SPIKE	10X	HEXANE
PEST MATRIX SPIKE	20X	HEXANE
PEST TCLP SPIKE	10X	HEXANE

Attachment 8

DILUTION CHART

EPH-A / S Dilutions	AMOUNT SAMPLE	AMOUNT CH2CL2	AMOUNT 5 ALPHA IS	FINAL VOLUME
1X	300µL	N / A	3µL	300µL
2X	200µL	200µL	4µL	400µL
5X	100µL	400µL	5µL	500µL
10X	100µL	900µL	10µL	1000µL
20X	50µL	950µL	10µL	1000µL
50X	20µL	980µL	10µL	1000µL
100X	10µL	990µL	10µL	1000µL
200X	5µL	995µL	10µL	1000µL

EPH-A SIM Dilution	AMOUNT SAMPLE	AMOUNT CH2CL2	AMOUNT SIM IS	FINAL VOLUME
1X	300µL	N / A	3µL	300µL

BNA-A/S Dilutions	AMOUNT SAMPLE	AMOUNT CH2CL2	AMOUNT BNA IS	FINAL VOLUME
1X	300µL	N / A	6µL	300µL
2X	200µL	200µL	8µL	400µL
5X	100µL	400µL	10µL	500µL
10X	100µL	900µL	20µL	1000µL
20X	50µL	950µL	20µL	1000µL
50X	20µL	980µL	20µL	1000µL
100X	10µL	990µL	20µL	1000µL
200X	5µL	995µL	20µL	1000µL

A = Aqueous
S = Soil

BNA IS = Semivolatile Internal Standard

AMRO Environmental Laboratories Corporation

111 Herrick Street, Merrimack, NH 03054
TEL: (603) 424-2022 • FAX: (603) 429-8496
www.amrolabs.com

SEPARATORY FUNNEL LIQUID-LIQUID EXTRACTION METHOD 3510C

Procedure Number: OL-2003

Revision No.: 6

Revision Date: 12/23/2009

Review Date: N/A

Prepared By: Kristen Albert Date: 12/23/09

Approved By: Kristen Albert Date: 1/22/10
Extraction Section Supervisor

Approved By: Mary Schmidt Date: 1/22/10
Laboratory Director

Approved By: Paula Benham Date: 1/22/10
Quality Assurance Manager

Property of AMRO Environmental Laboratories Corporation

TABLE OF CONTENTS

		Page
1.0	SCOPE AND APPLICATION	3
2.0	METHOD SUMMARY	3
3.0	SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE	3
4.0	POTENTIAL PROBLEMS AND INTERFERENCES	4
5.0	HEALTH AND SAFETY	6
6.0	INSTRUMENTS AND EQUIPMENT	6
7.0	REAGENTS AND STANDARDS	8
8.0	PROCEDURE	14
9.0	CALCULATIONS	21
10.0	QUALITY CONTROL	22
11.0	DATA REVIEW AND STORAGE	23
12.0	REFERENCES	23
	Attachment 1 Semivolatile Organic Extraction Worksheet	24
	Attachment 2 Pesticides/PCBs Extraction Worksheet	25
	Attachment 3 EPH Extraction Worksheet	26
	Attachment 4 Separatory Funnel Liquid-Liquid Extraction Qualification Card	27
	Attachment 5 Extraction Information Summary	28
	Attachment 6 Preparation of Surrogates, Matrix Spike and Internal Standards	29
	Attachment 7 Surrogate and Spike Checks	30
	Attachment 8 Dilution Chart	31
	Attachment 9 Fingerprint/DRO Extraction Worksheet	32

1.0 SCOPE and APPLICATION

1.1 This method describes a procedure for isolating organic compounds from aqueous samples. This method also describes concentration techniques suitable for preparing the extract for the appropriate determinative methods.

2.0 METHOD SUMMARY

2.1 A measured volume of sample, usually 1.0 liter, at a specified pH, is serially extracted with methylene chloride using a separatory funnel.

2.2 The extract is dried, concentrated and, as necessary, exchanged into a solvent compatible with the cleanup or determinative method.

2.3 The extract is dried using sodium sulfate in a glass powder funnel rather than a drying column due to availability and cost.

2.4 Method modification – If emulsions are observed, the emulsion is removed into a test tube. The test tube is centrifuged, then the solvent is removed and placed in the Erlenmeyer flask used to collect the solvent layer. If an emulsion still exists, the centrifuge step is repeated. Alternatively, emulsions may be manually broken up using a clean glass pipette and gently mixing the emulsion. If it is not possible to break an emulsion then continuous liquid-liquid extraction must be used.

2.5 The extract is concentrated to between 2 and 10ml in a Kuderna-Danish flask fitted with a three ball snyder column On a heated water bath. In the Case of EPH1.1, 50 ml of hexane for solvent exchange are added to the top of the snyder column when the DCM volume in the KD has reduced to between 10-20ml.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

3.1 Samples should be received and stored in 1-liter amber glass jars at 4°C.

3.2 Pesticide/PCB samples received for EPA Method 608 must be checked upon receipt to be within pH range 5-9. If not, they must be pH adjusted or extracted within 72hrs.of sampling. Use 10N Sodium Hydroxide solution, or 50% Sulfuric Acid Solution to adjust the pH. Record the volume of acid or base used.

3.3 Store extracts separate from standards at 4°C.

3.4 Holding time is measured from date of collection to date the extraction solvent first touches the sample.

3.5 The Sample Holding Times:

Analysis	Sample Matrix	Holding Time
Semivolatile Organics	Aqueous	Samples extracted within 7 days and extracts analyzed within 40 days following extraction
Organochlorine Pesticides and PCB's	Aqueous	Samples extracted within 7 days and extracts analyzed within 40 days following extraction
EPH, EPH Rev 1.1	Aqueous	Samples extracted within 14 days and extracts analyzed within 40 days following extraction
TPH, ETPH, DRO, DRO(ME)	Aqueous	Samples extracted within 7 days and extracts analyzed within 40 days following extraction

4.0 POTENTIAL PROBLEMS AND INTERFERENCES

4.1 Soap residue, which results in a basic pH on the glassware surfaces, may cause degradation of certain analytes. Specifically, Aldrin, Heptachlor, and most organophosphorus pesticides will degrade in this situation. This problem is especially pronounced with glassware that may be difficult to rinse. These items should be hand-rinsed very carefully to avoid this problem.

4.2 Emulsions – If an emulsion occurs, slowly drain as much methylene chloride into flask as possible without allowing emulsions to drain. Then slowly drain the emulsion into disposable test tubes. Centrifuge.

4.2.1 After the sample has been centrifuged, there should be a layer of water on the top and the methylene chloride on the bottom.

4.2.2 Pipette the water layer back into the separatory funnel and pipette the methylene chloride into the Erlenmeyer flask.

4.2.3 If very little methylene chloride is recovered after centrifuging, remove the solvent then centrifuge again.

4.2.4 Make sure to document the presence of the emulsion on the extraction log.

4.2.5 Alternatively, a clean glass pipette can be used to manually break up emulsions. This method is not effective if heavy emulsions are present.

4.2.6 If all the above techniques fail to break the emulsion, then continuous liquid-liquid extraction (EPA 3520) should be employed in lieu of separatory funnel extraction.

4.3 Problems with the pH:

4.3.1 EPH samples should all be preserved with HCl at the time of sampling. If a sample pH is found to be greater than pH=2 upon receipt, notify the supervisor. The supervisor may have extraction personnel preserve the sample. DO NOT PRESERVE UNLESS APPROVED BY A SUPERVISOR. Record the pH in the extraction log, and proceed with the extraction.

4.3.2 The volume of acid or base should not exceed 1% of the total initial sample volume being extracted (i.e. 1000mL of sample – no more that 10mL acid or base can be added for pH adjustment.)

4.3.3 Care must be taken to ensure the proper extraction pH is reached for BNA extraction. EPA Method 625 requires basic then acidic order for extraction. SW-846 Method 3510C allows acidic, then basic extraction. Make sure to carefully adjust sample pH and properly document it. If pH is not properly adjusted, the procedure may not fully extract all analytes of interest. PAH/PAHSIM samples may be extracted at neutral pH.

4.4 Pre-extraction Sample Dilutions:

4.4.1 Before a dilution is performed on the "water" sample, determine if the sample is water-soluble. First place Deionized Water in a vial, then pipette a small amount of the sample in the water, gently swirl. The sample should mix evenly with the water, no layers should form. If layers do occur, the sample is not water-soluble. Notify the supervisor before proceeding.

4.4.2 If it is determined that a dilution is needed and can be done, then use deionized water to obtain desired dilution.

4.4.3 When any sample is received which is a darkly colored liquid, viscous liquid, or liquid with pH>11, contact the supervisor for instructions before proceeding. The sample may need to be diluted or an emulsion test performed before extraction.

4.5 If normal final volume is not achieved due to nature of sample, make a notation on the appropriate extraction worksheet; Semivolatile (Attachment1); Pesticides/PCB (Attachment 2), EPH (Attachment 3), and Fingerprint (Attachment 9) so the analyst will be aware adjustment in calculation is needed.

4.6 If at any point extract volume is reduced to <0.75mL then analytes may be lost. Indicate problem and cause on extractions log, and notify supervisor or analyst. Attempt re-extraction within holding time ASAP.

4.7 If sample will not concentrate to final volume, see supervisor for instruction.

5.0 HEALTH AND SAFETY

5.1 AMRO places a high value on laboratory safety. The air quality of the laboratory has been monitored. Fire extinguishers are located in various areas of the lab. The laboratory evacuation plan is posted in every room, with a designated meeting place.

5.2 All new analysts receive training on the safe handling of samples, standards, the changing of gas cylinders, and the operation of instruments. In the lab, clean lab coats and gloves are worn when working with samples. Neat standards are made up in hoods. When gas tanks are replaced, the carrier with chain is used properly, and all gas tanks are chained in place. A leak detector is used to check for any gas leaks.

5.3 Care is taken with glassware and syringes to prevent injury. Broken glass and syringes are promptly removed to broken glass containers. First aid kits are available throughout the lab. There are also eye-wash stations and an emergency shower.

5.4 MSDS's are reviewed for each chemical used to ensure proper precautions are observed when handling chemicals.

5.5 Pollution prevention – The use of chemical exhaust hood are required when working with chemicals. They are specifically designed to minimize analyst exposure. The hood exhaust is monitored periodically to ensure environmental exposure is minimized.

6.0 INSTRUMENTS AND EQUIPMENT

6.1 Shaker-Floor Model 8 position orbital shaker

6.2 Separatory funnel-2.0 Liter, with stopper

6.3 Erlenmeyer Flask, 250mL and 1000mL

6.4 pH paper

6.5 Aluminum foil and white Labeling tape

6.6 Test tubes 16X125mm

6.7 Centrifuge

6.8 Pipettes and bulbs

6.9 Separatory funnel stand

6.10 Sonicator

6.11 Kuderna-Danish (K-D) apparatus. (Alternatively, in the case of PCB/Pesticide aqueous samples, use Zymark Turbovap II apparatus.):

6.11.1 Concentrator tube- 10mL, graduated (Kontes K-570050-1025 or equivalent). A ground-glass stopper is used to prevent evaporation of extracts.

6.11.2 Evaporation flask-500mL (Kontes K-570001-500 or equivalent). Attach to concentrator tube with springs, plastic clips, clamps, or equivalent.

6.11.3 Snyder column-Three ball macro (Kontes K-503000-0121 or equivalent).

6.11.4 Snyder column-Two ball micro (Kontes K-569001-0219 or equivalent).

6.11.5 Springs-1/2 inch (Kontes K-662750 or equivalent).

6.12 Boiling chips- Solvent-extracted, approximately 10/40 mesh (PTFE or equivalent).

6.13 Six position Water Baths

6.14 Vials-2mL,5ml, glass with PTFE-lined screw-caps or crimp tops.

6.15 Zymark Turbovap II concentration apparatus

6.16 N-evap Nitrogen Blowdown Apparatus

7.0 REAGENTS AND STANDARDS

7.1 Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available. Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

7.2 DI water- AMRO reagent water – Deionized and activated carbon cleaned water from a Culligan System that is checked monthly for Residual Chlorine, Conductivity, Heterotrophic Plate count, pH, Arsenic, Barium, Cadmium, Chromium, Copper, Iron, Lead, Nickel, Selenium, Silver, Zinc and Mercury. Resistivity and pH are monitored daily. Instrument and Procedural Blanks are also used to monitor contaminant levels through out the laboratory and demonstrate water is organic free.

7.3 Sodium sulfate (granular, anhydrous), Na_2SO_4. Purify by heating to 400°C for 4 hours in a shallow tray.

7.4 Sodium hydroxide solution (10N), NaOH. Dissolve 40g NaOH in Organic-free water and dilute to 100 mL. Other concentrations of hydroxide solutions may be used to adjust the sample pH, provided that the volume added does not appreciably change (e.g.<1%) the total sample volume.

7.5 Sulfuric acid solution (1:1 v/v), H_2SO_4. Slowly add 250mL of H_2SO_4 to 250mL of organic-free reagent water.

7.6 Hydrochloric acid solution (1:1 v/v), HCl.

7.7 Acetone. Pesticide residue grade or purer.

7.8 Extraction/exchange solvents:

7.8.1 Methylene chloride, boiling point 39°C. Pesticide residue grade or purer.

7.8.2 Hexane, boiling point 68°C. Pesticide residue grade or purer.

7.9 pH test strips with 1 pH unit increments.

7.10 Stock standard solutions: Stock standards should be stored in Teflon sealed crimp or screw-cap vials at 4 degrees Celsius and should be protected from the light. Stock standards should also be checked frequently for signs of degradation.

7.10.1 TPH-GCFID Surrogate stock solution -O-terphenyl from Restek #31097

7.10.2 TPH-GCFID Matrix Spike stock solution - used for LCS and Spikes - fuel oil #2, pure, obtained from Rochette Oil Co. This is a different lot number from the Calibration Stock Standard.

7.10.3 BNA LCS Stock Solution Components
8270 Mega Mix - 500-1000µg/mL obtained from Restek #31850
8270 Benzidines - 2000µg/mL obtained from Restek #31852
Custom Acetophenone - 2000µg/mL obtained from Restek #558859
8270 Cal. Mix # 1 - 2000µg/mL obtained from Restek #31618
Benzoic Acid - 2000µg/mL obtained from Restek #31879

7.10.4 BNA Surrogate in Tinted Methanol 100:150µg/mL obtained from Environmental Express (#M0014)

7.10.5 BN Surrogate- 5000 µg/mL from Restek (#31062)

7.10.6 Acid Surrogate - 10000µg/mL from Restek (#31063)

7.10.7 BN Matrix Spike Mix - 5000µg/mL obtained from Restek (#31074)

7.10.8 Acid Matrix Spike Mix - 7500µg/mL obtained from Restek (#31075)

7.10.9 TCLP BN Matrix Spike – 2,000µg/mL obtained from Restek (#31028)

7.10.10 TCLP Acid Matrix Spike – 2,000µg/mL obtained from Restek (#31027)

7.10.11 EPH Surrogate – 4,000µg/mL obtained from Restek #31479

7.10.12 EPH Aromatic Hydrocarbon Standard – 1000µg/mL from Restek (#31458)

7.10.13 EPH Aliphatic Hydrocarbon Standard - 1000µg/mL from Restek (#31459)

7.10.14 Pesticide/PCB Surrogate – 200µg/mL obtained from Restek #3200

7.10.15 Pest Full List Matrix Spike – Organochlorine 2,000µg/mL from Restek (#32415), HCB 1,000µg/mL from Restek (#32231).

7.10.16 PCB Spike – Aroclor 1016/1260 mix - 1,000µg/mL obtained from Restek (#32039).

7.10.17 BNA or PAH Internal Standard – 2000µg/mL obtained from Restek (#31206).

7.10.18 EPH Internal Standard – 5 alpha Androstane - 2000µg/mL obtained from Restek (#31065)

7.11 Working standards:

7.11.1 Working TPH-GCFID surrogate standard – 1mL of surrogate stock is brought to a 10mL final volume in acetone. Final concentration is 1,000µg/mL.

7.11.2 TPH-GCFID Matrix Spike working standard - 1gram of stock brought to 100 mL final volume with acetone. Final concentration is 10,000 ng/µL.

7.11.3 BNA LCS Mix – 10mL final volume in Methanol with the addition of each of the following:

8270 Mega Mix - 1,000µl
8270 Benzidines - 500µl
Custom Acetophenone - 500µl
8270 Cal. Mix # 1 - 250µl
Benzoic Acid - 250µl

Final concentrations are as follows:
8270 Mega Mix - 50-100µg/ml
8270 Benzidines - 100µg/ml
Custom Acetophenone - 100µg/ml
8270 Cal. Mix # 1 - 50µg/ml
Benzoic Acid - 50µg/ml

7.11.4 BN and Acid Surrogate – Prepared by Environmental Express; 30mL 100:150 BN:A Surrogate in Tinted Methanol. See 7.10.5

7.11.5 BN Matrix Spike Mix - 500µL of Stock to 25mL with Methanol for a final concentration of 100ng/µL.

7.11.6 Acid Matrix Spike Mix - 500µL of Stock to 25mL with Methanol for a final concentration of 15ng/µL.

7.11.7 TCLP BNA Matrix Spike – 500µL of the stock TCLP BN and Acid Matrix Spike solutions to 10mL with methanol for a final concentration of 100µg/mL for each analyte.

7.11.8 EPH Surrogate – 1mL of stock to 100mL with Acetone for a final concentration of 40ng/µL.

7.11.9 EPH Matrix Spike – 1,250µL Aliphatic, 1,250µL aromatic to 25mL with Acetone for a final concentration of 50µg/ml .

7.11.10 Pesticide/PCB Surrogate – 400µL of stock to a final volume of 250mL with Acetone for a final concentration of 0.32ng/µL.

7.11.11 Pesticide Full List Spike – 10µL of Organochlorine and 20µL of HCB to 50mL final volume with Acetone for a final concentration 0.40µg/ml

7.11.12 PCB Matrix Spike – 1mL of Aroclor 1016/1260 mix stock to 100 mL final volume with Acetone for a final concentration of 10ng/µL.

7.11.13 BNA or PAH Internal Standard – 2000ug/mL obtained from Restek (#31206)

7.11.14 PAH-SIM Internal Standard Solution – 100uL of the BNA/PAH IS Stock to 1mL final volume with methylene chloride for a final concentration of 200ug/mL for each analyte.

7.11.15 EPH Internal Standard – 2000ug/mL of 5-alpha-androstane in methylene chloride obtained from Restek (#31065)

7.11.16 EPH Fractionation Surrogate Spike Solution – 4000ug/mL obtained from Restek (#31480)

7.12 Tracking of Reagents and Standards

It is important to be able to track all analytical reagents and standards back to their sources. AMRO personnel to accomplish this use the following procedures:

7.12.1 Standards, neat compounds and reagents from commercial sources are documented in the Chemical Receiving Logbook by sample receiving personnel or designate. Each solution or compound is assigned a unique standard receipt ID number, which consists of the letter "A" and a five digit sequential number. The date received, source, lot number, expiration date and disposal date are recorded. The expiration dates are provided from the manufacturer and AMRO employees complete the disposal dates when standards are used up or disposed. Refer to the Certificate of Analysis Logbook for standard concentration information. The Certificates are kept on file in the Extraction Section.

7.12.2 Organic Standard Tracking - The Organic Standards Tracking Log System consists of a Standard ID Index Logbook, a Stock Standards Logbook, and a Working Standards Logbook. The ID index assures that no two standards are assigned the same ID number.

7.12.3 Stock Standards Logbook:

Whenever a stock standard solution is opened or is prepared from a neat compound, this information is recorded in the Stock Standard Logbook. The stock solution is assigned a new ID number consisting of the letter "S", the date of preparation plus a letter suffix starting with the letter "A". This ID along with the compound name, concentration and initials of the person making the stock are included on the label. Stock standards are good one year from the date prepared or the date provided by manufacturer, whichever is shorter. Example - The fourth semivolatile standard prepared on April 15, 1989 would have the standard ID S041589D. This number will be recorded in the logbook and written on the container.

7.12.4 Working Standards Logbook:

Whenever a working standard solution opened or is prepared, whether from AMRO stocks or commercially obtained stocks, the information is recorded in the Working Standard Logbook. The solution is assigned a new ID number consisting of the letter "S", the date it is prepared plus a letter suffix. This number along with a descriptive name, concentration (or conc. varied) and the initials of the person preparing the solution are included on the label. The expiration of working standards varies depending on the use. Standards should be used in accordance with method specifications and manufacturer's instructions.

7.12.5 Standard Storage:

Standards and reagents are stored per method specifications and manufacturer's instructions. Semivolatile, Pesticide, PCB, Petroleum standards are stored in refrigerators at 4°C± 2°C, freezers at -10 °C, and ambient temperature depending upon the method and manufacturer requirements.

7.12.6 Solvent Check Analysis

All extraction procedures are performed using pesticide residue grade solvents and a method or procedural blank analysis is performed when a new lot number is received to verify the absence of target analytes.

7.13 Surrogates and Spikes

Table of Surrogates and Spikes-Water

Method #'s	Based in	Solution	Concentration	Amount
8270	Methanol	BNA Tinted Surrogate	100 and 150ng/µL	500µL in all samples
	Methanol	BNA Full List	100 and 150ng/µL	500µL in LCS, LCSD
8270 PAH	Methanol	BNA Tinted Surrogate	100 and 150ng/µL	500µL in all samples
	Methanol	PAH MS	100 and 150ng/µL	500µL in LCS, LCSD
8270 PAH-SIM	Methanol	BNA Surrogate	100 and 150ng/µL	50µL in all samples
	Methanol	BNA Full List Or PAH MS	100 and 150ng/µL	50µL in LCS, LCSD
EPH1.1	Acetone	EPH Surrogate	40ng/µL	1.0mL in all samples
	Acetone	EPH Matrix Spike	50ng/µL	1.0mL in LCS, LCSD
Pesticide	Acetone	PCB/Pest Surrogate	0.32µg/mL	200µL in all samples
	Acetone	Pest Full List Spike	0.4µg/mL	200µL LCS, LCSD
PCB	Acetone	PCB/Pest Surrogate	0.32µg/mL	200µL in all samples
	Acetone	PCB Matrix Spike	10µg/mL	400µL in LCS, LCSD
FING/DRO	Acetone	O-terphenyl surrogate	1000ng/µL	100µL in all samples
	Acetone	#2 Fuel Oil	10000ng/µL	200µL in LCS, LCSD

Note: Surrogate and spike amounts are based on the assumption of nominal final volume for the extract. If it is known a different final volume will be required see the section supervisor for instructions before proceeding.

8.0 PROCEDURE

8.1 All funnels and stoppers, and necessary glassware are dried with acetone, or air dried and rinsed with methylene chloride. An Erlenmeyer flask for each sample must also be dried with acetone and rinsed with methylene chloride.

8.2 The meniscus of the sample container is marked prior to transfer to the separatory funnel.

8.3 The samples are transferred to the separatory funnels that have been labeled with the corresponding sample number. The entire contents of the sample container should be transferred including small amounts of sediment if present. If large amounts of sediment are present in the sample bottle then contact the supervisor immediately before proceeding. Excluding the sediment is allowable only with client permission and must be documented in the logbook.

8.4 If there is an adequate amount of sample or sample duplicate available, a sample is chosen for the Matrix Spike and Matrix Spike Duplicate. The aliquot size should be about the same for the native sample and the QC samples. Be certain that Chain-Of-Custody is checked to allow for all other tests to be done on the sample. The funnels must be clearly labeled with the sample #, sample #MS, and sample #MSD.

8.4.1 If there is only enough sample to have a matrix spike, notify analyst and department manager so client can be contacted.

8.4.2 In some cases, the client may specify which sample is to used for MS/MSD; if not , the laboratory shall pick a representative sample based on the following:

A. MS/MSD shall **NOT** be performed on Rinsate Blank or Field Blank. Watch for client sample IDs containing codes like FB, EB, RB, etc. that might indicate a field blank sample.
B. Adequate sample weight/volume.
C. Client requested QC deliverables.

8.4.3 If there is not adequate sample to have a Matrix Spike, then a Laboratory Control Sample (LCS) and Laboratory Control Sample Duplicate (LCSD) are extracted and analyst/department manager is notified.

8.4.4 For every 20 client samples prepare the following QC samples per method: Method Blank (MB), Laboratory Control Sample (LCS), and LCS Duplicate (LCSD). Unless the client requests a MS/MSD which is usually communicated in the chain of custody.

8.5 One liter of filtered drinking water for each the blank and a Laboratory Control Sample (LCS) are extracted for every 20 samples.

8.6 Test the initial pH of the sample and document it on the extractions log.

8.6.1 pH of EPH waters should be ~ 2.0

8.6.2 pH of waters for pesticide analysis should be between 5.0-9.0

8.7 pH is adjusted with 1:1 (v/v) Sulfuric Acid or 10N Sodium Hydroxide, or as indicated, according to the test being performed. Document any adjustments on the extraction log. To test the pH of aqueous samples, use a disposable pasteur pipette. Remove a few drops of sample and place them onto a strip of pH paper. Record the pH of the sample in the extraction logbook. Only use a pipette once for each sample. Dispose of each pipette after use.

8.7.1 Pesticides/PCB-pH should be between 5.0-9.0, or adjust.

8.7.2 EPH waters are preserved in HCl (1:1 v/v), pH~2.0. The blank and the LCS/LCSD need to be preserved with ~2.0 mL of HCl (1:1 v/v) before surrogates and spikes are added.

8.7.3 8270 PAH (or BN only)-initial pH should be between 5.0-9.0. For full BN analysis add a measured amount of 10N NaOH to the sample to reach a final pH of ~ 11.0. It is not necessary to adjust the pH of PAH only samples before extraction.

8.7.4 8270 (ABN)-initial pH should be between 5.0-9.0 on receipt. This is a two part extraction - First samples are acidified with a measured amount of 1:1 H_2SO_4 to a pH of <2. If the sample is alkaline or highly buffered then thoroughly mix the sample and allow sufficient time for the pH to stabilize below 2 before extracting. Improper acid fraction pH will significantly reduce analyte recovery. In the second part the samples are made alkaline with a measured amount of 10N NaOH to pH ~ 11.

8.7.5 625 (BNA)-initial pH should be between 5.0-9.0. This is a two part extraction - First the samples are made alkaline with a measured amount of 10N NaOH to pH ~ 11. Next the samples are acidified with a measured amount of 1:1 H_2SO_4 to pH <2. If the sample is alkaline or highly buffered then thoroughly mix the sample and allow sufficient time for the pH to stabilize below 2 before extracting. Improper acid fraction pH will significantly reduce analyte recovery.

8.8 Spikes and Surrogates

8.8.1 See Table of Spikes and Surrogates-Water for the correct surrogate and spike amounts.

8.8.2 All syringes used must be rinsed clean in the correct solvent before and after use.

8.8.3 All spikes and surrogates must be added to the sample before the pH is changed or solvent is added.

8.8.4 One person should be responsible for adding the spikes and surrogates to the samples.

8.8.5 A witness must be present while surrogates and spikes are being added to the samples. The witness is to make sure that the correct surrogates and spikes are being added and in the correct amount to each sample. The person who is the witness is also responsible for signing off that they did witness the samples being spiked and surrogated in the correct extraction logbook.

8.9 Add 60mL of Methylene Chloride to the sample bottle, seal, and shake for 30s to rinse the inner surface. Transfer the solvent to the separatory funnel. If sediment in the bottle, avoid formation of emulsions by gently turning the bottle to rinse the inner surface and avoid disturbing the sediment.

8.10 Each funnel is then shaken vigorously for two minutes using 8 position Floor Model Shaker for 2L separatory funnels. **Be certain to vent the funnels into a hood periodically while shaking.** If the funnel is not vented properly, it could explode. Venting should be done immediately after separatory funnel has been sealed and shaken once.

8.11 After each shake, the Methylene Chloride is drained into Erlenmeyer flasks that have been labeled with the sample number, date and test being performed. **Double check the match of funnel and flask labels each time before draining the solvent to prevent mix-ups.**

8.12 The number of times 60mL of Methylene Chloride is added and shaken depends on the test being performed. The first three 60mL aliquots must be used to rinse the sample bottle before transfer to the separatory funnel.

8.12.1 8270 (ABN): 6 shakes: First three shakes are done while samples are acidic. Three more shakes are done while the samples are basic (see Section 8.7.5) Final solvent volume = 360mL.

8.12.2 625 (BNA): 6 shakes:First three shakes are done while samples are basic. Three more shakes are done while samples are acidic (see Section 8.7.6) Final solvent volume = 360mL.

8.12.3 All other tests are three shakes. Final volume = 180mL.

After each shake, allow the solvent and sample layers to separate for a minimum of 10 minutes before being drained. If the emulsion interface between layers is more than one-third the size of the solvent layer, the analyst must employ mechanical techniques to complete the phase separation. The optimum technique depends upon the sample and may include stirring, filtration of the emulsion through glass wool, centrifugation, or other physical methods.

If the emulsion cannot be broken by stirring or filtration (recovery of < 80% of the methylene chloride, corrected for the water solubility of methylene chloride), then transfer the emulsion into a clean centrifuge tube and centrifuge for 2 minutes. Using a Pasteur pipette carefully remove the bottom solvent layer and transfer it to the extract solvent flask. If emulsion still exists repeat centrifuge step. Transfer any separated solvent to the solvent flask. Note the presence of emulsions and difficulty in separations in the extraction logbook comments column. See Sec. 4.2.6 if the emulsion is very bad and cannot be broken.

8.13 The Erlenmeyer flasks should be covered with aluminum foil between shakes to prevent contamination and evaporation. After the last shake is drained, an Elastic should be placed over the foil to hold it in place.

8.14 Measure initial volume of sample by refilling the original bottle to the mark made in Section 8.2 with water then measure the volume of the sample that was in the bottle by transferring it to a 1L graduated cylinder. Document actual volumes in the extraction log. If extracts are not to be concentrated immediately, they must be placed in refrigeration until concentration can be completed.

8.15 K-D technique for Concentrating Extract

8.15.1 Assemble a Kuderna-Danish (K-D) concentrator (Section 6.11) by attaching a 10mL concentrator tube to a 500mL evaporation flask, fixed in place with a blue plastic spring clip, and a white sample # label.

8.15.2 Dry the extract by passing it through a powder funnel containing a plug of clean glass wool in the stem about ½ full of anhydrous sodium sulfate. Do not use the same funnel to dry the BN fraction extract and then the ACID fraction extract, especially if any traces of water or emulsion are present in the flask. This can cause a loss of acid fraction analytes. Always use a new funnel or filter the acid fraction first. Collect the dried extract in a K-D concentrator. Both fractions should be combined before concentration unless special requirements make it clear the extracts must be concentrated separately. Rinse the Erlenmeyer flask, which contained the solvent extract, with 20 – 30mL of Methylene Chloride and add it to the column to complete the quantitative transfer.

8.15.3 Attach a three-ball Snyder column to the K-D after having disposed of the used NA2SO4 funnels. Pre-wet the Snyder column by adding about 1mL of Methylene Chloride to the top of the column. Place the K-D apparatus on a hot water bath (15°C -20°C above the boiling point of the solvent) so that the concentrator tube is partially immersed in the hot water and the entire lower rounded surface of the flask is bathed with hot vapor. Adjust the vertical position of the apparatus and the water temperature as required to complete the concentration in 10–20 minutes. At the proper rate of distillation, the balls of the Snyder column will actively chatter, but the chambers will not flood. When the apparent volume of liquid reaches 5mL, remove the K-D apparatus from the water bath and allow it to drain and cool for at least 10 minutes. If the concentration rate slows significantly or stops during concentration, remove the K-D from the water bath and notify the supervisor immediately. Continued application of heat after most of the solvent has evaporated from a high boiling residue can cause the loss of target analytes.

8.15.3.1 For EPH samples, exchange 2 times with 25 mLs Hexane at ~10mL

8.15.4 Remove the Snyder column and rinse the flask and its lower joints into the concentrator tube with 1-2mL of Methylene Chloride (or exchange solvent for methods using exchange solvent, i.e., use last solvent to rinse). If sulfur crystals are a problem, proceed to Method 3660 for cleanup. The extract may be further concentrated by using the Nitrogen blow-down technique outlined in Sec 8.20 or adjusted to the correct nominal final volume with the solvent last used.

8.16 Turbovap II Techniques for Concentrating Extract

8.16.1 See SOP # OL-2004 **Automated Soxhlet Extraction for details of turbovap procedures. Only PCB/Pest waters are concentrated in Turbovap tubes, with two hexane exhcanges to a final volume of 4mL.**

8.17 All 1.0 mL final volumes are to be measured using a clean class A volumetric flask marked "TC" and placed in 2.0 mL screw top vial. If final volume of extract is less than desired final volume, volume may be achieved through use of clean solvent as described below.

8.18 All 2.0 mL and 4.0 mL final volumes are measured by comparison to the proper reference vial, matching up the meniscus.

NOTE: Reference vials are made each time a new lot of vials are received. Using a syringe, 2mL of Hexane are transferred into a 5 mL screw top vial and the meniscus is marked with a permanent marker. The same is done for 4.0mL, using 4.0mLs of Hexane. A record is kept of the new vial lot numbers and date of preparation.

8.19 Final volumes are as follows:

8.19.1 PAH, BNA (8270 & 625)(see 8.17):1.0mL in screw cap vial. If the volume is not less than 0.75mL, Methylene Chloride can be used to bring final volume to 1.0mL. If volume is <0.75mL, volume may be brought up to 1.0mL with clean Methylene Chloride and a note must be written in logbook about the lowest concentration volume.

8.19.2 EPH1.1(see 8.18):2.0 mL in screw cap vial. If final volume is <1.0mL Hexane may be used to bring final volume to 1.0mL. A note must be recorded in logbook if volume before Hexane addition is < 0.75mL.

8.19.3 FING/DRO (see 8.17): 1.0 mL in screw cap vial. If final volume is <1.0mL, Methylene Chloride may be used to bring final volume to 1.0mL. A note must be recorded in logbook if volume before Methylene Chloride addition is < 0.75mL.

8.19.4 Pesticide/PCB &PCB (see 8.18): 4.0mL in 40mL vial. Hexane can be added to bring final volume to 4.0mL. A note must be recorded in logbook if volume before hexane addition <3.0mL.

8.19.5 All final volumes must be recorded in respective logbooks along with initials and date. Once entire batch for day is complete, a photocopy of the page is given to analyst and samples are signed over to analyst. If analyst is not present, samples are placed in refrigerator and copy of batch placed on analyst desk.

8.20 Nitrogen blow-down technique

8.20.1 Place the concentrator tube in a warm bath (35°C) and evaporate the solvent to the final volume indicated, using a gentle stream of clean, dry nitrogen. Carefully adjust the gas flow with the knob at the top of each gas tube. A dimple should form on the solvent surface and small ripples should reach the tube walls. Do not apply so much gas flow or move the gas tube tip so close that the solvent splashes.

CAUTION: New plastic tubing must **NOT** be used between the carbon trap and the sample, since it may introduce contaminants.

8.20.2 CAUTION: When the volume of solvent is reduced significantly below 1mL, Semivolatile analytes may be lost.

8.20.3 CAUTION: If sample will not concentrate to its optimal final volume then adjust the solvent to nearest whole number with addition of clean solvent with respect to test type. Do not over concentrate a viscous sample. If the rate of solvent reduction

slows significantly or stops then immediately remove the sample tube from the water bath and proceed as above. A note must be recorded into logbook to indicate the problem encountered.

8.21 Preparation of Samples for Analysis: note: This step no longer takes place in the extraction lab. For reference only.

8.21.1 BNA Samples:

8.21.1.1 Using a clean 500µL syringe rinsed with Methylene Chloride take 300µL of the extract and place into a pre-labeled crimp top vial. Double check the label match before transfer.

8.21.1.2 Add 6µL of BNA Internal Standard Solution (I.S.) to the extract and crimp vial with cap. Make sure to check the level of BNA I.S. to be sure the solution has not evaporated. Minimize the amount of time when the I.S. vial is open to reduce evaporation.

8.21.1.3 Mark the level of the I.S. when all extracts are prepared.

8.21.1.4 Make sure all crimp vials caps will not twist and are legibly and properly labeled.

8.21.2 EPH1.1 Samples:

8.21.2.1 Add 10µL of fractionation surrogate per 2.0mL final volume of EPH sample and thoroughly mix the sample. The fractionation surrogate is much less dense than the extract and will not mix well unless shaken.

8.21.2.2 Using a clean 500µL syringe rinsed with Methylene Chloride take 300µL of the extract and place into a crimp top vial.

8.21.2.3 Add 3µL of EPH Internal Standard Solution (I.S.) to the extract and crimp vial with cap. Make sure to check the level of EPH I.S. to be sure the solution has not evaporated. Minimize the amount of time when the I.S. vial is open to reduce evaporation.

8.21.2.4 Mark the meniscus levels of the I.S. and fractionation surrogate when all extracts are prepared.

8.21.2.5 Make sure all crimp vials are properly labeled.

8.21.3 PCB Samples:

8.21.3.1 After acid washing (see SOP OL-2019) and copper cleanup (see SOP OL-2020), use Pasteur pipettes to place approximately 1mL of each extract from the top solvent layer into properly labeled crimp top vials. If the top layer appears cloudy allow it to settle longer or centrifuge the supernatant.

CAUTION: Transferring any sulfuric acid into the Auto-sampler vial will destroy the GC column and damage the detector if the sample is injected. Be very careful that ONLY the clear hexane layer is transferred to the crimp top vial.

8.21.3.2 Crimp the tops of the vials and mark the meniscus level on each vial.

8.21.4 Pesticide Samples:

8.21.4.1 After Florisil cleanup (see SOP OL-2018) and copper cleanup (see SOP OL-2020) use Pasteur pipettes to place approximately 1mL of each extract from the top of the extract into properly labeled crimp top vials.

8.21.4.2 Crimp the tops of the vials and mark the meniscus level on each vial.

8.21.5 FING/DRO Samples:

8.21.5.1 Use Pasteur pipettes to place approximately 500uL of each extract from the top of the extract into properly labeled crimp top vials.

8.21.5.2 Crimp the tops of the vials and mark the meniscus level on each vial.

9.0 CALCULATIONS

Not Applicable.

10.0 QUALITY CONTROL

10.1 Any reagent blanks, Matrix Spikes (MS), Matrix Spike Duplicate (MSD) and or Sample Duplicate (DUP) should be subject to exactly the same analytical procedure as those used on the actual samples.

10.2 The same amounts of sample must be extracted for QC samples as for routine client samples to assure the same extraction efficiency.

10.3 One method blank must be extracted with each batch of samples. The method blank is used to determine if the extraction procedure was successful and if there is any contamination associated with the extraction.

10.4 The surrogate is used to determine the efficiency of the extraction and must be added to each sample, blank, LCS, MS/MSD, and sample duplicate prior to extraction.

10.5 The MS/MSD is used to determine the effects of the matrix on the analytes of interest in the analysis. They are extracted with every twenty client samples unless otherwise specified by the client.

10.6 In some cases, the client may specify which sample is to be used for MS/MSD; if not, the laboratory shall pick a representative sample based on the following:

A. MS/MSD shall **NOT** be performed on Rinsate Blank or Field Blank. Watch for client sample IDs containing codes like FB, EB, RB, etc. that might indicate a field blank sample.

B. Adequate sample weight.

C. Client requested QC deliverables.

10.7 If there is not adequate sample to have a Matrix Spike, then a Laboratory Control Sample (LCS) and Laboratory Control Sample Duplicate (LCSD) are extracted and analyst/department manger is notified.

10.8 The LCS used to evaluate the laboratory performance in a clean matrix. The LCS confirms the extraction/analysis was properly performed when matrix effects cause the MS/MSD recoveries to be unacceptable. The acceptable LCS proves the extraction did not affect the recovery of the analytes, therefore it is extremely important to be careful when extracting, concentrating, and transferring the LCS.
Failure of the LCS may necessitate re-extraction of the entire batch

10.9 In case of concentration <1mL, analytes may be lost. Contact the supervisor or initiate re-extraction before holding time has expired. In any case, documentation of the lowest extract volume in the prep logbook is required

10.10 When a sample or a portion of a sample is lost during extraction or concentration, see the supervisor immediately for corrective action plan.

10.11 Any potential or suspected mix-ups in sample IDs, matrix spikes, or surrogate spikes must be communicated to the supervisor immediately so proper corrective action can be started as soon as possible. All possible errors and corrective action must be noted in the logbook. Carefully document any problems or unusual conditions in the comment section. This information is necessary for a non-conformance summary if QC sample or surrogate recovery problems occur. Record all observations about unusual sample color, odor, the presence of sediment or product phases or oily sheens, etc. Note any differences in the MS or MSD or DUP aliquots used for QC or obvious differences in the final extracts. This information is very important in explaining QC analytical result discrepancies.

11.0 DATA REVIEW AND STORAGE

11.1 All related preparation information and observations will be noted in the appropriate extraction worksheets

11.2 All cross-outs must be a single line and should be initialed and dated.

12.0 REFERENCES

12.1 USEPA SW846-Update III, Method 3510C, Rev 3, 12/96.

12.2 USEPA SW846-Update III, Method 3500B, Rev 2, 12/96.

12.3 USEPA SW846-Update III, Chapter 1, 7/94.

12.4 EPA Method 625, 40 CFR Part 136, Appendix A. 1996

12.5 EPA Method 608, 40 CFR Part 136, Appendix A Section 9.2 of Method 608.

Attachment 1

AMRO Environmental
Laboratories Corporation

SEMIVOLATILE ORGANIC EXTRACTION WORKSHEET

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

Concentration Method: Turbovap, K-D (Circle One)

Rev. No.: OL-2003: 5 Matrix: Water Na/Rev. No.: OL-2004: 5 Matrix: Soil/Sludge Other Matrix:

TION DATE:
TIME:
BY: Released by:
BY:
TION SOLVENT LOT #:
ED BY:

SURR. AMT.:
MS AMT.:
SURROGATE/
SPIKE WITNESS:
INTERNAL STANDARD ID:
LIMS BATCH ID:

*SW-846 Method 3520C: Initial extraction pH <2 and Secondary extraction pH >11. EPA 625: Initial extraction pH <11 and Secondary extraction pH <2

Sample Number	Sample Amount Used (mL or g)	Sample pH	Initial Extraction pH	Secondary Extraction pH*	Conc. Date & Analyst	Final Volume (mL)	Int. Std. Added By/Date	Comments (Ext Appearance and Color)

Surrogate Spike		Matrix Spike		Water Bath Temperature:
Solution ID	Spiking compounds and Concentration (µg/mL)	Solution ID	Spiking compounds and Concentration (µg/mL)	Sulfuric Acid Lot Number:
				Sodium Hydroxide Lot Number:

Attachment 2

) Environmental
ratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

PESTICIDES/PCBs EXTRACTION WORKSHEET

Concentration Method: Turbovap; K-D (Circle One)

o./Rev. No.: OL -2003;5 Matrix : Water

SOP No./Rev. No.: OL -2004;5 Matrix : Soil/Sludge

Other Matrix:

ACTION DATE : ______

YST(S) ______

ODY Released by ______

ed By ______

ACTION SOLVENT(S) / LOT #s ______

ANGE SOLVENT / LOT # ______

SURR. AMT. ______

MS AMT. ______

SURROGATE/ ______

SPIKE WITNESS ______

LIMS BATCH ID ______

REVIEWED BY: ______

ab Sample Number	Sample Amount Used (mL or g)	Sample pH *	Adjusted pH *	Solvent Added (mL)	Conc. Date & Analyst	Final Volume (mL)	Cu Clean up Date/ Init	H2SO4Clean up Date/Init	Comments (Ext Appearance and Color)

Surrogate Spike		Matrix Spike		
Solution ID	Spiking compounds and Concentration (µg/mL)	Solution ID	Spiking compounds and Concentration (µg/mL)	Water Bath Temperature
				Ultrasonic Tuning Date/By

* Adjust pH if not between 5 and 9.

qc/general/forms/pestextlog Rev. 12/12/08

Attachment 3

AMRO Environmental Laboratories Corporation

EXTRACTABLE PETROLEUM HYDROCARBONS (EPH) EXTRACTION WORKSHEET

111 Merrick Street
Manchester, NH 03054
(603) 424-4022

Concentration Method: Turbovap; K-D

SOP No./Rev. No.: OL-1001 Matrix: Water SOP No./Rev. No.: OL-1004 Matrix: Soil/Sludge Other Matrix:

EXTRACTION DATE: _____ SURR. AMT: _____
ANALYST(s): _____ MS AMT: _____
CUSTODY/Released by: _____ SURROGATE/ _____
Received By: _____ SPIKE WITNESS: _____
EXTRACTION SOLVENT / LOT #: _____ INTERNAL STANDARD ID: _____
LIMS BATCH ID: _____ FRACTIONATION STANDARD ID: _____

Lab Sample Number	Sample Volume Used (mL or g)	Sample pH	Extraction pH #2	Conc. Date & Analyst	Final Volume (mL)	Fractionation Added By/Date	Int. Std. Added By/Date	Comments (Est. Appearance and color)
MB								

Surrogate Spike		Matrix Spike		Water Bath Temperature	
Solution ID	Spiking Components and Conc. (µg/mL)	Solution ID	Spiking Components and Conc. (µg/mL)		ENTERED BY: _____

Attachment 4

AMRO Environmental
Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

QUALIFICATION CARD FOR SEPARATORY FUNNEL LIQUID-LIQUID EXTRACTION

Trainee: _____ Signature: _____

Trainer: _____ Signature: _____

I. Knowledge Factors:

SOP Title: _____ Revision Number/Date: _____

1. Did the Trainee read and understand the above SOP? Yes ☐ No ☐ NA ☐
2. Was the Trainee instructed on how to properly fill out the documentation? Yes ☐ No ☐ NA ☐
3. Has the Trainee been instructed on the proper procedures for addressing potential problems? Yes ☐ No ☐ NA ☐

II. Practical Factors:

1. Has the Trainee completed a Precision and Accuracy Study? Yes ☐ No ☐ NA ☐
2. Has the Trainee completed an acceptable Performance Evaluation sample? Yes ☐ No ☐ NA ☐
3. Did the Trainee completed an acceptable Laboratory Control Sample (LCS)? Yes ☐ No ☐ NA ☐
4. Has the Trainee performed manual integration as indicated in the SOP? Yes ☐ No ☐ NA ☐

Completion Date: _____ Trainer's Signature: _____

I _____ have read, understood and follow the above method/SOP, which is in use at AMRO Laboratories for the analysis of samples under the National Environmental Laboratory Accreditation Program, have met the Demonstration of Capability.

Section Manager/ Supervisor: _____ Date: _____

QA Manager: _____ Date: _____

qc/qcmemos/forms/qualcardsepfunliqliqex Rev. 0 10/00

Attachment 5

EXTRACTION ORGANIZATION SUMMARY

Analysis	QC	Matrix	Drying Agent	Type of Surr.	Surr. Amt.	Type of Spike	Spike Amt	Acid / Base First	Extraction Solvent	Solvent Amt (ml)	Final Vol
8270 PAH SIM	MB, LCS	A	N / A	BNA Tinted Surrogate	50µL	BNA Full List Spike	50µL	N / A	CH2CL2	3 x 60mL	1mL
	MS, MSD	S	Sodium Sulfate					N / A	CH2CL2/Acetone	70 / 70	
8270 PAH ONLY	MB, LCS	A	N / A	BNA Tinted Surrogate	500µL	BNA Full List Spike	500µL	N / A	CH2CL2	3x60mL	1mL
	MS, MSD	S	Sodium Sulfate					N / A	CH2CL2/Acetone	70 / 70	
8270	MB, LCS	A	N / A	BNA Tinted Surrogate	500µL	BNA Full List Spike	500µL	1 H2SO4 2 NaOH	CH2CL2	6x60mL	1mL
	MS, MSD	S	Sodium Sulfate					N / A	CH2CL2/Acetone	70 / 70	
625	MB, LCS	A	N / A	BNA Tinted Surrogate	500µL	BNA Full List Spike	500µL	1 NaOH 2 H2SO4	CH2CL2	6x60mL	1mL
	MS, MSD	S	Sodium Sulfate					N / A	CH2CL2/Acetone	N/A	
BNA TCLP	MB LCS, MS,MSD	S	N / A	BNA TintedSurrogate	500µL	BNA TCLP Spike	500µL	1 H2SO4 2 NaOH	CH2CL2	6X60mL	1mL
EPH Rev. 1.1	MB,LCS LCSD, LCSD	A	N/A	EPH Surrogate	1000µL	EPH Matrix Spike = LCS+LCSD	1000µL	HCL to controls	CH2CL2	3x60mL	2mL
		S	Sodium Sulfate					N/A	CH2CL2	140mL	2mL
PCB ONLY	MB, LCS	A	N / A	PEST/PCB Surrogate	200µL	PCB Matrix Spike= LCS + MS + MSD	400µL	N / A	CH2CL2	3x60mL	4mL
	MS, MSD	S	Sodium Sulfate		500µL		1000µL	N / A	Hexane/Acetone	70 / 70	10mL
Pest ONLY	MB, LCS	A	N / A	PEST/PCB Surrogate	200µL	Full List Spike LCS + MS + MSD	200µL	N / A	CH2CL2	3x60mL	4mL
	MS, MSD	S	Sodium Sulfate		500µL		500µL	N / A	Hexane/Acetone	70 / 70	10mL
PEST/ PCB	P/P MB PCB LCS, Pest LCS, PCB MS&MSD, Pest MS&MSD	A	N / A	PEST / PCB Surrogate	200µL	Pest Full List Spike= Pest LCS,MS,MSD PCB spike=PCB LCS, MS,MSD	200µL Pest 400µL PCB	N / A	CH2CL2	3x60mL	4mL
		S	Sodium Sulfate		500µL		500µL Pest 1000µL PCB	N / A	Hexane/Acetone	70 / 70	10mL
PEST TCLP	MB, LCS, MS, MSD	S	N / A	Pest/PCB Surrogate	200µL	PEST TCLP Matrix Spike	200µL	N / A	CH2CL2	3x60mL	4mL
PCB OIL	MB,MS & MSD	OIL	N / A	P/P Surr.	500µL	PCB Spike	1000µL	N / A	Hexane	9.5/8.5mL	10mL
PCB Wipes	MB,LCS, MS,MSD	Wipe	N / A	P/P Surr.	1000µL	PCB Spike	2000µL	N / A	Hexane	19/17mL	20mL
Fing	MB,LCS, MS,MSD	A	N / A	O-terphenyl Surrogate 1000ng/µl	100µL	#2 Fuel Oil Matrix Spike 10000 ng/µL	200µL	N / A	CH2CL2	3x60mL	1mL
		S	Sodium Sulfate		100µL		400µL	N / A	CH2CL2	20mL	20mL
DRO	MB,LCS, MS MSD	A	N / A	O-terphenyl Surrogate 1000ng/µl	100µL	#2 Fuel Oil Matrix Spike 10000 ng/µL	200µL	N / A	CH2CL2	3x60mL	1mL
		S	Sodium Sulfate		100µL		400µL	N / A	CH2CL2	140mL	10mL
MEDRO	MB,LCS,LCSD, LCS II	A	N / A	O-terphenyl Surrogate 20ng/µL	1000µL	LCS=DRO MS 50 LCS II=#2 Fuel Oil MS	1000µL/ 100µL	N / A	CH2CL2	3x60mL	1mL
		S	Sodium Sulfate		1000µL			N / A	CH2CL2	140mL	1mL
ETPH	MB,LCS, MS,MSD	A	N / A	O-terphenyl Surrogate 500ng/µL	100µL	#2 Fuel Oil Matrix Spike 10000 ng/µL	200µL	N / A	CH2CL2	3x60mL	1mL
		S	Sodium Sulfate		100µL		200µL	N / A	CH2CL2	140mL	5mL

qc/qcmemos/forms/extractionlist2009 Rev7 09/11/2009

Attachment 6

PREPARATION OF SURROGATES, MATRIX SPIKES AND INTERNAL STANDARDS

Surrogate/Spike name	Compound name	Compound Amount (µL)	Solvent type	Final Volume
BNA SURROGATE Attachment 9	BN SURROGATE MIX	1000µL	METHANOL	50mL
	ACID SURROGATE MX	750µL		
BN MATRIX SPIKE Attachment 10	BN MATRIX SPIKE MIX	500µL	METHANOL	25mL
ACID SPIKE Attachment 11	ACID MATRIX SPIKE MIX	500µL	METHANOL	25mL
BNA FULL LIST SPIKE Attachment 12	CLP SEMIVOLATILE CALIBRATION MIX	1000µL	METHANOL	10mL
	BENZYL ALCOHOL	500µL		
	TCL BENZIDINES MIX	500µL		
	BENZOIC ACID	500µL		
	PYRIDINE	500µL		
	n-NITROSODIPHENYLAMINE	200µL		
	SS TCL PHENOLS MIX	250µL		
TCLP BNA SPIKE Attachment 13	TCLP BN SPIKE MIX	250µL	METHANOL	5mL
	TCLP ACID SPIKE MIX	250µL		
EPH SURROGATE Attachment 14	EPH SURROGATE MIX	1000µL	ACETONE	100mL
EPH SPIKE Attachment 14	EPH MATRIX SPIKE MIX	625µL	ACETONE	25mL
PEST/PCB SURROGATE Attachment 15	PEST/PCB SURROGATE MIX	400µL	ACETONE	250mL
PEST SPIKE	PEST MATRIX SPIKE	500µL	ACETONE	25mL
PCB SPIKE	AROCLOR 1016	1000µL	ACETONE	100mL
	AROCLOR 1260	1000ul		
TCLP PEST SPIKE Attachment 16	TCLP PEST SPIKE MIX	10µL	ACETONE	50mL
BNA IS Attachment 17	SEMIVOLATILE INTERNAL STANDARD	ALL	NOT APLLICABLE	ALL
EPH IS	5-ALPHA ANDROSTANE	ALL	NOT APPLICABLE	ALL
EPH FRACTIONATION SURROGATE Attachment 18	CUSTOM FRACTIONATION SURROGATE	ALL	NOT APPLICABLE	ALL
SIM IS	BNA IS	100µL	METHYLENE CHLORIDE	1000µL

***Amount is subject to change- check with analyst before making it up.**

EPH Spike needs to be warmed up before use due to crystallization at room temperature.

Attachment 7

SURROGATE AND SPIKE CHECKS

SOLUTION	DILUTION	SOLVENT
QQ PAH SURROGATE	5X	CH2CL2
QQ PAH MARTIX SPIKE	5X	CH2CL2
QQ PCB SURROGATE	10X	HEXANE
QQ PCB MATRIX SPIKE	5X	HEXANE
EPH SURROGATE	5X	CH2CL2
EPH MATRIX SPIKE	5X	CH2CL2
BNA SURROGATE	2X	CH2CL2
BN MATRIX SPIKE	2X	CH2CL2
ACID MARTIX SPIKE	2X	CH2CL2
BNA FULL LIST SPIKE	2X	CH2CL2
BNA TCLP SPIKE	2X	CH2CL2
PEST/PCB SURROGATE	20X	HEXANE
PCB MATRIX SPIKE	10X	HEXANE
PEST MATRIX SPIKE	20X	HEXANE
PEST TCLP SPIKE	10X	HEXANE

Attachment 8

DILUTION CHART

EPH-A / S Dilutions	AMOUNT SAMPLE	AMOUNT CH2CL2	AMOUNT 5 ALPHA IS	FINAL VOLUME
1X	300µL	N / A	3µL	300µL
2X	200µL	200µL	4µL	400µL
5X	100µL	400µL	5µL	500µL
10X	100µL	900µL	10µL	1000µL
20X	50µL	950µL	10µL	1000µL
50X	20µL	980µL	10µL	1000µL
100X	10µL	990µL	10µL	1000µL
200X	5µL	995µL	10µL	1000µL

EPH-A SIM Dilution	AMOUNT SAMPLE	AMOUNT CH2CL2	AMOUNT SIM IS	FINAL VOLUME
1X	300µL	N / A	3µL	300µL

BNA-A/S Dilutions	AMOUNT SAMPLE	AMOUNT CH2CL2	AMOUNT BNA IS	FINAL VOLUME
1X	300µL	N / A	6µL	300µL
2X	200µL	200µL	8µL	400µL
5X	100µL	400µL	10µL	500µL
10X	100µL	900µL	20µL	1000µL
20X	50µL	950µL	20µL	1000µL
50X	20µL	980µL	20µL	1000µL
100X	10µL	990µL	20µL	1000µL
200X	5µL	995µL	20µL	1000µL

eous S = Soil BNA IS = Semivolatile Internal Standard

Attachment 9

AMRO Environmental Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

FINGERPRINT EXTRACTION WORKSHEET

SOP No./Rev. No.: OL-2003/Rev.5 Matrix: Water
SOP No./Rev. No.: OL-2004/Rev.5 Matrix: Soil

Performed By: _____ Date: _____
Extraction Solvent/ Lot No.: _____ Surr. Amt.: _____
Surrogate /Spike Added Witness: _____ Spike Amt.: _____
Custody Released By: _____ LIMS Batch ID: _____
_____ Received By: _____

Lab. Sample Number	Sample Volume (ml)/ Sample Weight (g)	Solvent Vol. (ml)	Final Volume (ml)	Comments
MB-				
LCS-				

Surrogate Spike		Matrix Spike	
Solution ID	Spiking Compounds and Concentration	Solution ID	Spiking Compounds and Concentration

qc/qcmemos/forms/fingerprintex Rev. 1 07/06/01

AMRO Environmental Laboratories Corporation

111 Herrick Street, Merrimack, NH 03054
TEL: (603) 424-2022 • FAX: (603) 429-8496
www.amrolabs.com

VOLATILE ORGANICS ANALYSIS

SW-846 METHOD 8260B

Procedure Number: OL-2001

Revision No.: 12

Revision Date: 12/03/2012

Review Date: N/A

Prepared By: Suzanne Karan Date: 2/27/13

Approved By: Suzanne Karan Date: 2/27/13
Organic Manager

Approved By: Nancy Schmidt Date: 2/27/13
Laboratory Director

Approved By: Nancy Schmidt Date: 2/27/13
Quality Assurance Manager

Property of AMRO Environmental Laboratories Corporation

TABLE OF CONTENTS

		Page
1.0	SCOPE AND APPLICATION	4
2.0	METHOD SUMMARY	7
3.0	DEFINITIONS	7
4.0	SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE	8
5.0	POTENTIAL PROBLEMS AND INTERFERENCES	11
6.0	HEALTH AND SAFETY	13
7.0	INSTRUMENTS AND EQUIPMENT	14
8.0	REAGENTS AND STANDARDS	14
9.0	GC/MS PROCEDURE	23
	9.1 Instrument Conditions and Setting	23
	9.2 Instrument Demonstration of Capabilities	24
	9.3 Tuning	26
	9.4 Initial Calibration Procedure	27
	9.5 GC/MS Daily Calibration Procedure	30
10.0	SAMPLE PROCEDURE	32
	10.1 Preparation of Samples	32
	10.2 Analysis of samples	34
	10.3 Evaluation of Results	35
	10.4 Quantitation of Compounds	37
11.0	INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR	41
12.0	CALCULATIONS	42
13.0	QUALITY CONTROL	43
14.0	DATA REVIEW AND STORAGE	47

TABLE OF CONTENTS (cont.)

15.0 REFERENCES 50

Attachment 1 Volatile Internal Standards With Corresponding Target 51

Attachment 2 8260 NSI MegaMix 54

1.0 SCOPE and APPLICATION

This procedure details the steps taken by AMRO Environmental Laboratories Corporation to produce accurate and reliable results for volatile organic analyses using Method 8260B, Rev. 2 12/96 from the SW-846 Manual.

Method 8260B is used to determine volatile organic compounds in ground and surface water, aqueous sludges, waste solvents, oily wastes, mousses, tars, fibrous wastes, polymeric emulsions, filter cakes, spent carbons, spent catalysts, soils, and sediments.

The following lists of compounds are analyzed by purge and trap GC/MS using a 5mL aliquot of sample:

TABLE 1

CAS. NO.	COMPOUND	WATER REPORTING LIMITS (µg/L)	MEDIUM LEVEL (MEOH) SOILS REPORTING LIMITS (µg/Kg)	LOW LEVEL SOILS REPORTING LIMITS (µg/Kg)
75-71-8	Dichlorodifluoromethane	5	100	5
74-87-3	Chloromethane	3	100	5
75-01-4	Vinyl chloride	2	50	5
75-00-3	Chloroethane	5	100	5
74-83-9	Bromomethane	2	100	5
75-69-4	Trichlorofluoromethane	2	100	5
79209	Methyl acetate	5	125	25
60297	Diethyl ether	5	250	25
74-88-4	Idomethane	2	50	5
67-64-1	Acetone	10	250	20
75-35-4	1,1-Dichloroethene	1	50	5
75-15-0	Carbon disulfide	2	100	5
75-09-2	Methylene chloride	5	50	25
107-02-8	Acrolein	75	N/A	N/A
107-13-1	Acrylonitrile	10	N/A	N/A
1634-04-4	Methyl tert-butyl ether	2 (1)	25	5
156-60-5	trans-1,2-Dichloroethene	2	50	5
75650	tertiary Butanol	20	2500	100
75-34-4	1,1-Dichloroethane	2	50	5
108-20-3	Diisopropyl ether	2	50	5
109-05-4	Vinyl acetate	10	N/A	N/A
637-92-3	Ethyl tertiary butyl ether	2	50	5

CAS. NO.	COMPOUND	WATER REPORTING LIMITS (µg/L)	MEDIUM LEVEL (MeOH) SOILS REPORTING LIMITS (µg/Kg)	LOW LEVEL SOILS REPORTING LIMITS (µg/Kg)
78-93-3	2-Butanone	10	250	20
594-20-7	2,2-Dichloropropane	2	50	5
156-59-2	cis-1,2-Dichloroethene	2	50	5
67-66-3	Chloroform	2	50	5
74-97-5	Bromochloromethane	2	50	5
110-82-7	Cyclohexane	5	100	5
71-55-6	1,1,1-Trichloroethane	2	50	5
56-23-5	Carbon tetrachloride	2	50	5
107-06-2	1,2-Dichloroethane	2	50	5
71-43-2	Benzene	1	25	5
994-05-8	Tertiary amyl methyl ether	2	50	5
109999	Tetrahydrofuran	10	250	20
79-01-6	Trichlororethene	2	50	5
108872	Methyl Cyclohexane	2	50	5
78-87-5	1,2-Dichloropropane	2	50	5
75-27-4	Bromodichloromethane	2	50	5
123-91-1	1,4-Dioxane	50	2500	50
74-95-3	Dibromomethane	2	50	5
108-10-1	4-Methyl-2-pentanone	10	250	20
10061-01-5	cis-1,3-Dichloropropene	1	50	5
108-88-3	Toluene	2 (1)	25	5
10061-02-6	trans-1,3-Dichloropropene	2	50	5
79-00-5	1,1,2-Trichloroethane	2	50	5
106-93-4	1,2-Dibromoethane	2	50	5
110-75-8	2-Chloroethyl-vinyl-ether	10	N/A	N/A
591-78-6	2-Hexanone	10	250	20
142-28-9	1,3-Dichloropropane	2	50	5
127-18-4	Tetrachloroethene	2	50	5
124-48-1	Dibromochloromethane	2	50	5
108-90-7	Chlorobenzene	2	25	5
630-20-6	1,1,1,2-Tetrachloroethane	2	50	5
100-41-4	Ethylbenzene	2 (1)	25	5
108-38-3	m-Xylene	2 (1)	25	5
106-42-3	p-Xylene	2 (1)	25	5
95-47-6	o-Xylene	2 (1)	25	5
100-42-5	Styrene	2	50	5
75-25-2	Bromoform	2	50	5

CAS. NO.	COMPOUND	WATER REPORTING LIMITS (µg/L)	MEDIUM LEVEL (MEOH) SOILS REPORTING LIMITS (µg/Kg)	LOW LEVEL SOILS REPORTING LIMITS (µg/Kg)
98-82-8	Isopropylbenzene	2 (1)	25	5
79-34-5	1,1,2,2-Tetrachloroethane	2	50	5
96-18-4	1,2,3-Trichloropropane	2	50	5
108-86-1	Bromobenzene	2	50	5
103-65-1	n-Propylbenzene	2	25	5
95-49-8	2-Chlorotoluene	2	50	5
106-43-4	4-Chlorotoluene	2	50	5
108-67-8	1,3,5-Trimethylbenzene	2 (1)	25	5
98-06-6	tert-Butylbenzene	2 (1)	25	5
95-63-6	1,2,4-Trimethylbenzene	2 (1)	25	5
135-98-8	sec-Butylbenzene	2 (1)	25	5
99-87-6	4-Isopropyltoluene	2 (1)	25	5
541-73-1	1,3-Dichlorobenzene	2	25	5
106-46-7	1,4-Dichlorobenzene	2	25	5
104-51-8	n-Butylbenzene	2 (1)	25	5
95-50-1	1,2-Dichlorobenzene	2	25	5
96-12-8	1,2-Dibromo-3-chloropropane	5	125	5
120-82-1	1,2,4-Trichlorobenzene	2	25	5
87-68-3	Hexachlorobutadiene	2	50	5
91-20-3	Naphthalene	5 (2)	50	5
87-61-6	1,2,3-Trichlorobenzene	2	50	5
110-57-6	Trans-1,4-dichloro-2-butene	5	50	5

* (Reporting Limit for 8260Aromatics)

2.0 METHOD SUMMARY

2.1 Samples are introduced to the GC/MS System by directly placing the VOA vials into the autosampler tray. Standards are prepared in volumetrics and transferred to 40mL VOA vials. The autosampler syringe delivers 5mL to the purging chamber along with the internal standards and surrogates (the autosampler is equipped with a syringe or vial, which the operator fills with the internal standard and surrogate mix for waters and internal standard mix for soils). Also, a 40mL VOA vial containing Bromofluorobenzne (BFB) at a concentration of 50ng/5mL is placed on the tray for tuning (no SS is added).

2.2 Helium purges through the chamber and the volatile analytes are absorbed on the trap, a tube containing an OV-1/Tenax/Silica Gel/Charcoal mixture. After purging is complete, the trap is heated and backflushed with helium to desorb the compounds. The analytes are carried along a heated transfer line to the GC inlet, where the glass liner meets the narrow bore capillary column. At this point the analytes are heated, mixed and split. The column is temperature programmed to separate the analytes and is interfaced by a Mass Spectrometer for detection.

2.3 Identification of target analytes is accomplished by comparing their mass spectra with that of standards. Quantitation is done by comparing the response of a major ion relative to that of an internal standard using from 8 to 10 point calibration curve.

2.4 The GC/MS operators should be thoroughly trained and skilled in the use of purge and trap GC/MS before being authorized to analyze and report sample results independently. All analysts shall complete Qualification Card for SW-846 Method 8260B.

2.5 Method Modification – The compounds listed above include the 8260 compounds. AMRO has demonstrated that the additional analytes are achievable through initial demonstration of capability.

3.0 DEFINITIONS

3.1 **Method Blank:** An aliquot of reagent water, which is carried through the entire analytical procedure with the samples, its purpose is to determine whether contamination is present during the analysis. A method blank is analyzed 1 for every analytical batch of samples.

3.2 **Laboratory Control Sample:** An aliquot of reagent water which known quantities of the method analyte are added in the laboratory. The LCS is analyzed exactly like a sample, and its purpose is to determine the degree to

which the analytical result approaches the "true value" of the concentration of the analyte being determined. The percentage recovery is calculated in order to assess the efficiency of the analysis.
One (1) LCS is analyzed for every analytical batch of samples. An LCSD is analyzed for MCP projects.

3.3 **Sample Duplicate:** A duplicate is analyzed for every 20 samples in the form of a Matrix Spike/Matrix Spike Duplicate to verify the method precision.

3.4 **Matrix Spike:** A specific aliquot of sample into which a known amount of analyte is added. The analytical spike is analyzed with the sample batch and the percent recovery is calculated in order to assess the matrix effect on the analytical system.

4.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

4.1 All samples must be iced or refrigerated at 4°C ± 2°C from the time of collection until analysis.

4.2 **Aqueous** sample collection is done by our clients using 40mL pre-washed and pre- preserved glass vials. The sampler is instructed to fill the vial so it is completely full to the point of a positive meniscus but not overflowing without any air bubbles. A Teflon-sealed cap is then screwed tight onto the vial. The vial is inverted to insure that there are no air bubbles. A duplicate sampling is always done so that another vial of the same sample is available for analysis in case one of the following occurs:

A. The sample dilution has to be made.
B. There's an air bubble in the vial
C. The vial is broken in transport.

4.3 All aqueous samples **must** be analyzed within 14 days of collection and **should** be field preserved with 1:1 HCl to a pH<2.

4.4 All aqueous samples are pH checked **after** analysis. Paper pH strips are used to determine the pH of the sample by dipping the paper strip into the sample VOA vial and comparing it to the color chart on the front of the pH strip container. The pH results are documented in the injection run logs for each sample. All samples analyzed that have a pH of > 2 must be analyzed within **7 days of collection**. If this unpreserved holding time is exceeded, the data is to be flagged and this information is included on the final report. Samples analyzed using SW-846 Method 8260B may be unpreserved if reactive compounds are suspected to be present. If all the sample vials have a pH<2, the holding time is **14 days**.

4.5 If samples are suspected to contain Residual Chlorine, the samplers are sent 125ml bottles with 10 drops of a 10% Sodium Thiosulfate solution. The samples are collected in the 125ml bottles and then poured into VOA vials preserved with HCL.

All wastewater and drinking water samples are checked after analysis for residual chlorine with chlorine test strips. The results are recorded on the injection log with a - , for none detected, and a + for a positive reading. Any positive would cause the data to be flagged.

4.6 Sample Compositing Procedure: The following method is used upon client request to prepare a composite of wastewater volatile samples for analysis:

4.6.1 Check the chain-of-custody to determine if the flow rates are equal or unequal.
4.6.2 The sample vials are stored in the refrigerator banded together.
4.6.3 If flows are ***equal***, pour the entire contents of all the VOA vials that need to be composited into an appropriate size Erlenmeyer flask (250 or 500 mL).
4.6.4 Swirl the flask **gently** so as not to release the volatile compounds of the samples.

4.6.5 **Gently** pour the sample back into vials and tightly screw on Teflon-lined septa caps.
4.6.6 Label the vials with the appropriate project number and sample ID (comp).
4.6.7 Always prepare at least two vials of a composite.
4.6.8 If flow rates are ***unequal***, the client provides the amounts of sample needed of each sample vial to prepare the composite.
4.6.9 Using a graduated cylinder or gas-tight syringes, measure out the exact amount needed from each sample portion and gently pour into an Erlenmeyer flask.

4.7 Continue by following procedure steps 4.6.4 through 4.6.7.

4.8 Compositing of aqueous samples other than wastewater must be analyzed separately and the results averaged.
4.9 Store samples at 4°C until needed for analysis.

4.10 8260/5035 and VPH Methanol Soil Sample Preparation:

10mL of purge and trap grade methanol is measured out into VOA vials, weighed, recorded and sent out for sample collection. The VOA vials are returned with about 10g of soil in each sample vial. The VOA vials are

reweighed to determine sample weight and spiked with 20ul of the VOA surrogate spike mix at 1,250 ng/ul. One methanol vial is sent out as a trip blank with each project.

4.11 Methanol Soil Collection for the State of New Jersey:

4.11.1 25 mL of purge and trap methanol are measured into VOA vials, spiked with 25µL of VOA surrogate spike mix at a concentration of 2,500ng/µL, and sent out for sample collection. One is sent as methanol trip blank. The VOA vials are returned with approximately 10g of soil in each sample vial.

4.12 EnCore Sampler Procedure:

EnCore samplers containing soil samples have a 48 hour holding time. When EnCore samplers are received from the field, two sodium bisulfate vials, or two Voa water vials if they will be frozen, and one methanol vial are prepared. Using the EnCore Extrusion tool, remove the soil from each EnCore sampler and place into a vial prepared with sodium bisulfate. Repeat the procedure for another prepared sodium bisulfate vial. Remove a soil aliquot from another EnCore sampler and place into a prepared methanol vial. These vials are used for extraction and analysis. The 14-day hold time for soil samples begins at the time of collection, not the time of preservation.

4.13 Methanol Vials: 10mL of purge and trap grade methanol is measured out into VOA vials, spiked with 20µL of a VOA surrogate mix at 1,250 ng/µL, weighed and recorded in the EnCore soil prep log.

4.14 Sodium Bisulfate Vials: 5mL of VOA reagent water and 1.0g of sodium bisulfate is added to a VOA vial, weighed and recorded into the Sodium Bisulfate preparation logbook. One NaHSO4 vial is sent out as a trip blank with each project.

4.15 Soil samples may be collected in a VOA vial and either frozen on site (14 days holding time) or sent to the lab where they must be either frozen or preserved in methanol within 48 hours. The holding time is 14 days from sample collection.

4.16 Soil samples for low soil analysis may also be collected in VOA vials and frozen on site, with or without voa reagent water or 20% NaHSO4 solution. Samples frozen without the 20% NaHSO4 solution must be analyzed within 48 hours of thawing unless preserved with 20% NaHSO4 solution.The holding time is 14 days from sample collection.

4.17 Soil samples received for low soil analysis which are not preserved by 20% NaHSO4 solution or frozen on site must be analysed within 48 hours or preserved by freezing.

5.0 POTENTIAL PROBLEMS AND INTERFERENCES

It is important to be able to demonstrate that analytical results are not biased by laboratory contamination. The GC/MS operator is responsible for taking the following precautions.

5.1 GLASSWARE and SYRINGES:

1.1.1 All glassware and syringes used in the preparation of volatile organic standards or samples are thoroughly cleaned before each use.

1.1.2 Syringes for transferring methanol based standards are rinsed with methanol a minimum of three times before each use. Syringes for samples and aqueous standards are rinsed with methanol and then three times with distilled volatile-free water before each use.

1.1.3 Volumetric flasks and other glassware used in the preparation of samples or standards are rinsed with methanol and then three times with distilled water for aqueous based samples and standards or three times with methanol for methanol standards.

5.2 PURGE and TRAP UNITS Tekmar LSC 2000,Tekmar LSC 3000

The Purge and trap unit can be a source of contamination in volatile organic samples.

To minimize the possibility of this occurring, the following steps are taken.

5.2.1 The Tekmar LSC 2000, 3000 and autosampler automatically drains the sample out after purging and bakes out the trap at 225°C for 8 minutes while purging helium through the purging chamber. The autosampler rinses its syringe with distilled water and also flushes the purge lines and purge chamber twice during the bake cycle.

5.2.2 The sample analyses are examined before running the instrument the next day. If a sample contains high amounts of analytes, the next sample is examined to see if it contains any of the analytes. If there is any possibility of analytes carrying

over from the previous sample, the sample(s) following are re-analyzed.

5.2.3 Method blanks are analyzed daily and must meet acceptance criteria, analytes other than common laboratory contaminants should be less than ½ the RL, before samples are analyzed..

5.2.4 Occasionally, the purging chamber is cleaned with soap and water, or solvents and then rinsed.

5.3 CONTAMINATION FROM OTHER SOURCES:

5.3.1 Special precautions are taken for Methylene Chloride and Acetone contamination. The analytical and sample storage area is isolated from the extraction lab. All carrier gas lines and purge gas plumbing are made of copper or stainless steel tubing. The volatile lab is isolated in a separate room. Occasionally Methylene Chloride will show up in water blanks or methanol blanks, rarely above 5ppb. All data must be flagged if the level of Methylene Chloride exceeds the reporting level.

5.3.2 Trip blanks are analyzed with samples to check for contamination. Trip blanks are provided by AMRO and if returned by the client they are always analyzed to check for contamination by diffusion of volatile organics through the septum seal of the sample container into the sample during shipment and storage.

5.3.3 Volatile organic sampling vials may be contaminated. Vials supplied by AMRO have been purchased pre-cleaned from a reputable supplier that uses the EPA protocol to clean their vials. AMRO policy does not allow re-use of volatile organic sampling vials.

5.4 MATRIX INTERFERENCE

5.4.1 Sometimes, when a sample is analyzed, it foams, or contains compounds that interfere with the internal standards or surrogates. Such a sample is not re-analyzed due to potential harm to the instruments. It is considered to be due to matrix interference and the data is flagged and listed in the case narrative. A copy of the chromatogram may be sent to the client.

6.0 HEALTH AND SAFETY

6.1 AMRO has a laboratory safety program in place that applies to all employees. There is a safety officer as well as employees with 40 hours of OSHA training. The air quality of the laboratory has been monitored and employees are sent for physicals. All employees receive fire and safety training upon employment.

6.2 Fire extinguishers are located in various areas of the lab. A lab evacuation plan is posted in every room, with a designated meeting place.

6.3 All new analysts receive training on the safe handling of samples, standards, the changing of gas cylinders, and the operation of instruments. In the lab, clean laboratory coats and gloves are worn when working with samples. Neat standards are made up in hoods. When gas tanks are replaced, the carrier with chain is used properly, and all gas tanks are chained in place. Soap is used to check for any leaks.

6.4 Care is taken with glassware and syringes to prevent injury. Broken glass and syringes are promptly removed to broken glass containers. First aid kits are available throughout the lab. There are also eyewash stations and an emergency shower.

6.5 MSDS's are reviewed for each chemical used to ensure proper precautions are observed when handling chemicals.

6.6 Pollution prevention – The use of chemical exhaust hood are required when working with chemicals. They are specifically designed to minimize analyst exposure. The hood exhaust is monitored periodically to ensure environmental exposure is minimized.

6.7 Waste control – AMRO takes whatever steps possible to minimize waste. This includes volume reduction where appropriate. AMRO also properly segregates wastes according to contaminants and a commercial vendor is utilized for waste disposal.

7.0 INSTRUMENTS AND EQUIPMENT

7.1 SW-846 Method 8260B is performed on Hewlett Packard 5890 and 6890 Gas Chromatographs with 5971 and 5972 Mass Selective Detectors. They are equipped with purge and trap units, auto samplers, and data systems with the following software: Hewlett Packard DOS Chemstation for data acquisition, and Enviroquant for data processing, including the NBS 54K Library or NIST 74K Library of Mass Spectra. Columns used for each instrument are listed in section 9.1.

7.2 Edwards Vacuum Pump

7.3 Balance: Analytical 0.0001g

7.4 Gas Tight Syringes: 10, 25, 50, 100, 250, 500, 1,000uL, 5, 10, or 25 mL with manufacturer tolerances of ±1%.

7.5 Class A volumetric flasks: 1, 2, 5, 10, 25, 50, 100, 250, 500, &1,000mL

7.6 Stainless steel spatulas.

7.7 Glass disposable pipets.

7.8 Pre-cleaned 40mL VOA vials with Teflon Septum and screw caps.

8.0 REAGENTS AND STANDARDS

8.1 AMRO VOA reagent water – Reverse Osmosis/Granular Activated Carbon (RO/GAC) Water from a Culligan System. Method Blanks are used to monitor contaminant levels of volatile analytes. Reagent water is used for making up daily standards, dilutions, water blanks, and rinsing flasks and syringes.

8.2 Methanol, purge and trap grade, from Fisher Scientific or Burdick and Jackson is used for making up standards and rinsing syringes.

8.3 1:1 Hydrochloric Acid (HCl) for preservation.

8.4 Sodium Thiosulfate (ACS) Granular – purchased from Fisher Scientific. Refer to sample receipt SOP for more information.

8.5 Sodium Bisulfate (ACS) Granular from Fisher Scientific.

8.6 Stock solutions of standards

8.7 Both stock and working standards in methanol are stored in the freezer. Daily standards are made up in water, stored without headspace, and are discarded after each day of use.

8.8 Occasionally, clients may ask for additional compounds, which may be purchased and analyzed to provide a semi-**quantitative result that would be considered estimated.** Complete method start-up and initial demonstration of proficiency is required for all new analytes reported without qualifiers.

8.9 Good laboratory procedure for making up standards is as follows:

8.9.1 All syringes and volumetric flasks are rinsed three times with methanol.

8.9.2 Syringe needles are wiped with Kimwipes and air dried by pumping the plunger up and down several times

8.9.3 The volumetric flask is filled with methanol as high as possible, leaving room for the addition of the standard.

8.9.4 The standard is drawn up in the syringe above the desired level, inverted to allow any air bubble to rise to the needle, and the plunger is pushed to the correct amount.

8.9.5 The needle is wiped with a Kimwipe and the needle is placed into the flask, preferably under the methanol and the plunger is pushed down gently to avoid purging.

8.9.6 If the needle can not reach the methanol, even with tilting the flask, then it should be eluted slowly down the side of the glass.

8.10 Initial and CCV calibration stock standards: Used within six months after ampule opening unless otherwise indicated:

8.10.1 Refer to Attachment 1. NSI MegaMix obtained from NSI at 2,000µg/mL in Methanol.

8.10.2 VOC MIX #6 obtained from Supelco at concentration 2,000µg/mL is used for calibration. Ampule used weekly.

8.10.3 8260 Ketone Mix obtained from ECS at 2,000µg/mL containing Acetone, 2-Butanone, 2-Hexanone, 4-Methyl-2-pentanone (µg/mL)

8.10.4 8260 Add-ons Mix obtained from ECS at 2,000 ug/mL containing Carbon Disulfide, Vinyl Acetate, Iodomethane and Methyl-tert-butyl ether (MTBE).

8.10.5 New Hampshire Oxgenates Mix from ECS at 2,000 ug/mL containing Ethyl tertiary butyl ether, Diisopropyl ether, Tertiary amyl methyl ether, and at 20,000 ug/mL, tertiary Butanol.

8.10.6 Acrolein obtained from Restek 20,000 µg/mL used for calibration.

8.10.7 1,4-Dioxane obtained from Restek 20.000 ug/ml used for calibration.

8.11 Stock Quality Control check standards (used for LCS): Used within **six months** after ampule opening unless otherwise indicated.

8.12 CAL MIX 2000 obtained from Restek at 2,000µg/mL.

8.13

8.14 CAL MIX #1 obtained from Restek, concentration 2,000µg/mL. Used from calibration verification. Good for one month after opening.

8.15

Restek Custom VOA Mix #1: Used for Calibration

Compound	Concentration (µg/mL)
Acetone	2,000
2-Butanone	2,000
2-Hexanone	2,000
4-Methyl-2-Pentanone	2,000
Methyl-tert-butyl-ether	2,000
Tetrahydrofuran	2,000
Diethyl ether	2,000

Restek Custom VOA Mix #2: Used for Calibration

Compound	Concentration (µg/mL)
Carbon Disulfide	2,000
1,1,2-Trichlorotrifluoroethane	2,000
Dichlorofluoromethane	2,000
Methylmethacrylate	2,000
2-Chloroethylvinyl ether	2,000
Acrylonitrile	2,000
Iodomethane	2,000

Restek Custom Oxygenates Standard: Used for Calibration

Compound	Concentration (µg/mL)
Diisopropyl ether	2,000
Tertiary amyl methyl ether	2,000
Tertiary Butanol	20,000
Ethyl tertiary butyl ether	2,000

8260 Add Ons Mix #3 from ECS at 2,000ug/ml containing methyl acetate, cyclohexane, methyl cyclohexane, and freon(113).

Vinyl Acetate is obtained from Restek at 2,000ug/mL.

Trans-1,4-Dichloro-2-butene is obtained from Restek at 2000ug/mL.

1,3,5 Trichlorobenzene is obtained from Chem Service at 99.5% purity. A primary stock solution is prepared by dissolving 0.1343g in 10mLs of Methanol. 745ul of the primary stock solution is diluted to 5mLs of Methanol to produce a stock stock of 2000ng/uL.

8.16 1,4-Dioxane is obtained from Supelco at 2,000 ug/mL.

8.17 8260A Internal Standard obtained from Restek, contains Fluorobenzene, Chlorobenzene-d5, 1,4 Dichlorobenzene-d4 at 2,500 ng/µL.

8.18 8260A surrogate solution is obtained from Restek and contains 1,2-Dichloroethane-d4, Toluene-d8, p-Bromofluorobenzene, Dibromofluoromethane at 2,500 ng/µL.

8.21 4-Bromofluorobenzene (BFB) obtained from Supelco at concentration 2,000 ng/µL used to tune instruments. Used within three months.

8.22 Working standards - **good for one week** unless otherwise indicated. When calibrating the system, a new standard is always used. The daily CCV, which is used to check the initial calibration, may be used until it fails to pass criteria.

8.22.1 Initial and daily calibration working standards mix. Combine the following stock mixes into one 5mL volumetric flask and transfer to a 5mL vial with a septum cap. Store in the freezer at all times.

8.22.1.1 NSI MegaMix – 250 µL of Stock to 5 mL final volume with Methanol for a final concentration of 100 ng/µL.

8.22.1.2 VOC mix #6: 250uL of stock to 5 mL in methanol, final concentration.100ng/µL.

8.22.1.3 8260 Add Ons Mix – 250 µL of Stock to 5 mL final volume with Methanol for a final concentration of 100 ng/µL.

8.22.1.4 8260 Ketones Mix – 250 µL Stock to 5 mL final volume with Methanol for a final concentration of 100 ng/µL.

8.22.1.5 NH Oxygenates Mix—250uL Stock to 5 mL final volume with Methanol for a final concentration of 100 ng/µL.

8.22.1.6 Acrolein – 250 µL of stock to 5mL final volume in methanol for a final concentration of 1000 ng/µL.

8.22.1.7 1,4-Dioxane-100uL of Stock to 5mL final volume with Methanol for a final concentration of 500 ng/uL

8.23 Quality control check standards (LCS)– good three months unless otherwise specified.

8.23.1 CAL Mix #1: 25uL of stock Cal Mix #1 to 5mL final volume in Methanol for a final concentration of 10ng/µL. Good one week.

8.23.2 CAL Mix – consists of the following:

8.23.2.1 CAL MIX 2000 – 125 uL of Stock to 25mL final volume with Methanol for a final concentration of 10 ng/µL.

8.23.2.2 Custom std mix #1 - 125uL stock to 25mL final volume in methanol for a final concentration of 10ng/µL.

8.23.2.3 Custom std mix #2 – 125µL of Stock to 25mL final volume with Methanol for a final concentration of 10ng/µL.

8.23.2.4 Custom Oxygenates Mix – 125µL of Stock to 25mL final volume with Methanol for a final concentration of 10ng/uL.

8.23.2.5 8260 Add Ons Mix #3- 125uL of Stock to 25mL final volume with Methanol for a final concentration of 10ng/uL.

8.23.2.6 1,4-Dioxane- 625uL of Stock to 25mL final volume with Methanol for a final concentration of 50ng/uL.

8.23.7 Trans-1,4-dichloro-2-butene – 125uL of Stock to 25mL final volume with Methanol for a final concentration of 10ng/uL.

8.23.8 1,3,5-Trichlorobenzene – 125uL of Stock to 25mL final volume with Methanol for a final concentration of 10ng/uL.

8.24 IS/Surrogate solution

8.24.1 Instrument V1a
120 µL of 8260 IS Mix and 8260 SS mix to 10 mL in methanol. Final concentration 30ng/µL.

Instrument V2
400uL of 8260 IS Mix to 10 mL in methanol. Final concentration 100ng/µL.

Instrument V3
400uL of 8260 IS Mix and 8260 SS Mix to 10 mL in methanol. Final concentration 100ng/µL.

8.26 BFB

8.26.1 125µL stock to 10 mL in methanol, final concentration 25ng/µL.

8.27 Surrogate soil spiking solution

8.27.1 2.5mL of Restek 8260A surrogate stock solution into 5mL of methanol, for a final concentration of 1,250µg/mL

8.28. Daily Standards are made up daily in VOA reagent water. All standards for extracted soil calibration or calibration verification are made in reagent water with 4% methanol added. Surrogates and Internal Standards are added by the autosampler for all water and low level soil standards.

8.29.1 Initial calibration standards:

8.29.1.1 0.5, 1, 2, 5, 10, and 25µL of the combined working solution, plus 40uL of the surrogate calibration working solution when calibrating for soils, into 100mL of reagent water to prepare the 0.5, 1, 2, 5, 10, and 25µg/L aqueous and soil standards, respectively. To prepare the 50, 100, 200, and 300 µg/L aqueous standards, add 25, 50, 100, and 150µL of the combined working solution, plus 15, 10, 5, and 2µL respectively of the surrogate calibration working solution when calibrating for soils, into 50mL of reagent water. For low soils; 5mls of 5, 10, 25, 50, 100, 200, and 300ug/L standard is transferred to VOA vial containing 5g of sand. Lowest level standard for specific compounds are listed below:

COMPOUND	LOWEST CONC. STD (UG/L) WATER	LOWEST CONC. STD (UG/L) LOW LEVEL SOIL	LOWEST CONC. STD (UG/L) MED. LEVEL SOIL
Dichlorodifluoromethane	1	5	1
Chloromethane	1	5	1
Chloroethane	1	5	1
Bromomethane	1	5	1
Dichlorofluoromethane	1	5	1
Trichlorofluoromethane	1	5	1
Freon –113	2	5	1
Diethyl Ether	1	5	1
Acetone	5	10	2
Carbon Disulfide	1	5	1
Methylene Chloride	1	10	1
Tertiary Butanol	20	50	20
Diisopropyl ether	1	5	1
Butanone	5	10	2
Tetrahydrofuran	2	10	2
1,4-Dioxane	25	25	25
4-Methyl-2-Pentanon	2	10	2
2-Hexanone	2	10	2
Bromoform	1	5	1
1,2-Dibromo-3-chloropropane	2	5	2
Hexachlorobutadiene	1	5	1
m,p-Xylene	1	4	1
Vinyl acetate	5	10	5
Acrolein	50	NA	NA
Acrylonitrile	2	10	2

8.30.1 Daily calibration verification standards

8.30.1.1 LCS: 100µL Cal Mix solutions to 50 mL DI, and Cal Mix #1, 100 µL to 50 mL DI, for a final concentration 20µg/L.

8.30.1.2 BFB: 40µL working standard solution to 100 mL DI, final concentration 10ng/mL.

8.31 Tracking of Analytical Standards

8.31.1 Chemical Receipt

The receipt of all standards, neat compounds and reagents from commercial sources is documented in the Chemical Receiving Logbook by sample receiving personnel or designate. Each solution or compound is assigned a unique standard receipt ID number, the letter "A" and a five digit sequential number. The date received, source, lot number, expiration date and disposal date are recorded. The expiration dates are provided from the manufacturer and the disposal dates are completed by AMRO employees when standards are used up or disposed.

8.31.2 Standards Preparation

Standards are prepared as written in the respective SOPs. In order to assure the accuracy of standards the following general guidelines are used:

8.31.2.1 AMRO purchases pesticide residue grade solvents and purge and trap grade Methanol for organic standard preparation and organic sample extractions.

8.31.2.2 ACS reagent grade chemicals are used when the method warrants.

8.31.2.3 Any stock standards that are purchased are accompanied by a certificate of analysis from the manufacturer.

8.31.2.4 Class A volumetric glassware is used to prepare standards.

8.32 Standard Tracking

It is important to be able to track all analytical standards back to their sources. The following procedure is used by AMRO personnel to accomplish this goal:

All chemicals that are received are logged into the Chemical Receiving Logbook, which assigns a number prefixed with the letter "A". The lot number, manufacturer, expiration date, and date received are also recorded. The Certificates of Analysis have the "A"number on them as well as the ampules or bottles, etc. Identical

ampules are further identified by using numbers (1, 2, 3, etc.). The Amro number is recorded in the various logbooks whenever these chemicals are used.

Organic Standard Tracking

8.32. Working Section - Whenever a working standard solution opened or is prepared, whether from AMRO stocks or commercially obtained stocks, the information is recorded in the Working Standard section of the standard tracking log. The solution is assigned a new ID number based on the date it is prepared plus a letter suffix. This number along with a descriptive name, concentration (or conc. varied) and the initials of the person preparing the solution are included on the label. Standards should be used in accordance with method specifications and manufacturer's instructions.

8.33 Standard Storage - Standards and reagents are stored per method specifications and manufacturer's instructions. Volatile standards are stored in a freezer at minus 10°C to 20°C.

8.34 Solvent Check Analysis

All extraction procedures are performed using pesticide residue grade solvents and a method or procedural blank analysis is performed when a new lot number is received to verify the absence of target analytes.

9.0 GC/MS PROCEDURE

9.1 Instrument Conditions and Settings

9.1.1 GC/MS (V-1A): HP-624 20 m x 0.18 mm ID column 35 ° C for 5 min., 8 ° C/min to 195 ° C, hold for 3 min. for a total of 28 min. analyzed time Tekmar LSC 3000 purge and trap Centurion Autosampler Supelco Trap E

9.1.2 GC/MS (V-2): HP-624 25m x 0.2mm ID column 35 ° C for 5 min., 8 ° C/min to 195 ° C, hold for 3min. for a total of 28 min. analyzed time

Tekmar LSC 2000 purge and trap Dynatech Archon w/s autosampler.
Supelco Trap E

9.1.3 GC/MS (V-3): HP-624 25m x 0.2mm ID column 35°C for 5 min., 8°C/min to 195°C, hold for 3 min. for a total of 28 mins analyzed time
Tekmar LSC 3000 purge and trap Dynatech Archon w/s autosampler. Trap E

9.1.4 V1A and V3 have Water Management Systems with a 150°C Bake, 100°C Purge and 50°C Desorb.

9.1.5 Settings:

Purge gas - helium grade 99.995	Desorb Flow - 30 mL/min
Purge time - 11 minutes	Desorb Time - 4 min at 200°C
Purge flow - 30-40 mL/min	Bake Time - 8 min at 225°C

Tekmar valve and transfer line temp - 105°C
Injection port temp - 225°C
Detector temp - 160-180°C
Transfer line temp - 280°C
Split Ratio 30:1

Purge temp. – ambient for all Dynatrap/Tekmar 2000 AS. 40°C for all low level soils.

V-1 has an Electronic Pressure Control – constant flow 0.5 mL/min.

9.2 Initial Demonstration of Capabilities

It is important to be able to demonstrate that all sample analyses were performed in an 'in-control' manner. It is the responsibility of the GC/MS operator to perform the following procedures prior to sample analysis.

9.2.1 Initial Demonstration of Lab Performance

The ability of AMRO to produce accurate and precise data is demonstrated per instrument/per analyst for each method. This information was entered on an Excel® spreadsheet and is kept on file with the QC department along with the associated chromatograms and quantitation output pages. It consists of an Initial Calibration (IC) for all target analytes, Initial Calibration Verification (ICV) for all target analytes, a Method Detection

Limit Study (MDL) and Precision and Accuracy Study (P&A) for each analyte, each instrument and each matrix .

9.2.2 MDL

The method detection limit is defined in 40 CFR 136 Appendix B. The MDL is determined initially by the analysis of a minimum of seven replicate samples, all containing an analyte(s) of the same low-level concentration. These replicate samples are put through all the preparation steps that a sample is put through. The standard deviation of the results of these analyses are multiplied by the appropriate student T-test value and the resulting value is deemed the method detection limit for that specific analyte.

MDL studies of each analyte must be reported initially for each instrument, column, matrix, and extraction method. To ensure that reasonable MDL values are determined, an MDL check sample is analyzed by spiking an interference free matrix with all target analytes at about two times the determined MDL. The MDL check sample is taken through the same process as the MDL. If any of the target analytes are not detected, the MDL study is modified and repeated until the MDL check sample is detectable. The MDL check will be analyzed quarterly and/or after major instrument maintenance or changes in the instrumentation or instrumental conditions to verify sensitivity of the method.

LOQ/LOD

The LOD (limit of detection) is an estimate of the lowest amount of an analyte that can be detected. This estimate would be derived from MDL studies and calibration curves (the low-level standards).

To determine the LOQ (limit of quantation), low level standards are prepped and analyzed. The level should be at one to two times the reporting limit. The percent recoveries are calculated and criteria established for expected recoveries. For 8260 analysis, a standard at 2ppb and 10ppb are analzyed. The 10ppb standard will be used for determining the recoveries of analytes with reporting limits of 5 or 10ppb. The 2ppb standard can be used for determining the recoveries of analytes with a reporting limit of 1 or 2ppb. To start, the criteria will be 70-130%, with 10% allowed at 60-140%. The LOQ studies should be done annually.

9.2.3 Precision &Accuracy

Accuracy is a measure of the degree to which the analytical result approaches the "true" value of the concentration of the analyte being determined. Precision in the laboratory is determined by the comparison of duplicates, where duplicate samples result from an original sample that has been split for identical analyses. Precision and Accuracy in the laboratory is assessed initially by the analyses of a minimum of 4 replicate samples at a mid-level point of the expected range. The percent recoveries and Relative Standard Deviations (RSD) are evaluated and compared to method specifications or default limits where applicable.

The regular analysis of known standards such as the Laboratory Control Samples (LCS), and matrix and analytical spikes also assess accuracy. Accuracy within the laboratory is expressed in terms of percent recovery.

The precision of data is regularly evaluated by determining the relative percent difference (RPD) of duplicate (replicate) analyses.

9.3 Tuning

The mass spectrometer must be verified to be in tune, has adequate sensitivity, is standardizing for the compounds of interest, and is demonstrating that the system is free of interferences. Calibration begins with the analysis of Bromofluorobenzene (BFB). This performance test must be passed before any samples, blanks, or standards are analyzed. The calibration is good for 12 hrs from the injection time of the BFB for 8260B.

9.3.1 **Tuning** - 50 ng of BFB (40 µL of a 25ng/µL solution) is added to 100 mL of VOA free water. 5 mL is purged for 11 minutes and desorbed onto the chromatographic column. The analysis is performed at 100°C to 150°C. A scan delay of two to five minutes is used. After the scan delay, data is acquired for five to ten minutes. The expected elution time of the BFB is six to eight minutes from the start of data acquisition. The background corrected average of three scans at the apex or of the entire peak of the peak is checked against the tuning requirements in Table 1. One simple subtraction of background is required within twenty scans of the left side of the peak. Also an average or a single scan is acceptable. There is a procedure file program in the software that will locate and check the BFB for a passing spectrum in the manner explained above. This procedure will be used routinely to eliminate any subjectivity from the tuning process. If this procedure fails to produce ion abundances that meet the criteria, it will display the message "no passing

spectrum found in data file: xxxxx" on the printer. If this occurs the BFB must be re-analyzed. If repeated analyses fail to produce acceptable results, then the instrument must be manually tuned according to the Hewlett-Packard reference manual, if the tune does not meet criteria. Once an acceptable tune is obtained, the following items are documented in the analyzed log:

9.3.1.1 The scan number(s) of the good tune and background corrections used to achieve it.

9.3.1.2 The time of injection.

9.3.1.3 Once a good spectrum is found a hardcopy of the following information is filed in the daily calibration file.

9.3.1.4 The following is the BFB tune criteria:

Table 2
BFB Mass - Intensity Specifications

Mass	Intensity Required (relative abundance)
50	15 to 40% of Mass 95
75	30 to 60% of Mass 95
95	Base peak, 100% relative abundance
96	5 to 9% of Mass 95
173	Less than 2% of Mass 174
174	Greater than 50% of Mass 95
175	5 to 9% of Mass 174
176	Greater than 95% but less than 101% of Mass 174
177	5 to 9% of Mass 176

9.4 Initial Calibration Procedure

A multi-level calibration consisting of 0.5, 1, 2, 5, 10, 25, 50, 100, 200, 300 ug/l is performed using standards obtained commercially. The three internal standards that are used: Fluorobenzene, Chlorobenzene-d5, and 1,4 Dichlorobenzene-d4 at a level of 25.0 ug/L. An ICV(Initial calibration verification) std containing the full list of compounds is also analyzed with the calibration curve.

9.4.1 The RRF (Relative Response Factor) is calculated as follows:

$$RRF = \frac{(Ax \times Cis)}{(Ais \times Cx)}$$

where: Ax = Area of the characteristic ion for the compound being measured.
Ais = Area of the characteristic ion for the specific internal standard.
Cis = Concentration of the specific internal standard.
Cx = Concentration of the compound being measured.

The average RRF and % Relative Standard Deviation (%RSD) must be calculated for each compound using the 8-10 RRF values calculated for each compound from the initial (8-10 point) calibration curve.

If the % RSD of any compound is less than or equal to 15%, then the relative response factor is assumed to be constant over the calibration range, and the average relative response factor may be used for quantitation. See Table 3 for analyte list and criteria.

If the % RSD of any compound is 15% or greater, construct calibration curves of area ratio (A / Ais) versus concentration ratio (Cx/ Cis) using first order (Linear Regression) or second order (Quadratic Regression) regression fit of the initial calibration points. The requirement for coefficient of determination (R^2) is equal to or greater than 0.990. If the Linear Regression criteria is not met, then Quadratic equation (second order) may be used with a minimum of 6 data points. In either case, the curve must be printed and stored in the file with the initial calibration to document evaluation. The analyst should select the regression order, which introduces the least calibration error into the quantitation and minimizes the y-intercept value (constant term).

Linear and Quadratic Regressions each have several options available in the software. The analyst must chose which order will be used. Options available are equal weighting, inverse of conc., and inverse square of conc.. The analyst should choose the curve order and weighting which gives the best coefficient of the determination (COD) and a y-intercept nearest to the origin, given the calibration blank is clean.

The percent relative standard deviation ***must*** be less than 15% for each compound. However, the % RSD for each individual calibration check compound (CCC) ***must*** be less than 30%. Late-eluting compounds usually have much better agreement. The CCCs are:

1,1-Dichloroethene
Chloroform
1,2-Dichloropropane
Toluene
Ethylbenzene
Vinyl chloride

If the % RSD greater than 30% is measured for any CCC, then corrective action to eliminate a system leak and / or column reactive sites is required before attempting another calibration.

9.4.1.1 A system performance check should be made before this calibration curve is used. Five compounds (the System Performance Check Compounds, or SPCCs) are checked for a minimum average relative response factor. These compounds are:

Chloromethane	0.1
1,1-Dichloroethane	0.1
Bromoform	0.1
1,1,2,2-Tetrachloroethane	0.3
Chlorobenzene	0.3

These compounds are used to check compound stability and to check degradation caused by contaminated lines or active sites in the system. See Table 3 for summary of the acceptance limits.

The analyst may drop the lowest or highest point for an analyte, possibly requiring either a change in reporting limits or narrowing the calibration range. An entire level may be deleted if there is cause to believe there was a poor injection, etc. The section head should examine the calibration to ensure the proper procedures were followed.

Table 3

Criteria for Initial and Continuing Calibration for 8260B

Volatile Compound		Initial and Continuing Calibration Minimum RRF	Initial Calibration Maximum % RSD	Continuing Calibration Maximum % Drift
Chloromethane	(SPCC)	(0.100)		
Vinyl chloride	(CCC)		(30%)	(20%)
1,1-Dichloroethane	(SPCC)	(0.100)		
1-1-Dichloroethene	(CCC)		(30%)	(20%)
Chloroform	(CCC)		(30%)	(20%)
Bromoform	(SPCC)	(0.100)		
1,1,2,2-Tetrachloroethane	(SPCC)	(0.300)		
Toluene	(CCC)		(30%)	(20%)
Chlorobenzene	(SPCC)	(0.300)		
Ethylbenzene	(CCC)		(30%)	(20%)
1,2 Dichloropropane	(CCC)		(30%)	(20%)

The ICV, which was analyzed with the calibration , ***must*** be evaluated at +/- 25%.

9.5 <u>GC/MS Daily Calibration Procedure:</u>

9.5.1 Daily Calibration Check:

9.5.1.1 The 8260 ccv; 25ul of the 100ng/ul 8260 working standard into a 100ml volumetric containing Voa water,(continuing calibration at 25ppb but
varied periodically) must pass 8260B criteria to continue.
The average response factor or calibration curve of the initial calibration is verified daily using a calibration standard and must meet the criteria of CCC's <20% drift.

% Drift = c1 - c2/c1 x 100

where: c1 is the analyte concentration
c2 is the standard concentration

The CCC's are Vinyl Chloride, 1-1 Dichloroethene, Chloroform, 1-2 Dichloropropane, Toluene, and Ethyl Benzene.

For MCP or RCP samples, any target analyte outside of +/- 30% is listed on the narrative form. If more than 10% of the compounds are outside the criteria, then recalibration is required.

9.5.1.2 The five SPCC compounds are checked for a minimum average relative response factors. The acceptance criteria is listed in Table 2.

9.5.2 The internal standards must be monitored for retention time and area of response. The internal standard areas may not vary by more than - 50% or + 200% and their retention times by ±30 seconds from the comparable standard in the initial calibration.

9.5.2.1 If the first CCV standard does not pass the system should be checked for problems and corrected before analyzing a second CCV. Common causes of failure are: (1) purge flow too slow which will depress the RRFs of the poor purgers like bromoform and 1,1,2,2-tetrachloroethane, (2) purge flow too fast which will depress the RRFs of the gas analytes like chloromethane, (3) contamination in the autosampler/purge&trap system trap, valves, or lines which can degrade 1,1-dichloroethane and 1,1,2,2-tetrachloroethane.

9.5.2.2 New initial calibrations are always analyzed after major system changes such as replacing filaments, cleaning the source, significant re-tuning of the mass spectrometer, significant changes in purge & trap conditions, etc.

Laboratory Control Sample : A LCS is prepared using 100µL in 50ml DI of a 10ng/µL secondary source standard. For soil LCS, 2 mL Methanol, 100µL of 10 ng/µL second Source standard mix in 50 ml DI is used.

Clients requesting QC are provided with the full list of target analtyes, the % recoveries achieved, and the laboratory control limits.
For samples requiring MCP or RCP, an LCSD is also analyzed and all target compounds outside of +/- 30% must be noted on the case narrative.

9.5.3 Blank analysis: A 5 mL aliquot of volatile free laboratory water is analyzed in the same manner as standards and samples to demonstrate that the system is interference free. When this has been demonstrated sample analysis may begin. A hardcopy of the blank chromatogram and quant output page is filed with the daily calibration data. The blank should not contain any analyte above one half the reporting limit with the possible exception of common laboratory contaminants such as Acetone and Methylene Chloride. The common laboratory contaminants must be less than the reporting limit. If there are any analytes over these limits and the samples are positive for these analytes, the samples must be re-analyzed when possible. If re-analysis is not possible, all results must be appropriately qualified on the client's report.

10.0 SAMPLE PROCEDURE

10.1 Preparation of Samples

Once the calibration procedure has been successfully completed the analysis of actual samples may begin. It is the responsibility of the GC/MS operator to follow these procedures. To determine which samples need to be analyzed on a given day, a daily work list is printed and used by the analyst to know when the analysis needs to be completed to satisfy the preservation / holding time requirements and the client's requests.

10.1.1 Preserved aqueous samples must be analyzed within 14 days from date of sampling. The pH must be <2.

10.1.2 Nonpreserved aqueous samples must be analyzed within 7 days.

10.1.2 In general, water samples are analyzed at 5 mL unless there is a known history of contamination in the sample or some matrix problem, which requires a dilution to be analyzed. For a dilution of 1:10, 5mls of sample is removed with a gastight syringe and added to a 50ml volumetric flask containing distilled water. VOA Reagent water is added to the 50mL mark, capped, the volumetric is inverted three times, and poured gently into a VOA vial for analysis.

10.1.3.1 All water samples, standards and blanks are spiked with internal standards and surrogate standards at 25µg/l prior to analysis by the instrument.

10.1.3.2 Allow samples to come to room temperature.

10.1.3.3 Aqueous samples are checked the day after analysis with low range pH paper to ensure it was preserved to a pH <2 at the time of collection, unless sample was not preserved. If the pH is <2 of a preserved sample,it is noted in the case narrative. Drinking and wastewater samples are also checked for residual chlorine with chlorine test strips.

Soil samples are extracted by weighing out 10 grams of sample into a 40-mL vial and adding 10 mL of methanol and spiked with 20ul of surrogate mix. The weights and the procedure used are recorded in the Soil Prep Log. Methanol blanks and a LCS are prepared each day soils are analyzed. 10 mls of methanol is added to a VOA vial and spiked with 20ul of surrogate mix. The LCS also has 100ul of the QC mix containing all compounds added upon dilution into a 50ml volumetric. For every twenty soil samples a spike and spike duplicate are prepared by spiking 100ul of a 10ng/ul mix in to a 50ml volumetric containing 2mls of a methanol extraction. EPA 5035 Methanol Field Preserved , VPH, and New Jersey soils are extracted on-site using the VOA vials containing methanol that were prepared in the laboratory.

Soil samples must be extracted and analyzed within 14 days from the date of collection. EnCore samplers soil contents must be preserved in methanol or 20% sodium bisulfate solution within 48 hours of sampling and analyzed within 14 days from collection. The Method blank and LCS are prepped daily by adding 5g of clean Ottawa sand to a VOA vial and 5mls of the sodium bisulfate solution. Ten ul of The QC mix (containing the full list of compounds), is added to the LCS.
Soil samples that are frozen on site have 14 days holding time.

Soil samples may be extracted in 5ml of VOA water and frozen in the lab within 48 hours of collection to preserve them for a holding time of 14 days.

10.2 Analysis of Samples

10.2.1 Every analytical batch of samples requires the following:

- BFB TUNE
- 8260 STANDARD (at 25ppb usually but concentration varied)
- LABORATORY CONTROL SAMPLE (LCS) – 20 µg/L PROCEDURAL (METHOD) BLANK
- SAMPLES
- MS/MSD- For every 20 client samples a spike and spike duplicate is required. They are spiked by AMRO with the LCS spike containing the full list of compounds . 100µl of a 10ng/µl mix is added to a 50ml volumetric containing 10mls of a water sample. Samples must be selected for spiking at random and rotated among clients and sites from batch to batch. In some cases, the client may specify which sample is to used for MS/MSD; if not , the laboratory shall pick a representative sample based on the following:

  A. MS/MSD shall not be performed on the Trip Blank, Rinsate Blank or Field Blank.
  B. Adequate sample weight/volume.
  C. Client requested QC deliverables.

10.2.2 Samples and standards are introduced to the GC/MS System using 40mL VOA vials, which are put into the autosampler tray. The autosampler syringe delivers 5mL to the purging chamber along with the internal standards and surrogates (the autosampler is equipped with a syringe or vial, which the operator fills with the internal standard and surrogate mix for waters). Also, a 40mL VOA vial containing Bromofluorobenzene (BFB) at a concentration of 50ng/5mL is placed on the tray for tuning (no SS is added).

10.2.3 Check the reservoir for water.

10.2.4 Check the IS and SS vials.

10.2.5 Type in the sequence of samples into the computer.

10.2.6 Recheck the vials in the autosampler to make sure they match the typed sequence.

10.2.7 Check the Helium.

10.2.8 Helium purges through the chamber and the volatile analytes are absorbed on the trap, a tube containing an OV-1/Tenax/Silica Gel/Charcoal mixture. After purging is complete, the trap is heated and backflushed with helium to desorb the compounds. The analytes are carried along a heated transfer line to the GC inlet, where the glass liner meets the narrow bore capillary column. At this point the analytes are heated, mixed and split. The column is temperature programmed to separate the analytes and is interfaced by a Mass Spectrometer for detection.

10.2.9 The raw data will print from the instrument as each sample is running.

10.3 Evaluation of Results

10.3.1 Identification of Compounds (Qualification)

Carefully evaluate the EICP and sample to reference spectrum match for each hit above or near the reporting limit that is detected by the data system. The qualitative identification of compounds is based on retention time and on the comparison of the sample mass spectrum, after background subtraction, with characteristic ions in a reference mass spectrum. The characteristic ions are the three ions of greatest relative intensity, or any ions over 30% relative intensity if less than 3 such ions occur in the reference spectrum. Compounds are identified as being present if:

- The intensities of the characteristic ions of a compound maximize in the same scan within one scan of each other.
- The relative retention time of the sample component is within ± 0.06 RRT units of the RRT of the standard component.

- The relative intensities of the characteristic ions agree within 20% of the relative intensities of those ions in the reference spectrum.

10.3.1.1 All 624 target isomers are reported individually, with the exception of m- and p-xylene, which co-elute and are reported as an isomer sum. All other target isomers should meet the following resolution requirement: Sufficient GC resolution is achieved if the height of the valley between the two isomer peaks is less than 25% of the sum of the two peak heights.

10.3.1.3 Clients sometimes ask for identification of the 10 to 20 largest non-target peaks in sample chromatograms, referred to as Tentatively Identified Compounds (TICs). The Hewlett Packard Enviroquant Library Search Compounds (LSC) program will automatically print out the spectral PBM search results for the largest peaks (operator chooses the number) along with possible matches for their spectra. The operator decides whether there is a good match of the sample and reference spectra or the spectrum remains classified as "unknown". Use the following guidelines when making tentative identifications:

- Relative intensities of the major ions in the reference spectrum (ions greater than 10% of the most abundant ion) should be present in the sample spectrum.
- The relative intensities of the major ions should agree within 20%.
- Molecular ions present in the reference spectrum should be present in the sample spectrum.

- Ions present in the sample spectrum but not in the reference spectrum should be reviewed for possible background contamination or the presence of co-eluting compounds.
- Ions present in the reference spectrum but not in the sample spectrum should be reviewed for possible subtraction from the sample spectrum because of background contamination or co-eluting peaks. Data system library reduction programs can sometimes create these discrepancies.

10.4 Quantitation of Compounds

The identified compound will be quantitated based on its response compared to that of its internal standard. Refer to Attachments (7A-7C)

10.4.1 When the mass spectrometer is linear, the concentration of each analyte in the sample is, for water samples:

$$\text{Concentration } \mu g/L = \frac{(Ax)(Is)}{(Ais)(RF)}$$

Ax = area of characteristic ion for compound being measured
Is = concentration of internal standard injected (ng/ul)
Ais = area of characteristic ion for internal standard
RF = mean relative response factor for compound being measured

10.4.2 The integration of compounds for standards and samples should be performed to be in the same manner as the initial calibration integration. Cases where the initial calibration is in question should be investigated to ensure it is not related to poor maintenance, damaged or defective column, or other issues, which should be solved before further analysis.

10.4.3 The following must be checked for each compound present in standards and samples to ensure proper integration has been performed.

- The peak shape of the calibration compound must be maintained for standards and samples. This should take into account any shouldering, peak tailing, and peak co-elution. Carefully evaluate the EICP of each gas analyte, all ketone targets (esp. acetone and 2-butanone), methylene chloride, all esters, and tetrahydrofuran for proper integration in all standards and samples because these targets often exhibit broad peaks and poor signal to noise ratios. Carefully examine the following target hits due to posible misidentification by the data system: chloroethane, 1,2,3-trichloropropane, 4-methyl-2-pentanone, n-propyl benzene, 2-chlorotoluene, and the dichlorobenzene isomers.

- The EICP retention time windows for each compound of the calibration must be applied to standards and samples. If there is a retention time shift confirmed by comparison of the Internal Standards and Surrogates then carefully examine each EICP for potential target shifts. Watch especially in the narrow retention time windows where a shift might cause all or part of a peak to leave the window and be missed or mis-integrated by the data system. If false negatives due to retention time shifting appear likely then the sample must be reanalyzed.

- The baseline integration techniques for each compound of the calibration must be maintained for the standards and the samples. This should take into account elevated baselines, column compensation corrections and negative peaks in samples.

- Make sure that positive identification of compounds has been established thru EICP's and all method requirements have been met.

- Ensure any positive results are within the lower and upper levels of the calibration curve and above the reporting limits for each compound.

All positive results above the calibration curve must be reanalyzed in dilution.

Manual integration and Q-deleting procedures:

The raw data is printed out before any manual integration or Q-deleting is performed and handed in with the report. This raw data can be reproduced at any time by requanting the data file by the method used.

The Q-deleting procedure is used when the area counts are very low and produce a negative or false positive. Also it is used when the computer finds an incorrect peak.

Manual integration is used when the computer gets only part of a peak, due to the irregular shape of the peak or a very large peak, or misses a peak entirely.

All manual integration is performed by integrating the entire peak at the baseline, exactly as the computer would.

10.4.4 If there are any cases where the integration or spectral identification of a compound is questionable after ensuring the above steps have been followed then consult another qualified analyst. The chromatograms and spectra should be printed in these cases, dated and initialed by the analyst and the qualified consultant.

10.4.5 Analytes with initial calibration RRFs >15%RSD are fitted to a linear regression or quadratic regression in the initial calibration. The software will automatically quantitiate the analyte by the parameters set for the initial calibration, average response, linear regression or quadratic regression.

10.4.6 Clients may ask for estimated concentrations of non-calibrated compounds. The Hewlett Packard LSC software will do this automatically, requiring only a dilution factor.

10.4.7 Once all the data has been evaluated it is submitted for data review. The following must be submitted for each project:

10.4.7.1 The raw data from the instrument that was printed while the sample was running. This consists of the quantitiation report and the chromatograms.

10.4.7.2 The data after it has been reviewed by the analyst. This consists of the quantitiation report that was reviewed.

10.4.7.3 A copy of the injection log(s) associated with the samples for the project.

10.4.7.4 Copies of the preparation sheets associated with the samples.

10.4.7.5 A copy of the applicable blanks if the project is a Level 2 package or higher. See the Quality Systems Manual for Package Levels.

10.4.7.6 If the project is a Level 4 or 5, copies of the following items must be provided to data review: Initial Calibration summary and raw data along with the information described in sections 10.4.7.1 to 10.4.7.5 are required.

10.4.7.7 The GC/MS Checklist is completed by the analyst that provides an overview of the issues associated with the data. Any items that do not meet acceptable criteria must be qualified by the analyst in the form of a documented investigation of the issue(s) written on the narrative form.

11.0 INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR

Instrument maintenance and repair records are maintained to document satisfactory instrument performance. The operator is generally responsible to see that records are well kept. Records of major maintenance and repair are kept in the instrument maintenance log per instrument. Routine maintenance procedures such as changing the internal standards and surrogates in the autosampler need only be recorded in the instrument analysis log.

11.1 Daily maintenance procedures:

The following items should be checked on every day that an instrument is used for analysis.

11.1.1 Trap and column performance is monitored by checking the response factor of key compounds, which indicate trap and column degradation and observing column bleed. Change trap or column if necessary.

11.1.2 Check that gases have adequate supply to last until the following day. Change tanks if necessary.

11.1.3 Check data file space and quant space.

11.2 As needed maintenance procedures:

11.2.1 Check split flow on GC.

11.2.2 Check purge gas flow on the purge&trap. Adjust if necessary.

11.2.3 Check Teflon ferrules on purge&trap for wear. Replace if necessary.

11.2.4 Check Teflon purge lines on purge&trap for wear. Replace if necessary.

11.2.5 Change the vacuum pump oil.

11.2.6 Clean the analyzer source. This will become necessary if a high background becomes apparent which is not attributable to column degradation or the system cannot meet BFB criteria.

11.2.7 Replace the electron multiplier when the maximum gain no longer provides the required sensitivity.

11.2.8 Replace the ion source filament as needed.

12.0 CALCULATIONS

12.1 All data files, which are imported into the LIMS data system must have specific headers, test codes, etc.

12.1.1 An example of water and soil 8260 sample headers are as follows:

[0503005-01A] df=1MF=5UG{8260_W}
xtr03/03/05 samp=5ml fv=5ml

Example of an *8260 water sample* which arrived in March of 2005
The DF=1, signifies a dilution factor of one.
MF=5UG, indicates the results are in ug, and the sample amount purged is 5mls.
The sample was collected on 3/3/5.
The samp=5ml, means a 5ml sample size
The fv=5ml, final volume(purged) is equal to 5mls.

[0503005-01A]df=10MF=250UG{8260_MS}
xtr03/03/05 samp=21.345g s=88.5 fv=5ml

Example of an *8260 methanol soil sample* which arrived in March Of 2005.

The df=10, signifies a dilution factor of 10.
MF=250UG, indicates the results are in ug, and the 500 equals;

MF=(total amount purged-5mls water / 0.2mls methanol extract purged) * 10mls methanol –total volume methanol

samp=21.345g, means 21.345grams sample extracted.
S=88.5 , indicates the percent solids = 88.5%
The fv=5ml, signifies a final volume of 5mls.

12.1.2 For MCP and some specific projects, the methanol soil samples are corrected for % moisture in the soils, which dilutes out the methanol. This diluting factor can to be calculated as follows:

(100-%solids) * sample weight(g)/100 = total amount(mls) of water in sample.

mls of water in sample + mls of methanol / mls of methanol = dilution factor.

For example, a sample with a weight of 15.543g extracted with 10mls of methanol and a %solids of 81.5%, would have a dilution factor (LIMS factor) as follows.

(100-81.5) * 15.543g/100 + 10mls / 10mls = 1.288

This LIMS factor would adjust all target analytes and surrogates. (by * 1.288)

13.0 QUALITY CONTROL

A formal quality control program is in operation at the present time at AMRO. The Laboratory Control limits for surrogate, matrix spikes and laboratory control sample spike are updated as needed.

13.1 Standards

13.1.1 The spiking solutions are obtained commercially. New lots of spiking solution are compared to the ones currently in use before being used. If they differ by more than 10%, then replace spike. If still out, new calibration curves will probably need to be prepared with the new solutions.

13.2 Internal standard

13.2.1 All samples, standards, and blanks are spiked with internal standards at 25 µg/l in water and soil extractions prior to analysis. Internal standard areas are monitored.

13.2.2 If examination of the total ion chromatogram shows no evidence of matrix interference or elevated baseline, the samples should be re-analyzed to determine if there is some other matrix effect behavior or that the added internal standard solution is no longer acceptable for use. If re-analysis exhibits the same behavior then the analyst will report the data and

generate a Non-Conformance report with some assessment of data impact.

13.2.3 If examination of the total ion chromatogram shows evidence of matrix interference or elevated baseline, the analyst should evaluate whether a dilution is warranted due to peak distortion. If there are no chromatographic anomalies, the data is reported as is since the internal standard is designed to allow for some matrix effects or inlet discrimination.

13.3 Surrogates

13.3.1 All samples, standards, and blanks are spiked with surrogate standards at 25µg/l in water and low soil analysis, and at 100µg/l in methanol preserved soils prior to analysis. Surrogate recoveries are monitored. Surrogate recoveries for samples are input into spreadsheets to calculate mean and standard deviation and to establish laboratory guidelines for recovery limits. All surrogates recovery limits are generated based on Control Charts. These limits are updated as needed. If the percent recovery for any surrogate compound is found to be out of acceptable range, the data must be evaluated. If the surrogate recovery is outside of the upper acceptance limit and there is an assignable cause, the data can be reported with a note of qualification. If the surrogate recovery is outside of the range and there is no assignable cause, the sample must be re-analyzed. If it is not possible to re-analyzed the samples due to hold time constraints, the data must be qualified.

13.3.2 For samples requiring MCP or RCP, surrogate recovery outside of ±30%, must be noted in Case Narrative.

13.4 Blanks

13.4.1 Blanks are analyzed daily. Soil extraction method blanks are analyzed with soils. Blanks are evaluated to ensure analyte levels are below reporting limits. If any compounds are seen in blanks greater than one half the reporting limit, the system is checked for contamination, and the blank is re-analyzed. If common laboratory contaminants Methylene Chloride and/or Acetone are present above the reporting limits and samples contain positive results for these analytes the samples must be reanalyzed or reported with B flag qualifiers. AMRO has

observed Naphthalene presence in the blanks at levels below reporting limits due to carryover from the VPH Standard containing 100 ppb of Naphthalene. Analysis should not proceed if the initial blanks are greater than one half the reporting limit for any other analytes and the problem can be corrected by instrument adjustment or cleaning, e.g. analyzing additional blanks

13.4.2 Trip blanks are analyzed along with the samples they arrived at the lab with. Their purpose is to assess the possibility of cross-contamination of the samples while in transport. If provided, they are analyzed with the samples they are used to assess.

13.4.3 Field blanks are also analyzed when they are provided by the client.

13.5 Laboratory Control Samples

13.5.1 Laboratory Control Samples (LCS) are prepared with samples and analyzed with the sample matrix they correspond to. The LCS for water contains all target analytes. *If LCS does not produce acceptable recoveries based on 8260 limits then they are re-analyzed. If the LCS is still unacceptable, the LCS solution is checked, as well as the calibration. If the LCS % Recovery results are above the acceptance limits and the sample results are ND, the sample's results are not impacted. This however must be noted in the project case narrative.*

13.5.2 All Laboratory Control Sample limits are generated based on Control Charts. These limits are updated as needed.

13.6 Matrix Spikes

13.6.1 For aqueous samples, an MS and an MSD must be analyzed with every 20 sample analytical batch.

13.6.2 MS and MSD limits are generated based on Control Charts. These limits are updated on an annual basis.

13.6.3 If the results of both matrix spike samples do not meet acceptance criteria then matrix interference is suspected. The Laboratory Control Sample (LCS) is reported to prove that the system is 'in-control' and

the spike results are suspected to be due to matrix interference, providing the LCS was acceptable.

13.7 Duplicates

13.7.1 A duplicate is analyzed for every 20 samples in the form of a Matrix Spike/Matrix Spike Duplicate. The results are evaluated to ensure acceptable reproducibility for the analysis. The Relative Percent Difference (RPD) between the concentrations of the analysis are calculated as follows:

$$\%RPD = \frac{(MS\ conc. - MSD\ conc)}{(MS\ conc. + MSD\ conc.)/2)} * 100$$

13.7.2 The %RPD must be ≤25%.

13.7.3 If the %RPD is not acceptable then an assignable cause such as sample non-homogeneity or carry over from a high sample, etc is explored. If a reasonable cause is found the batch is accepted, if not the MS and MSD are reanalyzed.

13.8 The following Quality Control rules should be followed for all Massachusetts Contingency Plan (MCP) and Reasonable Confidence Protocol (RCP) projects:

13.8.1 MS/MSD: Must contain all target compounds. %REC's should be between 70-130% for all target compounds. RPD's should be <20% for all water and soil samples.

13.8.2 LCS/LCSD: %REC's must be between 70-130% for all target compounds. Document exceedances in Case Narrative.

13.8.3 Surrogates: %REC's must be between 70-130% for all surrogates. Reanalyze unless obvious interference or Methanol preserved soil with moisture >25% or high recovery but no target hits.

13.8.4 ICAL: Recalibrate if >20% of non-CCC analyte have %RSD's >30 or r<0.99. Report all analyte with quadratic regression quant in the Case Narrative.

13.8.5 CCAL: Recalibrate if >10% of non-CCC analyte have %D>30%.

13.8.6 Reporting: Report both sets if one is extracted inside the holding

time and other outside the holding time. Provide chromatograms if the Quality Control problems are attributed to matrix effects. Report reanalysis if Internal Standard areas fail after re-run. Report all analytes with quadratic regression quant in Case Narrative. Document dilution in Case Narrative.

13.9 Corrective Action

13.9.1 Problems that are identified at the bench level and are corrected by the analysts are noted on the GC/MS Data Review Checklist. If any non-conformance is determined by lab manager review, a QC review or Corrective Action is to be included with the applicable report. Sections are informed of non-conformance issues in an effort to prevent reoccurrence. Any issues that are made evident by a client, resulting in corrective actions being completed which identify the issue, cause and correction. This information is provided to the client.

14.0 DATA REVIEW AND STORAGE

AMRO's goal for completeness is 100%. The following data calculating, reviewing and reporting procedures are followed to obtain that goal.

14.1 Data Validation - performed by the analyst:

When an analysis of a sample is complete, the analysis for that sample should be checked and the data calculated as soon as possible to identify any problems while still within the holding time for the analysis. The following steps should be taken to ensure that a good analysis has been obtained.

14.1.1 Check that all calibration analyses associated with the sample meet criteria to ensure acceptance criteria is met.

14.1.2 Check the internal standard areas. They should be -50 to +200% of the I.S. areas in the Initial Calibration standard.

14.1.3 Compare the surrogate recoveries to the AMRO limits. The default VOA surrogate recovery limits are as follows and are used until in house limits are generated.

14.1.4 Check the LCS to be sure the results are inside the limits, as well as the matrix spike and matrix spike duplicate results.

14.1.5 Check the analyzed times to be sure the tuning requirements are met.

4.1.6 Check that no compounds exceed the calibration range. If there are, these samples must be reanalyzed at a dilution.

14.1.7 Check the chromatography (good peak shape, baseline not noisy, good sensitivity).

14.1.8 Check the analysis for carryover or contamination. If any carryover is evident, these samples must be reanalyzed.

14.1.9 Check that the amount of sample analyzed is correctly recorded in the chromatogram header.

14.1.10 Check spectrum, area, and retention time of any positive hits on the quant output page.

14.1.11 Perform the final calculations on any positively identified compound in µg/L, taking into account dilution factors, etc.

Calculate the multiplier which equals grams of sample purged and write it on the quant output page. The soil multiplier is calculated by the following calculation:

$$\text{grams sample purged} = \frac{\text{sample wt. grams}}{\text{mL Methanol extracted}} \times \frac{\text{\% solids}}{100} \times \text{mL Methanol purged}$$

soil multiplier = 5mls purge/ gms sample purged

14.1.12 Check the chromatogram for very large peaks not picked up by quant. If any are present, check the spectrum to be sure it is not a target compound that is over the calibration range or outside the normal retention time window. If not a target compound, make a note on the chromatogram that the peak is an unknown and use the library to identify if possible.

14.1.13 Check to see if there are any other analyses of the sample. If so, check to see if the data agrees.

Any problems discovered during this preliminary data check will necessitate re-analysis unless the lab manager authorizes use of the data with appropriate data qualifiers.

All calculations should be written in black ballpoint pen ink. All cross-outs should be a single line and should be initialed. The person performing these data calculations and checks should sign and date the bottom of the quant page.

14.2 Data Review - performed by the department supervisor or designate.

When all samples for a given project have been analyzed and the results have been calculated, the project goes through the following data review procedure:

14.2.1 The reviewer reads over all associated paperwork to become familiar with the requirements of the project.

14.2.2 The project is checked for completeness.

14.2.3 Data sheets are checked for accuracy.

14.2.4 The data calculations are spot-checked. If any problems are encountered then the whole package should be checked.

14.2.5 The QC data sheets are checked.

Any problems encountered by the reviewer are brought to the attention of the lab manager.

14.3 Data Reporting

Many report options are available to clients of AMRO. It is AMRO policy to discuss with all clients their reporting requirements soon after receipt of the samples. The cover letter for the data reports will address any quality control problems, either with the condition of the samples upon receipt or with the analyses, or contain a statement that no quality control problems were encountered. The letter will also contain a statement that it is an integral part of the data report.

14.4 Data Archival

14.4.1 GC/MS Data Files.

All raw GC/MS data files are archived through the Network and are backed up on a tape drive through the server.

14.4.2 Data Reports.

Final data and QC reports are input into Excel and spreadsheet files. Template files exist on the Network for final data reports, daily QC check reports, sample spike reports, initial precision and accuracy data, wastewater method accuracy data, surrogate recovery data, and MDL data. When data is input template files are renamed as follows:

data reports XXX#####

Where X 's are the first three characters of the AMRO client code and #'s are the AMRO project and sample number.

15.0 REFERENCES

15.1 40 CFR Part 136 Appendix B, 1984.

15.2 USEPA Office of Solid and Hazardous Waste - SW-846 Method Chapter 1, Rev. 1 7/92.

15.3 USEPA Office of Solid and Hazardous Waste - SW-846 Method 8000B, Rev. 2 12/96.

15.4 USEPA Office of Solid and Hazardous Waste - SW-846 Method 8260B, Rev. 2 12/96

15.5 New Jersey Department of Environmental Protection "Methodology for the Field Extraction/Preservation of Soil Samples with Methanol for Volatile Organic Compounds", 2/97.

15.6 Department of Defense Quality Systems Manual For Environmental Laboratories, Final Version 3, January 2006.

15.7 Massachusetts Contingency Plan (MCP), Revision 4, May 28, 2004.

Attachment 1

Volatile Internal Standards With Corresponding Target Compounds and Surrogates Assigned For Quantitation

#	Compound Name	Primary Ion	Secondary Ion
Internal Standard	Fluorobenzene	96	70
	Dichlorodifluoromethane	85	87
	Chloromethane	50	52
	Vinyl Chloride	62	64
	Chloroethane	64	66
	Bromomethane	94	96
	Dichlorofluoromethane	67	69
	Trichlorofluoromethane	101	103
	Methyl Acetate	59	43
	Freon 113	151	153
	Diethyl Ether	74	59
	Acetone	58	43
	Iodomethane	142	127
	1,1-Dichloroethene	96	61
	Carbon Disulfide	76	78
	Methylene Chloride	49	84
	Acrolein	56	55
	Acrylonitrile	53	52
	Tertiary Butanol	59	87
	Methyl tert-butyl ether	73	41
	trans-1,2-Dichloroethene	96	61
	Diisopropyl Ether	45	87
	1,1-Dichloroethane	63	65
	Vinyl Acetate	43	86
	Ethyl Tertiary Butyl Ether	59	87
	2-Butanone	72	43
	2,2-Dichloropropane	77	79
	cis-1,2-Dichloroethene	96	61
	Chloroform	83	85
	Tetrahydrofuran	42	72
	Bromochloromethane	128	130
Surrogate	Dibromofluoromethane	113	111
	Tertiary Amyl Methyl Ether	73	55
Surrogate	1,2-Dichloroethane-d4	65	67
	Cyclohexane	56	84
	1,1,1-Trichloroethane	97	99
	1,1-Dichloropropene	75	110
	Carbon Tetrachloride	117	119
	1,2-Dichloroethane	62	49
	1,4-Dioxane	88	58

Attachment 1 Page 2

Volatile Internal Standards With Corresponding Target Compounds and Surrogates Assigned For Quantitation

#	Compound Name	Primary Ion	Secondary Ion
	Benzene	78	77
	Trichloroethene	95	132
	Methyl Cyclohexane	83	55
	1,2-Dichloropropane	63	62
	2,4,4-Trimethyl-2-pentene	55	97
	Methyl Methacrylate	69	100
	Bromodichloromethane	83	85
	Dibromomethane	93	95
	4-Methyl-2-Pentanone	85	43
	cis-1,3-Dichloropropene	75	39
Surrogate	Toluene-d8	98	100
	Toluene	92	91
	trans-1,3-Dichloropropene	75	39
	1,1,2-Trichloroethane	97	85
	1,2-Dibromoethane	107	109
	2-Chloroethyl-Vinyl-ether	63	43
Internal Standard	Chlorobenzene-d5	117	82
Surrogate	4-Bromofluorobenzene	174	95
	2-Hexanone	58	43
	1,3-Dichloropropane	76	41
	Tetrachloroethene	164	166
	Dibromochloromethane	129	127
	Chlorobenzene	112	77
	1,1,1,2-Tetrachloroethane	131	133
	Ethylbenzene	91	106
	m,p-Xylene	106	91
	o-Xylene	106	91
	Styrene	104	78
	Bromoform	173	175
Internal Standard	1,4-Dichlorobenzene-d4	152	150
	Isopropylbenzene	105	120
	Cyclohexanone	55	98
	1,1,2,2-Tetrachloroethane	83	85
	1,2,3-Trichloropropane	75	77

Attachment 1 Page 3

Volatile Internal Standards With Corresponding Target Compounds and Surrogates Assigned For Quantitation

#	Compound Name	Primary Ion	Secondary Ion
	Bromobenzene	156	77
	n-Propylbenzene	91	120
	2-Chlorotoluene	91	126
	4-Chlorotoluene	91	126
	1,3,5-Trimethylbenzene	105	120
	tert-Butylbenzene	119	91
	1,2,4-Trimethylbenzene	105	120
	sec-Butylbenzene	105	134
	4-Isopropyltoluene	119	134
	1,3-Dichlorobenzene	146	111
	1,4-Dichlorobenzene	146	111
	n-Butylbenzene	91	92
	1,2-Dichlorobenzene	146	111
	1,2-Dibromo-3-chloropropane	75	156
	1,2,3-Trichlorobenzene	180	182
	Hexachlorobutadiene	225	227
	Naphthalene	128	129
	1,2,4-Trichlorobenzene	180	182
Surrogate	2,5-Dibromotoluene	250	89

Attachment 2
8260 NSI MegaMix

Certificate of Analysis

A09955
#1→#4

NSI Solutions, Inc. * 7212 ACC Blvd. * Raleigh, NC 27617 * 1-800-234-7837

Mixture Name: 8260 VOC Mix
Catalog Number: C-700-06

Expiration Date: 04/15
Solvent: P&T Methanol
(FLAMMABLE, IRRITANT,CARCINOGEN)

COMPOUND NUMBER	ANALYTE	PURITY (%)	GRAVIMETRIC CONCENTRATION (ug/mL)
W-212-09	Bromoform	99.65	2001
W-360-05	Carbon tetrachloride	99.97	2000
W-21-05	Chloroform	98.33	2000
W-200-12	Chlorodibromomethane	99.82	2000
W-46-09	Dichlorobromomethane	99.35	2000
W-12-05	1,1-Dichloroethane	99.64	2000
W-09-04	1,2-Dichloroethane	99.92	2000
W-27-07	1,1-Dichloroethene	99.91	2000
W-28-06	trans-1,2-Dichloroethene	99.44	1999
W-42-03	Dichloromethane	99.84	2001
W-30-06	1,2-Dichloropropane	99.92	2000
W-520-14	cis-1,3-Dichloropropene	99.08	2000
W-451-08	trans-1,3-Dichloropropene	98.73	2000
W-14-06	1,1,2,2-Tetrachloroethane	98.15	2000
W-10-07	1,1,1-Trichloroethane	99.45	2000
W-13-05	1,1,2-Trichloroethane	98.53	2000
W-04-04	Benzene	99.95	2000
W-406-05	Bromobenzene	99.98	1999
W-136-02	Bromochloromethane	99.84	2000
W-1104-05	sec-Butylbenzene	99.97	2000
W-06-10	Chlorobenzene	99.92	2000
W-152-03	4-Chlorotoluene	97.30	2000
W-1097-03	Dibromomethane	98.95	2000
W-23-04	1,2-Dichlorobenzene	99.30	2000
W-214-05	1,3-Dichlorobenzene	99.77	2000
W-25-07	1,4-Dichlorobenzene	99.85	2000
W-1167-06	2,2-Dichloropropane	99.91	2003
W-36-05	Ethylbenzene	99.81	2000
W-669-03	1-Methyl ethyl benzene	99.97	2000
W-83-06	Tetrachloroethene	99.79	2000
W-84-04	Toluene	99.87	2000
W-175-03	1,2,3-Trichlorobenzene	99.80	2000
W-07-03	1,2,4-Trichlorobenzene	99.75	2000
W-85-04	Trichloroethene	98.62	2000
W-201-03	o-Xylene	99.36	2000
W-50-05	Hexachlorobutadiene	98.22	2000
W-53-04	Naphthalene	99.76	2000
W-150-02	2-Chlorotoluene	99.47	2000
W-171-04	1,2-Dibromoethane	99.90	2000
W-173-13	cis-1,2-Dichloroethene	96.49	2000
W-202-05	m-Xylene	99.82	2000
W-257-03	Styrene	99.93	2000
W-368-05	1,2,3-Trichloropropane	99.60	2000
W-1107-04	1,2,4-Trimethylbenzene	98.40	2000

NSI

Attachment 2
8260 N SI MegaMix

Certificate of Analysis

NSI Solutions, Inc. * 7212 ACC Blvd. * Raleigh, NC 27617 * 1-800-234-7837

COMPOUND NUMBER	ANALYTE	PURITY (%)	GRAVIMETRIC CONCENTRATION (ug/mL)
W-1105-04	n-Butylbenzene	99.96	2000
W-1106-02	tert-Butylbenzene	99.41	2000
W-993-10	1,2-Dibromo-3-chloropropane	99.22	2000
W-1109-02	1,3-Dichloropropane	99.89	2001
W-1166-04	1,1-Dichloropropene	96.76	2000
W-1108-03	4-Isopropyltoluene	99.16	2000
W-1112-04	n-Propylbenzene	99.72	2000
W-335-04	1,1,1,2-Tetrachloroethane	98.94	2000
W-1103-02	1,3,5-Trimethylbenzene	98.85	2000
W-203-06	p-Xylene	99.82	2000
W-473-04	Acetonitrile	99.86	2001
W-03-08	Acrylonitrile	99.97	2006
W-476-05	Allyl chloride	99.01	2001
W-363-06	Carbon disulfide	99.88	1993
W-1110-01	2-Chloroethanol	99.45	2008
W-827-02	cis-1,4-Dichloro-2-butene	94.14	2002
W-831-06	trans-1,4-Dichloro-2-butene	97.06	1998
W-285-03	Diethyl ether	99.96	2001
W-480-04	1,4-Dioxane	99.95	2004
W-687-03	Ethyl methacrylate	99.30	2000
W-253-04	Iodomethane	99.57	1997
W-659-07	Isobutyl alcohol	99.97	2004
W-686-02	Methacrylonitrile	99.95	1999
W-439-03	Methyl methacrylate	99.96	2000
W-54-04	Nitrobenzene	99.92	1997
W-1313-01	2-Nitropropane	96.89	1998
W-338-02	Propionitrile	99.14	2000
W-685-02	Tetrahydrofuran	99.95	2000
W-493-02	1,1,2-Trichlorotrifluoroethane	99.81	1990
W-1246-02	Di isopropyl ether	99.84	1999
W-528-02	Methyl acrylate	99.94	2001
W-901-02	Cyclohexane	99.97	2008
W-1305-02	Methyl cyclohexane	99.97	2008
W-1429-02	Methyl acetate	99.88	2001

PREPARATION: Reported concentration value has been corrected for purity. Concentration is calculated from wt/vol or vol/vol measurements using microbalances calibrated with NIST traceable weights and/or ASTM Class A volumetric glassware or calibrated equivalent labware.

STORAGE & HANDLING: Store at ≤ -18° C. Allow to equilibrate to room temperature before use.

Kristi Bright

Kristi Bright, Organic Chemist

Environmental
Laboratories Corporation

111 Herrick Street, Merrimack, NH 03054
TEL: (603) 424-2022 • FAX: (603) 429-8496
www.amrolabs.com

Determination of Trace Metals using Perkin Elmer AAnalyst 600 Graphite Furnace Atomic Absorption Spectroscopy
Method EPA 200.9 and SW-846 7000 Series

Procedure Number: IL-3065

Revision No.: 1

Revision Date: 03/09/2010

Review Date: N/A

Prepared By: _____ Date: 03/11/10

Approved By: _____ Date: 03/11/10
Inorganic Manager

Approved By: _____ Date: 03/10/10
Laboratory Director

Approved By: _____ Date: 03/10/10
Quality Assurance Manager

Property of AMRO Environmental Laboratories Corporation

TABLE OF CONTENTS

		Page
1.0	SCOPE AND APPLICATION	3
2.0	METHOD SUMMARY	3
3.0	DEFINITIONS	4
4.0	SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE	5
5.0	POTENTIAL PROBLEMS AND INTERFERENCES	6
6.0	HEALTH AND SAFETY	8
7.0	INSTRUMENTS AND EQUIPMENT	8
8.0	REAGENTS AND STANDARDS	9
9.0	PROCEDURE	12
10.0	INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR	21
11.0	CALCULATIONS	24
12.0	QUALITY CONTROL	25
13.0	DATA REVIEW AND STORAGE	28
14.0	REFERENCES	30
	Attachment 1 Calibration and QC Standards	31
	Attachment 2 GFAA and CVAA Data Review Checklist	32
	Attachment 3 Qualification Card for Methods EPA 200.9/SW-846 7000 Series	33

1.0 SCOPE and APPLICATION

1.1 The Perkin Elmer AAnalyst 600 is used to determine metals in aqueous, soil, solid sludge, air and wipe sample matrices. The methods listed in section 1.3 are applicable to metals in drinking, surface, and saline waters and domestic and industrial wastes.

1.2 The samples must undergo a digestion procedure in order to dissolve the metals of interest from the matrix. The digestion procedures used are dependent on what metals are being identified. Applicable metals digestion procedures for Methods listed in section 1.3 are listed below:

Water Digestion Methods:	**Soil Digestion Methods:**
SW-846 Method 3010A	SW-846 Method 3050B
EPA 200.2 & 200.9	SW-846 Method 3051

1.3 Applicable analysis methods are listed below:

1.3.1 Arsenic (As), 7060A, Antimony (Sb) 7041, Cadmium (Cd) 7131A, Lead (Pb) 7421, Selenium (Se) 7740, Thallium 7841 (Tl), Silver (Ag) 7761.

1.3.2 200.9 for Arsenic (As), Antimony (Sb), Cadmium (Cd), Lead (Pb), Selenium (Se), Thallium (Tl), Silver (Ag).

2.0 METHOD SUMMARY

2.1 Samples are digested by an appropriate method (See Preparation SOPs). The digestates are poured into 1.1mL autosampler cups and placed into an autosampler tray. The sample ID's are recorded in a sample information file in the Perkin Elmer software. By software command, the autosampler will pipet 20uL (or any specified volume) of sample along with 5 uL of matrix modifier onto a graphite platform that has been inserted into a graphite tube. The sample is put through a multistep furnace program consisting of drying, charring, and atomizing. During atomization, the absorption of an appropriate wavelength of light is measured and corrected for background absorption using a Zeeman background correction method and Stabilized temperature Platform Furnace technology.

2.2 Modifications:

2.2.1 The matrix modifiers used are palladium and magnesium nitrate.

2.2.2 Dissolved metals do not require digestion but AMRO digests them to allow matrix matching between the samples and the instrument standards.

2.2.3 Hydrochloric acid (HCl) is used to facilitate the sample preparation for both GFAA and ICP analyses. To over come the use of HCl in the preparation the following action are taken:

2.2.3.1 Modifier of palladium magnesium nitrate.
2.2.3.2 Hydrogen (5%)- argon (95%) gas mixture.

2.2.4 For DOD projects, the ICB, CCB, and Method Blank values **must** be <1/2 RL.

3.0 DEFINITIONS

3.1 Reporting Limit Standard (RL/CRA): The lowest level standard is incorporated in the calibration curve as a calibration standard.

3.2 Preparation Sheet: The hardcopy of the preparation sheet prepared at the time of digestion to convey amounts used and dilutions made to samples.

3.3 Preparation Batch: The set of 20 samples or less prepared on the same day.

3.4 Method Blank (MB): A DI water sample carried through the entire analytical procedure.

3.5 Laboratory Fortified Blank (LCS): A DI water sample spiked with a known amount of analyte and then carried through the entire analytical procedure. The analyte recovery must be within 85-115% of the true value for 200.9 and 80-120% for 7000.

3.6 Laboratory Fortified Blank (LCSD): A DI water sample spiked with a known amount of analyte and then carried through the entire analytical procedure. The analyte recovery must be within 80-120% for 7000.

3.7 Matrix Spike (MS & MSD): Routine samples spiked with a known amount of analyte and then carried through the entire analytical procedure. The analyte recovery must be within 70-130% of the true value for 200.9 and 75-125% for 7000 series or a matrix effect suspected. The difference between the MS and the MSD should be <20%.

3.8 Sample Duplicate: A separate aliquot of sample carried through the entire analytical procedure. The difference between the Sample and Duplicate should be less than 20%

3.9 Method Detection Limit (MDL): The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater then zero. It is determined by analyzing seven replicates of a low-level standard that is 2-3 times the IDL and has been carried through the entire analytical procedure. The standard deviation is then multiplied by 3.143 (the student T test value for seven replicates) to obtain the MDL. For eight replicates, the Student T test value is 2.996.

3.10 Instrument Detection Limit (IDL): The IDL is calculated by analyzing seven or eight replicates of UNDIGESTED low level standard (2 – 3 times the estimated IDL) and calculating the standard deviation. The standard deviation is then multiplied by 3.143 (the student T test value for seven replicates) to obtain the IDL. For eight replicates, the Student T test value is 2.996.

3.11 Reporting Limit Standard (CRA/RL): A low level standard used to verify linearity near the detection limit. The concentration is generally 2 to 5 times the MDL.

3.12 Post Digestion Spike (PDS): A spike added to a sample after digestion to evaluate its matrix. A recovery of 85-115% indicates no matrix interference.

3.13 Matrix Modifier: A combination of elements added to the furnace along with the sample in order to minimize matrix effects. AMRO uses Palladium and Magnesium Nitrate for all elements in combination with a gas mixture of 95% Argon and 5% Hydrogen.

3.14 Instrument Stability Demonstration: Precision study prior to calibration with an RSD < 5% - 5 reps for 200.9 and 3 reps for 7000.

4.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

4.1 Aqueous Samples:

Prior to sample collection, consideration should be given to the type of data required (i.e. dissolved or total recoverable), so that appropriate preservation and pretreatment steps can be taken. The pH of all aqueous samples must be tested upon receipt at the Laboratory to ensure the sample has been properly preserved. If properly acid preserved, the sample can be held up to 6 months before analysis.

4.1.1 Dissolved elements:

For the determination of dissolved elements, the sample must be filtered through a 0.45μm pore diameter membrane filter at the time of collection or as soon thereafter as practically possible. Acidify the filtrate with (1+1) nitric acid immediately following filtration to pH <2.

4.1.2 Total elements:

For the determination of total recoverable elements in aqueous samples, samples are not filtered, but acidified with (1+1) nitric acid to pH < 2. Preservation is done at the time of collection.

4.2 Solid Samples:

Digestion is required for all soil, sediment, sludge samples. Solid samples usually require no preservation prior to analysis other than storage at 4°C. The sample can be held up to 6 months before analysis.

5.0 POTENTIAL PROBLEMS AND INTERFERENCES

5.1 Interferences during preparation:

5.1.1 Organic materials present in samples must be oxidized by an acid digestion prior to analysis.

5.1.2 Contamination of sample can be a major source of error. Sample preparation work areas should be scrupulously clean. Method blanks are used as indication of contamination. Calibration blanks are used to auto zero the instrument before calibration. These absorbances should be monitored. Too high a calibration blank will lower the absorbance on calibration standards.

5.2 Interferences during analysis:

5.2.1 Spectral interferences

5.2.1.1 These interferences occur when light is absorbed at the same wavelength as the element of interest by an element, molecule, or compound that is not the element of interest.

5.2.1.2 Molecular- Gases generated in the furnace during atomization may have molecular absorption bands encompassing the analytical wavelength, which can

cause interference. Background correction or using an alternate wavelength outside the absorption band can help eliminate the interference. Also a background correction using the Zeeman effect where the atomic

spectral line is split in a magnetic field. The atomic signal is affected by the magnetic field, whereas the background molecular absorbance is not.

5.2.1.3 Atomic- This occurs when an absorbing wavelength of an element present in the sample but not being determined falls within the width of the absorption line of the element of interest. The result can cause erroneously high concentration, due to the contributing interfering element.

5.2.1.3.1 Also interference can occur when resonant energy from an element in a multi-element lamp or a metal impurity in the lamp cathode falls within the band pass of the slit setting and that metal is present in the sample. Electrodeless discharge lamps can also prevent these types of interferences.

5.2.2 Non-spectral interferences

5.2.2.1 These interferences are caused by elements or compounds which enhance or suppress the formation of "free analyte atoms" during the atomization step. Examples are chloride, sulfide, sulfate, phosphate, magnesium, nickel, and many elemental oxides. For the most part these interferences are reduced or eliminated by using matrix modifiers in conjunction with end cap graphite tubes with platforms. The effectiveness of these modifiers is evaluated for every prep batch by performing analytical spikes. In the instance where the modifiers are unsuccessful, the method of standard additions is employed to compensate for the specific interference.

5.2.2.2 The pyrolytically-coated graphite tubes need to be high temperature conditioned to remove impurities. The conditioning process will also enhance the life of the tube.

5.2.2.3 Smoke-producing matrices- The interferences from these types of matrices can be reduced by extending the charring time.

5.2.2.4 Ionization interferences have not been reported with furnace techniques.

6.0 HEALTH AND SAFETY

6.1 AMRO places a high value on lab safety. The air quality of the laboratory has been monitored. Fire extinguishers are located in various areas of the lab. A lab evacuation plan is posted in every room, with a designated meeting place.

6.2 All new analysts receive training on the safe handling of samples, standards, the changing of gas cylinders, and the operation of instruments. In the lab, clean lab coats and gloves are worn when working with samples. All standards are made up in hoods or an appropriately clean Lab bench. When gas tanks are replaced, the carrier with chain is used properly, and all gas tanks are chained in place. Soap is used to check for any leaks.

6.3 Care is taken with glassware and syringes to prevent injury. Broken glass and syringes are promptly removed to broken glass containers. First aid kits are available throughout the lab. There are also eye-wash stations and an emergency shower.

6.4 MSDS's are reviewed for each chemical used to ensure proper precautions are observed when handling chemicals.

6.5 Pollution prevention – The use of chemical exhaust hood are required when working with chemicals. They are specifically designed to minimize analyst exposure. The hood exhaust is monitored periodically to ensure environmental exposure is minimized.

7.0 INSTRUMENTS AND EQUIPMENT

7.1 Perkin Elmer AAnalyst 600

7.1.1 Lamps:

7.1.1.1 As EDL (Perkin-Elmer cat. No. N305-0605)
7.1.1.2 Se EDL (Perkin-Elmer cat No. N305-0672)
7.1.1.3 Sb Hollow Cathode Lamp cat No. N0305-0170
7.1.1.4 Pb Hollow Cathode Lamp cat No. N066-1299
7.1.1.5 Tl Hollow Cathode Lamp cat No. N305-0183
7.1.1.6 Ag Hollow Cathode Lamp cat No. N305-0102

7.1.1.7 Cd Hollow Cathode Lamp cat No. N305-0115

7.2 AS-800 Autosampler for model AAnalyst 600

7.3 Perkin Elmer cooling system for AAnalyst 600

7.4 Computer – Lenovo with MS Windows XP Professional with Service Pack 3.

7.5 Perkin Elmer software AA using Winlab 32 version 6.5 for AAnalyst 600

7.6 PCI-GPIB (MINIMITE] IEEE interface card (ordered through National Instruments).

7.7 Brother Laser HL-5240 printer for AAnalyst 600.

7.8 THGA graphite tubes end cap type Perkin Elmer P/N 8300-0655 box of 20

7.9 Box of 5 set THGA contact rings Perkin Elmer P/N 8050-4036

7.10 Compressed Argon gas, ultra high purity

7.11 Compressed gas 95.0% argon and 5.0% hydrogen, ultra high purity

7.12 2.0mL disposable sample cups from Perkin Elmer B0119079 qty: 1000 cups

7.13 1.1mL disposable sample cups from Perkin Elmer B0510397 qty: 2000/bag

7.14 7.0 L disposable sample cups from Perkin Elmer B3001567 qty: 100/bag.

7.15 American Power Conversion battery pack power Back Ups 650 for computer.

8.0 REAGENTS AND STANDARDS

8.1 Deionized Water (DI), ASTM Type I. or purchased distilled water.

8.2 Diluent – DI water acidified with HCL and HNO3, 2% solution of each.

8.3 Magnesium nitrate solution (10000mg/L; Perkin Elmer cat No. 8019-0634).

8.4 Palladium stock solution (10000 mg/L; Perkin Elmer cat No. 8019-0635).

8.5 Modifier preparation:
To a 200mL volumetric flask containing approximately 50mL of DI water, add 100mL of concentrated nitric acid and swirl flask. Pipet 2.0mL of stock Palladium solution into flask and 1.2mL of stock magnesium nitrate solution. Add DI water to bring volume to the 200mL mark.

8.9 Super stock standard solutions are purchased annually from Inorganic Ventures or another approved supplier:

8.9.1 Custom multi-element solution AMRO CAL/CCV1 see certificate of analysis included in Graphite Furnace Standard Log.

8.9.2 Custom multi-element solution AMRO CAL/CCV2 see certificate of analysis included in Graphite Furnace Standard Log.

8.10 Independent standard from AccuStandard Inc., or other approved supplier.

8.10.1 Multi-element Plasma Emission (ICP) Standard Item Number QCS-01-1-5 see certificate of analysis included in Graphite Furnace Standard Log.
An equivalent standard, but different standard Item Number from AccuStandard may also be used.

8.10.2 Multi-element Plasma Emission (ICP) Standard Item Number: QCS-02-1-5 see certificate of analysis included in Graphite Furnace Standard Log.
An equivalent standard, but different standard Item Number from AccuStandard may also be used.

8.11 Working Stocks- Working stocks (for calibration standards) are prepared from super stocks in 10% hydrochloric acid (HCl) and 2.0% nitric acid (HNO3) solution. For preparation detail please refer to Graphite Furnace Standard Log. New standards are always evaluated against old standards. The new standards should agree within 10% of the old standards. These stocks are prepared monthly. Working stocks for the independent standard is prepared in 2% HCl and 2% HNO3 from super stocks.

8.12 Daily calibration standards- These standards are prepared from the working stock solutions. Standards are prepared weekly. Refer to Attachment 1. For DoD projects all standards are prepared daily.

8.13 ICV solutions- Independent calibration verification standards. The stock solutions are prepared monthly and daily solutions are prepared weekly. Refer to Attachment 1. For DoD projects all standards are prepared daily.

8.14 CCV solutions- Continuing calibration verification solutions. These solutions are the middle point calibration standard. Refer to Attachment 1. For DOD projects all standards are prepared daily.

8.15 RL solutions- These solutions are the reporting limit solutions used as the lower limit standard in the calibration curve. For preparation please refer to Attachment 1.

8.16 Calibration Blanks - These solutions are 2.0% HCl and 2.0% nitric acid solutions. These solutions are also used as diluent solutions in diluting and in standard preparation.

8.17 Tracking of Analytical Standards

It is important to be able to track all analytical reagents and standards back to their sources. The following procedure is used by AMRO Inorganic personnel to accomplish this:

8.17.1 Chemical Receiving Log: The receipt of all standards and reagents from commercial sources is documented in the Chemical Receiving Log. The date received, AMRO ID, chemical name, source, lot number, quantity, storage location, and expiration date are recorded. The AMRO ID is written as an A followed by a 4 digit number (example A0001). Refer to the Graphite Furnace Standard Logbook for standard concentration information.

8.17.2 Graphite Furnace Standard Log: Working standards and LCS solutions made from stock standards listed in the Chemical Receiving Log are documented in the Graphite Furnace Standard Log. The corresponding analysis, preparation date, standard name, AMRO ID, amount used, final volume, final concentration, Standard ID, expiration date, storage location and analyst initials are recorded. The Standard ID is written as an S followed by 1, 2, 3, 4, and 5 then month, day, and year

(example S#MMDDYY). The # refers to the standard number that has been assigned by arbitration.

8.17.2.1 The LCS/MS/MSD spikes/stock solution is referred to as FSPKkMMDDYY which indicates furnace spike month, day and year of preparation.

8.18 Standard Storage: Standards and reagents are stored per method specifications and manufacturer's instructions. Metals standards are stored in a dark, cool area of the lab in a labeled box.

9.0 PROCEDURE

9.1 All calibrations are linear.

9.1.1 Lead and Thallium are calibrated at 2, 5, 10, 25 and 37.5µg/L
9.1.2 Arsenic, Selenium and Antimony are calibrated at 5, 10, 25, 50 and 75 µg/L
9.1.3 Silver is calibrated at 0.4, 1.0, 2.0, 5.0, 10 and 20.0 µg/L
9.1.4 Cadmium is calibrated at 1.0, 2.5, 4.99, 12.5, 24.9 µg/L
9.1.5 Calibration solutions are poured into autosampler cups at least once a day. The standard positions are noted in the method file for each element located in the method editor window of AA WinLab software.

9.2 Instrument Parameters forAAnalyst 600:

	AS	PB	SE	CD	TL	AG	SB
Wavelength (nm)	193.7	283.3	196.0	228.8	276.8	328.1	217.6
Slit Width	0.70	0.70	2.0	0.70	0.70	0.70	0.70
Timing (Sec)							
Read Time	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Read delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BOC Time	2.0	2.0	2.0	2.0	2.0	2.0	2.0

Furnace program: **Thallium**

STEP NO.	TEMP. (°C)	RAMP	HOLD	INTERNAL FLOW	GAS TYPE	READ
1	110	20	20	250	Spl	-
2	140	10	30	250	Spl	-
3	700	10	20	250	Spl	-
4	400	1	5	250	Norm	-
5	1600	0	5	0	Norm	Yes
6	2400	1	3	250	Norm	-

Furnace program: **Selenium**

STEP NO.	TEMP. (°C)	RAMP	HOLD	INTERNAL FLOW	GAS TYPE	READ
1	110	10	20	250	Spl	-
2	140	10	30	250	Spl	-
3	1150	10	20	250	Spl	-
4	800	1	15	250	Norm	-
5	1900	0	5	0	Norm	Yes
6	2400	1	3	250	Norm	-

Furnace program: **Silver**

STEP NO.	TEMP. (°C)	RAMP	HOLD	INTERNAL FLOW	GAS TYPE	READ
1	110	10	20	250	Spl	-
2	140	10	30	250	Spl	-
3	800	10	20	250	Spl	-
4	600	1	5	250	Norm	-
5	1700	0	4	0	Norm	Yes
6	2400	1	3	250	Norm	-

Furnace program: **Cadmium**

STEP NO.	TEMP. (°C)	RAMP	HOLD	INTERNAL FLOW	GAS TYPE	READ
1	110	10	20	250	Spl	-
2	140	10	30	250	Spl	-
3	500	10	20	250	Spl	-
4	300	1	5	250	Norm	-
5	1400	0	4	0	Norm	Yes
6	2400	1	3	250	Norm	-

Furnace program: **Lead**

STEP NO.	TEMP. (°C)	RAMP	HOLD	INTERNAL FLOW	GAS TYPE	READ
1	110	10	20	250	Spl	-
2	140	10	30	250	Spl	-
3	1000	10	20	250	Spl	-
4	800	1	5	250	Norm	-
5	1900	0	5	0	Norm	Yes
6	2400	1	3	250	Norm	-

Furnace program: **Arsenic**

STEP NO.	TEMP. (°C)	RAMP	HOLD	INTERNAL FLOW	GAS TYPE	READ
1	110	10	20	250	Spl	-
2	140	10	30	250	Spl	-
3	1200	10	20	250	Spl	-
4	800	1	5	250	Norm	-
5	2000	0	5	0	Norm	Yes
6	2400	1	3	250	Norm	-

Furnace program: **Antimony**

STEP NO.	TEMP. (°C)	RAMP	HOLD	INTERNAL FLOW	GAS TYPE	READ
1	110	10	20	250	Spl	-
2	140	10	30	250	Spl	-
3	1200	10	20	250	Spl	-
4	800	1	5	250	Norm	-
5	1900	0	5	0	Norm	Yes
6	2400	1	3	250	Norm	-

9.3 Method editor/ checks window:

Calibration:
Recalibrate instrument periodically - no
Analyze standards at end of run -no
Analysis:
Check precision -yes
Check precision on samples, calibration standards, recovery samples, and QC samples.
Limits: precision check signal – peak area
Signal limit – 0.005 A-s
If signal >limit and RSD > 20% then reanalyze 1 time.
If background > 1 au then reanalyze 1 time.
Reanalyze samples beyond calibration range – yes
Over cal limit is 90% of calibration range
Check range on samples dilute and reanalyze after all replicates
Alternate sample vols (µl): 10 and 5.
For cadmium – alternate sample vols (µl): 2 and 1.
For silver-alternate sample vols (µl): 5 and 2.
Perform matrix check calculation: No
Perform recovery measurements: Yes
Concentration units: calibration µg/l
For most elements, the expected Post Spike concentration increase is 25µg/l
Recovery limits: lower –85% upper – 115%

9.10 MSA files:

9.10.1 If the MSA (Method of Standard Addition} is needed, two procedures are followed: *One point* MSA is acceptable in most cases. The one point MSA is achieved by formula correcting the solution concentration for the percent recovery of the analytical spike recovery. The corrected solution concentration would be equal to the uncorrected solution concentration divided by percent recovery in the analytical spike of the sample expressed as a fraction. For all DOD/ projects and for special projects, or sometimes at the choice of the analyst a *Three points* MSA is performed. A correlation coefficient of equal to or greater than 0.995 is needed.

9.10.2 The method of standard additions is an indirect technique and is never as accurate as the direct determination of concentration from a calibration curve. It is always preferable to avoid MSA's by attempting to remove interferences;
The absorbance of samples and spiked additions are plotted on x and y axes, respectively. The absolute value of the x-intercept is the MSA-corrected concentration.
There are two assumptions that must be true for accurate results for MSA's.
The calibration curve must be linear up to the concentration of the sample plus the concentrated addition and the matrix must have the same effect on the added analyte as it has on the naturally – occurring analyte.
For the purposes of this SOP, the three point MSA is conducted by manual spiking of the sample at approximately 50%, 100%, and 150% of the sample concentrated.

If the correlation coefficient is less than 0.995, reanalyze and choose the analysis with the highest correlation coefficient.

9.11 Furnace Optimization/Method development

9.11.1 Generally select the default conditions for the method as a starting point. Then optimize the drying conditions by running a blank and

checking for drying by placing a mirror over the injection port {with the fume extractor off} and observe for moisture as an indicator of drying completeness. For the purposes of this SOP the fume extractor is not used in any of the methods run. Hot injection is used, injecting at approximately 110°C with a two step dry program at 110°C and 140°C. The drying temperature should be as high as possible without boiling or spattering.

9.11.2 Optimizing for the char step is done by varying the char temperatures by 50°C either up or down from the default condition and choosing the temperature that gives the highest absorbances and sharpest peaks.

9.11.3 The char ramp time should use one second for each 100°C change in going from the dry to the char step. With the use of the alternate gas a second char step is included with only a 1s ramp time. In that step the alternate gas is shut off to purge with pure argon gas.

9.11.4 Optimizing for the atomization step is similar to optimizing for the char step. The default temperature is the starting point. Vary the temperature by 50°C either up or down from the default temperature and choose the temperature with the highest absorbances and sharpest peaks.

9.11.5 A final burn out step is included to clean the tube after each burn. This burn out temperature is at 2400°C ramp 1s and hold for 3 s.
Generally in an analysis if the peaks are trailing not giving a sharp peak, or returning to the base line an increase of 50°C in the atomization temperature will correct the problem.

9.12 Reformat

9.12.1 The data will automatically be exported at the end of the run to C:\Bob's AA RESULTS as a text file (Ammddyy.txt). Open the file in Excel and make sure the test codes and sample ID's are correct and all columns are complete. Save the file in: LIMS IMPORT ON PLUTO (N)\OPTIMA3\METALS\AA 600. Save as an Excel file. Import the file into LIMS.

9.12.2 Then at the GFAA computer, go to UTILITIES and DATA MANAGER. MAKE SURE THE DATES FOR THE STANDARDS, THE ICV, AND THE MOCIFIER are correct. Highlight a file and select REPORT titled AANALYST 600 REPORT.rep. Make sure the correct element and all the samples are selected and print the report and include it with the raw data. If there is more than one element in a data file, select each (one at a time) and print.

9.12 Sample Analysis:

9.15.1 Turn on the power to the instrument. The argon and argon-hydrogen for the alternate gas may be left on to deliver gas at 50psi. The instrument has internal valves that shut the gas off when the instrument is not in use. The instrument may be left on at all times also.

9.15.2 After the AAnalyst 600 has been on for **One Minute**, start the Winlab software.

9.15.2 The water cooler is activated by the instrument.

9.15.4 Arrange samples to be analyzed as follows:

Sequence	Cup No.	Sample id	Comment
1	148	S0	Calibration blank
2-7	1 - 6	S1, S2, S3, S4, S5, S6	Calibration Standards (r2>=0.995)
8	121/129	IPC (Applicable to 200 series only.)	Instrument performance check for 200.9 method (±5%)
9	124/131	ICV	Initial calibration verification (±10%)
10	148	ICBMMDDYY	Instrument controlled at ±RL.
11	½	RL1/RL2	Instrument controlled at ±30%
12	10	BW, BSMMDDYY	Method Blank (±RL)
13	11/12	LW, LSMMDDYY	Laboratory control sample (±20% SW-846 Methods, ±15% 200.9 Methods)
14	13	Xxxxxxxxxxxxxxxxxxxxx	Batch QC sample
15	13	Xxxxxxxxxxxxxxxxxxxxx	Analytical spike of sample (±15%). All samples are spiked except MCP
16	14	XxxxxxxxxxxxxxxxxD	Sample duplicate (<20% RPD).
17	15	XxxxxxxxxxxxxxxxxS	Matrix spike of sample (±25% SW-846 Methods, 70 – 130% 200.9 Method).
18	16	XxxxxxxxxxxxxxxxxxSD	Matrix spike duplicate (See above, <20%RPD between recoveries).
19-22	17-20	Xxxxxxxxxxxxxxxxxxxx	4 samples
23	121/129	CCVMMDDYY	Continuing Calibration Verification (±10%).
24	148	CCBMMDDYY	Instrument controlled at ±RL.
25-34	21-30	Xxxxxxxxxxxxxxxxxxx	10 sample + analytical spikes
35	121/129	CCV	Continuing Calibration Verification (±10%).
36	148	CCB	Instrument controlled at ±RL.

Note: 1. For ICB and CCB, when the blank values are greater than ±RL limits and sample concentrations are over 10X the blank value, the sample data is acceptable. If sample concentrations are over the RL and less than 10X the blank value the samples require re-analysis.

2. All DOD projects: ICB, CCB and Method Blank values must be <1/2RL.

9.15.5 More samples can be added to tray. Sample tray has 148 positions. The first six positions are standards and instrument QC. Position 121 is for IPC/CCV at 25 ug/L. Position 124 is a 25 u/L ICV. Position 129 is an IPC/CCV at 50 ug/L and position 131 is for a 50 ug/L ICV. Position 126 is for the matrix modifier. Position 134 is the stock (100 ug/L) solution for post digestion spikes. Position 148 is for the calibration blank and CCB.

9.15.5.1 Start with the blanks and LCS's from all batches added to the run.

9.15.5.2 Proceed following the order in which the samples appear on the prep sheet.

9.15.5.3 Mark on the prep sheet the numbers of the autosampler positions in which each sample will go. Generally this will be position number seven to start.

9.15.5.4 Pour samples into autosampler cups and load into the appropriate position.

9.15.8 Pour all the samples into the 1.1mL sample cups. Place the samples into the autosampler tray as outlined by the autosampler positions marked on the prep sheet. The standards will be poured into the1.1 mL sample cups and placed in the auto sampler tray as outlined in the method for the elements to be run.

9.15.9 The matrix modifiers are poured in the larger 2mL or 7mL cups as appropriate. Sometimes the 2mL cups are OK to use.

9.15.11 From the AAWinLab main window click on the box labeled method. Select the method to be run. Click on OK. The computer screen will return to the main window of AA WinLab. The method name selected will be shown in the upper right hand corner of the window on the right side of the box named method. Click on the box for method editor. The method editor window will be opened for the method selected. Click on the on bottom tab for calibration. The calibration window will be opened. Click on the bottom tab for Checks. The check window will be opened. Click on set for perform recovery measurements. The recovery measurement window will be opened. Click on the side tab frequency. The frequency window will be opened. In the box for

samples in AS locations fill in the autosampler locations for samples to be analytically spiked. Generally all samples are analytically spiked except the LCS, and the two matrix spike samples. Click on OK. The main checks window will be opened. Click on the bottom tab QC. The QC sample description window will be opened. If new QC samples have been made enter the new QC sample ID's . When everything is correct go to file and save. If multiple methods are being run go to file open method and click and select the methods to be run. Click on OK. Repeat procedure as with the first method and finally save. Repeat with any other methods to be run. Finally open up the method to be first run. Close the method editor window once the first method to be run as been selected. The main window for AA WinLab will be opened. Click on the top box for lamps. The align lamps window will be opened.

Note: Make sure that the proper lamps have been installed, and aligned. The lead lamp should always be lamp No.3. The lamp type is either HCL or EDL. It will show the current in mA. The wavelength and slit width is also shown. For arsenic and selenium {the two EDL lamps} make sure these two lamps have been turned on previously at least one half hour ahead before running these elements.

9.15.12 The main window of AAWinLab software will be opened. At the top of the window open up the window Automated analysis.

The Automated analysis window has a column for methods to be run. A column for delay in minutes between methods. An columns to use the entire sample info file, or to use autosampler locations as listed. Double click on method entry field to display methods dialog. Select the Sample Information file to be run. These entries are all under the automated analysis window setup. Once the methods to be run have been selected, and autosampler positions for each method have been entered. The sample information file to be run selected. Click on the bottom button Analyze. The automated analysis window /analysis progress window will be open. This window will show % of samples complete {run}, current status idle or replicate of 1 or 2 if running, autosampler location, and Id. The atomizer section will show step of, time and, temp. The autosampler controls block will show select location, flush sampler, and standby. Before doing analysis click on the flush sampler button to flush the autosampler tip.

9.15.13 The cooling water to furnace is activated once the furnace method has been started.

9.15.14 Check that the printer has enough paper for the analysis data.

9.15.15 Before the first analysis of the day, check the number of burns on the tube to see if it needs to be replaced. Then analyze five replicate analyses of a mid-range standard. The precision MUST be < 5 % to continue. Also use one of the data points to calculate the characteristic mass. The acceptable range for characteristic mass is ±20%.

9.15.16 If the precision check is OK, and the autosampler has been filled and checked, start the analysis by pressing the "Analyze All" button in the software.

9.16 Method of Standard Additions:

9.16.1 The method of standard additions (MSA) is an indirect technique and is never as accurate as the direct determination of concentration from a calibration curve.

9.16.2 The absorbances of samples and spiked additions is plotted on x and y axes, respectively. The absolute value of the x-intercept is the MSA-corrected concentration.

9.16.3 There are two assumptions that must be true for accurate results for MSA's:

9.16.3.1 The calibration curve must be linear up to the concentration of the sample plus the most concentrated addition.

9.16.3.2 The matrix must have the same effect on the added analyte as it has on the naturally-occurring analyte.

9.16.4 Unless specifically requested otherwise, a one point MSA is used for all SW-846-7000 series. DOD samples require 3 point MSA's if an MSA is needed. For one point MSA's and formula MSA-corrected solution concentration in µg/L= uncorrected solution concentration divided by percent recovery in the analytical spike of the sample expressed as a fraction.

10.0 INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR

10.1 Fill the wash reservoir with 2% mixture of Nitric and Hydrochloric acids and a few drops of Triton X-100 to prevent cross contamination on the autosampler tip.

10.2 A stock of replacement lamps should be on hand for all elements routinely used.

10.3 Do not leave EDL's lit longer than is necessary. However, care should be taken to avoid lighting them an excessive number of times.

10.4 The air filters at the rear of the instrument should be cleaned monthly in order to keep dust out of the electronics department. There is also a filter on the side of the instrument also. Clean the side filter when doing the back filter.

10.5 Be careful not to hit the IEEE cables on the rear of the instrument when cleaning the bench. This could cause communication problems.

10.6 Furnace maintenance to occur daily:

10.6.1 Change graphite tube when:

10.6.1.1.1 A portion of the tube visible from the introduction port is rough, or upon opening the furnace a bad deterioration of tube or badly burned tube is noted. Generally three to four hundred burns is max and tubes usually last about 700 burns.

10.6.1.2 To change a graphite tube or contact rings follow this procedure:
From the main window of AAWinLab click on the button at the top of screen labeled furnace. The furnace control window is opened click on the button on the bottom labeled open/close. This will open the furnace. For changing of the graphite tube. Remove the old tube. Before inserting the new tube clean the rings with 1% nitric acid using cotton tipped cleaning sticks that have no glue on them. Clean the sample port also with 1% nitric acid. This removes excess carbon build up on the rings. Reinsert a new tube and click on the open/close button on the screen. This will close the graphite furnace. On each end of the furnace there are quartz windows that are held by a rubber gasket in a holder screwed into the furnace. Remove the window holders on each side with the metal tool that is supplied.

Clean the quartz windows with methyl alcohol and lens paper. Reinsert the windows back on each end of the furnace. Tightened the holder with the metal tool . Make sure it is tight. In the furnace control window click on the standby button. This will raise the autosampler arm into up position. Clean the autosampler tip with methyl alcohol first and then 1% nitric acid by inserting the tip into the solution and wiping with Kimwipes. Check the alignment of the tip by lowering the auto sampler arm into the furnace tube. There is a mirror on an arm on the right side of the furnace. On the left side of the furnace the arm has a light blocker. These arms can be lowered to see the tip in the tube. The tip should go in the center of the sample port hole of the tube. Observe this by looking straight down on the sample port hole with a flash light. If touching one side or other realign the tip. On the front of the AS-800 there are two adjusting thumb screws on the auto sampler. The one on the front of the auto sampler adjusts the inward and outward of the auto sampler arm. The thumb screw on the left side of the auto sampler adjusts the movement to the left or right of the arm. There are two thumb screws on top of the auto sampler. The depth control knob on the right of the autosampler is used to adjust the depth of the tip in the sample cup. The depth in the tube should be adjusted to not quite touching the bottom of the tube. The dept in the cup should be not quite touching the bottom of the cup. Once the tip has been aligned in the tube and the cup.

To change the contact rings follow the procedure as outlined in the Users Guide for the THGA Graphite Furnace and AS-800 Autosampler.

Contact ring life is 3000 to 4000 cycles. Once a tube or contact rings have been changed the tube and contact rings need to be conditioned. In AAWinLab software a furnace program has been installed for furnace conditioning. To run the conditioning program of the furnace an analytical method must be opened that has a lamp installed for that method. Generally a lead method is ok. The lead lamp is always kept in the first position of the lamp turret. This is recommended by Perkin Elmer because of the wavelength of the lead line

is optimal for initialization of the instrument after shut down. From the furnace control window click on the button condition tube. This will start the conditioning program. Once the conditioning program has been run close the window for Furnace control. The main window of AAWinLab will be open. At the top of the window click on tools, diagnostics, and furnace, to reset the tube cycles to zero, and cylinder cycles to zero. Before resetting for both note the number of cycles for each in the furnace maintenance book.

10.7 When handling any of the graphite parts wear gloves to prevent skin oils from contaminating the graphite. **NOTE**: Fingerprints shorten tube's life.

11.0 CALCULATIONS

11.1 Instrument concentrations are in µg/L.

11.2 For water samples: The results are reported in µg/L. The sample concentration reported will be in µg/L units times the dilution factor.

11.3 For soil samples: Multiply the results in µg/L times the final volume of digestate in liters divided by the dry wt of sample in grams times the dilution factor to give results in mg/kg. In the sample info file if the sample weight has been entered in wet weight, and units entered in as mg/Kg the AAWinLab software will calculate the sample result in mg/Kg as wet weight. For sample results being reported in LIMS. The raw data being imported into LIMS is in calibration units of ug/L. The LIMS has the prep info entered separately such as weight and volume. The percent solids info is entered separately. The final sample result will be mg/Kg accounting also for dilution factor. To check this result for correctness take the sample result on the raw data in mg/Kg and divide by the percent solids and multiply times 100. This will account for the dry weight. Always multiply times the dilution factor.

11.4 Recovery measurements of Spikes: Recovery measurements are calculated by subtracting the unspiked sample concentration in standard concentration units (µg/L) from the spiked sample concentration in standard concentration units and dividing by the true value of the spike in µg/L. If the sample concentration was "undetected, then the recovery calculation is done with a value of Zero for the unspiked result.

11.5 Method of standard additions:

11.5.1 Unless specifically requested, a one-point MSA is used for all analyses. The MSA-corrected solution concentration equals the uncorrected solution concentration in µg/L divided by the percent recovery in the analytical spike of the sample expressed as a fraction.

11.5.2 The equation used for three point MSA's is A = K1 + (K2 C). The concentration is the x-intercept, where A = the difference between the Absorbance for the aliquot with added standard and the Absorbance measured for the sample, K1 = the coefficient on the untreated sample,

K2 = the coefficient on the sample that has been spiked. Both coefficients are determined by the least squares routine. The sample with no addition is treated as just another point by the least squares routine that determines the K1 and K2 coefficients. Quantitative measurements in atomic absorption are based on the Beer-Lambert Law, which states that concentration is proportional to Absorbance.

$$C = K\,A = K \text{ Log } \frac{Io}{I}$$

C = Concentration added to an aliquot of sample.
A = Absorbance
Io and I are incident and transmitted source intensities.
K is a proportionality constant.

11.5.3 All calculations for the batch QC are done on the raw data showing the LCS recovery, the matrix spike recovery, matrix spike duplicate recovery, % RPD between sample and sample duplicate concentrations.

12.0 QUALITY CONTROL

12.1 Instrument QC:

12.1.1 Calibration equation – Linear, zero intercept.

12.1.2 Control limits for calibration ≥ 0.995 correlation coefficient.

12.1.3 Frequency of calibration-Once in 24 hours or whenever switching elements, or whenever limits for instrument QC are not met.

12.1.4 Initial Calibration Verification (ICV): This standard is run initially after the calibration. The control limits are ± 10%. If out of control stop and recalibrate.

12.1.5 Initial Performance Check (IPC): This standard is run initially after the calibration for 200.9 methods. The control limits are ± 5%. If out of control stop and recalibrate.

12.1.6 Initial calibration blank (ICB)- This blank solution is analyzed initially after the ICV check. The control limit is ±RL. If out of control, stop and recalibrate. If the initial calibration blank value is > ±RL, this indicates biases in the analysis. Any sample that is 10X this value or greater is reportable. Any sample that is between the RL and <10X the value is not reportable. Any value that is <RL is reportable. A nonconformance summary report is required.

12.1.7 Reporting limit standard (RL/CRA)- This low level standard is run as the first or second standard in the calibration after the ICB check. The control limits are ±30%. If out of control the instrument will recalibrate..

12.1.8 Continuing Calibration Verification standard (CCV)- This is the midpoint standard in the calibration. This standard is run every 10 samples. The control limits are ±10%. If out of control, recalibrate. Rerun samples since last acceptable CCV.

12.1.9 Continuing Calibration blank (CCB)- This blank solution is analyzed after the CCV check standard. The instrument control limit is ±RL. Refer to Section 9.4 for guidance on what is acceptable to report if the CCB is out of control. If samples are between the RL and <10X the CCB value, recalibrate and rerun all samples from the last good CCV and CCB QC check that fall into this category.

12.1.10 Any sample will automatically be diluted if its concentration is greater than 90% of the highest standard. Also, samples with background absorbance >1.0 are automatically diluted.

12.2. Batch QC:

12.2.1 Preparation Blank (MB) - The control limits are **< RL**. If out of control, reanalyze the blank to confirm. If still out of control reprep any sample that has a concentration that is greater than the reporting limit but is less than 10 times the determined blank value. All other samples can be reported. Indicate the blank being out of control on the metals validation/ outlier report. Control limits for all DOD projects is **< ½ RL**.

12.2.2 Laboratory Control Sample (LCS/LCSD)- This is the blank spike sample. There should be one blank spike sample per twenty samples for 200.9 and two for SW-846 batches. The control limits are ±15% for 200.9 or ±20% for SW-846 samples. If out of control re-digest the entire batch is required.

12.2.3 Matrix Spike (MS) - This is the matrix spike sample. There is one matrix spike sample per twenty samples. The control limits are 75-125% for SW-846 and 70-130% for 200.9. If out of control, sample dilution can be performed if the sample concentration is high enough. Don't dilute below the reporting limit. If sample concentration is greater than four times the spike concentration, the sample spike recovery is not applicable. A comment on the metals validation/ outlier report is necessary when the MS recovery is outside the acceptance limits.

12.2.4 Matrix Spike Duplicate (MSD)- The matrix spike duplicate sample is run following the matrix spike sample. There is one matrix spike duplicate sample per twenty samples The control limits are the same as the matrix spike sample. If out of control follow the same procedure as for the matrix spike sample. The %RPD must be calculated between the two spiked sample concentrations to show sample heterogeneity. The %RPD limit between the MS and MSD is <20%.
In some cases, the client may specify which sample is to used for MS/MSD; if not, the laboratory shall pick a representative sample based on the following:

A. MS/MSD shall not be performed on Rinsate Blank or Field Blank.
B. Adequate sample weight/volume.
C. Client requested QC deliverables.

12.2.5 Sample duplicate (DUP): The control limit of 20% or less RPD for the sample results. If out of control, rerun samples to confirm. A greater than 20% result indicates sample heterogeneity. A comment on the metals validation/ outlier report should be filled out indicating sample heterogeneity. A duplicate is required every 20 samples.

12.2.6 Serial Dilution: Routine Serial Dilutions are not typically needed for the majority of drinking and waste water samples due to the limited working range of the furnace methods. However, all samples are given a post digestion spike (PDS). If the PDS fails, the sample is diluted (serial dilution) and the diluted sample is analyzed followed by a PDS on the dilution. By calculating the spike recovery on the

original sample and the diluted sample as well as the RPD between the original and diluted sample, the effect of the matrix can be evaluated and corrected. The criteria for the serial dilution is +/- 10%.

12.2.7 The control limits for spike recoveries are 85-115%. If out of control, sample interference may be indicated. This may be over come by either diluting the sample, if sample concentration permits it. If it is not possible to dilute, Method of Standard Additions can be done. A one point MSA calculation is acceptable. The sample in ppb is divided by the percent recovery of the analytical spike and multiplied by 100. This will give the corrected sample concentration in ppb. Since the instrument will automatically dilute and respike the sample, two PDS values plus the serial dilution will be available for matrix evaluation.

12.2.8 Duplicate injections (no post digestion spikes) or Sample + PDS must be performed on every sample in the batch.

13.0 DATA REVIEW AND STORAGE

13.1 Data Reduction:

13.1.1 Immediately after analysis of samples, the original data is reviewed. QC calculations are performed manually in the raw data. A metals validation/ outlier report is filled out. Any items whether instrument QC or batch QC that are out of control are noted in this outlier report. If samples are to be rerun or diluted these are noted in the outlier report.

13.1.2 Data that is bracketed by instrument QC which do not meet control limits need to be crossed out.

13.1.3 Dilute and reanalyze samples when the background peak height exceeds 2 AU's.

13.1.4 Dilute and reanalyze samples when the "uncorrected concentration" exceeds the concentration of the highest standard.

13.2 Transfer Data to LIMS and verify with raw data.

13.3 Data Review:

13.3.1 All related preparation information and observations will be noted in the digestion logbook.

13.3.2 All cross-outs must be a single line and should be initialed and dated. Analyst review is documented on the GFAA and CVAA Data Review Checklist (Attachment 2).

13.3.3 When an analysis of a sample is complete, the analysis for that sample should be checked and the data calculated as soon as possible to identify any problems while still within the holding time for the analysis. A copy of the Runlog which has been signed with analyst initials and dated needs to be put into a 3 ring notebook for Runlogs.

13.3.4 The Section Supervisor and/or Data Reviewer shall review all samples for a given project that have been analyzed and the results have been calculated, the project goes through the following data review procedure. The reviewer reads over all associated paperwork to become familiar with the requirements of the project. The project is checked for completeness. The Runlog is checked for accuracy. The data calculations are checked. The QC requirements are checked. Any Non-Conformance reports are included. Any problems encountered by the reviewer are brought to the attention of the lab manager.

14.0 REFERENCES

14.1 Test Methods for Evaluating Solid Waste, SW-846, Edition, Revision 2, USEPA, December 1996.

14.2 The THGA Graphite Furnace: Techniques and Recommended Conditions", by Perkin Elmer, Publication B3210.10, release 1.2.

14.3 Atomic Absorption Spectroscopy AA WinLab Software Guide", by Perkin Elmer Part No. 0993-6190, 1996.

14.4 AAnalyst 600 Simultaneous Mult-element Atomic Absorption Spectrometer Installation Maintenance System Description", by Perkin Elmer Publication B3119.10 release 1.1 / Feb. 95.

14.5 Department of Defense Qualtity Systems Manual for Environmental Laboratories, Revision 3, January 2006.

14.6 Massachusetts Contingency Plan (MCP), Revision 3, May 22, 2003.

14.7 Method 200.9, Determination of Trace Elements by Stabilized Temperature Graphite Furnace Atomic Absorption, Revision 2.2, May 1994.

Attachment 1
Attachment 1

AMRO SPECTROSCOPY STANDARDS FOR 2009/2010

14-Sep-09 | PE-4100ZL & PE-6000 SIMMA

Element	IV CAL/CCV-1 Stock ug/mL	IV CAL/CCV-2 Stock ug/mL	AMRO INTCAL Monthly ug/L 1.0->100mL	AMRO S5-mmddyy WEEKLY ug/L 2.0->100 4.76	AMRO S3-mmddyy WEEKLY ug/L 1.0->100 2.80	AMRO S2-mmddyy WEEKLY ug/L 0.50->100 1.78	AMRO S1-mmddyy WEEKLY ug/L 0.50->500 6	AMRO S1Low-mmddyy WEEKLY ug/L 0.20->500 71	AMRO S2Low-mmddyy WEEKLY ug/L 0.20->100 72, 79	AMRO SPK/LCS PER BATCH ug/L 0.25->50
As		499.9	4999	100.0	50.0	25.0	5.00	2.00	10.0	25.0
Pb		499.9	4999	100.0	50.0	25.0	5.00	2.00	10.0	25.0
Se		500.1	5001	100.0	50.0	25.0	5.00	2.00	10.0	25.0
Tl		499.9	4999	100.0	50.0	25.0	5.00	2.00	10.0	25.0
Cd		249.3	2493	49.9	24.9	12.5	2.49	1.00	4.99	12.5
Sb	500		5000	100.0	50.0	25.0	5.00	2.00	10.0	25.0
Ag		100.07	1000.7	20.0	10.0	5.00	1.00	0.400	2.00	5.00

INDEPENDENT

Element	VHG ICV QS-1 ug/mL	VHG ICV QS-2 ug/mL	AMRO INT-ICV MONTHLY ug/L 1->100mL	AMRO ICV-mmddyy WEEKLY ug/L 5->100mL 5	AMRO awICV-mmddyy WEEKLY ug/L 2.5->100mL 70	AMRO ICV-CdAg-mmddyy WEEKLY ug/L 2.5->500mL 75
As	100		1000	50.0	25.0	
Pb	100		1000	50.0	25.0	
Se	100		1000	50.0	25.0	
Tl	100		1000	50.0	25.0	
Cd	100		1000			5.00
Sb	100		1000	50.0	25.0	
Ag		50	500			2.50

Attachment 2

AMRO Environmental
Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

GFAA and CVAA DATA REVIEW CHECKLIST

LAB ORDER: _____ CLIENT: _____

Method:

Analysis:

A.	GENERAL			
1.	Copy of Digestion Log?	Y	N	NA
2.	Copy of Instrument Run Log?	Y	N	NA
3.	All samples met digestion and/or analysis holding time criteria?	Y	N	NA
4.	Initial Calibration meets method criteria for GFAA, min. 3 std plus a blank? R >0.995	Y	N	NA
5.	Initial Calibration meets method criteria for CVAA, min. 5 std plus a blank? R >0.995	Y	N	NA
6.	Initial Calibration Verification (ICV) meets method criteria: ±10%?	Y	N	NA
7.	Is the RL1 check QC at ±20%?	Y	N	NA
8.	Initial Calibration Blank (ICB) free of contamination?(<½RL)	Y	N	NA
9.	Initial Performance Calibration(IPC) meets criteria: ±5% ?	Y	N	NA
10.	Continuing Calibration Verification(CCV) meets method criteria: ±10% ?	Y	N	NA
11.	Continuing Calibration Blank(CCB) free of contamination?(<½RL)	Y	N	NA
12.	Are CCV and CCB analyzed after every 10 samples ?	Y	N	NA
13.	Was post digestion performed? If yes was %R=85-115?	Y	N	NA
14.	Was the serial dilution performed? If yes was %R= 90-110?	Y	N	NA
15.	Method Blank- contaminant free(<½RL)?	Y	N	NA
16.	Are all reported results within calibration range?	Y	N	NA
17.	LCS % Recovery criteria met for all compounds?	Y	N	NA
18.	MS/MSD %R's and %RPD's are met for all compounds?	Y	N	NA
19.	%RPD criteria met between sample and duplicate?	Y	N	NA

COMMENTS

Analyst (s) _____ DATE: _____

REVIEWER _____ DATE OF REVIEW: _____

qc/qcmemos/Forms/GFAACVAAchecklist Rev. 1 07/03/01

Attachment 3

AMRO Environmental
Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

QUALIFICATION CARD FOR SW-846 METHOD 7000 SERIES

Trainee: _____ Signature: _____

Trainer: _____ Signature: _____

I. Knowledge Factors:

SOP Title: _____ Revision Number/Date: _____

1. Did the Trainee read and understand the above SOP? Yes ☐ No ☐ NA ☐
2. Was the Trainee instructed on how to properly fill out the documentation? Yes ☐ No ☐ NA ☐
3. Has the Trainee been instructed on the proper procedures for addressing potential problems? Yes ☐ No ☐ NA ☐

II. Practical Factors:

1. Has the Trainee completed a Precision and Accuracy Study? Yes ☐ No ☐ NA ☐
2. Has the Trainee completed the maintenance schedule followed by a successful calibration? Yes ☐ No ☐ NA ☐
3. Has the Trainee demonstrated the ability to review and document Instrument QC and Batch QC problems? Yes ☐ No ☐ NA ☐

Completion Date: _____ Trainer's Signature: _____

I _____ have read, understood and follow the above method/SOP, which is in use at AMRO Laboratories for the analysis of samples under the National Environmental Laboratory Accreditation Program, have met the Demonstration of Capability.

Section Manager/ Supervisor: _____ Date: _____

QA Manager: _____ Date: _____

qc/qcmemos/forms/7000qualcard Rev. 0 09/00

AMRO Environmental Laboratories Corporation

111 Herrick Street, Merrimack, NH 03054
TEL: (603) 424-2022 • FAX: (603) 429-8496
www.amrolabs.com

Pensky-Martens Closed Cup Method for Determining Ignitability

SW-846 Method 1010

Procedure Number: IL-3045

Revision No.: 1

Revision Date: 08/25/2003

Review Date: 03/02/2010

Prepared By: Peter [signature] Date: 3/2/10

Approved By: Robert E. Brashart Date: 03/02/10
Inorganic Manager

Approved By: [signature] Date: 3/2/10
Laboratory Director

Approved By: Robert E. Brashart Date: 03/02/10
Quality Assurance Manager

Property of AMRO Environmental Laboratories Corporation

AMRO Environmental Laboratories Corporation

111 Herrick Street, Merrimack, NH 03054
TEL: (603) 424-2022 • FAX: (603) 429-8496
www.amrolabs.com

Pensky-Martens Closed Cup Method for Determining Ignitability

SW-846 Method 1010

Procedure Number: IL-3045

Revision No.: 1

Revision Date: 08/25/2003

Review Date: 03/10/2008

Prepared By: Paula Benham Date: 3/10/08

Approved By: Gowri Mahendraraja Date: 3/10/08
Inorganic Manager

Approved By: Maria W. Bordes Date: 3/10/08
Laboratory Director

Approved By: Paula Benham Date: 3/10/08
Quality Assurance Manager

Property of AMRO Environmental Laboratories Corporation

TABLE OF CONTENTS

		Page
1.0	SCOPE AND APPLICATION	3
2.0	METHOD SUMMARY	3
3.0	DEFINITIONS	3
4.0	SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE	4
5.0	POTENTIAL PROBLEMS AND INTERFERENCES	4
6.0	HEALTH AND SAFETY	4
7.0	INSTRUMENTS AND EQUIPMENT	5
8.0	INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR	5
9.0	REAGENTS AND STANDARDS	6
10.0	PROCEDURE	7
11.0	CALCULATIONS	9
12.0	QUALITY CONTROL	9
13.0	DATA REVIEW AND STORAGE	10
14.0	REFERENCES	11
	Attachment 1 Flash Point SW-846 Method 1010 worksheet	12
	Attachment 2 Wet Chemistry Data Review Checklist	13
	Attachment 3 Flash Point SW-846 Method 1010 Qualification Card	14

1.0 SCOPE and APPLICATION

1.1 Determination of flashpoint using a Pensky-Martens closed cup tester for soils or liquids.

2.0 METHOD SUMMARY

2.1 Flashpoint is determined by heating the sample at a slow constant temperature, during which time a small flame is applied to the cup at regular intervals. Flashpoint is the lowest temperature at which application of the test flame causes the vapor above the sample to ignite. Combustion does not continue. Flashpoint can indicate the possible presence of highly volatile and flammable metals in a relatively nonvolatile and non flammable material.

3.0 DEFINITIONS

3.1 **Analytical Batch -** A group of samples of a similar matrix analyzed together with the same procedure, using the same reagents and within the same time period. Samples in each batch should be of similar composition (i.e. soil, water, oil, etc.). A batch shall not exceed 20 samples.

3.2 **Sample Duplicate - (DUP)** A duplicate sample aliquots of sample which is carried through the same digestion and analysis. The relative percent difference between the sample and sample duplicate is calculated and used to assess analytical precision.

3.3 **Water Halo-** This phenomenon is a dull bluish halo or glow around the test flame that can be confused with a true flash. This usually occurs at flash temperature but can occur at any temperature with halogenated hydrocarbons.

3.4 **Flash-** A large, distinct flame which propogates itself away from the test flame and over the entire surface of the sample instantaneously.

3.5 **Flashpoint-** The lowest temperature corrected to a barometric pressure of 760mm Hg at which an application of a test flame causes the vapor of a specimen to

4.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

4.1 Sample must be collected in a pre-cleaned, wide mouth glass bottle with a Teflon lined lid.

4.2 No preservative is required.

4.3 Holding Time, None Specified.

5.0 POTENTIAL PROBLEMS AND INTERFERENCES

5.1 None Specified

6.0 HEALTH AND SAFETY

6.1 AMRO has a laboratory safety program in place that applies to all employees. There is a safety officer as well as employees with 40 hours of OSHA training. The air quality of the laboratory has been monitored and employees are sent for physicals. All employees receive fire and safety training upon employment.

6.2 Fire extinguishers are located in various areas of the lab. A lab evacuation plan is posted in every room, with a designated meeting place.

6.3 All new analysts receive training on the safe handling of samples, standards, the changing of gas cylinders, and the operation of instruments. In the lab, clean laboratory coats and gloves are worn when working with samples. Neat standards are made up in hoods. When gas tanks are replaced, the carrier with chain is used properly, and all gas tanks are chained in place. Soap is used to check for any leaks.

6.4 Care is taken with glassware and syringes to prevent injury. Broken glass and syringes are promptly removed to broken glass containers. First aid kits are available throughout the lab. There are also eyewash stations and an emergency shower.

6.5 MSDS's are reviewed for each chemical used to ensure proper precautions are observed when handling chemicals.

6.6 Pollution prevention – The use of chemical exhaust hood are required when working with chemicals. They are specifically designed to minimize analyst exposure. The hood exhaust is monitored periodically to ensure environmental exposure is minimized.

6.7 Waste control – AMRO takes whatever steps possible to minimize waste. This includes volume reduction where appropriate. AMRO also properly segregates wastes according to contaminants and a commercial vendor is utilized for waste disposal.

7.0 INSTRUMENTS AND EQUIPMENT

7.1 Pensky-Martens Flashpoint tester with stirrer at 250 rpm ± 10rpm.

7.2 Standard thermometer:
7.2.1 must go to at least 200 degrees Fahrenheit.
7.2.2 Divisions: min. 1°F

7.3 Spatula

7.4 Igniter(to light flame)

7.5 Propane Source

7.6 Timer to check rate of temperature increase ± 1.1°F
(FP 27.2°C or 81°F ±2°F)

8.0 INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR

8.1 Clean benchtop area around tester.

8.2 Make sure tester is free of dust and dirt. Especially in cup holder.

8.3 Clean cup to make sure it is free of dirt, corrosive liquids and residue which could could interfere with analyses.

9.0 REAGENTS AND STANDARDS

9.1 Chemical Receipt: The receipt of all standards, neat compounds and reagents from commercial sources is documented in the Chemical Receiving Logbook by sample receiving personnel or designate. Each solution or compound is assigned a unique standard receipt ID number, the letter "A" and a four digit sequential number. The date received, source, lot number, expiration date and disposal date are recorded. The expiration dates are provided from the

manufacturer and the disposal dates are completed by AMRO employees when standards are used up or disposed.

9.2 Standards Preparation:. In order to assure the accuracy of standards the following general guidelines are used:

9.2.1 ACS reagent grade chemicals are used when the method warrants.

9.2.2 Any stock standards that are purchased are accompanied by a certificate of analysis from the manufacturer.

9.2.3 Class A volumetric glassware is used to prepare standards.

9.3 Standard Tracking: It is important to be able to track all analytical standards back to their sources. The following procedure is used by AMRO personnel to accomplish this:

9.3.1 Wet Chemistry and Mercury Standards - Working Standards and LCS solutions made from stock standards listed in the Chemical Receiving Log are documented in the Inorganic Standard Log. The corresponding analysis, preparation date, standard name, AMRO ID, amount used, initial concentration of standard, amount used, final volume, final concentration, Standard ID, expiration date, storage location, and analyst initials are recorded. The initial concentration of the standard is obtained from the certificates received from the manufacturer. The Standard ID is written as an "S" followed by a four digit sequential number. The expiration of working standards vary depending on the use. Standards should be used in accordance with method specifications and manufacturer's instructions.

9.3.2 Wet Chemistry and Metals Reagent Log - Working reagents are made from reagents listed in the Chemical Receiving Log are documented in the Reagent Log. The corresponding analysis, preparation date, reagent name, AMRO ID, initial concentration, amount used, final volume, final concentration, Solution ID, expiration date, storage location, and analyst initials are recorded. The initial concentration is obtained from the certificate received from the manufacturer. The Solution ID is written as an "R" followed by a 4 digit sequential number. The expiration of prepared reagents varies. Reagents should be used in accordance with method specifications and manufacturer's instructions.

9.3.4 Standard Storage - Standards and reagents are stored per method specifications and manufacturer's instructions. Wet Chemistry standards are stored at ambient temperature and in refrigerators at 4°C ± 2°C depending upon the method and manufacturers requirements.

9.4 P- xylene , reagant grade(FP 27.2°C or 81°F ± 2°F)

9.5 3% acetone solution

9.6 Silica sand

10.0 PROCEDURE

10.1 Inspect sample container to make sure there is no headspace. Keep the time the sample is exposed to air to a minimum.

10.2 Inspect tester tubing for wear and cracking, check shutter to see if it operates freely.

10.3 Turn on tester and gas.

10.3.1 Heater should be on so that the rate of increase doesn't exceed 11 degrees Fahrenheit.
10.3.2 Flame height should be about 1/4 " high.

10.4 Calibrate with p-Xylene and 3% acetone and record temperatures in flashpoint worksheet

10.4.1 p-Xylene should flash at 80.6° F 2 ° F;3% acetone should flash at 100° F ± 2 °F.

10.4.2 The p-Xylene can be poured back and reused. The acetone is dumped into trace solvent waste.

10.5 Between tests, clean cup lightly with methylene chloride, pour rinse into solvent waste and wipe with a paper towel.

10.5.1 Drive off any volatiles by briefly warming cup in tester.

10.5.2 After any sample flashes and before the next sample, a "blank" of silica sand must be tested.

10.6 For samples: place sample in cool (room temperature) cup up to fill line, place cup in tester, place lid securely on cup and insert thermometer until it sits in sample.

10.6.1 When analyzing soils, stirrer is not necessary.

10.6.2 For the analysis of liquid samples, attach the stirrer motor to the attachment on the cup lid and turn on the motor. Stop the stirrer when the flame is applied.

NOTE: Make sure the thermometer sits above the propeller so that it isn't broken by it and doesn't send mercury everywhere.

10.7 Record the temperature at the initial application of the test flame (expect = room temperature, 70-75°F maximum).

10.8 Apply flame every 2-5 degrees for at least a full second until thermometer reaches 200 °F. Check the rate of the rise for at least one full minute, using a timer. Temperature should rise 9-11 per minute.
For ordinary liquids 2-3°F/min. for solids and highly viscous materials.

10.9 If flash occurs then sample must be RE-TESTED by a different individual using fresh sample.

10.9.1 If no flash occurs on second try a third replicate must be performed to confirm results.

10.9.2 No flash on third test would confirm/suggest a water halo on the first test.

10.9.3 If a flash occurs on the re-test, the average of the two temperatures shall be reported. (The results should agree within 4°F.)

11.0 CALCULATIONS

11.1 If no flash occurs after reaching 200°F, report result as >200° F.

11.2 If flash does occur, report the average of the two flash positive flash tests.

11.3 Record the ambient barometric pressure (do not use pressure recorded at airport weather station as these are corrected for sea level readings) at the time of the test. When the pressure differs from 760mmHg (10.13kPa_, correct the flashpoint:
Corrected flash point = °F + 0.069760-Ambient barometric pressure, mm Hg)

11.4 Record the flash point to the nearest 1.0°F

11.5 RPD

$$\%RPD = \frac{(\text{sample result - duplicate result})}{(\text{sample result + duplicate result})/2} \times 100\%$$

12.0 QUALITY CONTROL

12.1 Samples must be selected for spiking and or duplicate at random and rotated among clients and sites from batch to batch. In some cases, the client may specify which sample is to used for MS/MSD and or duplicate; if not, the laboratory shall pick a representative sample based on the following:

A. MS/MSD, duplicate shall not be performed on Trip Blank,
Rinsate Blank or Field Blank.
B. Adequate sample weight/volume.
C. Client requested QC deliverables.

12.2 One LCS of p-Xylene is performed with every batch of 10 samples.

12.3 One sample duplicate is analyzed with batch of 10 samples.

12.4 p-Xylene must be run at the beginning and at the end of each batch of 10 samples. Acceptance Criteria for p-Xylene: 81 ± 2°F.

12.5 3% Acetone analyzed once per day. Acceptance Criteria for 3% Acetone: 100 ± 2°F

13.0 DATA REVIEW AND STORAGE

13.1 All related information and observations will be noted in the Flash Point/ Ignitability SW-846 Method 1010 worksheet (Attachment 1).

13.2 All cross-outs must be a single line and should be initialed and dated.

13.3 The analyst must complete the Wet Chemistry Data Review Checklist (Attachment 2).

14.0 REFERENCES

14.1 D 93-80, Test Methods for Flash Point by Pensky-Martens Closed Tester, American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103, 04.09, 1986.

14.2 Umana, M., Gutknecht, W., Salmons, C., et al., Evaluation of Ignitability Methods (Liquids), EPA/600/S4-85/053, 1985.

14.3 SW846 method 1010. Office of Solid and Hazardous Waste, Update III A&B, 4/98.

Attachment 1

AMRO Environmental Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

FLASH POINT/ IGNITABILITY

SW-846 Method 1010

IL-3045

Analyst: _____ Date: _____

Barometric Pressure (mm Hg): _____ p-Xylene Lot No.: _____

3% Acetone Lot No.: _____

Lab. Sample ID	Matrix O; L; S (1)	Flash Point (°F)(2,3)	%RPD(4)	Comments

Notes:

1. O= Oil; L= Liquid; S= Soil
2. Acceptance Criteria for p-Xylene: 81 ± 2°F
3. Acceptance Criteria for 3% Acetone: 100 ± 2°F
4. %RPD between Sample and Sample Duplicate: <20%
5. **p-Xylene must be run at the beginning and at the end of each bacth of samples**
6. Barometric Pressure Correction = °F + 0.06 (760- Barometric Pressure mm Hg)

qc/qcmemos/forms/flashpoint Rev. 2 08/00

Attachment 2

AMRO Environmental
Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

WET CHEMISTRY DATA REVIEW CHECKLIST

LAB ORDER: _____ CLIENT: _____

Method:

Analysis:

A.	GENERAL			
1.	Copy of Digestion Log?	Y	N	NA
2.	Copy of Instrument Run Log?	Y	N	NA
3.	All samples met digestion and/or analysis holding time criteria?	Y	N	NA
4.	Initial Calibration meets method criteria?	Y	N	NA
5.	Initial Calibration Verification (ICV) meets method or laboratory criteria?	Y	N	NA
6.	Continuing Calibration Verification(CCV) meets method criteria?	Y	N	NA
7.	Continuing Calibration Verification analyzed after every 10 samples ?	Y	N	NA
8.	Method Blank- contaminant free (½RL)?	Y	N	NA
9.	Are all reported results within calibration range?	Y	N	NA
10.	LCS % Recovery criteria met for all compounds?	Y	N	NA
11.	MS/MSD %R's and %RPD's are met for all compounds?	Y	N	NA
12.	%RPD criteria met between sample and duplicate?	Y	N	NA

COMMENTS:

Analyst (s) _____ DATE: _____

REVIEWER: _____ DATE OF REVIEW: _____

qc/qcmemos/Forms/wetchemchecklist Rev.1 07/06/01

Property of AMRO Environmental Laboratories Corporation

Attachment 3

AMRO Environmental
Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

QUALIFICATION CARD FOR FLASHPOINT/IGNITABILITY SW-846 1010

Trainee: _____ Signature: _____

Trainer: _____ Signature: _____

I. Knowledge Factors:

SOP Title: _____ Revision Number/Date: _____

1. Did the Trainee read and understand the above SOP? Yes ☐ No ☐ NA ☐
2. Was the Trainee instructed on how to properly fill out the documentation? Yes ☐ No ☐ NA ☐
3. Has the Trainee been instructed on the proper procedures for addressing potential problems? Yes ☐ No ☐ NA ☐

II. Practical Factors:

1. Has the Trainee completed a Precision and Accuracy Stud Yes ☐ No ☐ NA ☐
2. Has the Trainee completed an acceptable Performance Evaluation sample? Yes ☐ No ☐ NA ☐
3. Did the Trainee completed an acceptable Laboratory Control Sample (LCS)? Yes ☐ No ☐ NA ☐

Completion Date: _____ Trainer's Signature: _____

I _____ have read, understood and follow the above method/SOP, which is in use at AMRO Laboratories for the analysis of samples under the National Environmental Laboratory Accreditation Program, have met the Demonstration of Capability.

Section Manager/ Supervisor: _____ Date: _____

QA Manager: _____ Date: _____

qc/qcmemos/forms/1010qualcard Rev. 0 8/28/03

Property of AMRO Environmental Laboratories Corporation

AMRO Environmental Laboratories Corporation

111 Herrick Street, Merrimack, NH 03054
TEL: (603) 424-2022 • FAX: (603) 429-8496
www.amrolabs.com

Microwave Assisted Acid Digestion of Sediments, Sludges, and Soils according to SW-846 Method 3051

Procedure Number: IL-3022

Revision No.: 6

Revision Date: 04/25/2012

Review Date: 04/02/2013

Prepared By: _____ Date: 04/02/13

Approved By: _____ Date: 04/02/13
Inorganic Manager

Approved By: _____ Date: 4-2-13
Laboratory Director

Approved By: _____ Date: 4-2-13
Quality Assurance Manager

TABLE OF CONTENTS

		Page
1.0	SCOPE AND APPLICATION	3
2.0	METHOD SUMMARY	3
3.0	DEFINITIONS	4
4.0	SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE	4
5.0	POTENTIAL PROBLEMS AND INTERFERENCES	5
6.0	HEALTH AND SAFETY	5
7.0	INSTRUMENTS AND EQUIPMENT	6
8.0	REAGENTS AND STANDARDS	7
9.0	PROCEDURE	11
10.0	INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR	13
11.0	CALCULATIONS	13
12.0	QUALITY CONTROL	14
13.0	DATA REVIEW AND STORAGE	17
14.0	REFERENCES	17

1.0 SCOPE and APPLICATION

1.1 Application

1.1.1 This method is applicable to the microwave assisted acid digestion of sludges, sediments, and soils for analysis by graphite furnace absorption spectroscopy (GFAA) and inductively coupled argon plasma spectroscopy (ICP). This method is an alternative to EPA Method 3050B hot plate digestion.

1.1.2 Samples prepared by Method 3051 using nitric acid digestion may be analyzed by GFAA or ICP for Aluminum, Antimony, Arsenic, Barium, Beryllium, Boron, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Molybdenum, Nickel, Potassium, Selenium, Silver, Sodium, Strontium, Thallium, Tin, Titanium, Vanadium and Zinc.

1.1.3 This method is not applicable to EPA CLP samples or oil samples.

2.0 METHOD SUMMARY

2.1 A representative sample of 0.40g to 0.45g is digested in 8mL of $HN0_3$ and 2mL of HCL in a Teflon vessel for 10 minutes using microwave heating. After the digestion process, the sample is then cooled, mixed, and filtered prior to analysis.

2.2 Modifications

2.2.1 EPA Method 3051, Section 4.1.4: MARS Xpress vessels are used instead of PFA or TFM to accommodate the laboratory microwave unit.

2.2.2 EPA Method 3051, Section 7.3.1: Weighing of the vessel prior to use was eliminated in order to reduce labor costs without impacting quality. The vessel is tared before the sample aliquot is added and weighed (See section 7.2.1.).

2.2.3 Prior work over the past six years has shown that a modified 3051 procedure using 8mL of $HN0_3$ (instead of 10mL, Section 7.3.3 of Method 3051) and 2mL of HCl is valid. These modifications will permit the accurate determination of antimony, silver and tin in soils and was suggested by CEM.

2.2.4 Tin and Titanium are added as additional elements. Both are supported by startup data. Clients request tin periodically.

3.0 DEFINITIONS

3.1 Method Blank: An aliquot of reagent water, which is carried through the entire analytical procedure with the samples, its purpose is to determine whether contamination is present during the analysis. One method blank is analyzed for every batch of 20 samples.

3.2 Laboratory Control Sample: An aliquot of reagent water into which known quantities of the method analyte are added in the laboratory. The LCS is analyzed exactly like a sample, and its purpose is to determine the degree to which the analytical result approaches the "true value" of the concentration of the analyte being determined. The percentage recovery is calculated in order to assess the efficiency of the analysis. One LCS is analyzed for every batch of 20 samples.

3.3 Sample Duplicate: Two aliquots of a sample are which are carried through the same preparation and analytical procedures to verify the method precision. One sample duplicate is analyzed for every batch of 20 samples.

3.4 Sample Matrix Spike: A specific aliquot of sample into which a known amount of analyte is added. The analytical spike is analyzed with the sample batch and the percent recovery is calculated in order to assess the matrix effect on the analytical system. One sample matrix spike is analyzed for every batch of 20 samples.

4.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

4.1 Nonaqueous samples are refrigerated upon receipt. The holding time is six months.

5.0 POTENTIAL PROBLEMS AND INTERFERENCES

5.1 Very reactive or volatile materials that may create high pressures when heated may cause venting of the vessels with potential loss of sample or analytes. Allow samples to react completely after addition of concentrated acid before capping.

5.2 At the end of the microwave program, allow the vessels to cool to 100°C before opening the unit.

6.0 HEALTH AND SAFETY

6.1 AMRO places a high value on laboratory safety. The air quality of the laboratory has been monitored. Fire extinguishers are located in various areas of the lab. The laboratory evacuation plan is posted in every room, with a designated meeting place.

6.2 All new analysts receive training on the safe handling of samples, standards, the changing of gas cylinders, and the operation of instruments. In the lab, clean lab coats and gloves are worn when working with samples. Neat standards are made up in hoods. When gas tanks are replaced, the carrier with chain is used properly, and all gas tanks are chained in place. Soap is used to check for any leaks.

6.3 Care is taken with glassware and syringes to prevent injury. Broken glass and syringes are promptly removed to broken glass containers. First aid kits are available throughout the lab. There are also eyewash stations and an emergency shower.

6.4 Cautions for nitric acid and hydrochloric acid:

6.4.1 All handling of hot solutions containing these materials must be performed under a hood. Contact hazards and contingencies - Liquid and vapor cause severe burns. May be fatal if swallowed. Harmful if inhaled and may cause delayed lung injury. Do not get in eyes, on skin, on clothing. Do not breathe vapor. Keep in tightly closed container. Use with adequate ventilation. In case of contact, remove clothing and flush area with water spray. In case of ingestion, administer fluids immediately. In case of inhalation, remove from exposure.

6.4.2 Spills, storage and contingencies - Spillage may cause fire or liberate dangerous gas. Keep from contact with clothing and other combustible materials. Do no store near combustible materials. In case of spill, stop the spill, use the Acid Spill Kit and ventilate the area.

6.4.3 Fire hazards and contingencies - Strong oxidizer - contact with other material may cause fire. In case of fire, use water spray, alcohol foam, dry chemical, or carbon dioxide.

6.4.4 During addition to sample, nitric acid may evolve toxic nitrogen oxide Fumes. Therefore all work must be performed in a properly operating hood.

6.5 MSDS's are reviewed for each chemical used to ensure proper precautions are observed when handling chemicals.

6.6 Pollution prevention: The use of chemical exhaust hood are required when working with chemicals. They are specifically designed to minimize analyst exposure. The hood exhaust is monitored periodically to ensure environmental exposure is minimized.

7.0 INSTRUMENTS AND EQUIPMENT

7.1 CEM MARS (Microwave Accelerated Reaction System) 5 Microwave Sample Preparation System with Infrared Temperature Control Option.

7.2 This unit is NRTL approved. (ISO 9002 certified). The power rating is 1600 W at 100% power.

7.3 The cavity has been fluoropolymer coated and the exhaust system is corrosion resistant.

7.4 Xpress Vessels of 55 mL capacity vessels capable of 260 C.

7.4.1 24-Vessel set (cat# 907390) - $4,270
7.4.2 16-Vessel set (cat# 907370) - $3,165
7.4.3 8-Vessel set (cat# 907365) - $2065
7.4.4 Liner and screw cap (cat# 574125) - $175
7.4.5 Vent plug (cat# 212020) - $19.00
7.4.6 40-Place turntable (cat# 166000) - $960
7.4.7 Composite Sleeve (cat# 212025) - $46.00

7.5 0.25mL Eppendorf Pipet for spiking (Fisher# 03402-69, or comparable) or equivalent)

7.6 Repipet Universal Dispenser - 10mL volume range in the 0.05mL graduations (or equivalent)

7.7 52mL containers for sample storage (SCP Science #010-500-261)

7.8 10 cc. Syringe with Leur Lok Tip (VWR Cat # BD309604)

7.9 0.45u Syringe Filters, Non-Sterile (VWR Cat # 28196-077)

7.10 Fisher Top Loading Balance capable of weighing to 0.001 grams

7.11 Chemware Ultra-Pure PTFE boiling stones (Cat # 1590-G21)

7.12 Numbered plastic tray for weighing vessels.

8.0 REAGENTS AND STANDARDS

8.1 AMRO reagent water – Deionized Water (DI) from a DI System that is checked monthly for Residual Chlorine, Conductivity, pH, Arsenic, Barium, Cadmium, Chromium, Copper, Iron, Lead, Nickel, Selenium, Silver, Zinc and Mercury. Resistivity and pH are monitored daily. Instrument and Procedural Blanks are also used to monitor contaminant levels through out the laboratory. Alternatively, bottled distilled water may be used.

8.2 Before performing the analysis, the analyst should **read the Materials Safety Data Sheet (MSDS)** of all the reagents and standards carefully and be prepared to take necessary emergency action at all times.

8.3 Nitric acid for Trace Metals Analysis, Tedia, (NE4123), Concentrated.

8.4 Hydrochloric acid for Trace Metals Analysis, Tedia, (HE4088), Concentrated

8.5 Spiking solutions

8.5.1 The concentration of analytes in the spiking solution should be:

ANALYTE	CONCENTRATION IN SPIKE SOLUTION, MG/L	CONCENTRATION IN DIGESTATE, UG/L
Aluminum	200	8000
Antimony by ICP	50	2000
Antimony by GFAA	5.0	20
Arsenic by GFAA	5.0	20
Arsenic by ICP	200	2000
Barium	200	4000
Beryllium	5.0	800
Cadmium by ICP	5.0	800
Cadmium by GFAA	2.5	12.5
Calcium	500	20000
Chromium	20	4000
Cobalt	50	4000
Copper	500	2000
Iron	100	4000
Lead by GFAA	5.0	20
Lead by ICP	50	2000
Magnesium	500	20000
Manganese	50	4000
Molybdenum	50	4000
Nickel	50	4000
Potassium	500	20000
Selenium by GFAA	5.0	20
Selenium by ICP	200	1600
Silver by GFAA	1.0	5.0
Silver by ICP	5.0	400
Sodium	500	20000
Strontium	25	2000
Thallium by GFAA	5.0	20
Thallium by ICP	200	1600
Titanium	50	4000
Vanadium	50	4000
Zinc	50	4000

8.5.2 The ICP Spiking solution is a purchased Superstock. (See ICP Standard Log.)

8.5.3 The GFAA spiking solution is prepared from a purchased Superstock. (See GFAA Standard Log.)

TRACKING OF ANALYTICAL STANDARDS

8.6 Chemical Receipt

The receipt of all standards, neat compounds and reagents from commercial sources is documented in the Chemical Receiving Logbook by sample receiving personnel or designate. Each solution or compound is assigned a unique standard receipt ID number, the letter "A" and a four digit sequential number. The date received, source, lot number, expiration date and disposal date are recorded. The expiration dates are provided from the manufacturer and AMRO employees complete the disposal dates when standards are used up or disposed.

8.7 Standards Preparation

Standards are prepared as written in the respective SOPs. In order to assure the accuracy of standards the following general guidelines are used:

8.7.1 ACS reagent grade chemicals are used when the method warrants.

8.7.2 A certificate of analysis accompanies any stock standards that are purchased from the manufacturer.

8.7.3 Class A volumetric glassware is used to prepare standards.

8.8 Standard Tracking

It is important to be able to track all analytical standards back to their sources. AMRO personnel to accomplish this use the following procedure:

8.8.1 Wet Chemistry and Mercury Standards - Working Standards and LCS solutions made from stock standards listed in the Chemical Receiving Log are documented in the Inorganic Standard Log. The corresponding analysis, preparation date, standard name, AMRO ID, amount used, initial concentration of standard, amount used, final volume, final concentration, Standard ID, expiration date, storage location, and analyst initials are recorded. The initial concentration of the standard is obtained from the certificates received from the manufacturer. The Standard ID is written as an "S" followed by a four digit sequential number. The expiration of working standards varies depending on the use. Standards should be used in accordance with method specifications and manufacturer's instructions. . The expiration date for ICP standards

is six months. The expiration dates for GFAA intermediate and spiking solution is one month with the calibration standards made weekly but made daily for DOD.

8.8.2 Metals Standards

8.8.2.1 Axial Standards Log (OPTIMA) - Preparation and Standard ID's are listed in the Standard Log. Standards include: S1 (Calibration #1 & RL2), S2 (Calibration #2 & IPC/CCV), S3 Calibration #3, RL 1 (Reporting Limit), RL2 (two times the Reporting Limit),S4,S5 (linear range extending standards) ICSA & ICSAB (Interference Check Standards), ICV (Independent Source QC Standards), and Stock Solutions for Matrix/LCS spike additions. The Solution ID is written as the ID followed by the date prepared (example: S1042798 is standard S1 prepared on 042798). After a conformational analysis to verify the new standard and just prior to its use, the new ID is entered into the OPTIMA software. Until updated, this will be the ID printed on every run log and standard page for hardcopy tracking.

8.8.2.2 Graphite Furnace Standard Logs (GFAA): Preparation and Standard ID's listed in this log include: Purchased Stock Certificates: Intermediate Calibration, CCV, ICV, LCS/MS Solutions: and final Calibration Solutions, final ICV final CCV and final reporting limit. These standards are prepared from the same stock solution as those used for the ICP. The nomenclature is essentially the same, but there are more dilutions needed, which necessitate Intermediate Solutions. Nomenclature for intermediate solutions includes "INT", the type of solution, and the date prepared. After a conformational analysis to verify the new standard and just prior to its use, the new ID is entered into the PE-4100ZL and/or PE-SIMMA software. Until updated, this will be the ID printed on every run log and standard page for hardcopy training.

8.8.3 Wet Chemistry and Metals Reagent Log - Working reagents are made from reagents listed in the Chemical Receiving Log are documented in the Reagent Log, The corresponding analysis, preparation date, reagent name, AMRO ID, initial concentration, amount used, final volume, final concentration, Solution ID, expiration date, storage location, and analyst initials are recorded. The initial concentration is obtained from the certificate received

from the manufacturer. The Solution ID is written as an "R" followed by a 4 digit sequential number. The expiration of prepared reagents varies. Reagents should be used in accordance with method specifications and manufacturer's instructions.

9.0 PROCEDURE

9.1 Calibration of Microwave Equipment

9.1.1 This unit uses temperature feedback control capable of replicating the performance specifications for the method; therefore the calibration procedure may be omitted.

9.1.2 Microwave unit is calibrated yearly by CEM technicians. Pressure and temperature functions are checked as well as possible microwave leakage. Documentation of performance is to be kept on file in the laboratory.

9.2 Obtaining a Homogeneous Sample

10.5.1 Refer to SOP GL-1013 "Sample Homogenization for Soil, Solid and Semisolid Waste" for sample homogenization guidance and how to obtain a representative subsample.

9.2.1 If multiphase samples are submitted, the client is called to determine which phase is to be digested and by what method – for example, oils are typically digested by 3050B while homogeneous soils are digested by 3051.

9.3 Sample Digestion

9.3.1 Weigh 0.40g (0.40 to 0.45 to the nearest 0.001g) aliquot of a well-mixed sample into a tared vessel.

9.3.1.1 Set a vessel in the numbered tray to give it stability before transferring the sample aliquot into the liner.

9.3.1.2 It is important that the sample be deposited into the bottom of the liner without any on the sidewalls.

9.3.2 Note the number of the tray position on the Microwave Digestion logbook.

9.3.3 Add 8mL of HNO_3 and 2mL of HCl to each liner. Note any reactions that take place upon addition of acid. (NOTE: 8mL HNO_3 is added instead of 10mL in order to reduce waste. 2mL HCl is added in order to achieve matrix matching.

9.3.3.1 Add 0.20mL of each of the two ICP spike solutions and 0.10mL each of Sn and Mo stock spike solution to the LCS, MS and MSD. For GFAA LCS/LCSD, add 0.20mL of the HGA stock spike mix.

9.3.3.2 For the method blank (MB) and the LCS/LCSD samples, add 0.35 – 0.45 g of Teflon Boiling Stones. Since the boiling stones do not contribute to the analyte concentration, a nominal weight of 0.40 g will be recorded.

9.3.4 After making sure any initial reaction has stopped, screw the sample caps onto the vessel finger-tight, but snug.

9.3.5 Weigh the Vessel and sample to the nearest 0.001g prior to use and record this information in the microwave digestion log.

9.3.6 Put the first vessel from the number one tray position into the Number one position on the microwave tray, the second vessel into the number two position on the tray and continue until all vessels are on the tray. Make sure there are at least six vessels or the program will not work.

9.3.7 Place the tray into the microwave lining up the half-moon into the slot.

9.3.7.1 If running 16 or less samples, run program EPA 3051_16-xpress.

9.3.7.2 If running 16 or more samples, run program EPA 3051_24-xpress.

9.3.8 The program must bring the samples to 175°C in less than 5.5 minutes and maintain temperature between 170-180°C for the remainder of the 10-minute irradiation period. This program is identical to the requirements stated in SW-846 Method 3051.

9.3.9 To change programs, highlight "load Method" the hit select and highlight user directory and hit select again. Choose method and hit select.

9.3.10 After the program has finished, let samples cool for 15 – 20 minutes. Remove the vessels from the tray and weigh them a second time. The second weight must not differ by more than 1.4 g from the first weight or the sample must be reprepped.

9.3.11 Uncap each vessel and carefully transfer the contents into a labeled 50-ml tube. Rinse the Xpress vessel with DI and pour the contents into the tube. Bring the volume of the tube up to the 50-ml mark with DI and mix well. Let any precipitate settle and filter through a 0.45u filter before analysis.

9.4 Microwave Unit Setup

9.4.1 Turn on the microwave by depressing the toggle switch located in the rear of the system.

9.4.2 Place the loaded carousel onto the stand in the microwave cavity so that the pegs on the stand are inserted into the holes on the carousel

9.4.3 Close the microwave door and initiate program.

10.0 INSTRUMENT PREVENTAIVE MAINTENANCE AND REPAIR

10.1 Rinse the vessels and caps with tap water. Make sure all soil residue is removed.

10.2 Scrub vessels vigorously with soap and hot water. If any residue is still present, wipe the liner with acetone and rinse with water before soaking in acid.

10.3 Soak the vessels and caps in 10% HNO_3 for 20 minutes, rinse thoroughly with DI water and allow to dry completely.

11.0 CALCLATIONS

11.1 Correct all final results according to the formula: Final Concentration (mg/kg) = Observed concentration (ug/L) x Final Volume (L)/Aliquot Weight (g)

12.0 QUALITY CONTROL

12.1 Method Blanks:

A sample of deionized (DI) water is put through the procedure and analyzed as a Method Blank. A Method Blank is required 1 for every 20 samples. Teflon boiling stones are added to the method blank vessel.

12.2 Laboratory Control Sample:

A sample using DI water plus a spike of the appropriate analytes is put through the entire procedure and analyzed as a laboratory control sample (LCS). Control limits, which are not met for percent recovery in the LCS, indicate errors during the procedure and require reprep unless there is a definite assignable cause. The LCS control limits are 80%-120% for 6010B and 7000 Series. A LCS is required 1 for every 20 samples. Teflon boiling stones are added to the LCS/LCSD vessels.

12.3 Matrix Spike/ Matrix Spike Duplicate:

Duplicate aliquots of a commercial sample are spiked as a Matrix Spike and a Matrix Spike Duplicate and are put through the entire procedure. The concentration of the analyte in the unspiked sample aliquot should be no more than four times the amount added. If the sample result is greater than four times the amount added, the LCS is the only valid assessment of accuracy for the batch and the spike recovery is not evaluated for control. If the control limits are not met for Relative Percent Difference, the control limits for Percent Recovery in the Matrix Spike are not applicable, since sample heterogeneity is indicated and an inaccurate sample result used to calculate percent recovery is suspected. A matrix spike and matrix spike duplicate is required for every 20 samples for 6010B and 7000series. In some cases, the client may specify which sample is to used for MS/MSD; if not, the laboratory shall pick a representative sample based on the following:

A. MS/MSD shall not be performed on Rinsate Blank or Field Blank.
B. Adequate sample weight/volume.
C. Client requested QC deliverables.

12.4 Duplicate:

12.4.1 Duplicate samples are two aliquots of a sample, which are carried through the same sample preparation and analysis procedure to verify the precision of the method for that sample matrix. The %RPD (Relative Percent Difference) is calculated from the original and the duplicate sample. The %RPD can also be calculated between a matrix spike and matrix spike duplicate. The %RPD is calculated using the concentration of the matrix spike and matrix spike duplicate. If the control limits are not met for Relative Percent Difference, the control limits for Percent Recovery in the Matrix Spike are not applicable, since sample heterogeneity is indicated and an inaccurate sample result used to calculate percent recovery is suspected. The control limits are 0%-20% for 6010B and 7000 Series. The duplicate often refers to the %RPD between the matrix spike and the matrix spike duplicate. In some cases, the client may specify which sample is to be used for MS/Dup; if not, the laboratory shall pick a representative sample based on the following:

A. Method of extraction or digestion.
B. Duplicate shall not be performed on Trip Blank, Rinsate Blank or Field Blank.
C. Adequate sample weight/volume.
D. Client requested QC deliverables

12.5 Corrective Actions for Batch QC

12.5.1 The initial investigation of the problem involves:

12.5.1.1 Checking sample concentrations for being high compared to the spike concentration.

12.5.1.2 Checking calculations and raw data transcriptions (both QC and sample).

12.5.1.3 Checking sample concentrations and analytical sequence for influences such as carryover and mislabeling.

12.5.1.4 Reviewing the notes in the digestion worksheet and analytical notebook for signs of problems or heterogeneity.

12.6 Method Blank Corrective Actions

12.6.1 Method Blank results greater than ½ Reporting Limits (RL) will be investigated. If a sample is greater than the reporting limit and less than ten times the Method Blank results, the sample will be re-prepped and reanalyzed

12.7 Laboratory Control Sample Corrective Actions

12.7.1 Control limits, which are not met for recovery in the LCS requires the batch to be prepared and reanalyzed.

12.8 Matrix Spike Corrective Actions

12.8.1 Control limits which are not met for a majority of elements in the Matrix Spike, but are met in both the Post-Digestion Spike and the Serial Dilution may indicate analyst error during preparation or sample-specific interferences during preparation; re-preparation and reanalysis are required.

12.8.2 If the original results are confirmed after re-preparation, the results indicate sample-specific interferences during preparation. The original data are reported and flagged according to AMRO policy.

12.9 Relative Percent Difference Corrective Actions

12.9.1 Control limits, which are not met for Relative Percent Difference in the Duplicate Sample indicates sample heterogeneity. Check sample observations for documentation of visible heterogeneity. If no sign of failure of the total analytical system, including sample preparation, is found, the result will be flagged according to AMRO policy. A sign of failure of the analytical system requires re-prepping of the entire batch.

13.0 DATA REVIEW AND STORAGE

13.1 All related preparation information and observations will be noted in the digestion logbook.

13.2 All cross-outs must be a single line and should be initialed and dated. Analyst review is documented on the Microwave Trace Metals Digestion worksheet.

13.3 All data from each run will be properly labeled and placed in the central file in an appropriate storage area. Each central file will include a run log, sample digestion work sheet, and all original data.

14.0 REFERENCES

14.1 EPA-200.7 Determination of Metals and Trace Elements in Water and Wastes.

14.2 EPA-200.9 Determination of Trace Elements by Stabilized Temperature Graphite Furnace Atomic Absorption, Revision 2.2, May 1994.

14.3 Microwave Assisted Acid Digestion of Aqueous Samples and Extracts 3051,Test Methods for Evaluating Solid Waste, US EPA SW-846, 3rd Edition, Revision 2. December 1996.

14.4 40 CFR Part 136. Appendix B.

14.5 Department of Defense Quality Systems Manual for Environmental Laboratories, Revision 3, January 2006.

14.6 MARS Operation Manual, 600122, Rev. 1, August 2004.

111 Herrick Street, Merrimack, NH 03054
TEL: (603) 424-2022 • FAX: (603) 424-8496
www.amrolabs.com

Analysis of Metals by Inductively Coupled Plasma Optical Emission Spectrometry according to SW-846 Method 6010B

Perkin-Elmer Optima 7300 Dual View
SN – 077C0062402 09/24/12

Procedure Number: IL-3021

Revision No.: 9

Revision Date: 01/03/2013

Review Date: NA

Prepared By: _____ Date: 01-11-13

Approved By: _____ Date: 01-11-13
Inorganic Manager

Approved By: _____ Date: 1-11-13
Laboratory Director

Approved By: _____ Date: 1-11-13
Quality Assurance Manager

TABLE OF CONTENTS

		Page
1.0	SCOPE AND APPLICATION	3
2.0	METHOD SUMMARY	3
3.0	DEFINITIONS	4
4.0	SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE	5
5.0	POTENTIAL PROBLEMS AND INTERFERENCES	6
6.0	HEALTH AND SAFETY	8
7.0	INSTRUMENTS AND EQUIPMENT	9
8.0	REAGENTS AND STANDARDS	11
9.0	PROCEDURE	15
10.0	INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR	21
11.0	CALCULATIONS	23
12.0	QUALITY CONTROL	25
13.0	DATA REVIEW AND STORAGE	31
14.0	REFERENCES	32
	Table 1 Primary Wavelengths 6010B/3010A	33
	Table 2 Secondary Wavelengths 6010B/3010A	34
	Table 3 Primary Wavelengths 6010B/3050A	35
	Table 4 Primary Wavelengths 6010B/3051A	36
	Table 5 Standard and QC Concentrations	37

1.0 SCOPE and APPLICATION

1.1 Application

1.1.1 This SOP describes the hardware and software operations of the Optima-DV ICP Spectrometer for the analysis of: Aluminum, Antimony, Arsenic, Barium, Beryllium, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Lithium, Magnesium, Manganese, Nickel, Potassium, Selenium, Silver, Sodium, Thallium, Vanadium, Zinc, Boron, Tin, Titanium, Strontium, and Molybdenum in acidic, aqueous solutions. The instrument is capable of analyzing other elements as required following appropriate start-up procedures.

1.1.2 The Optima has the capability to determine elements simultaneously at different wavelengths. Whenever possible, this feature is employed to:

1.1.2.1 Confirm primary analytical result at secondary wavelength,
1.1.2.2 Extend Linear Range,
1.1.2.3 Permit reporting of data from secondary wavelength in instances where primary wavelength is out-of-control, useful for fast turn-around-samples.

1.1.3 This SOP is an equivalent to EPA Method 6010B with exceptions noted for TCLP analyses according to 40 CFR Appendix ll.

1.1.4 This SOP is applicable to waters, wastewaters, soils, oils, and sludges prepared by acid digestions such as 3005, 3010,3050B, and 3051.

2.0 METHOD SUMMARY

2.1 An aliquot of the sample is mixed with an Internal Standard Solution (Yttrium/Scandium) then pumped to the nebulizer where it is met by a precisely controlled flow of argon creating a very fine aerosol. This aerosol is transported by the argon to the center of the plasma. Within this axial channel, the sample is atomized and the elements are excited to emission at temperatures in the range of 4000-80000K. The emitted energy is directed through the entrance slit, diffracted by the grating, refocused on the exit slits, and then projected on to two appropriate segmented-Array charge-coupled devices (SCD). The SCD's convert the light energy into electrical signals that are digitized and processed by the computer.

2.2 AMRO routinely digests MS, MSD and sample duplicate to meet all

varying project QC requirements.

3.0 DEFINITIONS

3.1 **Analyte:** The element the analyst seeks to determine.

3.2 **Analytical Run:** A continuous analytical sequence consisting of digested samples plus all associated quality assurance measurements as described in the AMRO QA/QC Manual.

3.3 **Analytical Sample:** - Any solution introduced into the instrument on which an analysis is performed, excluding instrument calibration, calibration verification, and calibration blanks. The following are all analytical samples: digested samples, Duplicate Samples, Serial Dilutions, Post-Digestion Spikes, Matrix Spikes, Interference Check Standard A (ICSA), Interference Check Standard AB (ICSAB), Reporting Limit Standard (RL), Laboratory Control Sample (LCS & LCSD), and Method Blanks.

3.4 **Post-Digestion Spike (PDS):** The addition of a known amount of standard after digestion.

3.5 **Background Correction:** A technique to compensate for variable background contribution to the instrument signal.

3.6 **Batch:** A group of 20 or fewer samples digested (prepared) at the same time, in the same location, using the same method. Associated with each batch is a set of QC samples, including: Duplicate Samples, Matrix Spike (MS), Matrix Spike Duplicate (MSD), Serial Dilution (SD), Laboratory Control Sample (LCS & LCSD), and a Method Blank. Teflon boiling chips are used for solid/soil samples for Method Blanks, LCS and LCSD.

3.7 **Interelement Correction Factor (IEC):** Interelement interferences occur when elements in the sample emit radiation at wavelengths so close to that of the analyte that they contribute significant intensity to the analyte channel. This intensity contribution will then cause a high and erroneous concentration to be reported for the analyte. IEC's must be applied to the analyte to remove the effects of these unwanted emissions.

3.8 **Interference Check Standard A (ICSA):** A sample with Aluminum, Calcium, and Magnesium at 500 mg/L, Iron at 320 mg/L.

3.9 **Interference Check Sample (ICSAB):** A sample with aluminum, Calcium, and Magnesium at 500 mg/L Iron at 320 mg/L and all other Analyte elements at 0.5-1.0 mg/L except Na & K at 2.5mg/L..

3.10 **Instrument Detection Limit (IDL):** A value determined by analyzing seven calibration blanks. The standard deviation is multiplied by 3 to obtain the IDL. The IDL limits must be ≤ MDL limits.

3.11 **Linear Range:** The highest concentration of an analyte that can be analyzed with a recovery of the True Value between 90-110 %.

3.12 **Method Detection Limit (MDL):** The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater then zero. It is determined by analyzing seven replicates of a low level standard that is 2-3 times the IDL. The standard deviation is then multiplied by 3.143 (the student t test value for seven replicates) to obtain the MDL. For solid/soils an MDL study is performed using Teflon boiling chips.

3.13 **Reporting Limit Standard (RLP):** A low level standard used to verify linearity near the detection limit. The concentration is generally 3-5 times the MDL. See Table 1 for a list of metals RLs.

3.14 **Internal Standard (IS):** An internal standard solution containing Yttrium and Scandium at 10 mg/L is mixed with all calibration standards, all QC standards, and all samples. The intensity of Yttrium is used by the instrument as an internal standard to ratio the analytical intensity signals for both calibration and quantitation. This technique is useful in overcoming matrix interferences especially those caused by high dissolved solids. A second element, Scandium, is added to the IS solution in the rare event that Yttrium is present in the sample.

3.15 **Calibration:** Multi-element standards are used for calibration. For routine applications, a Blank and Four or Five Standards are used for the majority of the elements while Four Standards are employed for Aluminum, Calcium, Iron, and Magnesium.

4.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

4.1 All sample digestates (calibration, QC, and unknowns) must be in an aqueous matrix of Hydrochloric Acid (HCl) and Nitric Acid (HNO_3).

4.2 All standards and samples are corrosive. Care must be taken when handling, including the use of vinyl gloves, safety glasses and a lab coat. Hands must be washed before eating or smoking.

4.3 AMRO routinely stores all digestates for three months after digestion in case further analyses are required.

5.0 POTENTIAL PROBLEMS AND INTERFERENCES

5.1 Several types of interference effects may contribute to inaccuracies in the determination of trace elements. They can be summarized as follows:

5.1.1 Spectral interferences:

5.1.1.1 Overlap of a spectral line from another element-Interelement correction factors (IEC's) are required to compensate for any spectral interferences. These are mandatory for Aluminum, Calcium, Iron, and Magnesium. They should be determined and utilized for the remaining analytical channels. As an example of the impact of IEC's, if Arsenic were being determined in the presence of 500,000µg/L (500 mg/L) of Aluminum, an apparent (but false) Arsenic concentration of 4500 ug/L would be reported in an Arsenic-free sample if only background correction were being applied. With a properly selected IEC, this false signal would be reduced to a value less than the MDL. One additional point should be made. Note the effect of Cobalt on Lead. As with Arsenic, a false signal would be reported but this time the spurious signal is a negative value, -1,800µg/L. A negative concentration value indicates that the interfering line from Cobalt is on, or near, the background correction point selected for the lead wavelength. An IEC would be determined, however, instead of entering a positive value, a negative value would be entered into the ICP software. Once entered and verified, nebulization of the interferent (Cobalt) should produce an apparent concentration with an absolute value of less than the MDL for Lead.

5.1.1.2 Unresolved overlap of molecular band spectra - may require selection of an alternate wavelength.

5.1.1.3 Background contribution from continuous or recombination phenomena and Background contribution from stray light from the line emission of high concentration elements - Background must be measured adjacent to analyte lines on samples during analysis. The position selected for the background intensity measurement, on either or both sides of the analytical line, will be determined by the complexity of the spectrum adjacent to the analyte line. The position used must be free of spectral interference and reflect the same change in background intensity as occurs at the analyte wavelength measured. In addition, users of simultaneous multi-element instrumentation must assume the responsibility of verifying the absence of spectral interference from an element that could occur in a sample but for which there is no channel in the instrument array.

5.1.2 Physical Interferences:

5.1.2.1 Generally considered to be effects associated with the sample nebulization and transport processes. Such properties as change in viscosity and surface tension can cause significant inaccuracies especially in samples which may contain high dissolved solids and/or acid concentrations. The use of a peristaltic pump may lessen these interferences. If these types of interferences are operative, they must be reduced by employing the Internal Standard technique, dilution of the sample and/or utilization of standard addition techniques. Another problem which can occur from high dissolved solids is salt buildup at the tip of the nebulizer. This affects aerosol flow rate causing instrumental drift. Wetting the argon prior to nebulization or sample dilution has been used to control this problem. Also, it has been reported that better control of the argon flow rate improves instrument performance. This is accomplished with the use of mass flow controllers.

5.1.3 Chemical Interferences:

5.1.3.1 Characterized by molecular compound formation, ionization effects and solute vaporization effects. Normally these effects are not pronounced with the ICP technique. However, if observed, they can be minimized by careful selection of operating conditions (that is, incident power, observation position, and so forth), by buffering of the sample, by matrix matching, and by standard addition procedures. These types of interferences can be highly dependent on matrix type and the specific analyte element.

5.2 The instrument is programmed to analyze *two exposures* and report an average between the two results. The standard deviation and percent relative standard deviation (%RSD) along with the average result are printed for each metal. The %RSD must be <5%. This data is reviewed and the professional judgement of the analyst is used to determine if the precision between the replicates is acceptable. Typically, this type of review is not necessary with ICP unless there is a problem with the sample introduction system.

6.0 HEALTH AND SAFETY

6.1 AMRO places a high value on laboratory safety. The air quality of the laboratory has been monitored. Fire extinguishers are located in various areas of the lab. The laboratory evacuation plan is posted in every room, with a designated meeting place.

6.2 All new analysts receive training on the safe handling of samples, standards, the changing of gas cylinders, and the operation of instruments. In the lab, clean lab coats and gloves are worn when working with samples. Neat standards are made up in hoods. When gas tanks are replaced, the carrier with chain is used properly, and all gas tanks are chained in place. Soap is used to check for any leaks.

6.3 Care is taken with glassware and syringes to prevent injury. Broken glass and syringes are promptly removed to broken glass containers. First aid kits are available throughout the lab. There are also eye-wash stations and an emergency shower.

6.4 MSDS's are reviewed for each chemical used to ensure proper precautions are observed when handling chemicals.

6.5 Pollution prevention – The use of chemical exhaust hood are required when working with chemicals. They are specifically designed to minimize analyst exposure. The hood exhaust is monitored periodically to ensure environmental exposure is minimized.

7.0 INSTRUMENTS AND EQUIPMENT

7.1 Equipment:

7.1.1 Dual View ICP with the following specifications:

7.1.1.1 Optics – Two segmented-Array charged-coupled Device Detectors each cooled to 40° C.

7.1.1.2 Resolution - 0.006 in UV region.

7.1.1.3 Wavelength Range – 165-782 nm.

7.1.2 Source 1.5 KW R.F. solid state generator operating at 40 Mhz with automatic power control and automatic tuning.

7.1.3 Cooling Water Supply – Polyscience chiller Whisper Cool Model N0772046 (SN # 1C1280479).

7.1.4 Mass Flow Controller for argon flow to the nebulizer.

7.1.5 Three Channel Peristaltic Pump.

7.1.6 AS-90 Autosampler with automated restandardization and automated analysis of quality control check samples.

7.1.7 Lenovo Computer: Microsoft Windows XP Version 5.1.

7.1.8 WinLab32 Software Version 5.3.0.0656.

7.1.9 Torch, Perkin-Elmer Dual View, PE Cat. # N077-1500

7.1.10 Radial Purge Quartz Window, PE Cat # N077-0944.

7.1.11 Axial Purge Quartz Window, PE Cat # N077-1116.

7.1.12 Gem Cone, Low Flow Nebulizer, PE Cat # N077-0358

7.1.13 Cyclonic Spray Chamber, PE Cat. # N077-1501.

7.1.14 Alumina Injector Tip, 2.0 mm I.D., PE Cat # N069-5362.

7.1.15 Quartz Torch Bonnet, PE Cat # N077-5289.

7.1.16 RF Coil, PE Cat # N077-1536 (Requires PE Service to install).

7.1.17 Sipper for Auto Sampler, PE Cat. # B300-0159

7.1.18 Standard & QC Tubes, PE Cat. # B019-3234

7.1.19 17-mL Polypropylene Sample Tubes, 100mm round bottom, non-sterile, culture tubes, Elkay, Cat # 000-2018-001 (H&L)

7.1.20 Eppendorf Metal Free Clear Pipet Tips, (1000 µL)

7.1.21 Peristaltic Pump Tubing

7.1.21.1 Black/Black, VHG Cat # D180203

7.1.21.2 Green/Orange, VHG Cat # DCPT-007, Fisher Cat # 14-190-103

7.1.21.3 Red/Red, VHG Cat # D180201

7.1.22 Eppendorf Clear (Metal Free) Pipet Tips, 100 µL size

7.1.23 Nalgene Syringe Filters (0.45 u size),

7.1.24 10cc Syringe, Luer Lok,

7.1.25 Graduated, Conical Tubes with Caps, 15 mL polypropylene (used for IEC studies), Becton Dickinson, Cat. # Falcon 2097 Blue Max.

7.1.26 Serological Pipets, disposable and non-sterile, 10x1/10 mL size, Baxter, Cat. # P4650-110.

7.2 Materials:

7.2.1 Liquid Argon – 99.999 % at 70-120psig.

7.2.2 High Purity Nitrogen to purge the optical system at 30-120psig.

7.2.3 Compressed Air or Liquid Nitrogen for Shear Gas Supply at 75-100psig with pressure at the air dryer filter at 60psig.

7.2.4 Labware

7.2.4.1 For the determination of trace levels of elements, contamination and loss are of prime consideration. Potential contamination sources include improperly cleaned laboratory apparatus and general contamination within the laboratory environment from dust, rust, etc. A clean laboratory work area, designed for trace element sample handling must be used. Sample containers can introduce positive and negative errors in the determination of trace elements by (1) contributing contaminants through surface desorption or leaching, (2) depleting element concentrations through adsorption processes. All re-useable labware (glass, quartz, polyethylene, Teflon, etc.) including the sample container should be cleaned prior to use. Labware may be soaked overnight and thoroughly washed with laboratory-grade detergent and water, rinsed with water, and soaked in a mixture of dilute nitric and hydrochloric acid. (See AMRO dishwashing SOP.)

7.2.5 Glassware - 500mL and 1000mL volumetric flasks.

7.2.6 Storage - Teflon and Polyethylene bottles of 500 mL and 1000 mL size.

7.2.7 Disposable, metal free pipet tips.

7.2.8 Air Displacement Pipettes (Eppendorf) - 100µL 500µL, and 1000µL volumes.

8.0 REAGENTS AND STANDARDS

8.1 Nitric acid, VWR Omni Trace for Trace Metals Analysis or equivalent.

8.2 Hydrochloric acid, VWR Omni Trace for trace Metals Analysis or equivalent.

8.3 Water, Deionized Water, ASTM Type II (DI).

8.4 Standards

8.4.1 See ICP Standard Log OPTIMA for all standard preparation information. It is readily available near the ICP. This log contains copies of the Certificates of Analysis for each stock purchased for OPTIMA. It also gives an in depth explanation of all the standards required for OPTIMA ICP analysis. This log is used to document the preparation of all ICP calibration standards and instrument QC standards.

8.4.2 Calibration Standards (for concentrations, see Table 5)

8.4.2.1 The calibration standards are prepared as needed as described in the ICP Standard Log.

8.4.2.2 The superstock solutions are replaced annually.

8.4.3 Initial Calibration Verification Standard (ICV) (for concentrations, see Table 1)

8.4.3.1 The independent standards MUST be purchased from a different company than the calibration standards or, alternatively, the manufacturer must supply documentation that they trace back to different original stocks than the calibration standards do.

8.4.3.2 The ICV standard is prepared by adding 5mL of each ICV Superstock solution to a 500mL volumetric flask containing 5mL nitric acid and 25mL hydrochloric acid and diluting to the mark with DI water.

8.4.3.3 The ICV superstock solutions are replaced annually.

8.4.3.4 Analytical solutions are diluted from superstock as needed as described in the standards log.

8.4.4 Continuing Calibration Verification Standard (CCV) (for concentrations see Table 1).

8.4.4.1 The CCV is the same as ICP Standard S2. (See ICP Standard Log.)

8.4.4.2 The Custom Multielement Stock Standards are replaced annually.

8.4.4.3 Analytical solutions are diluted from the stock as needed.

8.4.5 Reporting Limit Standards for ICP (RL) (for concentrations see Tables 1-4).

8.4.5.1 See ICP Standard Log for prep instructions.

8.4.5.2 The stock solutions are replaced annually.

8.4.5.3 Analytical solutions are prepared as needed.

8.4.6 Interference Check Standard AB (ICSA) and Calibration Standard S4.

8.4.6.1 See ICP Standard Log for prep instructions.

8.4.6.2 The stock solutions are replaced annually.

8.4.6.3 Analytical solution is prepared as needed

8.4.7 Interference Check Standard AB (ICSAB).

8.4.7.1 See ICP Standard Log for prep instructions.

8.4.7.2 The stock solutions are replaced annually.

8.4.7.3 Analytical solution is prepared as needed.

8.4.8 Individual Element Solutions at 1000mg/L.

8.5 Chemical Receipt

8.5.1 The receipt of all standards, neat compounds and reagents from commercial sources is documented in the Chemical Receiving Logbook by sample receiving personnel or designate. Each solution or compound is assigned a unique standard receipt ID number, the letter "A" and a four digit sequential number. The date received, source, lot number, expiration date and disposal date are recorded. The expiration dates are provided from the manufacturer and the disposal dates are completed by AMRO employees when standards are used up or disposed.

8.6 Standards Preparation

Standards are prepared as written in the respective SOPs. In order to assure the accuracy of standards the following general guidelines are used:

8.6.1 ACS reagent grade chemicals are used when the method warrants.

8.6.2 Any stock standards that are purchased are accompanied by a certificate of analysis from the manufacturer.

8.6.3 Class A volumetric glassware is used to prepare standards.

8.7 Standard Tracking

It is important to be able to track all analytical standards back to their sources. The following procedure is used by AMRO personnel to accomplish this:

8.7.1 Metals Standards

8.7.1.1 Optima Standards Log (OPTIMA) - Preparation and Standard ID's are listed in the Standard Log. Standards include: Low S1 = RL1 (Reporting Limit), S1 (Calibration #1 & RL2), S2 (Calibration #2 & CCV), S3 (Calibration #3), S4 (Calibration #4 and ICSA), RL1 (Reporting Limit), RL2 (two times the Reporting Limit), ICSA &ICSAB (Interference Check Standards), ICV (Independent Source QC Standards), and Stock Solutions for Matrix/LCS spike additions. The Solution ID is written as the ID followed by the date prepared (example: S1042798 is standard S1 prepared on 042798). After a conformational analysis to verify the new standard and just prior to it's use, the new ID is entered into the OPTIMA software. Until updated, this will be the ID printed on every run log and standard page for hardcopy tracking.

8.7.2 Wet Chemistry and Metals Reagent Log - Working reagents are made from reagents listed in the Chemical Receiving Log are documented in the Reagent Log, The corresponding analysis, preparation date, reagent name, AMRO ID, initial concentration, amount used, final volume, final concentration, Solution ID, expiration date, storage location, and analyst initials are recorded. The initial concentration is obtained from the certificate received from the manufacturer. The Solution ID is written as an "R" followed by a 4 digit sequential number. The expiration of prepared reagents varies. Reagents should be used in accordance with method specifications and manufacturer's instructions.

9.0 PROCEDURE

9.1 Determination of IEC's

9.1.1 After the ICP has been calibrated, nebulize the single element solutions listed in Table 1 and note the "apparent concentration" values produced at each channel.

9.1.1.1 ICSA & ICSAB QC samples are analyzed daily and if under or over corrections are noted, single element solutions of Aluminum, Calcium, Iron, and Magnesium are analyzed and the IEC's are updated.

9.1.1.2 The elements with an "*" are analyzed quarterly (or as needed after maintenance: new torch, injector tip, etc.) and the IEC's are updated. These elements, along with Al, Ca, Fe, & Mg, compromise the majority of the interfering elements routinely encountered in environmental samples. In addition, they are analyzed annually to verify/update IEC's and to verify Linearity.

9.1.1.3 The following elements cause no spectral interferences: Antimony, Arsenic, Boron, Cadmium, Lithium, Sodium, Potassium, Strontium, Selenium, Silver, Thallium and Tin. However, they are analyzed annually to verify that fact and to confirm Linearity.

9.1.1.3 The following elements have little or no interference on the primary wavelengths of the environmental elements: Barium, Beryllium, Copper, Lead, Manganese, and Zinc. However, they are analyzed annually to update the IEC's on the secondary wavelengths and to confirm Linearity.

9.1.1.4 In the event of a major maintenance problem (new power tube, clean optics, etc.) a full IEC and Linearity study is performed.

9.1.2 The correction factor, K1, is then calculated from the equation, K1 = (Apparent Analyte Concentration, µg/L)/(Interferent Concentration, mg/L).

9.1.3 The IEC is then entered into the ICP software.

9.1.4 To verify the IEC's, reprocess the data file and observe the "apparent concentrations."

9.1.4.1 A value of less than 2 x MDL for each analyte should be obtained if the IEC is correct.

9.1.4.2 This data can also be used to verify the linear range for the elements

9.1.5 To update an existing IEC, analyze pure solutions as previously described and calculate the correction factor from the equation:

9.1.5.1 K1 = [(Current IEC x Conc. of interfering element) + (Apparent Conc.)]/Conc. of interfering element.

9.2 Determination of Linear Ranges

9.2.1 After calibration, analyze solutions of high concentration for all elements for which the instrument is calibrated.

9.2.1.1 The same solution of pure single elements may be used to determine Linear Range and verify IEC's in the same analytical run (See IEC Section)

9.2.2 The Linear Range for an element is established if the recovery of the high standard is within 90-110%.

9.2.2.1 For any element, which does not meet this requirement, the linear range will default to the highest calibration standard

9.3 Determination of IDL's

9.3.1 Pour a calibration blank solution into seven autosampler tubes, and analyze as individual samples.

9.3.2 Determine the standard deviation for seven replicates for each analyte.

9.3.3 The IDL = 3 x (standard deviation).

9.3.4 Provide all required information on the current Instrument Detection Limit study worksheet provided by the QA Department.

9.3.5 An IDL study is required at start-up and after any significant modification to the instrument.

9.4 Determination of MDL's

9.4.1 Digest seven individual aliquots of an MDL Solution using an appropriate digestion procedure which is 3-5 times the IDL for 6010B or

20% of the AMRO reporting limit. For soils the MDL study is performed using Teflon boiling chips.

9.4.2 Determine the standard deviation for the seven digestions for each analyte.

9.4.3 The MDL = 3.143 (the student T test value for seven replicates) x (average of the standard deviations).

9.4.4 Provide all required information on the current Method Detection Limit study worksheet provided by the QA department.

9.4.5 The MDL is performed annually.

9.4.6 To ensure that reasonable MDL values are determined, an MDL check sample is analyzed by spiking an interference free matrix with all target analytes at about two times the determined MDL. The MDL check sample is taken through the same process as the MDL. If any of the target analytes are not detected, the MDL study is modified and repeated until the MDL check sample is detectable. The MDL check will be analyzed quarterly and after major instrument maintenance or changes in the instrumentation or instrumental conditions to verify sensitivity of the method.

9.5 Precision and Accuracy

9.5.1 Precision and accuracy is done annually by each analyst for each matrix and analysis type. Digest and Analyze four Laboratory Control Samples with an acceptance limit of 80-120%.

9.6 Operational Parameters for the Optima Dual View

9.6.1 Plasma Information

9.6.1.1 Nebulizer argon flow – Approximately 0.55 LPM (Adjust for each nebulizer)

9.6.1.2 Plasma argon flow - 15 LPM

9.6.1.3 Auxiliary argon flow – 0.30 LPM

9.6.1.4 Forward RF power – 1450 watts

9.6.2 Peristaltic pump flow rate (sample) - 1.8mL/min.

9.6.3 Torch observation height - 18mm

9.6.4 Method Information (Optima_DV)

9.6.4.1 Number of elements – 27 (Variable – multiple wavelengths used)

9.6.4.2 Replicates – 2

The method states "multiple exposures" without giving a number. AMRO analyzes a comprehensive list of metals to meet all client needs while maintaining optimal use of the instruments. In order to accomplish this, three replicates of each sample are analyzed. For the Optima ICP three replicates would seriously degrade the analytical performance. There is a concern with buildup on the Nebulizer tip and other Sample Introduction problems from the length of sample period. Each replicate is read in the axial and radial mode which result in a "sample nebulization time" of nearly eight minutes. An %RSD of 2.5% between replicates is required to ensure the accuracy of the data. If the %RSD acceptance limit is exceeded, the sample is re-analyzed.

9.6.4.3 Read Delay – 45 seconds.

9.6.4.4 Flush time – 30 seconds.

9.6.4.5 Analysis data file name – MMDDYY A, B, C where: MM is the month, DD is the day and YY is the year of the analysis. A, B, C are analytical runs during the day.

9.6.4.6 Autosampler (SIF) table name – same as Analysis file.

9.6.4.7 Approximate analysis time – 4 to 7 minutes.

9.6.4.8 Integration Time – 5 to 25 seconds depending on elemental concentrations.

9.6.5 Rinse time between QC samples - 90 seconds

9.6.6 Additional 70 second rinse will be performed if previous sample contained high concentrations (> CCV) of prior selected analytes.

9.7 Start-Up ICP

9.7.1 Turn on Liquid Nitrogen Tank.

NOTE: Argon and chiller are always on!

9.7.2 Turn on the Nitrogen regulator to a pressure of 60 psig. Set the Argon pressure to 85 psig. Chiller temp should be <25 C.

9.7.3 Tighten the pump tubing, check flow of pump tubing and check the levels in the internal standard bottle, autosampler wash bottle, and the drain bottle.

9.7.4 Check DIAGNOSTIC WINDOW for any instrument "Warning Flags" and correct.

9.7.5 Open PLASMA CONTROL window.

9.7.6 Click the "PLASMA ON" button.

9.7.7 After ignition, wait about 60min. before starting to ensure temperature equilibrium. (This time can be used to prepare the autosampler table in the software and to pour the samples into the autosampler tubes).

9.8 Autosampler Table Setup (Sample Information Editor)

9.8.1 Open appropriate SIF format file (Water-200.7, Water-SW, Soil-3050B, Soil-3051, TCLP). These have the correct "Samp Types" and "Test Codes" necessary to transfer the data to LIMS.

9.8.2 Enter sample ID's and weight/ volume for soil samples and dilution factors as appropriate.

9.8.3 Save SIF as MMDDYY A, B, C. (Same as data files.)

9.8.3.1 Enter a CCV and CCB between every 10 samples at a minimum.

9.8.3.2 When all the samples have been entered, review the table and make sure the correct sample units (ug/L or mg/kg) have been selected and the appropriate initial, final, and continuing QC samples have been entered. Save the file.

9.8.3.3 Print the completed table and save in the Run Log File.

9.9 Profile - Profiling is used to establish optimum alignment of the spectrometer entrance slit image with respect to the exit slits. This is only necessary after cleaning sample introduction system and prior to Automatic Alignment of viewing position for Axial and Radial modes. To profile, select View Mode (Axial or Radial) then select Spectrometer Control.

9.9.1 Nebulize a 1.0 ppm manganese solution for Axial Viewing and a 10 ppm Mn for Radial Viewing and Click on "Optimize X & Y."

9.9.2 Optimize both Axial and Radial modes.

9.10 **Calibration** – Calibration is accomplished in the Automated Analysis Mode which has two options: (1) Calibrate and stop or (2) Run All (Calibrate and run QC and samples. After calibration, the instrument will print a "Calibration Summary". This includes: Analyte, Number of Standards, Equation Used, Intercept, Slope, Curvature, and Correlation Coefficient. The Correlation Coefficient MUST be ≥0.995 to report the data. The "Mean Corrected Intensities" for Standard # 2 (CCV – mid-standard) should be constant (within ±30%) over time and they provide an excellent indicator of correct instrument performance in the following areas:

9.10.1 Optical Alignment,

9.10.2 Transfer optics,

9.10.3 Nebulizer,

9.10.4 Torch and spray chamber,

9.10.5 Torch alignment,

9.10.6 Argon flow rates to the nebulizer and the torch,

9.10.7 RF power,

9.10.8 Peristaltic pump rate, and

9.10.9 Calibration standard solutions.

9.11 Sample Analysis

9.11.1 Select Automated Analysis Control

9.11.1.1 Select method "Dual View," for example.

9.11.1.2 Enter the SIF and the Result Set (Data File).

9.11.1.3 For auto shutdown, select SET then check "Shutdown Enabled for: End of Run, Wash 30 minutes after analysis, Turn off Plasma & Pump.

9.11.1.4 Select Analyze.

9.11.1.5 Click on Analyze All.

9.12 Shut-down ICP

9.12.1 Open PLASMA CONTROL and click on "PLASMA OFF".

9.12.2 DO NOT turn off Argon or Chiller.

9.12.3 Turn off Nitrogen, Air Compressor (if used), and Vent..

9.12.4 Cap the Autosampler QC tubes.

9.12.5 Fill the Autosampler rinse bottles for the next day's run, (Deionized Water).

9.12.6 Empty autosampler drain bottle as needed.

9.12.7 Preventive Maintenance.

10.0 INSTRUMENT PREVENTAIVE MAINTENANCE AND REPAIR

Preventative Maintenance is designed to keep the instrument operating at a consistent performance level. A maintenance program must be followed with some "common sense" regarding the quality of samples that are introduced. For example:

10.1 General Guidelines

10.1.1 Samples containing particulate must be filtered before analysis.

10.1.2 The TDS (Total Dissolved Solids) in a sample should not exceed 3,000mg/L (this is about the level in TCLP samples).

10.1.3 The acid matrix of HCl and HNO3 should be similar between standards and samples.

10.1.4 Organic samples **must** not be analyzed unless the entire sample introduction system is cleaned afterwards and an analytical method is developed, tested, and verified.

10.2 DAILY Schedule (D):

10.2.1 Check autosampler Rinse and Waste solutions and Argon & Nitrogen pressures.

10.2.2 Verify that intensity counts for first standard are in a range that indicates efficient sample introduction. Verify the precision values between replicates for the high standard are less than 1% RSD.

10.2.3 Change pump tubing every other day.

10.2.4 Make any standards that are low and verify concentration prior to use.

10.3 BI-WEEKLY (W):

10.3.1 Clean torch and Injector Tip. Replace O-rings as needed. Acid wash torch and soak tip in dilute Aqua Regia.

10.3.2 Check coolant level and top off water. Watch for green growth in water lines.

10.3.3 Check Nebulizer (if sputtering clean in Ultrasonic Bath) and Spray Chamber and clean if necessary.

10.3.4 Do Alignment (Axial and Radial) then run IEC single element standards.

10.3.5 Tweak IEC's as necessary. Update IEC Table and Method.

10.4 MONTHLY (M):

10.4.1 Clean filters.

10.4.2 Wipe off Rail on Auto Sampler and oil lightly.

10.4.3 Dust off instrument.

10.4.4 Archive database Results Data to LIMS. Then Delete data from database, Check database and Pack database.

10.5 SEMIANNUAL (S):

10.5.1 Drain chiller and refill with tap water.

10.6 REPAIRS/SERVICE (RS)

10.6.1 Record problem and resolution.

11.0 CALCULATIONS

11.1 All calculations pertaining to the conversion of intensity units into concentration units are done by the PE software. After calibration, the instrument will print a "Calibration Summary". This includes: Analyte, Number of Standards, Equation Used, Intercept, Slope, Curvature, and Correlation Coefficient. The Correlation Coefficient MUST be ≥ 0.995 to report the data.

11.2 Data from the ICP are rounded to three significant figures by the PE software. (This can be changed easily in the method.)

11.3 MSA-corrected concentrations (mg/L) = the absolute value of (-b/m)

11.3.1 b = y-intercept (Constant) of the regression analysis performed in the MSA.WK3 worksheet.

11.3.2 m - slope (X Coefficient) of the regression analysis performed in the MSA.WK3 worksheet.

11.4 Interelement Correction factor (K1) = (Apparent Analyte Concentration, µg/L)/(Interferent Concentration, mg/L).

11.5 Hardness, mg equivalent $CaCO_3$/L = ({Ca} in mg/L x 2.497) + ({Mg} in mg/L x 4.118

11.6 Instrument concentrations are in µg/L.

11.7 For water samples: The results are reported in µg/L. The sample concentration reported will be in µg/L units times the dilution factor.

11.8 For soil samples: Multiply the results in µg/L times the final volume of digestate in liters divided by the dry wt of sample in grams times the dilution factor to give results in mg/kg. In the sample info file if the sample weight has been entered in wet weight, and units entered in as mg/Kg the PE software will calculate the sample result in mg/Kg as wet weight. For sample results being reported in LIMS. The raw data being imported into LIMS is in calibration units of ug/L. The LIMS has the prep info entered separately such as weight and volume. The percent solids info is entered separately. The final sample result will be mg/Kg accounting also for dilution factor. To check this result for correctness take the sample result on the raw data in mg/Kg and divide by the percent solids and multiply times 100. This will account for the dry weight. Always multiply times the dilution factor.

11.9 % Recovery MS/MSD = Determined concentration – sample concentration/true value x 100

11.10 %RPD MS/MSD or DUP = (sample - dup)/((sample + dup)/2) x 100. Use concentrations of each in calculations.

12.0 QUALITY CONTROL

12.1 Periodic Demonstrations of Performance

12.1.1 Interelement Correction Factors: IEC's are updated as described in Section 9.1.1.

12.1.2 Linear Ranges: Linear Ranges are updated on an annual basis or as required.

12.1.3 The Internal Standard recovery (Y and/or Sc) must be between 75 – 125% or the sample will be diluted and reanalyzed.

QC Sample	Frequency	ICP QC Table	ICP Action Level	ICP Action	Analyst Response
ICV	Once, after calibration	ICV	± 10% of True Value	Stop	Correct problem and recalibrate.
ICB	Once, after ICV	ICB	>±2 x MDL	Flag Data	Correct problem and reanalyze affected samples.
RLP	Start	RLP	±30% of True Value	Flag Data	Correct problem; then recalibrate/reanalyze samples.
ICSA	Start	ICSA	<2 x MDL	Stop	Correct problem; then recalibrate/reanalyze samples.
ICSAB	Start	ICSAB	±20% of True Value	Stop	Correct problem; then recalibrate/reanalyze samples.
CCV	10% of analytical samples	CCV	±10% of True Value	Flag Data	Correct problem and reanalyze affected samples
CCB	Following each CCV	CCB	>±2 x MDL	Flag Data	Correct problem and reanalyze affected samples.

12.2 Calibration Curves are verified using a ICV solution from an independent source. The Correlation Coefficient for each element reported must be ≥ 0.995.

12.3 The ICB and CCB's are a solution of 1% HNO3 and 5% HCl in DI.

12.4 The frequency of Batch QC samples is 5% for Method 6010B, Method Blank, Laboratory Control Sample (LCS), Matrix Spikes and Serial Duplication sample (SD).

Analyte	Matrix Spike (MS) %R Limit	Matrix Spike Duplicate (MSD) %R Limit	Post-Digestion Spike (PDS) %R Limit	Serial Dilution (SD) RPD Limit	Matrix Duplicate (DUP) RPD Limit	MS/MSD Duplicate (DUP) RPD Limit	LCS Laboratory Control Sample
All Elements	75-125 (DoD limit 80-120%)	75-125 (DoDlimit 80-120%)	75-125	10	20	20	80-120

12.4.1 Method Blanks:

A sample of deionized (DI) water is put through the procedure and analyzed as a Method Blank. Method Blank results above the Laboratory Reporting Limits indicate contamination. The source of contamination will be investigated and corrected. A Method Blank is required 1 for every 20 samples. For DOD projects the method blank must be less than one half the reporting limit.

12.4.2 Laboratory Control Sample:

A sample using DI water plus a spike of the appropriate analytes is put through the entire procedure and analyzed as a laboratory control sample (LCS). Control limits which are not met for percent recovery in the LCS indicate errors during the procedure and require reprep unless there is a definite assignable cause. The LCS control limits are 80%-120% for 6010B. A LCS is required 1 for every 20 samples.

12.4.3 Matrix Spike/ Matrix Spike Duplicate:

Duplicate aliquots of a commercial sample are spiked as a Matrix Spike and a Matrix Spike Duplicate and are put through the entire procedure. The concentration of the analyte in the unspiked sample aliquot should be no more than four times the amount added. If the sample result is greater than four times the amount added, the LCS is the only valid assessment of accuracy for the batch and the spike recovery is not evaluated for control. If the control limits are not met for Relative Percent Difference, the control limits for Percent Recovery in the Matrix Spike are not applicable, since sample heterogeneity is indicated and an inaccurate sample result used to calculate percent recovery is suspected. The control limits are 75% - 125%. For DOD projects the limit is 80-120%. A matrix spike and matrix spike duplicate is required for every 20 samples for 6010B. In some cases, the client may specify which sample is to used for MS/MSD; if not the laboratory shall pick a representative sample based on the following:

A. MS/MSD shall not be performed on Rinsate Blank or Field Blank.
B. Adequate sample weight/volume.
C. Client requested QC deliverables.

12.4.4 Duplicate:

12.4.4.1 Duplicate samples are two aliquots of a sample, which are carried through the same sample preparation and analysis procedure to verify the precision of the method for that sample matrix. The %RPD (Relative Percent Difference) is calculated from the original and the duplicate sample. The %RPD can also be calculated between a matrix spike and matrix spike duplicate. The %RPD is calculated using the concentration of the matrix spike and matrix spike duplicate. If the control limits are not met for Relative Percent Difference, the control limits for Percent Recovery in the Matrix Spike are not applicable, since sample heterogeneity is indicated and an inaccurate sample result used to calculate percent recovery is suspected. The control limits are ≤20% for 6010B. The duplicate for 6010B often refers to the %RPD between the matrix spike and the matrix spike duplicate. In some cases, the client may

specify which sample is to be used for MS/Dup; if not, the laboratory shall pick a representative sample based on the following:

A. Method of extraction or digestion.
B. Duplicate shall not be performed on Trip Blank, Rinsate Blank or Field Blank.
C. Adequate sample weight/volume.
D. Client requested QC deliverables

12.4.5 Serial Dilution sample:

An aliquot of the analytical solution of a representative sample is diluted five-fold and analyzed as the Serial Dilution Sample to determine the presence of interferences during analysis. The control limit is ±10% for 6010B. A serial dilution is required 1 every 20 samples for 6010B.

12.4.5.1 The ICP Serial Dilution Analysis must be performed on a sample from each group of samples of a similar matrix type (i.e., water, soil).

12.4.5.2 Samples identified as field, site, or rinse blanks cannot be used for Serial Dilution Analysis.

12.4.6 Post-Digestion Sample:

An aliquot of analytical solution from a representative solution is spiked and analyzed as the Post-Digestion Sample to determine the presence of interferences during analysis. A post digestion spike is performed whenever a new or unusual sample matrix is encountered. It is also used when a matrix spike fails to verify matrix effects.

12.4.6.1 An analyte spike added to a portion of a prepared sample, or its dilution, should be recovered to within 75-125% of the known value. The spike addition should produce a minimum level of 10x and a maximum of 100x the IDL. If the spike is not recovered within the specified limits, a matrix effect should be suspected.

12.4.6.2 If the sample results are greater than four times the amount added, the Serial Dilution is the only valid assessment of interferences.

12.5 TCLP requirements:

12.5.1 If the concentration of any TCLP extract is within ±20% of the regulatory limit, or if the recovery rate of the matrix spike is <50%, a four-point method-of-standard additions is required (40 CFR 261)

12.5.1.1 Four aliquots are required; See supervisor for instructions on preparation of MSA aliquots.

12.5.1.2 The observed concentrations of the four aliquots will be entered into the Excel MSA_CALC.XLS worksheet which will subject the data to linear regression of external-calibration-derived concentrations (y-axis). The absolute value of the x-intercept is the MSA-corrected concentration.

12.6 Corrective Actions for Batch QC

12.6.1 The initial investigation of the problem involves:

12.6.1.1 Checking sample concentrations for being high compared to the spike concentration.

12.6.1.2 Checking calculations and raw data transcriptions (both QC and sample).

12.6.1.3 Checking sample concentrations and analytical sequence for influences such as carryover and mislabeling.

12.6.1.4 Reviewing the notes in the prep worksheet and analytical notebook for signs of problems or heterogeneity.

12.6.2 When control limits are not met for any batch QC, the analytical replicates are checked to verify that the out-of-control result is not a function of analytical variability.

12.6.3 Method Blank Corrective Actions

12.6.3.1 Method Blank results greater than the laboratory reporting limits it will be investigated. If a sample is greater than the reporting limit and less than ten times the Method Blank results, the sample will be re-prepped and reanalyzed. For DoD projects all analytes must be <½ RL. Any sample associated with a blank not meeting the criteria shall be re-

prepped and re-analyzed, except when the sample analysis resulted in a non-detect.

12.6.4 Laboratory Control Sample Corrective Actions

12.6.4.1 Control limits, which are not met for recovery in the LCS requires the batch to be prepared and reanalyzed

12.6.5 Post-Digestion Spike Corrective Actions

12.6.5.1 If the control limits are not met in the Post-Digestion Spike sample, a chemical or physical interference must be suspected, and the data for all affected analytes in the sample with that Post-Digestion Spike must be flagged according to AMRO policy.

12.6.6 Serial Dilution Corrective Actions

12.6.6.1 If the control limits are not met in the Serial Dilution sample, a chemical or physical interference must be suspected, and the data for all affected analytes in the sample with that Serial Dilution must be flagged according to AMRO policy.

12.6.7 Matrix Spike Corrective Actions

12.6.7.1 Control limits which are not met for a majority of elements in the Matrix Spike, but are met in both the Post-Digestion Spike and the Serial Dilution may indicate analyst error during preparation or sample-specific interferences during preparation; re-preparation and reanalysis are required.

12.6.7.2 If the original results are confirmed after re-preparation, the results indicate sample-specific interferences during preparation. The original data are reported and flagged according to AMRO policy.

12.6.8 Relative Percent Difference Corrective Actions

12.6.8.1 Control limits, which are not met for Relative Percent Difference in the Duplicate Sample indicates sample heterogeneity. Check sample observations for documentation of visible heterogeneity. If no sign of failure of the total analytical system, including sample preparation, is found, the result will be flagged according to AMRO

policy. A sign of failure of the analytical system requires re-prepping of the entire batch.

13.0 DATA REVIEW AND STORAGE

13.1 All related preparation information and observations will be noted in the digestion logbook.

13.2 All cross-outs must be a single line and should be initialed and dated. Analyst review is documented on the ICP Data Review Checklist.

13.3 All data from each run will be properly labeled and placed in the central file in an appropriate storage area. Each central file will include a run log, sample digestion worksheet, and all original data.

13.4 The Optima has the capability to generate analytical results with multiple lines. This is an extremely valuable feature. For example, the primary Antimony line at 206.833 has a serious spectral interference from Chromium. With the Optima, Antimony can be simultaneously determined at the 217.582 line and the results compared. Multiple wavelengths are utilized as much as practical in all methods to ensure accurate results (it's rare that two wavelengths would have the same spectral interference, for example) and to provide the analyst and the data reviewers a "reality check."

13.5 Another use of multiple lines is to extend linearity. The most sensitive Manganese line is 257.610 and it has a Linear Range of 20,000 µg/L. The slightly weaker Manganese line at 293.0000 can extend the Linear Range to 50,000µg/L.

13.6 Data Transfer

13.6.1 At the completion of the run, go to File/Utilities/and select WinLab32 – Off-Line.
13.6.2 Go to File/Utilities and select Data Manager.
13.6.3 Select a files (or files) to transfer and click on COPY.
13.6.4 Click BROUSE to locate the Limsimport on 'AMRO2' and click to open. Double click results to open the database and click OK to transfer the data.

13.6.5 After transferring, close the Data Manager (WinLab32 can stay open and run in the background).

14.0 REFERENCES

14.1 Optima 7300 Family Hardware Guide Operator's Manual, Perkin-Elmer (09906878 Release C), November 2010.

14.2 ICP WinLab Software Guide built into the WinLab software.

14.3 Inductively Coupled Plasma-Atomic Emission Spectrometry,6010B, Test Methods for Evaluating Solid Waste, SW-846, Edition, Revision 2, US EPA, December 1996.

14.4 40 CFR Part 136. Appendix B.

14.5 Department of Defense Quality Systems Manual for Environmental Laboratories, Final Version 3, January 2006.

Table 1. Primary Wavelengths

SW-846 Methods 6010B/3010A

ELEMENT	Wavelength, nm	RL (µg/L)	Linear Range(µg/L)
Aluminum	308.215	200	500,000
Antimony	206.833	20	20,000
Arsenic	188.979	50	10,000
Barium	233.527	200	60,000
Beryllium	313.107	4	2,000
Boron	208.957	250	40,000 (Carryover Likely)
Cadmium	214.44	5	10,000
Calcium	227.546	2500	500,000
*Chromium	267.716	10	20,000
*Cobalt	228.616	50	20,000
Copper	324.452	25	20,000 (Carryover Likely)
Iron	273.955	100	320,000
Lead	220.353	12	100,000
Lithium	670.784 (Radial)	100	50,000
Magnesium	279.077	2500	500,000
Manganese	257.61	15	20,000
*Molybdenum	202.03	25	20,000
*Nickel	213.604	40	40,000
Potassium	766.474 (Radial)	2500	500,000
Selenium	196.026	80	10,000
Silver	328.068	7	2,000
Sodium	589.592 (Radial)	2500	500,000
Strontium	421.522 (Radial)	10	12,500
Thallium	190.5	50	10,000
Tin	189.933	250	20,000
*Titanium	368.519	100	20,000
*Vanadium	292.402	50	40,000
Zinc	206.2	20	40,000

Table 2. Secondary Wavelengths

SW-846 Methods 6010B/3010A

ELEMENT	(Secondary Wavelength, nm)	RL (µg/L)	Linear Range (µg/L)
Aluminum	237.335	200	100,000
Aluminum	394.401	200	100,000
Antimony	217.582	20	20,000
Arsenic	193.696	50	10,000
Barium	230.425	200	60,000
Beryllium	234.861	4	10,000
Boron	182.527	250	40,000
Boron	249.677	250	40,000
Cadmium	226.502	5	10,000
Cadmium	228.802	5	10,000
Calcium	315.887	2500	100,000
Calcium	317.933	2500	100,000
Chromium	205.56	10	20,000
Copper	224.7	25	20,000 (Carryover Likely)
Copper	327.393	25	20,000 (Carryover Likely)
Iron	238.204	100	10,000
Iron	238.616	100	320,000
Lead	217	12	100,000
Lead	283.306	12	100,000
Manganese	260.568	15	20,000
Manganese	293.305	15	50,000
Nickel	227.022	40	40,000
Nickel	341.476	40	40,000
Silver	338.289	7	2,000
Sodium	330.237 (Axial)	NA	500,000 (Reference Only)
Strontium	407.771 (Radial)	10	5,000
Titanium	334.903 (Radial)	100	20,000
Titanium	337.279	100	20,000
Vanadium	270.093	50	40,000
Vanadium	290.88	50	40,000
Zinc	202.548	20	20,000
Zinc	213.857	20	20,000

Table 3. Primary Wavelengths

SW-846 Methods 6010B/3050A

ELEMENT	Wavelength, nm	RL (mg/Kg)	Linear Range(µg/L)
Aluminum	308.215	20	500,000
Antimony	206.833	4	20,000
Arsenic	188.979	5	10,000
Barium	233.527	20	60,000
Beryllium	313.107	0.5	2,000
Boron	208.957	25	40,000
Cadmium	214.44	0.5	10,000
Calcium	227.546	250	500,000
Chromium	267.716	1	20,000
Cobalt	228.616	5	20,000
Copper	324.452	2.5	20,000 (Carryover Likely)
Iron	273.955	10	320,000
Lead	220.353	2.5	100,000
Lithium	670.784 (Radial)	10	50,000
Magnesium	279.077	250	500,000
Manganese	257.61	1.5	20,000
Molybdenum	202.03	2.5	20,000
Nickel	213.604	4	40,000
Potassium	766.474 (Radial)	250	500,000
Selenium	196.026	12	10,000
Silver	328.068	1.4	2,000
Sodium	589.592 (Radial)	250	500,000
Strontium	421.522 (Radial)	1	12,500
Thallium	190.5	5	10,000
Tin	189.933	25	20,000
Titanium	368.519	10	20,000
Vanadium	292.402	5	40,000
Zinc	206.2	4	40,000

Table 4. Secondary Wavelengths

SW-846 Methods 6010B/3051A

ELEMENT	Wavelength, nm	RL (mg/Kg)	Linear Range(µg/L)
Aluminum	308.215	20	500,000
Antimony	206.833	4	20,000
Arsenic	188.979	5	10,000
Barium	233.527	20	60,000
Beryllium	313.107	0.5	2,000
Boron	208.957	25	40,000
Cadmium	214.44	0.5	10,000
Calcium	227.546	250	500,000
Chromium	267.716	1	20,000
Cobalt	228.616	5	20,000
Copper	324.452	2.5	20,000 (Carryover Likely)
Iron	273.955	10	320,000
Lead	220.353	2.5	100,000
Lithium	670.784 (Radial)	10	50,000
Magnesium	279.077	250	500,000
Manganese	257.61	1.5	20,000
Molybdenum	202.03	2.5	20,000
Nickel	213.604	4	40,000
Potassium	766.474 (Radial)	250	500,000
Selenium	196.026	8	10,000
Silver	328.068	1.4	2,000
Sodium	589.592 (Radial)	250	500,000
Strontium	421.522 (Radial)	1	12,500
Thallium	190.5	5	10,000
Tin	189.933	25	20,000
Titanium	368.519	10	20,000
Vanadium	292.402	5	40,000
Zinc	206.2	2	40,000

Table 5. Standard and QC Concentrations

SCP_STDS_2012

PERKIN-ELMER OPTIMA 3300DV ICP

December 2012 to 2013

Element	AMRO S1 ug/L 1.0_>1L	AMRO S2/CCV ug/L 5mL->1L	AMRO S3 ug/L 5mL->0.5L	AMRO S4 ug/L 100->1L 4->1L	AMRO ICV ug/L VHG	AMRO RL0.5 ug/L 0.20->1L sn@0.2	AMRO RL1 ug/L 0.5->1L	AMRO RL2 ug/L 1.0->1L	AMRO CCV ug/L 5mL->1L	AMRO CCV/Low ug/L 3mL->1L	AMRO LCS/SPK ug/L 0.20mL->0.05L	AMRO ICSA ug/L 100->1L 4->1L	AMRO ICSAB ug/L 100->1L 10.->1L 4->1L	(from CRI) AMRO PDS ug/L 5.0->0.05L 0.10->5.0mL	(from CRI) (+ Mix) AMRO IDL/MDL ug/L 0.5-->50
Al	400	10,000	20,000	500,000	1,000	80	200	400	10,000	6,000	8,000	500,000	501,000	784	40.0
Sb	40	2,525	5,050		1,000	8	20	40	2,525	1,515	2,020		253	78	4.00
As	100	2,500	5,000		1,000	20	50	100	2,500	1,500	2,000		250	196	10.0
Ba	400	5,000	10,000		1,000	80	200	400	5,000	3,000	4,000		500	784	40.0
Be	9.99	1,000	2,000		1,000	1.998	5.0	9.99	1,000	600	800		100	20	1.00
Cd	8	1,000	2,000		1,000	1.6	4.0	8	1,000	600	800		100	16	0.80
Ca	5000	25,000	50,000	500,000	21,006	1000	2500	5000	25,000	15,000	20,000	500,000	502,500	9,804	500
Cr	20	5,000	10,000		1,000	5.0	10	20	5,000	3,000	4,000		500	39	2.00
Co	100	5,000	10,000		1,000	25	50	100	5,000	3,000	4,000		500	196	10.0
Cu	50	2,500	5,000		1,000	12.5	25	50	2,500	1,500	2,000		250	98	5.00
Fe	200	5,000	10,000	301,204	1,000	40	100	200	5,000	3,000	4,000	300,200	300,451	392	20.0
Pb	50	2,500	5,000		1,000	10	25	50	2,500	1,500	2,000		250	98	5.00
Mg	5001	25,000	50,000	500,000	20,998	1000.2	2501	5001	25,000	15,000	20,000	500,000	502,500	9,806	500
Mn	30	5,000	10,000		1,000	6	15	30	5,000	3,000	4,000		500	59	3.00
Mo	50	2,505	5,010		1,000	10	25	50	2,505	1,002	2,004		501	98	5.00
Ni	80	5,000	10,000		1,000	16	40	80	5,000	3,000	4,000		500	157	8.00
K	5000	25,000	50,000		30,000	1000	2500	5000	25,000	15,000	20,000		2,500	9,804	500
Se	120	2,000	4,000		1,000	24	60	120	2,000	1,200	1,600		200	235	12.0
Ag	14	500	1,000		500	2.8	7.0	14	500	300	400		50	27	1.40
Na	5000	25,000	50,000		21,000	1000	2500	5000	25,000	15,000	20,000		2,500	9,804	500
Sr	20	2,500	5,000		1,000	4	10	20	2,500	1,500	2,000		250	39	2.00
Tl	100	2,000	4,000		1,000	20	50	100	2,000	1,200	1,600		200	196	10.0
Ti	200	5,000	10,000		1,000	40	100	200	5,000	3,000	4,000		500	392	20.0
V	100	5,000	10,000		1,000	20	50	100	5,000	3,000	4,000		500	196	10.0
Zn	40	5,000	10,000		1,000	8	20	40	5,000	3,000	4,000		500	78	4.00
Li	200	2,500	5,000		1,000	40	100	200	2,500	1,500	2,000		250	392	20.0
B	500	5,000	10,000		1,000	100	250	500	5,000	3,000	4,000		500	980	50.0
Sn	500	2,500	5,000		1,000	100	250	500	2,500	1,500	1,000		250	980	50.0

AMRO Environmental Laboratories Corporation

111 Herrick Street, Merrimack, NH 03054
TEL: (603) 424-2022 • FAX: (603) 429-8496
www.amrolabs.com

Aqueous Samples for Total or Dissolved Metals for analysis by ICP/Graphite Furnace Atomic Absorption by SW-846 Method 3010A

Procedure Number: IL-3020

Revision No.: 2

Revision Date: 01/12/2004

Review Date: 01/04/2010

Prepared By: Paula Benham Date: 1/11/10

Approved By: Robert E. Bosshart Date: 01/12/10
Inorganic Manager

Approved By: [signature] Date: 1/11/10
Laboratory Director

Approved By: Paula Benham Date: 1/11/10
Quality Assurance Manager

TABLE OF CONTENTS

		Page
1.0	SCOPE AND APPLICATION	3
2.0	METHOD SUMMARY	4
3.0	DEFINITIONS	4
4.0	SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE	5
5.0	POTENTIAL PROBLEMS AND INTERFERENCES	5
6.0	HEALTH AND SAFETY	6
7.0	INSTRUMENTS AND EQUIPMENT	7
8.0	REAGENTS AND STANDARDS	7
9.0	PROCEDURE	12
10.0	INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR	14
11.0	CALCULATIONS	14
12.0	QUALITY CONTROL	14
13.0	DATA REVIEW AND STORAGE	17
14.0	REFERENCES	18
	Attachment 1 Trace Metals Digestion Worksheet	19
	Attachment 2 3010A Qualification Card	20

1.0 SCOPE and APPLICATION

1.1 Application

1.1.1 This digestion procedure is used for the preparation of aqueous samples, TCLP extracts, and wastes that contain suspended solids for analysis by Inductively Coupled argon Plasma spectroscopy (ICP). The procedure is a hot acid leach for determining available metals.

1.1.2 Samples prepared by Methods 3010A using nitric acid digestion may be analyzed by ICP for Aluminum, Antimony, Arsenic, Barium, Beryllium, Boron, Cadmium, Calcium, Chromium, Cobalt, Copper, Gold, Iron, Lead, Magnesium, Manganese, Molybdenum, Nickel, Potassium, Selenium, Silver, Sodium, Strontium, Thallium, Tin, Titanium, Vanadium and Zinc.

1.1.3 Samples prepared by Method 3010A can be analyzed on the graphite furnace since Hydrochloric Acid is added to the standards and does not present an interference with STPF technology employed at AMRO Laboratory.

1.1.4 The results derived from analyses of the digestates produced by following the total metals procedures of this SOP will be reported as "Total Metals"; those following the dissolved metals procedures of this SOP will be reported as "Dissolved Metals".

1.2 Modifications

1.2.1 The initial sample volumes used by AMRO is 50mL, not 100 mL as specified by the Method. Instrument sensitivity is sufficient to not require concentration. Also the nature of the samples received by AMRO typically require dilution via digestion and/or analysis to provide accurate results.

1.2.2 Arsenic, Lead, Selenium, Thallium, Cadmium, Antimony, and Silver can be determined by Graphite Furnace since Hydrochloric Acid is added to the standards and does not present an interference with STPF technology employed at AMRO.

1.2.3 In place of beakers and hot plate, samples are digested on a hotblock with a digital temperature controller using 50mL tubes designed for use on the hotblock.

2.0 METHOD SUMMARY

2.1 Total Metals: A representative 50mL sample is refluxed in a covered beaker. This step is repeated with additional Nitric Acid until the digestate is clear in color or until the color has stabilized. After the sample has been brought to a low volume, it is refluxed with Hydrochloric Acid and brought to a final volume of 50 mL.

2.2 Dissolved Metals: The sample is filtered through a 0.45 um filter at the time of collection and the liquid phase is then acidified immediately with nitric acid.

2.3 AMRO routinely digests MS, MSD and sample duplicate to meet all varying project QC requirements.

3.0 DEFINITIONS

3.1 Method Blank: An aliquot of reagent water, which is carried through the entire analytical procedure with the samples, its purpose is to determine whether contamination is present during the analysis. One method blank is analyzed for every batch of 20 samples.

3.2 Laboratory Control Sample: An aliquot of reagent water into which known quantities of the method analyte are added in the laboratory. The LCS is analyzed exactly like a sample, and its purpose is to determine the degree to which the analytical result approaches the "true value" of the concentration of the analyte being determined. The percentage recovery is calculated in order to assess the efficiency of the analysis. One LCS is analyzed for every batch of 20 samples.

3.3 Sample Duplicate: Two aliquots of a sample are which are carried through the same preparation and analytical procedures to verify the method precision. One sample duplicate is analyzed for every batch of 20 samples.

3.4 Sample Matrix Spike: A specific aliquot of sample into which a known amount of analyte is added. The analytical spike is analyzed with the sample batch and the percent recovery is calculated in order to assess the matrix effect on the analytical system. One sample matrix spike is analyzed for every batch of 20 samples.

4.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

4.1 All sample containers must be cleaned according to the SOP on glassware cleaning.

4.2 Samples shall be acidified at the time of collection with nitric acid to pH<2. The holding time is six months at room temperature.

4.3 For the determination of dissolved elements, the sample should be filtered through a 0.45 um membrane filter at the time of collection.

4.3.1 If the samples are not filtered and acidified at the time of collection, the client is contacted to determine if filtration and acidification by the laboratory are desired.

4.3.1.1 If the client desires filtration and acidification by the laboratory use a portion of the sample to rinse the filter assembly, discard and then collect at least 100mL of filtrate. Transfer the filtrate into an appropriately labeled container. Record the volume in the preparation log. Acidify the filtrate to (pH < 2) immediately following filtration.

4.3.1.2 Make sure the container is labeled with the appropriate AMRO ID number, labeled as "Dissolved Metals," and has date filtered and analyst initials.

4.3.1.3 The resultant data are flagged with a footnote, which States: "These samples were filtered at the request of the client. The results represent the dissolved metals content at the time of filtering."

5.0 POTENTIAL PROBLEMS AND INTERFERENCES

5.1 Non-homogeneous samples may result in poor accuracy and precision. The analyst should note problem samples under comments on the digestion worksheet.

6.0 HEALTH AND SAFETY

6.1 AMRO places a high value on laboratory safety. The air quality of the laboratory has been monitored. Fire extinguishers are located in various areas of the lab. The laboratory evacuation plan is posted in every room, with a designated meeting place.

6.2 All new analysts receive training on the safe handling of samples, standards, the changing of gas cylinders, and the operation of instruments. In the lab, clean lab coats and gloves are worn when working with samples. Neat standards are made up in hoods. When gas tanks are replaced, the carrier with chain is used properly, and all gas tanks are chained in place. Soap is used to check for any leaks.

6.3 Care is taken with glassware and syringes to prevent injury. Broken glass and syringes are promptly removed to broken glass containers. First aid kits are available throughout the lab. There are also eyewash stations and an emergency shower.

6.4 Cautions for nitric acid and hydrochloric acid:

6.4.1 All handling of hot solutions containing these materials must be performed under a hood. Contact hazards and contingencies - Liquid and vapor cause severe burns. May be fatal if swallowed. Harmful if inhaled and may cause delayed lung injury. Do not get in eyes, on skin, on clothing. Do not breathe vapor. Keep in tightly closed container. Use with adequate ventilation. In case of contact, remove clothing and flush area with water spray. In case of ingestion, administer fluids immediately. In case of inhalation, remove from exposure.

6.4.2 Spills, storage and contingencies - Spillage may cause fire or liberate dangerous gas. Keep from contact with clothing and other combustible materials. Do no store near combustible materials. In case of spill, stop the spill, use the Acid Spill Kit and ventilate the area.

6.4.3 Fire hazards and contingencies - Strong oxidizer - contact with other material may cause fire. In case of fire, use water spray, alcohol foam, dry chemical, or carbon dioxide.

6.4.4 During addition to sample, nitric acid may evolve toxic nitrogen oxide Fumes. Therefore all work must be performed in a properly operating hood.

6.5 MSDS's are reviewed for each chemical used to ensure proper precautions are observed when handling chemicals.

6.6 Pollution prevention: The use of chemical exhaust hood are required when working with chemicals. They are specifically designed to minimize analyst exposure. The hood exhaust is monitored periodically to ensure environmental exposure is minimized.

7.0 INSTRUMENTS AND EQUIPMENT

7.1 Thermolyne Type 2200 Heavy-Duty hotplate (or equivalent).

7.2 100 mL Kimax Beakers (Fisher# 02-555-20A or equivalent)

7.3 Hotplate thermometer (Fisher Cat # 15-170-10D)

7.4 200 & 500uL Eppendorf pipets (or equivalent). (Fisher# 03402- or equivalent)

7.5 Repipet Universal Dispenser, 10 mL volume range in 0.05 mL graduations

7.6 52 mL containers for sample storage (Cat. #3264)

7.7 Digibloc 3000 hotblock (SCP Science p/n 010-500-001)

7.8 Digitubes, 50mL with caps and certification of volume (SCP p/n 010-500-261).

7.9 Disposable watch glasses (SCP p/n 010-500-019).

8.0 REAGENTS AND STANDARDS

8.1 AMRO reagent water – Deionized Water (DI) from a Culligan System that is checked monthly for Residual Chlorine, Conductivity, pH, Arsenic, Barium, Cadmium, Chromium, Copper, Iron, Lead, Nickel, Selenium, Silver, Zinc and Mercury. Resistivity and pH are monitored daily. Instrument and Procedural Blanks are also used to monitor contaminant levels through out the laboratory.

8.2 Before performing the analysis, the analyst should **read the Materials Safety Data Sheet (MSDS)** of all the reagents and standards carefully and be prepared to take necessary emergency action at all times.

8.3 Nitric acid for Trace Metals Analysis, Tedia, NE4123

8.4 Hydrochloric acid for Trace Metals Analysis, Tedia, NE408

8.5 Spiking solutions

8.5.1 The concentration of analytes in the spiking solution should be:

ANALYTE	CONCENTRATION IN SPIKE SOLUTION, MG/L	CONCENTRATION IN DIGESTATE, UG/L
Aluminum	2000	8000
Antimony by GFAA	5.0	20
Antimony by ICP	1000	2000
Arsenic by GFAA	5.0	20
Arsenic by ICP	500	2000
Barium	1000	4000
Beryllium	100	800
Cadmium by GFAA	2.0	12.5
Cadmium by ICP	200	800
Calcium	5000	20000
Chromium	1000	4000
Cobalt	1000	4000
Copper	500	2000
Iron	1000	4000
Lead by GFAA	5.0	20
Lead by ICP	500	2000
Magnesium	5000	20000
Manganese	1000	4000
Molybdenum	500	2000
Nickel	1000	4000
Potassium	5000	20000
Selenium by GFAA	4.0	20
Selenium by ICP	400	1600
Silver by GFAA	1.0	4.0
Silver by ICP	100	400
Sodium	5000	20000
Strontium	500	2000
Thallium by GFAA	4.0	20
Thallium by ICP	400	1600
Titanium	1000	4000
Vanadium	1000	4000
Zinc	1000	4000

8.5.2 The ICP Spiking solution is a purchased Superstock. (See ICP Standard Log.)

8.5.3 The GFAA spiking solution is prepared from a purchased Superstock. (See GFAA Standard Log.)

TRACKING OF ANALYTICAL STANDARDS

8.6 Chemical Receipt

The receipt of all standards, neat compounds and reagents from commercial sources is
documented in the Chemical Receiving Logbook by sample receiving personnel or designate. Each solution or compound is assigned a unique standard receipt ID number, the letter "A" and a four digit sequential number. The date received, source, lot number, expiration date and disposal date are recorded. The expiration dates are provided from the manufacturer and AMRO employees complete the disposal dates when standards are used up or disposed.

8.7 Standards Preparation

Standards are prepared as written in the respective SOPs. In order to assure the accuracy of standards the following general guidelines are used:

8.7.1 ACS reagent grade chemicals are used when the method warrants.

8.7.2 A certificate of analysis accompanies any stock standards that are purchased from the manufacturer.

8.7.3 Class A volumetric glassware is used to prepare standards.

8.8 Standard Tracking

It is important to be able to track all analytical standards back to their sources. AMRO personnel to accomplish this use the following procedure:

8.8.1 Wet Chemistry and Mercury Standards - Working Standards and LCS solutions made from stock standards listed in the Chemical Receiving Log are documented in the Inorganic Standard Log. The corresponding analysis, preparation date, standard name, AMRO ID, amount used, initial concentration of standard, amount used, final volume, final concentration, Standard ID, expiration date, storage location, and analyst initials are recorded. The initial concentration of the standard is obtained from the certificates received from the manufacturer. The Standard ID is written as an "S" followed by a four digit sequential number. The expiration of

working standards vary depending on the use. Standards should be used in accordance with method specifications and manufacturer's instructions. The expiration date for ICP standards is six months. The expiration dates for GFAA intermediate and spiking solution is one month with the calibration standards made weekly but made daily for DOD.

8.8.2 Metals Standards

8.8.2.1 Axial Standards Log (OPTIMA) - Preparation and Standard ID's are listed in the Standard Log. Standards include: S1 (Calibration #1 & RL2), S2 (Calibration #2 & IPC/CCV), S3 Calibration #3, RL 1 (Reporting Limit), RL2 (two times the Reporting Limit),S4,S5 (linear range extending standards) ICSA & ICSAB (Interference Check Standards), ICV (Independent Source QC Standards), and Stock Solutions for Matrix/LCS spike additions. The Solution ID is written as the ID followed by the date prepared (example: S1042798 is standard S1 prepared on 042798). After a conformational analysis to verify the new standard and just prior to it's use, the new ID is entered into the OPTIMA software. Until updated, this will be the ID printed on every run log and standard page for hardcopy tracking.

8.8.2.2 Radial Standards Log (SPECTRO 2) - Preparation and Standard ID's are listed in the Standard Log. Standards include: NS1 (Calibration #1 & CCV), NS2 (Calibration #2 & IPC), NRL 1 (Reporting Limit), NRL2 (two times the Reporting Limit), NS3, NS4, NS5 and NS6 (Linear Range Extending Standards), ICSA &ICSAB (Interference Check Standards), NICV (Independent Source QC Standards), and Stock Solutions for Matrix/LCS spike additions. The Solution ID is written as the ID followed by the date prepared (example: NS1042798 is standard NS1 prepared on 042798). After a conformational analysis to verify the new standard and just prior to its use, the new ID is entered into the SPECTRO2 software. Until updated, this will be the ID printed on every run log and standard page for hardcopy tracking.

8.8.2.3 Graphite Furnace Standard Logs (GFAA): Preparation and Standard ID's listed in this log include: Purchased Stock Certificates: Intermediate Calibration, CCV, ICV, LCS/MS Solutions: and final Calibration Solutions, final ICV final

CCV and final reporting limit. These standards are prepared from the same stock solution as those used for the ICP. The nomenclature is essentially the same, but there are more dilutions needed, which necessitate Intermediate Solutions. Nomenclature for intermediate solutions includes "INT", the type of solution, and the date prepared. After a conformational analysis to verify the new standard and just prior to it's use, the new ID is entered into the PE-4100ZL and/or PE-SIMMA software. Until updated, this will be the ID printed on every run log and standard page for hardcopy training.

8.8.3 Wet Chemistry and Metals Reagent Log - Working reagents are made from reagents listed in the Chemical Receiving Log are documented in the Reagent Log, The corresponding analysis, preparation date, reagent name, AMRO ID, initial concentration, amount used, final volume, final concentration, Solution ID, expiration date, storage location, and analyst initials are recorded. The initial concentration is obtained from the certificate received from the manufacturer. The Solution ID is written as an "R" followed by a 4 digit sequential number. The expiration of prepared reagents varies. Reagents should be used in accordance with method specifications and manufacturer's instructions.

9.0 PROCEDURE

Obtaining a Homogeneous Sample

9.1.1 Thoroughly mix the sample in the original container.

9.1.2 Any problems encountered, which might interfere in getting a homogeneous sample, should be noted (flagged) on the worksheet (e.g. half water and half silt organic material, etc.).

9.2 Dissolved Metals

9.2.1 See Section on Sample Handling and Preservation for proper handling of dissolved samples.

9.2.2 DI water must be prepared and analyzed in the same fashion as the samples as a filter blank.

9.3 Digestion

9.3.1 If samples contain undissolved solids at greater than 1% (i.e. visible solid matter) see your supervisor for further instructions.

9.3.2 Label the containers with the sample I.D. and pour the sample into the appropriately labeled tube up to the 50mL mark (see obtaining a homogeneous sample).

9.3.3 Record the volume in the preparation log.

9.3.4 Transfer the sample to a 100mL acid-washed beaker if using beakers and hotblock in place of Digibloc.

9.3.5 Add 1.5 mL of concentrated nitric acid and cover with a ribbed watch glass.

9.3.5.1 NOTE: For laboratory control samples, matrix spike (MS) and matrix duplicates (D), the spiking solution must be added after the water and the acids, or low spike recoveries may be obtained.

9.3.5.2 Add 0.20mL each of the ICP spike solutions and 0.20 mL of the GFAA spike solution to the respective LCS, MS and MSD samples. See Section 9.2 for QC frequency.

9.3.5.3 A preparation blank consisting of DI water and all reagents is digested along with the samples.

9.3.5.4 Document and notify the immediate supervisor if acid additions cause precipitation of the sample.

9.3.6 Place the samples on a heated hot plate and cautiously reduce the volume to 5-10mL (NOTE: The final volume is left to the discretion of the analyst in cases where samples spatter or contain high TDS). Cool and add another portion of Nitric Acid. Cover the beaker with a non-ribbed watch glass and reflux gently.

NOTE: If the sample goes to dryness, it MUST be reprepped.

9.3.7 Continue heating, adding additional nitric acid, as necessary until the digestion is complete: either light in color or no change of appearance with continued refluxing. Evaporate to a low volume 5-10mL and
remove the beaker to cool.

9.3.8 Add 2.5mL of concentrated Hydrochloric Acid, cover the beaker, and reflux an additional 15 minutes to dissolve any precipitate or reside. Cool the sample. Transfer the sample to the appropriately labeled tube if using beakers and hotplate.

9.3.9 Rinse the beaker or flask into the container with DI water to the 50 mL mark. For Digibloc only need to carefully bring to 50mL mark **Mix all samples thoroughly**.

9.3.10 Record the final volume in the logbook.

9.3.11 The sample is now ready for analysis. If the sample contains insoluble material that could clog the nebulizer, it MUST be filtered using a 0.45u filter prior to analysis.
Note: Filtration, if required, is ALWAYS done by the ICP or HGA analyst and never as part of the preparation procedure.

9.4 Preventive Maintenance

9.4.1 See SOP's for glassware washing, and maintenance and use of pipettes. There is no required preventive maintenance for heaters and associated equipment.

9.4.2 On a weekly basis, or as needed, wipe down hotblock and racks with DI dampened cloth.

10.0 INSTRUMENT PREVENTAIVE MAINTENANCE AND REPAIR

10.1 Refer SOP's for glassware washing, and maintenance and use of pipettes. There is no required preventive maintenance for heaters and associated equipment.

10.2 On a weekly basis, or as needed, wipe down hotblock and racks with DI dampened cloth.

11.0 CALCLATIONS

11.1 Not applicable unless initial volume is different than the final volume. If it is see instrument analyst.

12.0 QUALITY CONTROL

12.1 Method Blanks:

A sample of deionized (DI) water is put through the procedure and analyzed as a Method Blank. Method Blank results above ±2x MDL (MDL check) indicate contamination. The source of contamination will be investigated and corrected. If the samples are less than ten times the Method Blank results and greater than 2x MDL (MDL check), the samples will be re-prepped. A Method Blank is required 1 for every 20 samples.

12.2 Laboratory Control Sample:

A sample using DI water plus a spike of the appropriate analytes is put through the entire procedure and analyzed as a laboratory control sample (LCS). Control limits which are not met for percent recovery in the LCS indicate errors during the procedure and require reprep unless there is a definite assignable cause. The LCS control limits are 80%-120% for 6010B. A LCS is required 1 for every 20 samples.

12.3 Matrix Spike/ Matrix Spike Duplicate:

Duplicate aliquots of a commercial sample are spiked as a Matrix Spike and a Matrix Spike Duplicate and are put through the entire procedure. The concentration of the analyte in the unspiked sample aliquot should be no more than four times the amount added. If the sample result is greater than four times the amount added, the LCS is the only valid assessment of accuracy for the batch and the spike recovery is not evaluated for control. If the control limits are not met for Relative Percent Difference, the control limits for Percent Recovery in the Matrix Spike are not applicable, since sample heterogeneity is indicated and an inaccurate sample result used to calculate percent recovery is suspected. A matrix spike and matrix spike duplicate is required for every 20 samples for 6010B and 7000 series. In some cases, the client may specify which sample is to used for MS/MSD; if not , the laboratory shall pick a representative sample based on the following:

A. MS/MSD shall not be performed on Rinsate Blank or Field Blank.
B. Adequate sample weight/volume.
C. Client requested QC deliverables.

12.4 Duplicate:

12.4.1 Duplicate samples are two aliquots of a sample, which are carried through the same sample preparation and analysis procedure to verify the precision of the method for that sample matrix. The %RPD can also be calculated between a matrix spike and matrix spike duplicate. The %RPD (Relative Percent Difference) is calculated from the original and the duplicate sample. The %RPD is calculated using the concentration of the matrix spike and matrix spike duplicate. If the control limits are not met for Relative Percent Difference, the control limits for Percent Recovery in the Matrix Spike are not applicable, since sample heterogeneity is indicated and an inaccurate sample result used to calculate percent recovery is suspected. The control limits are 0%-20% for 6010B and 7000 series. The duplicate for 6010B often refers to the %RPD between the matrix spike and the matrix spike duplicate. In some cases, the client may specify which sample is to be used for MS/Dup; if not, the laboratory shall pick a representative sample based on the following:

A. Method of extraction or digestion.
B. Duplicate shall not be performed on Trip Blank, Rinsate Blank or Field Blank.
C. Adequate sample weight/volume.
D. Client requested QC deliverables

12.5 Corrective Actions for Batch QC

12.5.1 The initial investigation of the problem involves:

12.5.1.1 Checking sample concentrations for being high compared to the spike concentration.

12.5.1.2 Checking calculations and raw data transcriptions (both QC and sample).

12.5.1.3 Checking sample concentrations and analytical sequence for influences such as carryover and mislabeling.

12.5.1.4 Reviewing the notes in the digestion worksheet and analytical notebook for signs of problems or heterogeneity.

12.6 Method Blank Corrective Actions

12.6.1 Method Blank results greater than 2 x MDL will be investigated. If a sample is greater than the reporting limit and less than ten times the Method Blank results, the sample will be re-prepped and reanalyzed

12.7 Laboratory Control Sample Corrective Actions

12.7.1 Control limits which are not met for recovery in the LCS requires the batch to be prepared and reanalyzed

12.8 Matrix Spike Corrective Actions

12.8.1 Control limits which are not met for a majority of elements in the Matrix Spike, but are met in both the Post-Digestion Spike and the Serial Dilution may indicate analyst error during preparation or sample-specific interferences during preparation; re-preparation and reanalysis are required.

12.8.2 If the original results are confirmed after re-preparation, the results indicate sample-specific interferences during

preparation. The original data are reported and flagged according to AMRO policy.

12.9 Relative Percent Difference Corrective Actions

12.9.1 Control limits which are not met for Relative Percent Difference in the Duplicate Sample indicates sample heterogeneity. Check sample observations for documentation of visible heterogeneity. If no sign of failure of the total analytical system, including sample preparation, is found, the result will be flagged according to AMRO policy. A sign of failure of the analytical system requires re-prepping of the entire batch.

13.0 DATA REVIEW AND STORAGE

13.1 All related preparation information and observations will be noted in the digestion logbook.

13.2 All cross-outs must be a single line and should be initialed and dated. Analyst review is documented on the Trace Metals Digestion (Attachment 1).

13.3 All data from each run will be properly labeled and placed in the central file in an appropriate storage area. Each central file will include a run log, sample prep sheet, and all original data.

14.0 REFERENCES

14.1 EPA-200.7 Determination of Metals and Trace Elements in Water and Wastes.

14.2 EPA-200.9 Determination of Trace Elements by Stabilized Temperature Graphite Furnace Atomic Absorption, Revision 2.2, May 1994.

14.3 Acid Digestion of Aqueous Samples and Extracts for Total Metals for Analysis by FLAA or ICP Spectroscopy, 3010A. Test Methods for Evaluating Solid Waste, US EPA SW-846, 3rd Edition, Revision 2. December 1996.

14.4 40 CFR Part 136. Appendix B.

14.5 Department of Defense Quality Systems Manual for Environmental Laboratories, Revision 3, January 2006.

Attachment 1

AMRO Environmental Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

TRACE METALS DIGESTION WORKSHEET

SW-846 Methods: 3010A / 3050B
EPA Methods: 200.7 / 200.9

Performed By: _____ Date: _____
Temp: _____ HNO3 ID No.: _____
HCl ID No.: _____
Acceptable temperature of 90-95 °C LIMS Batch ID: _____

Lab Order	Lab Sample Number	Sample Description	Initial Volume(mL)/ Weight (g)	Final Volume (mL)	Spike Added (mL)	Comments

Matrix Spike	
Solution ID	Spiking Compounds and Concentration

qc/qcmemos/forms/tmdig Rev. 4 05/00

Attachment 2

AMRO Environmental
Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

QUALIFICATION CARD FOR SW-846 METHOD 3010A

Trainee: _____ Signature: _____

Trainer: _____ Signature: _____

I. Knowledge Factors:

SOP Title: _____ Revision Number/Date: _____

1. Did the Trainee read and understand the above SOP? Yes ☐ No ☐ NA ☐
2. Was the Trainee instructed on how to properly fill out the documentation? Yes ☐ No ☐ NA ☐
3. Has the Trainee been instructed on the proper procedures for addressing potential problems? Yes ☐ No ☐ NA ☐

II. Practical Factors:

1. Has the Trainee completed a Precision and Accuracy Study? Yes ☐ No ☐ NA ☐
2. Has the Trainee demonstrated the ability to review and correct Batch QC problems? Yes ☐ No ☐ NA ☐

Completion Date: _____ Trainer's Signature: _____

I _____ have read, understood and follow the above method/SOP, which is in use at AMRO Laboratories for the analysis of samples under the National Environmental Laboratory Accreditation Program, have met the Demonstration of Capability.

Section Manager/ Supervisor: _____ Date: _____

QA Manager: _____ Date: _____

qc/qcmemos/forms/3010Aqualcard Rev. 1 07/17/03

AMRO Environmental Laboratories Corporation

111 Herrick Street, Merrimack, NH 03054
TEL: (603) 424-2022 • FAX: (603) 429-8496
www.amrolabs.com

REACTIVE SULFIDE

SW-846 Chapter 7 Section 7.3.4.2

Procedure Number: IL-3012

Revision No.: 2

Revision Date: 03/01/2010

Review Date: N/A

Prepared By: _____ Date: 3/1/10

Approved By: _____ Date: 03/01/10
Inorganic Manager

Approved By: _____ Date: 3/1/10
Laboratory Director

Approved By: _____ Date: 03/01/2010
Quality Assurance Manager

Property of AMRO Environmental Laboratories Corporation

TABLE OF CONTENTS

		Page
1.0	SCOPE AND APPLICATION	3
2.0	METHOD SUMMARY	3
3.0	DEFINITIONS	4
4.0	SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE	5
5.0	POTENTIAL PROBLEMS AND INTERFERENCES	5
6.0	HEALTH AND SAFETY	5
7.0	INSTRUMENTS AND EQUIPMENT	6
8.0	INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR	7
9.0	REAGENTS AND STANDARDS	7
10.0	PROCEDURE	8
11.0	CALCULATIONS	9
12.0	QUALITY CONTROL	9
13.0	DATA REVIEW AND STORAGE	10
14.0	REFERENCES	10
	Attachment 1 Reactive Sulfide worksheet	11
	Attachment 2 Wet Chemistry Data Review Checklist	12
	Attachment 3 Reactive Sulfide Qualification Card	13

1.0 SCOPE and APPLICATION

1.1 This method is applicable to all wastes, with the condition that waste that are combined with acids do not form explosive mixtures.

1.2 This method provides a way to determine the specific rate of release of hydrogen sulfide upon contact with an aqueous acid.

1.3 The procedure releases only the hydrogen sulfide evolved at the test conditions. It is not intended to measure forms of sulfide other than those that are evolvable under the test conditions.

1.4 AMRO Reporting Limits: 100mg/Kg.

2.0 METHOD SUMMARY

2.1 The regulation in 40 CFR 261.23 defines reactive wastes to include wastes that have any of the following properties: (1) readily undergo violent chemical change; (2) react violently or form potentially explosive mixtures with water; (3) generate toxic fumes when mixed with water or, in the case of cyanide - or sulfide-bearing wastes, when exposed to mild acidic or basic conditions; (4) explode when subjected to a strong initiating force; (5) explode at normal temperatures and pressures; or (6) fit within the Department of Transportation's forbidden explosives, Class A explosives, or Class B explosives classifications.

2.2 This definition is intended to identify wastes that, because of their extreme instability and tendency to react violently or explode, pose a problem at all stages of the waste management process. The definition is to a large extent a paraphrase of the narrative definition employed by the National Fire Protection Association. The Agency chose to rely almost entirely on a descriptive, prose definition of reactivity because most of the available tests for measuring the variegated class of effects embraced by the reactivity definition suffer from a number of deficiencies.

2.3 Characteristic of Reactivity Regulation
A solid waste exhibits the characteristic of reactivity if a representative sample of the waste has <u>any</u> of the following properties:

2.3.1 It is normally unstable and readily undergoes violent change without detonating.
2.3.2 It reacts violently with water.
2.3.3 It forms potentially explosive mixtures with water.

2.3.4 When mixed with water, it generates toxic gases, vapors, or fumes in a quantity sufficient to present a danger to human health or the environment.

2.3.5 It is a cyanide - or sulfide-bearing waste which, when exposed to pH conditions between 2 and 12.5, can generate toxic gases, vapors, or fumes in a quantity sufficient to present a danger to human health or the environment. (Interim Guidance for Reactive Cyanide and Reactive Sulfide, Steps 7.3.3 and 7.3.4 below, can be used to detect the presence of reactive cyanide and reactive sulfide in wastes.)

2.3.6 It is capable of detonation or explosive reaction if it is subjected to a strong initiating source or if heated under confinement.

2.3.7 It is readily capable of detonation or explosive decomposition or reaction at standard temperature and pressure.

3.0 DEFINITIONS

3.1 **Analytical Batch -** A group of samples of a similar matrix analyzed together with the same procedure, using the same reagents and within the same time period. Samples in each batch should be of similar composition (i.e. soil, water, oil, etc.). A batch shall not exceed 20 samples.

3.2 **Sample Duplicate - (DUP)** A duplicate sample aliquots of sample which is carried through the same digestion and analysis. The relative percent difference between the sample and sample duplicate is calculated and used to assess analytical precision.

3.3 **Method Blank** An analytical control consisting of all reagents which is carried through the entire analytical procedure. It is used to define the level of laboratory background contamination.

4.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

4.1 Samples containing, or suspected of containing, sulfide wastes should be collected with a minimum of aeration. The sample bottle should be filled completely, excluding all headspace, and stoppered. Analysis should commence as soon as possible, and samples should be kept in a cool, dark place until analysis begins.

4.2 It is suggested that samples of sulfide wastes be tested as quickly as possible, although they can be preserved by adjusting the sample pH to12 with strong base and adding zinc acetate to the sample, these will cause dilution of the sample, increase the ionic strength, and, possibly, change other physical or chemical characteristics of the waste which may affect the rate of release of the hydrogen sulfide. Storage of samples should be under refrigeration and in the dark.

4.3 Testing should be performed in a ventilated hood.

4.4 Holding time for this analysis is 7 days, which must include both preparation and analysis.

5.0 POTENTIAL PROBLEMS AND INTERFERENCES

5.1 Interference's are undetermined.

6.0 HEALTH AND SAFETY

6.1 AMRO has a laboratory safety program in place that applies to all employees. There is a safety officer as well as employees with 40 hours of OSHA training. The air quality of the laboratory has been monitored and employees are sent for physicals. All employees receive fire and safety training upon employment.

6.2 Fire extinguishers are located in various areas of the lab. A lab evacuation plan is posted in every room, with a designated meeting place.

6.3 All new analysts receive training on the safe handling of samples, standards, the changing of gas cylinders, and the operation of instruments. In the lab, clean laboratory coats and gloves are worn when working with samples. Neat standards are made up in hoods. When gas tanks are replaced, the carrier with chain is used properly, and all gas tanks are chained in place. Soap is used to check for any leaks.

6.4 Care is taken with glassware and syringes to prevent injury. Broken glass and syringes are promptly removed to broken glass containers. First aid kits are available throughout the laboratory There are also eyewash stations and an emergency shower.

6.5 MSDS's are reviewed for each chemical used to ensure proper precautions are observed when handling chemicals.

6.6 Pollution prevention – The use of chemical exhaust hood are required when working with chemicals .They are specifically designed to minimize analyst exposure. The hood exhaust is monitored periodically to ensure environmental exposure is minimized.

6.7 Waste control – AMRO takes whatever steps possible to minimize waste. This includes volume reduction where appropriate. AMRO also properly segregates wastes according to contaminants and a commercial vendor is utilized for waste disposal.

7.0 INSTRUMENTS AND EQUIPMENT

7.1 Round-bottom flask - 500 mL, three-neck, with 24/40 ground-glass joints.

7.2 Gas scrubber - 50 mL calibrated scrubber.

7.3 Stirring apparatus - To achieve approximately 30 rpm. This may be either a rotating magnet and stirring bar combination or an overhead motor-driven propeller stirrer.

7.4 Addition funnel - With pressure-equalizing tube and 24/40 ground-glass joint and Teflon sleeve.

7.5 Flexible tubing - For connection from nitrogen supply to apparatus.

7.6 Water-pumped or oil-pumped nitrogen gas - With two-stage regulator.

7.7 Rotometer - for monitoring nitrogen gas flow rate.

7.8 Analytical balance - capable of weighing to 0.001 g.

8.0 INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR

8.1 AMRO used Class I weights to check the calibration of the balances daily each day of use. The weights are inspected periodically for cleanliness. They are sent to an outside vendor for verification once every five years.

8.2 The analytical balance has a sensitivity of 0.01mg. It is checked using ASTM Class I weights at weights routinely measured on a daily basis and the actual weights are recorded in the Daily Balance Check Logbook. The balance is kept on a marble slab on a heavy table and is checked regularly to be sure it is level. The balance is calibrated annually by a certified service representative.

9.0 REAGENTS AND STANDARDS

9.1 AMRO reagent water – Deionized Water (DI) from a Culligan System that is checked monthly for Residual Chlorine, Conductivity, Heterotrophic Plate count, pH, Arsenic, Barium, Cadmium, Chromium, Copper, Iron, Lead, Nickel, Selenium, Silver, Zinc and Mercury. Resistivity and pH are monitored daily. Instrument and Procedural Blanks are also used to monitor contaminant levels through out the laboratory.

9.2 Sulfuric Acid (0.01N): - Add 2.8 mL concentrated H_2SO_4 to 500mL DI water and dilute to 1 L. Withdraw 100 mL of this solution and dilute to 1 L to make the 0.01N H_2SO_4.

9.3 Sulfide reference solution - Dissolve 4.02 g of $Na_2S_9H_2O$ in 1.0 L of DI water. This solution contains 680mg/L hydrogen sulfide. Dilute this stock solution to cover the analytical range required (100-570 mg/L).

9.4 Sodium hydroxide solution (0.25N): -Dissolve 10 g of NaOH in 100mL DI water and dilute to final volume of 1 L.

9.5 Tracking of Reagents and Standards

It is important to be able to track all analytical reagents and standards back to their sources. AMRO Inorganic personnel to use the following procedure:

9.5.1 <u>Chemical Receiving Log:</u> The receipt of all standards and reagents from commercial sources is documented in the Chemical Receiving Log. The date received, AMRO ID, chemical name, source, lot number, quantity, storage location, and expiration date are recorded. The AMRO ID is written as an A followed by a 4 digit number (example A0001). Refer to the Inorganic Certificate of Analysis Logbook for standard concentration information.

9.5.2 Reagent Log: Working reagents made from reagents listed in the Chemical Receiving Log are documented in the Reagent Log. The corresponding analysis, preparation date, reagent name, AMRO ID, amount used, final volume, final concentration, Solution ID, expiration date, storage location and analyst initials are recorded. The Solution ID is written as an R followed by a 4 digit number (example R0001).

9.5.3 Inorganic Standard Log: Working standards and LCS solutions made from stock standards listed in the Chemical Receiving Log are documented in the Inorganic Standard Log. The corresponding analysis, preparation date, standard name, AMRO ID, amount used, final volume, final concentration, Standard ID, expiration date storage location and analyst initials are recorded. The Standard ID is written as an S followed by a 4 digit number (example S0001).

9.6 Starch indicator: obtained commercially from Fisher Scientific.

9.7 Sodium thiosulfate 0.0250 N: obtained commercially from Fisher Scientific.

10.0 PROCEDURE

10.1 Add 30 mL of 0.25N NaOH solution to a calibrated scrubber and dilute with DI water to obtain an adequate depth of liquid.

10.2 Assemble the system and adjust the flow rate or nitrogen, using the rotometer. Flow should be 60 mL/min.

10.3 Add 10g of the waste to be tested to the system.

10.4 With the nitrogen flowing, add 250ml of 0.01N sulfuric acid to fill the flask half full, while starting the 30 minute test period.

10.5 Begin stirring while the acid is entering the round-bottom flask. The stirring speed must remain constant throughout the test.

NOTE 1: The stirring should not be fast enough to create vortex.

10.6 After 30 minutes, close off the nitrogen and disconnect the scrubber. Transfer solution and bring up to 50ml volume with a graduated cylinder. Transfer the solution to a 250ml plastic bottle. Seal the bottle and store at 4 °C.

10.7 Take 20 ml of digested sample and make up 100ml with DI water in 250 ml Erlenmeyer flask.

10.8 Place a 5mL of standard iodine solution (0.025 N iodine) in flask. The amount should be estimated to be in excess of the sulfide expected.

10.9 Add 1 mL of 6 N HCL

10.10 If the iodine color disappears, add more iodine until the color remains. Record the total number of millimeters of standard iodine used in performing steps 10.8

10.11 Add 2-3 drops of starch indicator. This will turn the contents of the flask blue. Continue the titration until the blue color disappears. Record the number of millimeters used for both steps.

10.12 Titrade with 0.0250N Sodium thiosulfate until clear.

11.0 CALCULATIONS

11.1 Determine the specific rate of release of H2S, using the following parameters:

11.1 Total releasable H2S (mg/kg) = $\frac{400\ (A-B)}{\text{sample weight (g)}}$

where:

A = mL of 0.0250N iodine solution
B = mL of 0.0250N Standard reduction Sodium thiosulfate Normality of iodine solution

11.2 The final sample results and the associated reporting limit should be adjusted for the moisture content of the sample.

12.0 QUALITY CONTROL

12.1 One Method Blank must be digested with every 20 samples. The acceptable criteria: < RL and <½ RL for USACE and NAVY Projects.

12.2 One Sample Duplicate is analyzed per batch of 10 samples. The RPD between the sample and duplicate results should be less than 20% (if the results are less than 4 times the reporting limit the RPD is not applicable.). If the RPD is greater than 20% reanalysis of the sample should be done to rule out analytical error.

12.3 Samples must be selected for Duplicatre at random and rotated among clients and sites from batch to batch. In some cases, the client may specify which sample is to used for MS/MSD; if not, the laboratory shall pick a representative sample based on the following:

A. Duplicate shall not be performed on Trip Blank, Rinsate Blank or Field Blank.
B. Adequate sample weight/ volume.
C. Client requested QC deliverables

12.4 The ICV is analyzed at the beginning of the analytical run and must be in the range 80 - 120 %. If not it should be re prepped and reanalyzed. If still out the analysis is halted until the failure is investigated.

12.5 CCVs are analyzed one for every 10 samples analyzed and must be in the range 80-120 %. If a CCV is out then all associated samples must be reanalyzed.

12.6 The ICB is analyzed at the beginning of the analytical run and must be less than the RL.

12.7 CCBs are analyzed one for every 10 samples analyzed and must be less than the RL. If the CCB is out, it and the associated samples must be reanalyzed.

13.0 DATA REVIEW AND STORAGE

13.1 All related preparation information and observations will be noted in the Reactive Sulfide worksheet (Attachment 1).

13.2 All cross-outs must be a single line and should be initialed and dated.

13.3 The analyst must complete the Wet Chemistry Data Review Checklist (Attachment 2)

14.0 REFERENCES

14.1 SW-846 Chapter 7 Section 7.3.4.2.

14.2 Sulfide, IL-3012.

Attachment 1

AMRO Environmental Laboratories Corporation

111 Merrick Street
Merrimack, NH 03054
(603) 424-2022

REACTIVE SULFIDE

SW-846 Chapter 7 Section 7.3.4.2

IL-3012

Preparation Date : _____

Analyst: _____

Titration Date: _____

Analyst: _____

Iodine N: _____	Iodine Stock Std. A: _____	Std. Lot No.: _____
Na2S2O3 N: _____	Na2S2O3 Stock Std. A: _____	ICV Lot No.: _____

Sample ID	Sample Amt. (mL) or (g)	Dry Wt. (%)	Vol. of 0.25N NaOH (mL)	Titrate Vol. (mL)	Dilution	Iodine (mL)	Na2S2O3 (mL)	Final Conc. (mg/L) or (mg/Kg)	Comments

$$\text{mg/L Sulfide} = \frac{400\,(A-B)}{\text{mL of sample}}$$

Where:

A= mL of 0.0250 N Standard Iodine Solution

B= mL of 0.0250 N Standard reducing Na2SO2O3 Solution

qc/qcmemos/forms/RECSulfide Rev.2 04/08/02

Property of AMRO Environmental Laboratories Corporation

Attachment 2

AMRO Environmental
Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

WET CHEMISTRY DATA REVIEW CHECKLIST

LAB ORDER: _____ CLIENT: _____

Method:

Analysis:

A.	GENERAL			
1.	Copy of Digestion Log?	Y	N	NA
2.	Copy of Instrument Run Log?	Y	N	NA
3.	All samples met digestion and/or analysis holding time criteria?	Y	N	NA
4.	Initial Calibration meets method criteria?	Y	N	NA
5	Initial Calibration Verification (ICV) meets method or laboratory criteria?	Y	N	NA
6	Continuing Calibration Verification(CCV) meets method criteria?	Y	N	NA
7	Continuing Calibration Verification analyzed after every 10 samples ?	Y	N	NA
8.	Method Blank- contaminant free (½RL)?	Y	N	NA
9.	Are all reported results within calibration range?	Y	N	NA
10.	LCS % Recovery criteria met for all compounds?	Y	N	NA
11.	MS/MSD %R's and %RPD's are met for all compounds?	Y	N	NA
12.	%RPD criteria met between sample and duplicate?	Y	N	NA

COMMENTS:

Analyst (s) _____ DATE: _____

REVIEWER _____ DATE OF REVIEW: _____

qc/qcmemos/Forms/wetchemchecklist Rev.1 07/06/01

Attachment 3

AMRO Environmental
Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

QUALIFICATION CARD FOR REACTIVE SULFIDE SW-846 Chapter 7 Section 7.3.4.2

Trainee: _____ Signature: _____

Trainer: _____ Signature: _____

I. Knowledge Factors:

SOP Title: _____ Revision Number/Date: _____

1. Did the Trainee read and understand the above SOP? Yes ☐ No ☐ NA ☐
2. Was the Trainee instructed on how to properly fill out the documentation? Yes ☐ No ☐ NA ☐
3. Has the Trainee been instructed on the proper procedures for addressing potential problems? Yes ☐ No ☐ NA ☐

II. Practical Factors:

1. Has the Trainee completed a Precision and Accuracy Study? Yes ☐ No ☐ NA ☐
2. Has the Trainee completed an acceptable Performance Evaluation sample? Yes ☐ No ☐ NA ☐
3. Did the Trainee completed an acceptable Laboratory Control Sample (LCS)? Yes ☐ No ☐ NA ☐

Completion Date: _____ Trainer's Signature: _____

I _____ have read, understood and follow the above method/SOP, which is in use at AMRO Laboratories for the analysis of samples under the National Environmental Laboratory Accreditation Program, have met the Demonstration of Capability.

Section Manager/ Supervisor: _____ Date: _____

QA Manager: _____ Date: _____

qc/qcmemos/forms/Reactive Sulfide qualcard Rev. 0 9/10/03

AMRO Environmental Laboratories Corporation

111 Herrick Street, Merrimack, NH 03054
TEL: (603) 424-2022 • FAX: (603) 429-8496
www.amrolabs.com

REACTIVE CYANIDE

SW846 Chapter 7 Section 7.3.3.2

Procedure Number: IL-3011

Revision No.: 2

Revision Date: 08/14/2003

Review Date: 03/02/2010

Prepared By: Peter [signature] Date: 3/2/10

Approved By: Robert E. Bosshart Date: 03/02/10
Inorganic Manager

Approved By: [signature] Date: 3/2/10
Laboratory Director

Approved By: Robert E. Bosshart Date: 03/02/10
Quality Assurance Manager

Property of AMRO Environmental Laboratories Corporation

AMRO Environmental Laboratories Corporation

111 Herrick Street, Merrimack, NH 03054
TEL: (603) 424-2022 • FAX: (603) 429-8496
www.amrolabs.com

REACTIVE CYANIDE

SW846 Chapter 7 Section 7.3.3.2

Procedure Number: IL-3011

Revision No.: 2

Revision Date: 08/14/2003

Review Date: 03/07/2008

Prepared By: Paula Benham Date: 3/10/08

Approved By: Gowri Mahendrarajah Date: 3/10/08
Inorganic Manager

Approved By: Marci W. Bobb Date: 3/10/08
Laboratory Director

Approved By: Paula Benham Date: 3/10/08
Quality Assurance Manager

Property of AMRO Environmental Laboratories Corporation

TABLE OF CONTENTS

		Page
1.0	SCOPE AND APPLICATION	3
2.0	METHOD SUMMARY	3
3.0	DEFINITIONS	3
4.0	SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE	4
5.0	POTENTIAL PROBLEMS AND INTERFERENCES	4
6.0	HEALTH AND SAFETY	5
7.0	INSTRUMENTS AND EQUIPMENT	6
8.0	INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR	6
9.0	REAGENTS AND STANDARDS	7
10.0	PROCEDURE	10
11.0	CALCULATIONS	12
12.0	QUALITY CONTROL	12
13.0	DATA REVIEW AND STORAGE	13
14.0	REFERENCES	14
	Attachment 1 Reactive Cyanide worksheet	15
	Attachment 2 Wet Chemistry Data Review Checklist	16
	Attachment 3 Reactive Cyanide Qualification Card	17

1.0 SCOPE and APPLICATION

1.1 This method is applicable to the determination of reactive cyanide in all wastes, with the condition that wastes that are combined with acids do not form explosive mixtures.

1.2 This method provides a way to determine the specific rate of release of hydrocyanic acid upon contact with aqueous acid.

1.3 This test measures only the hydrocyanic acid evolved at the test conditions. It is not intended to measure forms of cyanide other than those evolvable under the test conditions.

1.4 AMRO Reporting Limit: 20mg/Kg.

2.0 METHOD SUMMARY

2.1 A known aliquot of sample is treated with a dilute acidic solution in a closed system. The generated gas is swept into a scrubber with 0.25 N Sodium Hydroxide with Nitrogen gas. The resulting solution is then determined for Cyanide by titration or colormetrically.

2.2 This test measures only the hydrocyanic acid evolved at the test conditions. It is not intended to measure forms of cyanide other than those that are evolved under these test conditions.

3.0 DEFINITIONS

3.1 **Analytical Batch -** A group of samples of a similar matrix analyzed together with the same procedure, using the same reagents and within the same time period. Samples in each batch should be of similar composition (i.e. soil, water, oil, etc.). A batch shall not exceed 20 samples.

3.2 **Sample Duplicate - (DUP)** A duplicate sample aliquots of sample which is carried through the same digestion and analysis. The relative percent difference between the sample and sample duplicate is calculated and used to assess analytical precision.

3.3 **Method Blank** An analytical control consisting of all reagents which is carried through the entire analytical procedure. It is used to define the level of laboratory background contamination.

4.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

4.1 The sample should be collected in plastic or glass bottles of 100 mL or larger size. All bottles must be thoroughly cleansed and thoroughly rinsed to remove soluble material from containers. Samples containing, or suspected of containing, sulfide or a combination of sulfide and cyanide wastes should be collected with a minimum of aeration. The sample bottle should be filled completely, excluding all headspace, and stoppered.

4.2 Holding time for this analysis is 14 days, which must include both preparation and analysis.

4.3 Testing should be performed in a vented hood.

4.4 The preservation required for soil / sediment samples is maintenance at 4°C (± 2°C) until analysis.

5.0 POTENTIAL PROBLEMS AND INTERFERENCES

5.1 Interferences are undetermined.

6.0 HEALTH AND SAFETY

6.1 AMRO has a laboratory safety program in place that applies to all employees. There is a safety officer as well as employees with 40 hours of OSHA training. The air quality of the laboratory has been monitored and employees are sent for physicals. All employees receive fire and safety training upon employment.

6.2 Fire extinguishers are located in various areas of the lab. A lab evacuation plan is posted in every room, with a designated meeting place.

6.3 All new analysts receive training on the safe handling of samples, standards, the changing of gas cylinders, and the operation of instruments. In the lab, clean laboratory coats and gloves are worn when working with samples. Neat standards are made up in hoods. When gas tanks are replaced, the carrier with chain is used properly, and all gas tanks are chained in place. Soap is used to check for any leaks.

6.4 Care is taken with glassware and syringes to prevent injury. Broken glass and syringes are promptly removed to broken glass containers. First aid kits are available throughout the lab. There are also eyewash stations and an emergency shower.

6.5 MSDSs are reviewed for each chemical used to ensure proper precautions are observed when handling chemicals.

6.6 Pollution prevention – The use of chemical exhaust hoods are required when working with chemicals. They are specifically designed to minimize analyst exposure. The hood exhaust is monitored periodically to ensure environmental exposure is minimized.

6.7 Waste control – AMRO takes whatever steps possible to minimize waste. This includes volume reduction where appropriate. AMRO also properly segregates wastes according to contaminants and a commercial vendor is utilized for waste disposal.

6.8 Caution should be used when handling cyanide standards and distillates. Waste from this analysis must be disposed of in the appropriate waste streams: Waste from the distillation flask can be disposed of in the acid waste stream. Cyanide standards and the waste from the color portion of the analysis must be disposed in the basic (pyridine) stream. This waste must have the pH maintained at ≥12 while being stored prior to disposal

7.0 INSTRUMENTS AND EQUIPMENT

7.1 Round bottom flasks-500 mL, three neck, with 24/40 ground glass joints.

7.2 Stir plate

7.3 50 mL. gas scrubber

7.4 Addition funnel with pressure equalizing tube and 24/40 ground glass joints and Teflon sleeve.

7.5 Nitrogen gas cylinder

7.6 Flow meter for Nitrogen gas

7.7 HACH DR2010 Spectrophotometer

7.8 1.0 cm cell or larger.

7.9 Class A graduated glass volumetric clyinders 50mL.

7.10 Assorted volumetric glassware, pipette and micropipets

7.11 Balance

8.0 INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR

Distillation apparatus.

8.1 Clean area around equipment
8.2 Check tubing for leaks
8.3 Check glassware for cracks or jagged edges.
8.4 Change Nitrogen tank if necessary.

Spectrophotometer.

8.2 Daily:

8.2.1 Check that light bulb is working.
8.2.2 Wipe spectrophotometer clean with DI water.
8.2.3 Check cuvette for scratches or cracks.

8.3 Weekly:

8.3.1 Perform wavelength check.

8.4 Annual:

8.4.1 An outside contractor services instrument. AMRO uses Caley and Whitmore.

9.0 REAGENTS AND STANDARDS

AMRO reagent water – Deionized Water (DI) from a Culligan System that is checked monthly for Residual Chlorine, Conductivity, Heterotrophic Plate count, pH, Arsenic, Barium, Cadmium, Chromium, Copper, Iron, Lead, Nickel, Selenium, Silver, Zinc and Mercury. Resistivity and pH are monitored daily. Instrument and Procedural Blanks are also used to monitor contaminant levels through out the laboratory

9.1 Distillation and Preparation Reagents

9.1.1 Sodium hydroxide absorbing solution, and sample wash solution, 0.25 N: Dissolve 10 g of NaOH and dilute to one liter with distilled water.

9.1.2 Sulfuric acid (0.01N): add 2.8 mL. Concentrated H_2SO_4 to reagent water and dilute to 1000 mL. Withdraw 100 mL. of this solution and dilute to 1000mL.to obtain a final normality of 0.01N.

TRACKING OF ANALYTICAL STANDARDS

9.2 Chemical Receipt

The receipt of all standards, neat compounds and reagents from commercial sources is documented in the Chemical Receiving Logbook by sample receiving personnel or designate. Each solution or compound is assigned a unique standard receipt ID number, the letter "A" and a four digit sequential number. The date received, source, lot number, expiration date and disposal date are recorded. The expiration dates are provided from the manufacturer and AMRO employees complete the disposal dates when standards are used up or disposed.

9.3 Standards Preparation

Standards are prepared as written in the respective SOPs. In order to assure the accuracy of standards the following general guidelines are used:

9.3.1 ACS reagent grade chemicals are used when the method warrants.

9.3.2 A certificate of analysis accompanies any stock standards that are purchased from the manufacturer.

9.3.3 Class A volumetric glassware is used to prepare standards.

9.4 Standard Tracking

It is important to be able to track all analytical standards back to their sources. AMRO personnel to accomplish this use the following procedure:

9.4.1 Wet Chemistry and Mercury Standards - Working Standards and LCS solutions made from stock standards listed in the Chemical Receiving Log are documented in the Inorganic Standard Log. The corresponding analysis, preparation date, standard name, AMRO ID, amount used, initial concentration of standard, amount used, final volume, final concentration, Standard ID, expiration date, storage location, and analyst initials are recorded. The initial concentration of the standard is obtained from the certificates received from the manufacturer. The Standard ID is written as an "S" followed by a four digit sequential number. The expiration of working standards varies depending on the use. Standards should be used in accordance with method specifications and manufacturer's instructions.

9.4.2 Wet Chemistry and Metals Reagent Log - Working reagents are made from reagents listed in the Chemical Receiving Log is documented in the Reagent Log. The corresponding analysis, preparation date, reagent name, AMRO ID, initial concentration, amount used, final volume, final concentration, Solution ID, expiration date, storage location, and analyst initials are recorded. The initial concentration is obtained from the certificate received from the manufacturer. The Solution ID is written as an "R" followed by a 4 digit sequential number. The expiration of prepared reagents varies. Reagents should be used in accordance with method specifications and manufacturer's instructions.

9.5 Calibration and QC Standards

9.5.1 Calibration Standards:- Stock cyanide solution A, 1000mg/L CN : Commercially available through Lab Chem.

9.5.2 Working calibration standard cyanide solution A1: Prepare fresh daily by diluting 1.0mL of stock cyanide solution A (per section 9.5.1)) to 100mL with deionized water. (True Value= 10ppm CN).

9.5.3 Working calibration Standard solution A2- prepare freshly by diluting 10mL working solution A1 (per section 9.5.2) to 100mL deionized water (1.0ppm CN).

9.5.4 If necessary Stock Cyanide A can be prepared from Crystalline Potassium Cyanide from available from Aldrich:.

9.5.4.1 QC Stock Cyanide solution A, 1000mg/L CN:
Dissolve 0.2510g of KCN in 100mL of 0.25N NaOH **and dilute to 1 liter**. Standardize with 0.0192N $AgNO_3$ to obtain the true value.

9.5.5 QC Standard:- Stock cyanide solution B, 1000mg/L CN : Commercially available through Lab Chem.

Must be a different lot # than Stock Solution A

9.5.6 Working QC Cyanide Solution B1: Prepare fresh daily by diluting 1.0mL of stock cyanide solution B (per section 9.5.5) to 100mL with deionized water. (True Value = 10ppm CN).

This solution is to be used for preparing the Laboratory Control Sample.

9.5.7 Standard silver nitrate solution, (0.0192 N): Prepare by crushing approximately 5 g. AgNO3 crystals and drying to a constant weight at 104 deg. C. Weigh out 3.2647 g. of dried AgNO3, dissolve in distilled water and dilute to 1000 mL. (1mL. corresponds to 1 mg. CN)
This solution is to be used to determine the concentrations of the stock cyanide solutions and for any samples that are being quantified using the titrimetric method. This solution can be purchased commercially from Lab Chem

9.5.8 Rhodanine indicator: Used as the indicator for the titration procedure. Dissolve 20 mg of p-dimethyl-amino-benzalrhodanine in 100mL of acetone.

9.6 Colorimetric Reagents:

9.6.1 Sodium dihydrogenphosphate, 1 M: Dissolve 138 g of NaH2PO4 H2O in One liter of distilled water. **Refrigerate this solution at 4 degrees C**.

9.6.2 Chloramine-T solution, 0.4% (w/v): Dissolve 1.0 g of white soluble Chloramine T in 100mL of distilled water. **Prepare fresh at time of analysis.**

9.6.3 Pyridine-Barbituric Acid Reagent (Color Reagent): **Prepare this solution in the hood**. Place 15 g of barbituric acid in a 250 mL volumetric flask and add just enough distilled water to wash the sides of the flask (about 100 mL) and wet the barbituric acid. Add 75 mL of pyridine and mix. Add 15 mL of conc. HCl, mix, and cool to room temperature. Stir solution until reagents have dissolved. Dilute to 250 mL with distilled water and mix. This reagent is stable for approximately six months if stored in a cool, dark place. Discard if precipitate develops. This solution can be purchased commercially from Lab Chem.

10.0 PROCEDURE

10.1 Add 30 mL of 0.25N NaOH to the gas absorbing impinger.

10.2 Add about 10g of sample (weighed to the nearest 0.01 g) to 500 mL. flask.

10.3 Add 250mL of 0.01N H2SO4 to the addition funnel and set up the apparatus.

10.4 Close system and adjust flow rate of Nitrogen, using the flow meter, to 60 mL/min.

10.5 With the system closed and the Nitrogen flowing, slowly add the sulfuric acid solution.

10.6 Begin the 30 minute test period.

10.7 Stir solution throughout the test period with the magnetic stir plate. The speed should be enough to agitate the sample but not enough to cause a vortex.

10.8 After the 30 minute test period, close off the Nitrogen gas and disconnect the scrubber. Transfer solution and bring up to 50mL volume with a graduated cylinder. Transfer the solution to a 250mL plastic bottle. Seal the bottle and store at 4 °C.

10.9 Calibration

Prepare a series of cyanide standards by pipeting suitable volumes of standard solution A into 25mL volumetric flasks and add comparable volumes of 0.25N NaOH to bring standards to a final volume of 25mL. These standard solutions do not need to be distilled as long as the Laboratory Control Sample and another blank has gone through the distillation procedure.

Prepare as follows:

mL of Working Standard Solution A2/ final volume with 0.25N NaOH	**Conc. mg/mL CN (1mL = 1mg CN)**
0.00 25mL	0.00
0.50mL of 1ppm → 25mL	0.020
1.25mL of 1ppm → 25mL	0.050
2.50mL of 1ppm → 25mL	0.10
0.50mL of 10ppm → 25mL	0.20
0.75mL of 10ppm → 25mL	0.30
1.00mL of 10ppm → 25mL	0.40

10.10 Next, withdraw 25mL or less of the solution from the absorber and transfer to a 50mL volumetric flask. If less than 25mL is taken, dilute to 25mL with 0.25N NaOH 8.11 Add 7.5mL of sodium phosphate solution and mix.

10.11 Add 1mL of Chloramine T and mix. *See Note1.*

10.12 After 1 to 2 minutes, add 2.5mL of pyridine-barbituric acid solution and mix. Dilute to mark with distilled water and mix again. Allow 8 minutes for color development then read absorbance at 578 nm in a 1 cm cell within 15 minutes.

Note 1: Some distillates may contain compounds that have a chlorine demand. One minute after the addition of Chloramine T, test for residual chlorine with KI-starch paper. If the test is negative, add an additional 0.5mL of Chloramine T. After one minute, recheck the sample.

11.0 CALCULATIONS

11.1 Using the "lsqm 1" software program, prepare a standard curve by plotting absorbance of standards vs. standard cyanide concentrations.

11.2 Multiply by any dilution factors that were used either prior to distillation or when taking the sample through the colorimetric procedure.

11.3 To calculate the cyanide of solid samples in mg/Kg of original sample :

$$CN, mg/Kg = \frac{A \times D \times F}{B}$$

where: A = µg/L CN of sample from regression analysis curve
B = calculated grams of sample that on a dry weight basis
D = any dilution factor necessary to bracket sample value within standard values
F = sample receiving solution volume (0.050L)

12.0 QUALITY CONTROL

12.1 One Method Blank must be digested with every 20 samples. The acceptable criteria: < RL and <½ RL for Department of Defense (DOD) Projects.

12.2 One Sample Duplicate is analyzed per batch of 10 samples. The RPD between the sample and duplicate results should be less than 20% (if the results are less than 4 times the reporting limit the RPD is not applicable.). If the RPD is greater than 20% reanalysis of the sample should be done to rule out analytical error.

12.3 Curve generated from standards must have a correlation coefficient ≥ 0.995. If this in not achieved the curve must be re-made.

12.4 The ICV is analyzed at the beginning of the analytical run and must be in the range 85 - 115 %. If not it should be re prepped and reanalyzed. If still out the analysis is halted until the failure is investigated.

12.5 CCVs are analyzed one for every 10 samples analyzed and must be in the range 85-115 %. If a CCV is out then all associated samples must be reanalyzed.

12.6 The ICB is analyzed at the beginning of the analytical run and must be less than the RL (<½ RL for Department of Defense (DOD) Projects).
If the blank is greater than 0.020mg/L it must be repeated on a fresh sample of De-ionized water to rule out contamination. If the second blank is still greater than the RL (<½ RL for Department of Defense (DOD) Projects) the analysis should be halted until the contamination is investigated.

12.7 CCBs are analyzed one for every 10 samples analyzed and must be less than the RL (<½ RL for Department of Defense (DOD) Projects). If the CCB is out, it and the associated samples must be reanalyzed.

12.8 One Sample Duplicate should be run every batch of ten samples or one per day. The RPD between the sample and Duplicate must be ≤20%. If the RPD is >20% the sample is tested again to confirm the result and any comments on sample matrix type recorded in the Reactive Cyanide worksheet.

12.9 Samples must be selected for Duplicatre at random and rotated among clients and sites from batch to batch. In some cases, the client may specify which sample is to used for MS/MSD; if not, the laboratory shall pick a representative sample based on the following:

A. Duplicate shall not be performed on Trip Blank, Rinsate Blank or Field Blank.
B. Adequate sample weight/ volume.
C. Client requested QC deliverables

13.0 DATA REVIEW AND STORAGE

13.1 All related preparation information and observations will be noted in the Reactive Cyanide worksheet (Attachment 1).

13.2 All cross-outs must be a single line and should be initialed and dated.

13.3 The analyst must complete the Wet Chemistry Data Review Checklist (Attachment 2)

14.0 REFERENCES

14.1 SW-846 Chapter 7 Section 7.3.3.2

14.2 EPA Method 335.2 (Titrimetric; Spectrophotometric)

14.3 Standard Methods for the Examination of Water and Wastewaters, 19th Method 412.D

14.4 Method for Total Cyanide analysis by Midi Distillation

14.5 Test Method to Determine Hydrogen Cyanide Released from Wastes.

Attachment 1

AMRO Environmental Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

REACTIVE CYANIDE
SW-846 Chapter 7 Section 7.3.3.2
IL-3011

Analyst Distillation: _____ Analyst Colorimetric: _____
Distillation Date: _____ Date Colored: _____

Standard Curve: HACH DR/2010 at 578 nm

Std. Value (mg/L)	Intermed. Std. Conc. (ppm)	Vol. Cal. in 25mL	ABS
0.000	1	0.00	
0.020	1	0.50	
0.050	1	1.25	
0.100	1	2.50	
0.200	10	0.50	
0.300	10	0.75	
0.400	10	1.00	

Corr. Coff.=_____ RL (water)=20 mg/L RL (soil)=20 mg/Kg
CN Stock Std A_____ 1000 ppm Titrated Value_____
CN Stock Std QC A_____ 1000 ppm Titrated Value_____
1 ppm Std S_____ 1 ppm QC S_____
10 ppm Std S_____ 10 ppm QC S_____
ICV True Value= 0.2 mg/L
Low Level Std.True Value= 0.02 mg/L

Colorimetric Reagents	ID	mL
Sodium Phosphate Mono		
Chloramine-T		
Pyridine Barbituric Acid		

Volume colored = 25 mL

Sample ID	Sample Amt. (mL) or (g)	Dry Wt.	Volume of 0.25N NaOH	Color Volume (mL)	ABS @ 578nm	Initial Conc. (mg/L)	Final Conc. (mg/L) or (mg/Kg)	Comments

* Acceptance Limits for the ICV and CCV: ± 15% of the true value

qc/qcmemos/forms/RECCN Rev.3 06/00

Attachment 2

AMRO Environmental
Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

WET CHEMISTRY DATA REVIEW CHECKLIST

LAB ORDER: _____ CLIENT: _____

Method:

Analysis:

A.	**GENERAL**			
1.	Copy of Digestion Log?	Y	N	NA
2.	Copy of Instrument Run Log?	Y	N	NA
3.	All samples met digestion and/or analysis holding time criteria?	Y	N	NA
4.	Initial Calibration meets method criteria?	Y	N	NA
5.	Initial Calibration Verification (ICV) meets method or laboratory criteria?	Y	N	NA
6.	Continuing Calibration Verification(CCV) meets method criteria?	Y	N	NA
7.	Continuing Calibration Verification analyzed after every 10 samples ?	Y	N	NA
8.	Method Blank- contaminant free (½RL)?	Y	N	NA
9.	Are all reported results within calibration range?	Y	N	NA
10.	LCS % Recovery criteria met for all compounds?	Y	N	NA
11.	MS/MSD %R's and %RPD's are met for all compounds?	Y	N	NA
12.	%RPD criteria met between sample and duplicate?	Y	N	NA

COMMENTS:

Analyst (s) _____ DATE: _____

REVIEWER: _____ DATE OF REVIEW: _____

qc/qcmemos/Forms/wetchemchecklist Rev.1 07/06/01

Attachment 3

AMRO Environmental Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

QUALIFICATION CARD FOR REACTIVE CYANIDE SW-846 Chapter 7 Section 7.3.3.2

Trainee: _____ Signature: _____

Trainer: _____ Signature: _____

I. Knowledge Factors:

SOP Title: _____ Revision Number/Date: _____

1. Did the Trainee read and understand the above SOP? Yes ☐ No ☐ NA ☐
2. Was the Trainee instructed on how to properly fill out the documentation? Yes ☐ No ☐ NA ☐
3. Has the Trainee been instructed on the proper procedures for addressing potential problems? Yes ☐ No ☐ NA ☐

II. Practical Factors:

1. Has the Trainee completed a Precision and Accuracy Study? Yes ☐ No ☐ NA ☐
2. Has the Trainee completed an acceptable Performance Evaluation sample? Yes ☐ No ☐ NA ☐
3. Did the Trainee completed an acceptable Laboratory Control Sample (LCS)? Yes ☐ No ☐ NA ☐

Completion Date: _____ Trainer's Signature: _____

I_____have read, understood and follow the above method/SOP, which is in use at AMRO Laboratories for the analysis of samples under the National Environmental Laboratory Accreditation Program, have met the Demonstration of Capability.

Section Manager/ Supervisor: _____ Date: _____

QA Manager: _____ Date: _____

qc/qcmemos/forms/Reactive Cyanide qualcard Rev. 0 9/10/03

Property of AMRO Environmental Laboratories Corporation

AMRO Environmental Laboratories Corporation

111 Herrick Street, Merrimack, NH 03054
TEL: (603) 424-2022 • FAX: (603) 429-8496
www.amrolabs.com

pH

SM 4500-H+ B (Electrometric)

AND

SW-846 Method 9045C

Procedure Number: IL-3007

Revision No.: 8

Revision Date: 03/05/13

Review Date: N/A

Prepared By: Dawn M. Hengl Date: 3-5-13

Approved By: Robert G. Bonhart Date: 03-07-13
Inorganic Manager

Approved By: Mary Schmidt Date: 3-5-13
Laboratory Director

Approved By: Mary Schmidt Date: 3-5-13
Quality Assurance Manager

TABLE OF CONTENTS

		Page
1.0	SCOPE AND APPLICATION	3
2.0	METHOD SUMMARY	3
3.0	DEFINITIONS	3
4.0	SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE	3
5.0	POTENTIAL PROBLEMS AND INTERFERENCES	4
6.0	HEALTH AND SAFETY	5
7.0	INSTRUMENTS AND EQUIPMENT	5
8.0	INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR	6
9.0	REAGENTS AND STANDARDS	6
10.0	PROCEDURE	7
11.0	CALCULATIONS	10
12.0	QUALITY CONTROL	10
13.0	DATA REVIEW AND STORAGE	11
14.0	REFERENCES	11

1.0 SCOPE and APPLICATION

1.1 SM 4500H+ B is applicable to drinking, surface, and saline waters, domestic and industrial waters and acid rain (atmospheric deposition).

1.2 SW-846 Method 9045C is an electrometric procedure for measuring pH in solids and waste samples. Wastes may be solids, sludges, or non-aqueous liquids. If water is present, it must constitute less than 20% of the total volume of the sample.

2.0 METHOD SUMMARY

2.1 The pH of a sample is determined electrometrically using a combination electrode.

2.2 The soil sample is mixed with deionized water, and the pH of the resulting aqueous solution is measured. The pH of a sample is determined electrometrically using a combination electrode.

2.3 This procedure has been modified to use the TCLP tumbler for extraction rather than stirring in a beaker.

3.0 DEFINITIONS

3.1 **Analytical Batch** - A group of samples of a similar matrix analyzed together with the same procedure, using the same reagents and within the same time period. Samples in each batch should be of similar composition (i.e. soil, water, oil, etc.). A batch shall not exceed 20 samples.

3.2 **Sample Duplicate - (DUP)** A duplicate sample aliquot which is carried through the same through the same analysis. The relative percent difference between the sample and sample duplicate is calculated and used to assess analytical precision. A duplicate is performed every 10 client samples.

4.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

4.1 Aqueous samples should be analyzed within 24 hours of sampling. Soil samples should be analyzed as soon as possible.

4.2 High-purity waters and waters not at equilibrium with the atmosphere are subject to changes when exposed to the atmosphere, therefore the sample containers should be filled completely and kept sealed prior to analysis.

4.3 Soil samples are collected in glass jars and can be stored at 4°C until analysis is complete.

5.0 POTENTIAL PROBLEMS AND INTERFERENCES

5.1 The glass electrode, in general, is not subject to solution interferences from color, turbidity, colloidal matter, oxidants, reductants or high salinity. However, it must be thoroughly rinsed using DI water between testing of each buffer and sample.

5.2 Sodium error at pH levels greater than 10 can be reduced or eliminated by using a "low sodium error" electrode.

5.3 Coatings of oily material or particulate matter can impair electrode response. These coatings can usually be removed by gentle wiping or detergent washing, followed by distilled water rinsing. An additional treatment with hydrochloric acid (1:10) may be necessary to remove any remaining film.

5.4 Temperature effects on the electrometric measurement of pH arise from two sources:

5.4.1 The first is caused by the change in electrode output at various temperatures. This interference can be controlled with instruments having temperature compensation or by calibrating the electrode-instrument system at the temperature of the samples. AMRO utilizes a temperature compensation probe.

5.4.2 The second source is the change of pH inherent in the sample at various temperatures. This error is sample dependent and cannot be controlled. Bring all samples and calibration buffers to room temperature and record that temperature in the logbook. One calibration buffer and the samples should be within 2 pH units of each other.

5.5 Samples with very low or high pH may give incorrect readings on the meter. For samples with a true pH >10, the measurement may be incorrectly low. Strong acid solutions, with a pH of <1.0, may give incorrectly high measurements.

5.6 Calibration range is limited. If a result is outside the window of pH 4-10, then an additional pH buffer must be used to bracket the sample results to support extrapolation of the calibration. The control limits for these QC check standards will be ± 0.2 pH.

6.0 HEALTH AND SAFETY

6.1 AMRO has a laboratory safety program in place that applies to all employees. There is a safety officer as well as employees with 40 hours of OSHA training. The air quality of the laboratory has been monitored and employees are sent for physicals. All employees receive fire and safety training upon employment.

6.2 Fire extinguishers are located in various areas of the lab. A lab evacuation plan is posted in every room, with a designated meeting place.

6.3 All new analysts receive training on the safe handling of samples, standards, the changing of gas cylinders, and the operation of instruments. In the lab, clean laboratory coats and gloves are worn when working with samples. Neat standards are made up in hoods. When gas tanks are replaced, the carrier with chain is used properly, and all gas tanks are chained in place. Soap is used to check for any leaks.

6.4 Care is taken with glassware and syringes to prevent injury. Broken glass and syringes are promptly removed to broken glass containers. First aid kits are available throughout the lab. There are also eyewash stations and an emergency shower.

6.5 MSDSs are reviewed for each chemical used to ensure proper precautions are observed when handling chemicals.

6.6 Pollution prevention – The use of chemical exhaust hood are required when working with chemicals. They are specifically designed to minimize analyst exposure. The hood exhaust is monitored periodically to ensure environmental exposure is minimized.

6.7 Waste control – AMRO takes whatever steps possible to minimize waste. This includes volume reduction where appropriate. AMRO also properly segregates wastes according to contaminants and a commercial vendor is utilized for waste disposal.

7.0 INSTRUMENTS AND EQUIPMENT

7.1 pH Meter: Thermo Orion Star Series pH Meter – SN 010527

7.2 VWR Scientific pH Electrode, cat. No. 14002-778

7.3 Magnetic stirrer and Teflon-coated stirring bar.

7.4 Beaker: 50mL

7.5 Balance capable of weighing to 0.01g

7.6 250mL plastic bottles

7.7 Spatula

8.0 INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR

8.1 Electrode Maintenance

8.1. Daily (each time meter is in use)

8.1.1 Inspect the electrode for scratches, cracks, salt crystal build-up, or membrane/junction deposits.

8.1.2 Rinse off any salt build-up with distilled water, and remove any membrane/junction deposits as directed in the cleaning procedures below.

8.2 Probe Cleaning Procedures (as needed)

8.2.1 General – Soak in 0.1 M HCl or 0.1 M HNO_3 for half-hour. After any cleaning procedure, soak electrode in pH storage solution for at least one hour.

8.2.2 To remove Membrane/Junction Deposits Protein – Soak in 1% pepsin in 0.1 M HCl, for 15 minutes.

8.2.3 Inorganic - Soak in 0.1 M tetrasodium EDTA solution for 15 minutes.

8.2 .4 Grease and Oil – Rinse with mild detergent or methanol solution.

8.3 If cleaning and maintenance procedures fail to rejuvenate the electrode, replace the entire electrode.

9.0 REAGENTS AND STANDARDS

9.1 AMRO reagent water – Deionized Water that is checked monthly for Residual Chlorine, Conductivity, pH, Arsenic, Barium, Cadmium, Chromium, Copper, Iron, Lead, Nickel, Selenium, Silver, Zinc and Mercury. Resistivity and pH are monitored daily. Instrument and Procedural Blanks are also used to monitor contaminant levels through out the laboratory.

9.2 Buffer solutions: Commercially prepared Buffer Solutions (pH 2.0, 4.0, 7.0, 10.0 and 12.0).

9.3 Independent QC Check Buffer at pH 6.00.

9.4 Concentrated Hydrochloric Acid.

9.5 Hydrochloric Acid - (1:10) - To 9 mls DI water add 1 ml concentrated Hydrochloric Acid.

9.6 Storage Solution: pH 7.0 buffer or suggested manufacturer's solution.

9.7 TRACKING OF ANALYTICAL STANDARDS

9.8.1 Chemical Receipt

The receipt of all standards, neat compounds and reagents from commercial sources is documented in the Chemical Receiving Logbook by sample receiving personnel or designate. Each solution or compound is assigned a unique standard receipt ID number, the letter "A" and a five digit sequential number. The date received, source, lot number, expiration date and disposal date are recorded. The expiration dates are provided from the manufacturer and AMRO employees complete the disposal dates when standards are used up or disposed.

10.0 PROCEDURE

10.1 Calibration

10.1.1 The pH meter is calibrated daily using pH Buffers 4, 7 and 10.

NOTE: *Make sure there are no air bubbles in the bulb of the glass electrode. If there are any, just simply shake the electrode in a downward motion to get the solution into the bulb.*

10.1.2 Attach the pH electrode(s) to the meter.

10.1.3 Press the "calibrate" key to initiate the calibration sequence. PH CAL will be displayed for five seconds.

10.1.4 The first standard annuciator will be displayed, indicated by CAL.1. Place the electrode in pH 7.00 buffer. The reading will be displayed and updated as the calibration continues. When the flashing "pH" light stops blinking, press the

"calibrate" key to accept the value. Record the value of the reading in the logbook.

10.1.5 The pH 4 buffer annuciator will be displayed, indicated by CAL. 2. Remove the electrode from the pH 7.00 buffer. Rinse the electrode with deionized water and place it in the pH 4.00 buffer. The reading will be displayed and updated as the calibration continues. When the flashing "pH" light stops blinking, indicating electrode stability, press the "calibrate" key to accept the reading. Record the value of the reading in the logbook.

10.1.6 The pH 10 buffer annuciator will be displayed, indicated by CAL.3. Remove the electrode from the pH 4.00 buffer. Rinse the electrode with deionized water and place it in the pH 10.00 buffer. The reading will be displayed and updated as the calibration continues. When the flashing "pH" light stops blinking, indicating electrode stability, press the "measure" key to accept the reading. Record the value of the reading in the logbook.

10.1.7 SLP followed by the calculated slope will be displayed for two seconds. The meter will automatically switch to the MEASURE mode. Note the slope in the pH logbook. The slope should be between 92 and 102%. If the slope is outside of this range, re-calibrate the pH meter using fresh buffer solutions. If it is still out of range, follow the electrode cleaning procedures outlined in section 8.2.

10.1.8 Read pH Buffer 6.00 (the independent QC check buffer). Place probe in buffer and press the MEASURE key. When the pH light stops blinking, record the value in the pH logbook. The value should be in the range of 5.95 to 6.05. If the buffer solution is outside of the acceptance range, re-read using fresh buffer. If it is still out of range, re-calibrate the pH meter using fresh aliquots of pH 4 and 7 buffers and re-read the pH 6 buffer again. If it is still out of range, follow the electrode cleaning procedures outlined in section 8.2.

10.1.9 Read the deionized water (DI). Place probe in the DI aliquot and press the MEASURE key. When the pH light stops blinking, record the value in the pH logbook. The value should read in the range of 5.50 to 7.50. If the DI water is outside of the acceptance range, re-read using fresh aliquot. If it is still out of range, re-calibrate the pH meter using fresh aliquots of buffers and re-read the DI again. If it is still out of range, follow the electrode cleaning procedures outlined in Section 8. Continued out of range readings for the DI sample may indicate a problem with the water deionizing equipment. If this is the case, the deionized water system manufacturer should be notified if the equipment is in need of repair.

10.2 Procedure for water samples:

10.2.1 Standardize the meter and electrode system as outlined in Section 10.1.

10.2.2 Place the aqueous sample in a clean tube using a sufficient volume to cover the sensing elements of the electrodes and to give adequate clearance for the magnetic stirring bar.

10.2.3 If field measurements are being made, the electrodes may be immersed directly in the sample stream to an adequate depth and moved in a manner to insure sufficient sample movement across the electrode sensing element as indicated by drift free (<0.1 pH) readings.

10.2.4 Note and record the sample pH. As always after 10 samples are run a duplicate pH must be run.

10.2.5 Bracketing pH checks must be analyzed every 10 samples (i.e. if the sample pH is 5.55, read the pH 4 and 7 buffers as bracketing checks.) Results must be within acceptance criteria. If not, clean probe and read the checks again. If still not acceptable re-calibrate and re-analyze samples.

NOTE: *For acid rain samples it is most important that the magnetic stirrer is not used. Instead, swirl the sample gently for a few seconds after the introduction of the electrode(s). Allow the electrode(s) to equilibrate. The air-water interference should not be disturbed while measurement is being made. If the sample is not in equilibrium with the atmosphere, pH values will change as the dissolved gases are either absorbed or desorbed. Record sample pH and temperature.*

10.2.6 When the pH electrode is not in use, immerse it in the pH 7.0 buffer storage solution.

10.2.7 If any sample reading is <pH 4 or >pH 10, then a bracketing QC must be analyzed after the sample and achieve ± 0.2 pH units from true value to support control.

10.3 pH on Soils and Wastes Procedure Sample Preparation:

10.3.1 Weigh out a representative sample aliquot of 20g into a 250mL plastic bottle.

10.3.2 Add 20mL of DI water to sample aliquot.

10.3.3 One duplicate per 10 samples must be tumbled and analyzed.

10.3.4 Mix sample on TCLP tumbler for 5 minutes

10.3.5 Let soil suspension stand until the layers separate.

10.3.6 Decant some of the supernatent into a beaker or measuring tube. Stir the sample to insure homogeneity, but stir gently to minimize carbon dioxide entrapped. Electrodes may also be conditioned by dipping them into sample for 1 minute, blotting dry, then immersing in a fresh portion to read pH. For dilute, poorly buffered samples, 3-4 successive portions of sample may be used to equilibrate before reading pH.

10.3.7 Read the pH and record the value in the logbook.

10.3.8 If samples are hygroscopic and all the reagent water is absorbed, additional dilutions can be made. Begin with 20g of sample and 40mL of reagent water. If the supernatent is multiphasic, decant the oily phase and measure the pH of the aqueous phase.

10.3.9 If any sample reading is <pH 4 or >pH 10, then a bracketing QC must be analyzed after the sample and achieve ± 0.2 pH units from true value to support control.

11.0 CALCULATIONS

11.1 pH meters read directly in pH units. Report pH to the nearest 0.01 unit.

12.0 QUALITY CONTROL

12.1 Batch QC is performed in the form of duplicate samples, one every 10 client samples. Calculation of % RPD is inappropriate for comparison of pH values due to logarithmic nature. Subtract the duplicate values. The absolute difference between the original and the duplicate samples must be ± 0.1 pH units. However, for reporting purposes, the %RPD limit in LIMS is set 5%. However, for reporting purposes, the acceptable %Recovery limits in LIMS is set to 99-101%. If this limit is exceeded, then the sample, and its duplicate must be re-analyzed. The other nine client samples in the batch must also be re-analyzed to confirm accuracy in original readings, unless investigation determines some assignable cause of error unrelated to these values.

12.2 QC check buffer 7.0 must be within 6.95-7.05 pH units. It is analyzed after calibration and before analyzing samples. If outside these limits the meter must be re-calibrated. If it still doesn't work the buffer should be checked for contamination and a new bottle should be used.

12.3 An independent QC solution is used as an additional check. AMRO uses pH buffer 6.0 and it must be within 5.95-6.05 pH units.

12.4 All samples must be bracketed by control QC and must be within ± 0.05 pH units.

13.0 DATA REVIEW AND STORAGE

13.1 All related information and observations will be noted in the pH logbook.

13.2 All cross-outs must be a single line and should be initialed and dated.

13.3 The analyst must complete the Wet Chemistry Data Review Checklist.

14.0 REFERENCES

14.1 Standard Methods for the Examination of Water and Wastewaters, 22nd Edition: Method 4500-H+B.

14.2 Method 9045C, USEPA SW-846, Update III, Rev. 3, January, 1995.

14.3 VWR Scientific Products – VWR Brand Electrodes Manual for Ag/AgCl pH, Gel and Triode Electrodes.

14.5 THERMO Electron Corporation- Orion Star Series Meter User's Guide

AMRO Environmental Laboratories Corporation

111 Herrick Street, Merrimack, NH 03054
TEL: (603) 424-2022 • FAX: (603) 429-8496
www.amrolabs.com

Mercury in Solid or Semisolid Waste

SW-846 Method 7471A by Perkin Elmer FIMS 100 Automated Mercury Analyzer

Procedure Number: IL-3005

Revision No.: 5

Revision Date: 04/2/2013

Review Date: NA

Prepared By: Peter LeBrun Date: 4/2/13

Approved By: Robert E. Bosslant Date: 04/02/13
Inorganic Manager

Approved By: [signature] Date: 4-2-13
Laboratory Director

Approved By: [signature] Date: 4-2-13
Quality Assurance Manager

Property of AMRO Environmental Laboratories Corporation

TABLE OF CONTENTS

		Page
1.0	SCOPE AND APPLICATION	3
2.0	METHOD SUMMARY	3
3.0	DEFINITIONS	3
4.0	SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE	5
5.0	POTENTIAL PROBLEMS AND INTERFERENCES	5
6.0	HEALTH AND SAFETY	5
7.0	INSTRUMENTS AND EQUIPMENT	6
8.0	INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR	7
9.0	REAGENTS AND STANDARDS	7
10.0	PROCEDURE	11
11.0	CALCULATIONS	19
12.0	QUALITY CONTROL	19
13.0	DATA REVIEW AND STORAGE	22
14.0	REFERENCES	22

1.0 SCOPE and APPLICATION

1.1 This procedure is used for the preparation/determination of mercury in soils, sediments, bottom deposits and sludge-type materials.

1.2 AMRO routinely digests MS and MSD and Duplicate sample per batch, to meet all varying project QC requirements.

1.3 AMRO uses a Perkin-Elmer FIMS (Flow Injection Mercury System) 100 automated mercury analyzer. This instrument is an automated flameless AA mercury analyzer.

1.4 The Aqua Regia is generated in the sample tube by adding concentrated Hydrochloric Acid and concentrated Nitric Acid to ensure a fresh reagent for each sample and standard.

2.0 METHOD SUMMARY

2.1 Aqua Regia (generated in the sample tube) is added to a representative 0.6g aliquot of sample and heated for two minutes in a hot block at 95°C (± 2°C). Potassium Permanganate is added and the mixture is heated for an additional 30 minutes in a hot block at 95°C (± 2°C). Mercury in the digested sample is reduced with stannous chloride to elemental mercury, which is volatile and swept from the solution with argon and measured by a flameless AA procedure at wavelength of 253.7nm.

2.2 MODIFICATIONS:

2.2.1. Add 2 mL of hydroxylamine hydrochloride to each tube and mix well by shaking to reduce background noise.

2.2.2. The concentration of the Stannous Chloride is 1.1% per Perkin Elmer.

2.2.3. 16 ml of Potassium Permanganate: 5% solution. Is added to all samples and standards instead of 15 ml.

2.2.4. 5% nitric acid is use to dilute samples after they are digested and cooled.

3.0 DEFINITIONS

3.1 **Analytical Batch -** A group of samples of a similar matrix analyzed together with the same procedure, using the same reagents and within the same time period. Samples in each batch should be of similar composition (i.e. soil, water, oil, etc.). A batch shall not exceed 20 samples.

3.2	**Matrix Spike (MS)/ - Duplicate (MSD)**	Predetermined quantities of stock solutions of certain analytes, which are added to a sample matrix prior to sample digestion and analysis. Percent recoveries are calculated for each of the analytes detected. The relative percent difference between the samples is calculated and used to assess analytical precision. The concentration of the spike should be at the regulatory standard level.
3.3	**Sample Duplicate - (DUP)**	A duplicate sample aliquots of sample which is carried through the same digestion and analysis. The relative percent difference between the sample and sample duplicate is calculated and used to assess analytical precision.
3.4	**Laboratory Control-Sample (LCS)/ Duplicate (LCSD)**	A control sample of known composition. Aqueous and solid laboratory control samples are analyzed using the same sample preparation, reagents and analytical methods employed for samples received. Percent recoveries are calculated for each of the analytes detected. The relative percent difference between the samples is calculated and used to assess analytical precision. The concentration of the spike should be at the regulatory standard level.
3.5	**Method Blank**	An analytical control consisting of all reagents which is carried through the entire analytical procedure. It is used to define the level of laboratory background contamination.
3.6	**Instrument Detection Limit (IDL)**	Determined by multiplying by 3 the standard deviation obtained for the analysis of a standard solution (each Analyte in reagent water) at a concentration of 3 to 5 times instrument detection limit within 7 consecutive measurements per day.
3.7	**Method Detection Limit (MDL)**	The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater then zero. It is determined by analyzing seven replicates of a standard solution that is 2–3 times the IDL. The standard deviation is then multiplied by 3.143 (the student t test for seven replicates) to obtain the MDL or 2.998 for eight replicates. For soil MDL studies play sand must be used (7.11).

3.8 **Reporting Limit (RL)** The lowest level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions.

3.9 **Linear Range** The highest concentration of mercury that can be analyzed which is true value of the highest calibration standard.

4.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

4.1 Soil samples shall be refrigerated at 4°± 2°C until analyzed. The holding time for mercury is 28 days from collection date.

4.2 All sample containers must be cleaned according to the SOP on glassware cleaning.

5.0 POTENTIAL PROBLEMS AND INTERFERENCES

5.1 Possible interference from sulfide is eliminated by the addition of Potassium Permanganate.

5.2 Copper has been reported to interfere; however, copper concentrations as high as 10mg/L had no effect on recovery of Mercury from spiked samples.

5.3 Sea waters, brines and industrial effluents high in chlorides require additional permanganates. During the oxidation step, chlorides are converted to free chlorine, which will also absorb radiation at 253nm. Care must be taken to assure free chlorine is absent before the mercury is reduced and swept into the cell. This may be accomplished by using an excess of hydroxylamine hydrochloride reagent. Both inorganic and organic mercury spikes have been quantitatively recovered from seawater using this technique.

5.4 Low level mercury sample preparation, digestion and analysis may be subject to environmental contamination. This analysis should not be performed in areas with high ambient backgrounds where mercury was previously employed as an analytical reagent in analyses such as chemical oxygen demand (COD).

6.0 HEALTH AND SAFETY

6.1 AMRO has a laboratory safety program in place that applies to all employees. There is a safety officer as well as employees with 40 hours of OSHA training. The air quality of the laboratory has been monitored and employees are sent for physicals. All employees receive fire and safety training upon employment.

6.2 Fire extinguishers are located in various areas of the lab. A lab evacuation plan is posted in every room, with a designated meeting place.

6.3 All new analysts receive training on the safe handling of samples, standards, the changing of gas cylinders, and the operation of instruments. In the lab, clean laboratory coats and gloves are worn when working with samples. Neat standards are made up in hoods. When gas tanks are replaced, the carrier with chain is used properly, and all gas tanks are chained in place. Soap is used to check for any leaks.

6.4 Care is taken with glassware and syringes to prevent injury. Broken glass and syringes are promptly removed to broken glass containers. First aid kits are available throughout the lab. There are also eyewash stations and an emergency shower.

6.5 MSDS's are reviewed for each chemical used to ensure proper precautions are observed when handling chemicals.

6.6 Pollution prevention – The use of chemical exhaust hood are required when working with chemicals. They are specifically designed to minimize analyst exposure. The hood exhaust is monitored periodically to ensure environmental exposure is minimized.

6.7 Waste control – AMRO takes whatever steps possible to minimize waste. This includes volume reduction where appropriate. AMRO also properly segregates wastes according to contaminants and a commercial vendor is utilized for waste disposal.

7.0 INSTRUMENTS AND EQUIPMENT

7.1 Perkin-Elmer FIMS 100 automated mercury analyzer. This instrument is an automated flameless AA mercury analyzer. It is controlled by a Dell Octiplex computer with WinLab/FIMS software Ver 2.5. Samples and Standards are introduced by an AS-90 autosampler.

7.2 Environmental Express Hot block capable of reaching 95°C (±3°C).

7.3 Argon Cylinder with regulator

7.4 100µL, 200µL, 500µL and 1000uL Eppendorf pipets for spiking

7.5 Repipet Universal Dispensers, 5 mL volume range in 0.05 mL graduations

7.6 100mL containers for sample storage

7.7 100mL, 50mL, 500mL volumetric flasks. Only Class A volumetric glassware is used to prepare standards.

7.8 Plastic autosampler tubes

7.8 Autosampler racks B for samples and standards (Perkin-Elmer # B300-0132)

7.9 Analytical balance, capable of weighing to 0.0001g.

7.10 Thermometer

7.11 Play Sand, heated to 475 C, is added to the Method Blank and LCS/LCSD.

8.0 INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR

8.1 All maintenance must be documented in the maintenance logbook.

8.2 Daily:

8.2.1 Check calibration curve correlation (>0.995).

8.3 As Needed

8.3.1 Change pump and drain tubing.
8.3.2 Wipe off instrument with a damp cloth.
8.3.3 Archive files.
8.3.4 Clean racks and standard cups with DI water.
8.3.5 Change waste drain tubing.
8.3.6 Clean external optics.
8.3.7 Replace the mercury lamp

8.4 Semi Annually:

8.4.1 Change activated carbon in filter at the end of mercury system.

9.0 REAGENTS AND STANDARDS

Note: ***All reagents should be of analytical grade, suitable for mercury determination***

9.1 Nitric acid for Trace Metals Analysis, Omni Trace, EM or equivalent.

9.2 Sulfuric acid for Trace Metals Analysis,

9.3 Hydrochloric acid for Trace Metals Analysis, Omni Trace, or equivalent.

9.4 Deionized (DI) Water, ASTM Type I.

9.5 Potassium Permanganate: 5% solution. (W/V)

9.5.1 Dissolve 50g of potassium permanganate in 1000mL of DI water

9.6 Hydroxylamine Hydrochloride

7.7.1 Dissolve 120g of Hydroxylamine Hydrochloride in 1000 mL of DI water.

9.7 Stannous Chloride Solution: Add 13.2g of stannous chloride to 1000mL of 3%hydrochloric acid. Prepare fresh daily.

9.8 5% Nitric acid: Add 25 ml Nitric acid for Trace Metals Analysis, into 500 ml DI water.

9.9 3% Hydrochloric Acid Rinse Solution: Add 30mL of Hydrochloric acid for Trace Metals Analysis, Omni Trace or equivalent, to 1000mL DI water.

9.10 Refer to Mercury Standard Log for all standard preparation information. It is readily available near the FIMS. This log contains copies of the Certificates of Analysis for each stock purchased. It also gives an in depth explanation of all the standard required for analysis. This log is used to document the preparation of all Hg calibration standards and instrument QC standards.

9.11 Stock Mercury Solution: Hg 5 mg/L Standard. Use to prepare Working Standards for Calibration Standards, LCS and Spikes.

9.12 Calibration Standards - The Calibration Standard is a purchased standard. The Calibration Standard is replaced annually. The analytical solutions are prepared as needed.

9.12.1 Mercury Spike and LCS solution (500 ug/L): To a 50mL volumetric flask, add 5mL of DI and 2.5mL of HNO3 **THEN** 5.0mL of the Mercury Calibration Solution (5.0 mg/L) and dilute to the mark with DI. This solution is prepared Daily. If a 10-mg/L Calibration standard is used, reduce volume to 2.5 mL.

9.12.2 Working Mercury Calibration Solution (0.20mg/L): Use to prepare Calibration Standards. To prepare, add 2.5mL Nitric Acid and 2.0mL Of 5.0mg/L Hg Calibration Standard up to 50mL with DI water. Document in Mercury Standard Tracking Log. This solution is prepared Daily. If a 10 mg/L Calibration standard is used, reduce volume to 1.0 mL.

9.13 Stock Mercury Solution: Hg 20 mg/L Standard. Use to prepare Initial Calibration Verification (ICV). Note: ICV standard must be from a different source from the Hg standard. Initial Calibration Verification Standard (ICV) and be replaced annually. The ICV solution is run at the beginning of each run with a control limit of 90-110%. Analytical solutions are diluted as needed:

9.13.1 Working Mercury ICV Solution (0.60mg/L): Use to prepare ICV. To prepare, bring 1.25mL Nitric Acid and 3.0mL of 20mg/L Hg Standard. Bring to 100mL with DI water. Document in Mercury Standard Tracking Log. This standard is prepared Daily.

9.15 Continuing Calibration Verification Standard (CCV)

9.15.1 The CCV is prepared daily from the calibration standard. (See Hg Standard Log.) CCVs are run every 10 samples with a control limit of 80-120%.

9.16 Standards

9.16.1 Refer to Mercury Soil Standard Log for all standard preparation information. It also gives an in depth explanation of all the standards required for analysis. This log is used to document the preparation of all Hg calibration standards and instrument QC standards.

9.16.2 Calibration Standards

9.16.2.1 The Calibration Standard is a purchased standard.

9.16.3.2 The analytical solutions are prepared fresh.

9.16.3 Initial Calibration Verification Standard (ICV):

9.16.3.1 The analyst must document that the source of this standard is different than the calibration standard. The ICV Standard is a purchased standard. It is run at the beginning of each run. The acceptance criteria: 90-110%.

9.16.4 Continuing Calibration Verification Standard (CCV):

9.16.4.1 The CCV is prepared daily from the calibration standard. (Refer to

Hg Standard Log.) CCV's are run every 10 samples and at the end of the analytical sequence. The acceptance criteria: 80-120%.

9.16.5 Reporting Limit (RL) Standard for Hg (concentration = 0.20μg/L).

9.16.5.1 The RL Standard is prepared from the Calibration Standard. Refer to Mercury Soil Standard Log.

9.16.5.2 Analytical solutions are prepared fresh.

9.17 TRACKING OF ANALYTICAL STANDARDS

9.17.1 Chemical Receipt:

The receipt of all standards, neat compounds and reagents from commercial sources is documented in the Chemical Receiving Logbook by sample receiving personnel or designate. Each solution or compound is assigned a unique standard receipt ID number, the letter "A" and a 5 digit sequential number. The date received, source, lot number, expiration date and disposal date are recorded. The expiration dates are provided from the manufacturer and the disposal dates are completed by AMRO employees when standards are used up or disposed as indicated in the SOP "Sample Management GL-1006".

9.17.2 Standards Preparation:

Standards are prepared as written in the respective SOPs. In order to assure the accuracy of standards the following general guidelines are used:

9.17.2.1 ACS reagent grade chemicals are used when the method warrants.

9.17.2.2 A certificate of analysis accompanies any stock standards that are purchased from the manufacturer.

9.17.3 Standard Tracking:

It is important to be able to track all analytical standards back to their sources. The following procedure is used by AMRO personnel to accomplish this:

9.17.3.1 Mercury Standards, LCS Standards, and ICV Standards

Preparation and Standard ID's are listed in the Hg soil Standard Log. Standards include: S1 (Calibration Blank, ICB, CCB), S2 (0.20 μg/L

Calibration Standard and RL Standard), S3 (2.0 µg/L Calibration Standard), S4 (4.0 µg/L Calibration Standard), S5 (8.0 µg/L Calibration Standard), S6 (10.0µg/L Calibration Standard), S7 (16 ug/L Calibration Standard), CCV 6.0 µg/L Standard, and ICV (3.0 µg/L Independent Source QC Standard), and Stock Solutions for Matrix/LCS spike additions (Matrix/LCS spike addition = 5.0 µg/L). The Solution ID is the date prepared (example: is standard 032713 prepared on 03/27/13).

9.17.3.2.1 Wet Chemistry and Metals Reagent Log - Working reagents are made from reagents listed in the Chemical Receiving Log and are documented in the Reagent Log. The corresponding analysis, preparation date, reagent name, AMRO ID, initial concentration, amount used, final volume, final concentration, Solution ID, expiration date, storage location, and analyst initials are recorded. The initial concentration is obtained from the certificate received from the manufacturer. The Solution ID is written as an "R" followed by a 5 digit sequential number. The expiration of prepared reagents varies. Reagents should be used in accordance with method specifications and manufacturer's instructions as indicated in the SOP "Sample Management GL-1006".

10.0 PROCEDURE

10.1 Determination of Instrument Detection Limit (IDL):

10.1.1 Pour a calibration blank solution into seven autosampler tubes, and analyze as individual samples.

10.1.2 Determine the standard deviation for seven replicates.

10.1.3 The IDL = 3 x (standard deviations).

10.1.4 Provide all required information on the current Instrument Detection Limit study worksheet provided by the QA Department.

10.2 Determination of Method Detection Limit (MDL):

10.2.1 Digest at least seven individual aliquots of an MDL Solution using an appropriate digestion procedure, which is 3-5 times the IDL or 20% of the AMRO reporting limit. For soil MDL studies play sand must be used (7.11).

10.2.2 Determine the standard deviation for the seven digestions.

10.2.3 The MDL = 3.143 x (average of the standard deviations). If eight samples re digested, use 2.998.

10.2.4 Provide all required information on the current Method Detection Limit study on the worksheet provided by the QA department.

10.2.5 The MDL must be performed annually.

10.3 Precision and Accuracy:

10.3.1 Run four LCS's. Acceptance limits are 80-120%. Precision and accuracy is done annually by each analyst for each matrix and analysis type.

10.4 Linear Range:

10.4.1 The highest concentration of mercury that can be analyzed which is the true value of the highest calibration standard. This must be determined initially and verified annually.

10.5 Calibration Curve:

10.5.1 Take clean, labeled 100mL tubes and make the 8 standards listed below by adding the amount of Deionized Water shown plus 4.0mL of concentrated Hydrochloric Acid and 1.0 mL of concentrated Nitric Acid followed by the amount of Mercury standard listed below:

Standard (µg/L)	3 DI Water	Hg Calibration Working Std.
0 (CCB)	5.0 mL	0
0.2	5.0mL	100µL (Reporting Limit)
2.00	5.0mL	1.0mL
4.00	5.0mL	2.0mL
6.00 (CCV)	5.0mL	3.0mL
8.00	5.0mL	4.0mL
10.00	5.0mL	5.0mL
16	5.0ml	8.0ml
3.0 (ICV)	5.0mL	500µL Hg ICV Working Std

10.5.2 Place tubes in water bath at 95°C (±3°C) for two minutes. After two minutes remove the tubes.

10.5.3 After cooling, add 40 mL of DI and 16mL of Potassium Permanganate.

10.5.4 Mix thoroughly.

10.5.5 Place tubes back in hot block at 95°C (±3°C) and heat for 30 minutes. Document the temperature of the hot block in the mercury logbook. The temperature of the **hot block MUST be at 95 ±3°C**. Add the samples and wait until the temperature returns to 95 before starting the 30 minutes count.

10.5.6 Cool then add 2mL hydroxylamine hydrochloride to all samples to reduce the excess permanganate.

10.5.7 Fill standard to 100ml line with 5% nitric acid.

10.5.8 Pour standards into appropriately labeled standard tubes. Document preparation of the curve in the Mercury Standard Tracking Log.

10.6 Obtaining a Homogeneous Sample

10.6.1 Refer to SOP GL-1013 "Sample Homogenization for Soil, Solid and Semisolid Waste" for sample homogenization guidance and how to obtain a representative subsample.

10.6.2 If multiphase samples are submitted, the client is called to determine which phase is to be digested.

10.7 Sample Digestion

10.7.1 Transfer three well-mixed portions of sample, totaling 0.6g into an appropriately labeled tube. Weigh sample using an analytical balance to the 0.0001g place. Document weight in Hg logbook.

10.7.2 Prepare blank by adding 5.0mL DI, 4.0mL of HCl, and 1.0mL of HNO_3 to an appropriately labeled tube. Each batch of twenty samples requires a blank. Add 0.6 g of Blank Sand to the method blank.

10.7.3 Prepare LCS/LCSD by adding 5.0mL DI, 4.0mL of HCl, and 1.0mL of HNO_3 to an appropriately labeled tube then 1.0 mL of spiking solution (Sec 9.12.1). Each batch of twenty samples requires an LCS (true value = 5.0µg/L). Add 0.6 g of Blank Sand to the LCS & LCSD.

10.7.4 To each soil sample add 5.0mL DI, 4.0mL of HCl, and 1.0mL of HNO_3.

10.7.5 Prepare the Matrix Spike (MS) and Matrix Spike Duplicate (MSD) by choosing a sample and adding three well-mixed portions of sample, totaling a 0.6g aliquot of sample into tubes labeled with the sample ID plus MS or MSD. Add 1.0mL Spiking Solution (Sec 9.12.1) to the

appropriate commercial MS and MSD samples. Add 5.0mL DI, 4.0mL of HCl, and 1.0mL of HNO_3. Each batch of twenty samples requires an MS and an MSD. (true value = 5.0µg/L)

10.7.6 If needed for training or internal reference, an ERA soil sample can be prepped as an LCS.

10.7.7 Place tubes in the hot block at 95°C (±3°C) for two minutes then remove and cool. Add DI water to a volume of 40mL by using the 40mL line on the centrifuge tube.

10.7.8 Add 16mL Potassium Permanganate to each sample.

10.7.9 Mix thoroughly.

10.7.10 Loosely cap samples.

10.7.11 Place samples in the hot block at 95°C (± 3°C) for 30 minutes. Document the temperature of the hot block in the mercury logbook. The temperature of the **hot block MUST be at 95 ± 3°C**. Add the samples and wait until the temperature returns to 95 before starting the 30 minute count.

10.7.12. Allow samples to cool and add 2mL hydroxylamine hydrochloride to all samples to reduce the excess permanganate.

10.7.13. Fill samples to the 100ml line with 5% nitric acid solution.

10.7.14. Pour samples into appropriately labeled glass centrifuge tubes. Centrifuge as needed. They can also be filtered w/ a syringe filter and a 45µL syringe filter.

10.8 Instrument Start-up:

10.8.1 Switch on the spectrometer with the switch at the left-hand side of the spectrometer's front panel.

10.8.2 Switch on the computer and monitor with power switches on the front of each one.

10.8.3 Windows 95 will come up.

10.8.4 Double click AAWinLab folder on desktop. Instrument software will come up.

10.8.5 One the initial screen click Menus and Toolbar.

10.8.6 Put pump tubing in place, place reductant line in the Stannous Chloride and carrier line in 3% HCl.

10.8.7 Display FIAS Control window by choosing FIAS on the tool bar.

10.8.8 Press the FIAS on/off button. Instrument will go into an internal test mode.

10.8.9 Go to Autorun or press pump 1 on the FIAS control screen to rinse.

10.9 Creating and Modifying Sample Information Files

10.9.1 The system uses this file to label the data from samples both on the printed log of the results and in the results file. Information in this file is also used by the system to calculate final concentrations. A sample information file is especially useful for other data handling programs to manipulate the data.

10.9.2 To create a new sample information file, click on New Sample Info File in the File menu. The Sample Information Editor will appear.

10.9.3 Enter the sample information including all IDs in the cup where the sample will be placed. The amount of information that is entered depends on how the analysis results are to be reported, in weight/weight units or weight/volume units. The first eight positions are dedicated to Standards and Instrument QC as follows:

Position No.	4 Sample ID
1	Calibration Blank
2	Std. 0.20µg/L
3	Std. 2.0µg/L
4	Std. 4.0µg/L
5	Std. 8.0µg/L
6	Std. 10.0µg/L
9	Std 16.0 ug/L
7	ICV 3.0µg/L
8	CCV 6.0µg/L

The next nine positions are reserved for future QA/QC samples. Start analytical samples at Auto Sampler Position 17.

10.9.4 Save the sample information file by clicking on Save As Sample Info File in the File menu. The Save As dialog will appear. Type a name for the file (Mmddyy for example, M031099A) and click on OK.

10.9.5 To modify a stored sample information file click on Open Sample Info File in the File menu.

10.9.6 In the Open dialog select the sample information file to be opened and click OK.

10.9.7 In the Tools menu, click on Sample Information Editor and enter the new sample information.

10.9.8 Save the sample information file by clicking on Save As Sample Info File in the File menu. The Save As dialog will appear.

10.9.9 In this dialog, type a name for the file and click OK.

10.10 Setting Up the Automated Analysis Window:

10.10.1 Select the correct methods by double clicking on an entry field in the Method column in the Automated Analysis window. The Open Method dialog appears. Use this dialog to select the methods that are required.

10.10.2 Set a delay time between methods to allow the lamps to warm up before the system makes measurements by typing a value in the Delay column. This is not needed for mercury analysis.

10.10.3 Select the samples to be analyzed by using a sample information file or by selecting individual sample tray locations. To use a sample information file click on Open next to the Sample Information File entry field. Then Open Dialog appears. This dialog is used to select the name of the sample information file. In the Automated Analysis window, in the table, select the box in the Defined in Sample Info. File column. To select individual sample tray locations clear the box in the Defined in Sample Info. File column in the table in the Automated Analysis window. Type the locations of the samples in the Use Autosampler Locations Listed Below column. Type individual locations or a range of locations. Use commas to separate the locations and the ranges. Example: 10-15, 18,20,25-30 for the analyte addition technique, type only the locations of the pure sample solutions. If the locations of blanks, QC, checks or calibration solutions are typed in, they will be analyzed as if they were normal samples.

10.10.4 Select the data saving and print options by clicking Open next to the Results Data Set entry field. The Choose Results Data Set dialog will appear. Use this dialog to select the results data set. If the data set exists, new data will be added to it. Select the Save Data box to save the results in the selected data set. To print the results during the analysis, select the Print Log box.

10.10.5 Select items to switch off after the analysis by selecting the Off After Analyses options that are required.

10.11 Starting a Calibration Curve Analysis

There are two different options for performing a calibration curve analysis.

10.11.1 In the Automated Analysis Window, click on Analyze All. The system analyzes the calibration solutions first, immediately followed by the samples and any other solutions, for example, the QC and check samples.

10.11.2 In the Automated Analysis Window, click on Calibrate. The system will analyze the calibration solutions. If necessary edit the calibration curve. When the calibration curve is acceptable, click on Analyze Samples in the Automated Analysis window.

10.11.3 Following calibration, the instrument will print out a "Calibration data for Hg." The Correlation Coefficient MUST be better than 0.995.The Calculated Concentrations should be in good agreement with the True Values for the standards. The %RSD is usually less than 1.0%, with the possible exception of the 0.20 ug/L standard.

10.12 Loading the Autosampler Tray

10.12.1 Flow Injection autosampler – Make sure that the correct sample tray (Tray B) has been selected in the Method Editor on Calib. – Autosampler page. In the Automated Analysis window, click on the Analyze tab. Click on Load Tray. Place the loaded sample tray in the autosampler, or load the samples and other solutions into the sample tray in the autosampler. Make sure that the solutions are in the locations specified in the Method Editor, in the sample information file and in the Automated Analysis – Setup window. Click on Load Tray again.

10.13 Rinsing the Fluid System

10.13.1 Place the inlets of the pump tubes for the carrier, reductant and any other reagents in a container of the first rinsing solution.

10.13.2 Place the inlet of the sampling tube in a container of the first rinsing solution or if the autosampler is being used, place a container of the first rinsing solution in the wash location of the autosampler. In the Automated Analysis window, click on Select Location. In the Autosampler dialog, select Go to wash. Click on OK.

10.13.3 In the FIAS Control window click on the pump #1 icon to start the pump.

10.13.4 In the FIAS Control window, switch the FIAS-valve between the Fill and Inject positions a few times to rinse the inside of the valve.

10.13.5 Rinse the system for as long as necessary to remove all traces of the solution used previously.

10.13.6 If more than one rinsing solution is used, place the inlets of the pump tubes for the carrier, reductant and any other reagents in a container of the next rinsing solution.

10.14 Analysis Start up

10.14.1 When analysis is started, the system first checks for errors in the method and in the sample information file. If the system finds a fault that must be corrected before analysis can start, a message will appear and the fault must be corrected before the system will start the analysis.

10.14.2 When the button is clicked to start an analysis procedure, a green indicator will appear on the button and the other buttons will become inactive. The system uses the analytical conditions in the active method for each replicate. When all the solutions have been analyzed, the green indicator button disappears and the other buttons will become active.

10.14.3 The progress of the analysis is shown in the Automated- or Manual Analysis window.

10.15 Shutting Down the Flow Injection System

10.15.1 Rinse the fluid system with the correct rinsing solutions.

10.15.2 Switch the FIAS pumps off by clicking on On/Off for each pump in the FIAS Control window.

10.15.3 Switch off the spectrometer with the switch at the left-hand side of the front panel.

10.15.4 Turn off the carrier gas supply

10.15.5 Release the pressure on the pump tubes. Swing the pressure levers away from the pump tube magazines.

10.15.6 Empty the waste bottle. Dispose of waste solutions correctly, according to the safety regulations.

10.15.7 Switch off the computer and printer.

11.0 CALCULATIONS

11.1 Instrument Calibration Concentrations are in µg/L and Sample Concentration are in mg/kg. To verify soil results, perform the following calculation:

$$\text{Reported Conc. (mg/kg)} = \frac{\text{Determined conc. (µg/L) x Final Vol.(0.025L) x Dilution}}{\text{sample weight (g) x total solids (in decimal form)}}$$

11.2 % Recovery Laboratory Control Sample (water) = Determined concentration (µg/L)/true value x 100.

11.3 % Recovery MS/MSD = Determined concentration - sample concentration/true value x 100

11.4 %RPD MS/MSD or DUP = (sample - dup)/((sample + dup)/2) x 100. Use concentrations of each in calculations.

12.0 QUALITY CONTROL

12.1 Method Blank:

12.1.1 One Method Blank must be digested with every 20 samples or for every batch. The acceptable criteria: < RL and <½ RL for Department of Defense (DoD) projects.

12.1.2 The Method Blank results above the reporting limit indicate contamination. The source of contamination will be investigated and corrected. If a sample is greater than the reporting limit and less than ten times the Method Blank results, the sample will be re-digested and re-analyzed.

12.2 Matrix Spike and Matrix Spike Duplicate:

12.2.1 One matrix spike and one matrix spike duplicate are required for every 20 samples or for every preparation batch.

12.2.2 Samples must be selected for spiking at random and rotated among clients and sites from batch to batch. In some cases, the client may specify which sample is to used for MS/MSD; if not , the laboratory shall pick a representative sample based on the following:

A. MS/MSD shall not be performed on Trip Blank, Rinsate Blank or Field Blank.
B. Adequate sample volume.
C. Client requested QC deliverables

12.2.3 The concentration of the analyte in the unspiked sample aliquot should be no more than four times the amount added. If the sample result is greater than four times the amount added, the LCS is the only valid assessment of accuracy for the batch and the spike recovery is not evaluated for control. If the control limits are not met for Relative Percent Difference, the control limits for Percent Recovery in the Matrix Spike are not applicable, since sample heterogeneity is indicated and an inaccurate sample result used to calculate percent recovery is suspected. The acceptable criteria: % R=75-125%

12.3 Sample Duplicate:

12.3.1 One sample duplicate is required for every 20 samples or for every preparation batch.

12.3.2 Duplicate samples are two aliquots of a sample, which are carried through the same sample preparation and analysis procedure to verify the precision of the method for that sample matrix. The RPD (Relative Percent Difference) is calculated from the original and the duplicate sample. If one sample result is above the reporting limit and one is less than five times the reporting limit the data is acceptable. An RPD can also be calculated between a matrix spike and matrix spike duplicate. The RPD is calculated using the concentration of the matrix spike and matrix spike duplicate. If the control limits are not met for Relative Percent Difference, the control limits for Percent Recovery in the Matrix Spike are not applicable, since sample heterogeneity is indicated and an inaccurate sample result used to calculate percent recovery is suspected. The control limits are $\leq 20\%$.

12.4 Laboratory Control Sample

12.4.1 One LCS is required for every 20 samples or for every preparation batch.

12.4.2 The %R control limit for the LCS is 80-120%.

12.4.3 If the Control limits which are not met for percent recovery in the LCS indicates inaccuracy during the procedure and requires re-digestion and re-analysis.

12.5 The following chart contains the frequency and control limits for QC required during the analytical run.

QC Sample	Frequency	Hg Action Level	Hg Action	Analyst Response
ICV	Once, after calibration	±10% of True Value	Stop	Correct problem and recalibrate
ICB*	Once, after ICV	±RL	Stop	Correct problem and recalibrate
RL	Start	±30% of True Value	Flag Data	Use caution regarding low level samples
CCV	10% of analytical samples	±20% of True Value	Flag Data	Correct problem and reanalyze affected samples
CCB*	Following each CCV	± RL	Flag Data	Correct problem and reanalyze affected samples

* ± ½ RL for Department of Defense (DoD) projects.

12.6 Corrective Action for Batch QC:

12.6.1 The initial investigation of the problem involves:

12.6.1.1 Checking sample concentrations for being high compared to the spike or too low for the RPD limits.

12.6.1.2 Checking calculations and raw data transcriptions (both QC and sample).

12.6.1.3 Checking sample concentrations and analytical sequence for influences such as carryover and mislabeling.

12.6.1.4 Reviewing the notes in the Mercury Digestion worksheet (2) and analytical notebook for signs of problems or heterogeneity. A conclusion of heterogeneity is not made as an afterthought.

12.6.2 When the control limits are not met for any batch QC, the batch QC is rerun to verify that the out-of-control result is not a function of analytical variability.

13.0 DATA REVIEW AND STORAGE

13.1 All related preparation information and observations will be noted in the digestion logbook.

13.2 All cross-outs must be a single line and should be initialed and dated. Analyst review is documented on the GFAA and CVAA Data Review Checklist.

13.3 All data from each run will be properly labeled and placed in the central file in an appropriate storage area. Each central file will include a run log, sample digestion sheet, and all original data.

14.0 REFERENCES

14.1 SW846 Method 7471A. Office of Solid and Hazardous Waste, rev. 1, 9/94.

14.2 FIMS, Software Guide, Publication B3118.30, Release 1.0/July 1994.

14.3 Flow Injection Mercury Analysis, Setting Up and Performing Analyses, Publication B3118.20, Release 1.1/March 1994.

14.4 Flow Injection Mercury/Hydride Analyses, Recommended Analytical Conditions and General Information, Publication B3505, Release 4.0.

14.5 FIMS, Installation Maintenance System Description, Publication B3118.10, Release 1.1/June 1994.

14.6 40 CFR Part 136 Appendix B, 1984

14.7 Department of Defense Quality Systems Manual for Environmental Laboratories, Revision 3, January 2006.

AMRO Environmental Laboratories Corporation

111 Herrick Street, Merrimack, NH 03054
TEL: (603) 424-2022 • FAX: (603) 429-8496
www.amrolabs.com

Mercury in Liquid Waste (Manual Cold-Vapor Technique)

SW-846 Method 7470A

Procedure Number: IL-3002

Revision No.: 4

Revision Date: 01/23/2004

Review Date: 01/05/10

Prepared By: Paula Benham Date: 1/12/10

Approved By: Robert E. Burchart Date: 01/12/10
Inorganic Manager

Approved By: [illegible] Date: 1/12/10
Laboratory Director

Approved By: Paula Benham Date: 1/12/10
Quality Assurance Manager

Property of AMRO Environmental Laboratories Corporation

TABLE OF CONTENTS

		Page
1.0	SCOPE AND APPLICATION	3
2.0	METHOD SUMMARY	3
3.0	DEFINITIONS	3
4.0	SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE	5
5.0	POTENTIAL PROBLEMS AND INTERFERENCES	5
6.0	HEALTH AND SAFETY	6
7.0	INSTRUMENTS AND EQUIPMENT	6
8.0	INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR	7
9.0	REAGENTS AND STANDARDS	8
10.0	PROCEDURE	12
11.0	CALCULATIONS	21
12.0	QUALITY CONTROL	22
13.0	DATA REVIEW AND STORAGE	25
14.0	REFERENCES	26
	Attachment 1 Mercury Standard Log	27
	Attachment 2 Mercury Digestion Log	28
	Attachment 3 GFAA and CVAA Data Review Checklist	29
	Attachment 4 SW-846 Method 7470A Qualification Card	30

1.0 SCOPE and APPLICATION

1.1 This procedure is used for the preparation/determination of mercury in mobility-procedure extracts (Toxicity Characteristic Leaching Procedure - TCLP), aqueous wastes and ground waters.

1.2 Modifications:

1.2.1 Sample volume is reduced from 100mL to 25mL to reduce waste, all reagents are reduced accordingly. Reagent volume is rounded up to the nearest whole number for both the curve and samples due to limitations of the pipettes and various other measuring devices used in the laboratory.

2.0 METHOD SUMMARY

2.1 A representative 25mL aliquot of aqueous sample (or TCLP extract) is oxidized in a mixture of nitric acid/sulfuric acid, potassium permanganate and potassium persulfate at 95°C (±2°C) for two hours. Mercury in the digested sample is reduced with stannous chloride to elemental mercury, which is volatile and swept from the solution with argon and measured by a flameless AA procedure.

3.0 DEFINITIONS

3.1 **Analytical Batch -** A group of samples of a similar matrix analyzed together with the same procedure, using the same reagents and within the same time period. Samples in each batch should be of similar composition (i.e. soil, water, oil, etc.). A batch shall not exceed 20 samples.

3.2 **Matrix Spike (MS)/ - Duplicate (MSD)** Predetermined quantities of stock solutions of certain analytes, which are added to a sample matrix prior to sample digestion and analysis. Percent recoveries are calculated for each of the analytes detected. The relative percent difference between the samples is calculated and used to assess analytical precision. The concentration of the spike should be at the regulatory standard level.

3.3 **Sample Duplicate - (DUP)** A duplicate sample aliquot of sample which is carried through the same digestion and analysis. The relative percent difference between the sample and sample duplicate is calculated and used to assess analytical precision.

3.4 **Laboratory Control-Sample(LCS)/ Duplicate (LCSD)** A control sample of known composition. Aqueous and solid laboratory control sample are analyzed using the same sample preparation, reagents and analytical methods employed for samples received. Percent recoveries are calculated for each of the analytes detected.
The relative percent difference between the samples is calculated and used to assess analytical precision. The concentration of the spike should be at the regulatory standard level.

3.5 **Method Blank** An analytical control consisting of all reagents which is carried through the entire analytical procedure. It is used to define the level of laboratory background contamination.

3.6 **Instrument Detection Limit (IDL)** Determined by multiplying by 3 the standard deviation obtained for the analysis of a standard solution (each Analyte in reagent water) at a concentration of 3 to 5 times instrument detection limit within 7 consecutive measurements per day.

3.7 **Method Detection Limit (MDL)** The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater then zero. It is determined by analyzing seven replicates of a standard solution that is 2–3 times the IDL. The standard deviation is then multiplied by 3.143 (the student t test for seven replicates) to obtain the MDL or 2.998 for eight replicates.

3.8 **Reporting Limit (RL)** The lowest level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions.

3.9 **Linear Range** The highest concentration of mercury that can be analyzed

which is within 10% of the true value of the highest calibration standard.

4.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

4.1 Aqueous samples shall be acidified at the time of collection with (1+1) nitric acid to pH<2. The holding time is 28 days for aqueous samples and TCLP extracts.

5.0 POTENTIAL PROBLEMS AND INTERFERENCES

5.1 Possible interference from sulfide is eliminated by the addition of Potassium Permanganate.

5.2 Copper has been reported to interfere; however, copper concentrations as high as 10mg/L had no effect on recovery of Mercury from spiked samples.

5.3 Seawater brines and industrial effluents high in chlorides require additional permanganates. During the oxidation step, chlorides are converted to free chlorine, which will also absorb radiation at 253nm. Care must be taken to assure free chlorine is absent before the mercury is reduced and swept into the cell. This may be accomplished by using an excess of hydroxylamine hydrochloride reagent. Both inorganic and organic mercury spikes have been quantitatively recovered from seawater using this technique.

5.4 Low level mercury sample preparation, digestion and analysis may be subject to environmental contamination. This analysis should not be performed in areas with high ambient backgrounds where mercury was previously employed as an analytical reagent in analyses such as total Kjeldahl nitrogen (TKN) or chemical oxygen demand (COD).

6.0 HEALTH AND SAFETY

6.1 AMRO has a laboratory safety program in place that applies to all employees. There is a safety officer as well as employees with 40 hours of OSHA training. The air quality of the laboratory has been monitored and employees are sent for physicals. All employees receive fire and safety training upon employment.

6.2 Fire extinguishers are located in various areas of the lab. A lab evacuation plan is posted in every room, with a designated meeting place.

6.3 All new analysts receive training on the safe handling of samples, standards, the changing of gas cylinders, and the operation of instruments. In the lab, clean laboratory coats and gloves are worn when working with samples. Neat standards are made up in hoods. When gas tanks are replaced, the carrier with chain is used properly, and all gas tanks are chained in place. Soap is used to check for any leaks.

6.4 Care is taken with glassware and syringes to prevent injury. Broken glass and syringes are promptly removed to broken glass containers. First aid kits are available throughout the laboratory There are also eyewash stations and an emergency shower.

6.5 MSDSs are reviewed for each chemical used to ensure proper precautions are observed when handling chemicals.

6.6 Pollution prevention – The use of chemical exhaust hood are required when working with chemicals .They are specifically designed to minimize analyst exposure. The hood exhaust is monitored periodically to ensure environmental exposure is minimized.

6.7 Waste control – AMRO takes whatever steps possible to minimize waste. This includes volume reduction where appropriate. AMRO also properly segregates wastes according to contaminants and a commercial vendor is utilized for waste disposal.

7.0 INSTRUMENTS AND EQUIPMENT

7.1 Perkin-Elmer FIMS 100 automated mercury analyzer. This instrument is an automated flameless AA mercury analyzer. It is controlled by a Dell Octiplex computer with WinLab/FIMS software Ver 2.5. Samples and Standards are introduced by an AS-90 autosampler.

7.2 Hot Block Digestor (Environmental Express) or Water Bath capable of reaching 95°C (±2°C).

7.3 Argon Cylinder with regulator

7.4 100µL, 200µL and 1000µL Eppendorf pipets for spiking (Fisher # 03402-69) or equivalent).

7.5 Repipet Universal Dispensers, 5 mL volume range in 0.05 mL graduations

7.6 52 mL containers for sample storage (cat #3264)

7.7 100mL, 50mL, 500mL volumetric flasks. Only Class A volumetric glassware is used to prepare standards.

7.8 Glass autosampler tubes (Fisher #14-961-29)

7.8 Autosampler racks B for samples and standards (Perkin-Elmer # B300-0132)

7.9 Thermometer

8.0 INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR

8.1 All maintenance must be documented in the maintenance logbook.

8.2 Daily:

8.2.1 Check calibration curve correlation (>0.995).
8.2.2 Rinse before and after running samples for 10 minutes with 10% HCL.

8.3 Weekly:

8.3.1 Change pump and drain tubing.
8.3.2 Wipe off instrument with a damp cloth.
8.3.3 Archive files.
8.3.4 Clean racks and standard cups with DI water.

8.4 Monthly:

8.3.1 Change waste drain tubing.
8.3.2 Clean external optics.

8.5 Annually:

8.5.1 Replace liquid/gas separator.

8.6 As Needed

8.6.1 Replace the mercury lamp.

9.0 REAGENTS AND STANDARDS

Note: ***All reagents should be of analytical grade, suitable for mercury determination***

9.1 Nitric acid for Trace Metals Analysis, Omni Trace, EM (VWR# NX0407/2)

9.2 Sulfuric acid for Trace Metals Analysis, Fisher (Fisher # AS10SK-212)

9.3 Hydrochloric acid for Trace Metals Analysis, Omni Trace, EM (VWR# HX0607/2)

9.4 Deionized (DI) Water, ASTM Type I

9.5 Potassium Permanganate: 5% solution.

9.5.1 Dissolve 5 of potassium permanganate (Fisher P279-212) in 100mL of DI water.

9.6 Potassium Persulfate: 5% solution

9.6.1 Dissolve 5g of potassium persulfate (JT Baker 3239-01) in 100 mL of DI water.

9.7 Hydroxylamine Hydrochloride

9.7.1 Dissolve 120g of Hydroxylamine Hydrochloride in 1000 mL of DI water (JT Baker 2196-01)

9.8 Stannous Chloride Solution: Add 11g of stannous chloride (Fisher TI42-500) to 1.0L of 0.5N hydrochloric acid. Prepare fresh daily.

9.8.1 0.5N Hydrochloric Acid: Add 2.8mL Hydrochloric acid for Trace Metals Analysis, Omni Trace, EM (VWR# HX0607/2) to 200mL of DI water.

9.9 3% Hydrochloric Acid Rinse Solution: Add 30mL of Hydrochloric acid for Trace MetalsAnalysis, Omni Trace, EM (VWR# HX0607/2) to 900mL DI water.

9.10 Stock Mercury Solution: Hg 5ppm Standard . Use to prepare Working Standards for Calibration Standards, LCS and Spikes.

9.10.1 Working Mercury Calibration Solution (50µg/L): Use to prepare Calibration Standards, LCS, and Spikes. To prepare, bring 5.0mL Nitric Acid and 1.0mL of 5.0ppm Hg Calibration Standard up to 100mL with DI water. This Standard is prepared daily. Document in Mercury Standard Log (Attachment 1).

9.10.2 Working LCS and Spike solution (500µg/L): To a 50mL volumetric flask add 5.0mL DI and 2.5mL HNO_3. Add 0.5mL of Mercury cal solution. Dilute to 50-mL final volume with DI. This Standard is prepared daily.

9.11 Stock Mercury Solution: Hg 20mg/L Standard . Use to prepare Initial Calibration Verification (ICV). Note: ICV standard must be from a different source from the Hg standard.

9.11.1 Working Mercury ICV Solution (600µg/L): Use to prepare ICV. To prepare, bring 5.0mL Nitric Acid and 3.0mL of 20,000µg/L Hg Standard. Bring to 100mL with DI water. This Standard is prepared daily. Document in Mercury Standard Log (Attachment 1).

9.12 Standards

9.12.1 Refer to Mercury Standard Log for all standard preparation information. It is readily available near the PS200II. This log contains copies of the Certificates of Analysis for each stock purchased. It also gives an in depth explanation of all the standards required for analysis. This log is used to document the preparation of all Hg calibration standards and instrument QC standards.

9.12.2 Calibration Standards

9.12.2.1 The Calibration Standard is a purchased standard.

9.12.2.2 The Stock Calibration Standard is replaced annually.

9.12.2.3 The analytical solutions are prepared fresh.

9.12.3 Initial Calibration Verification Standard (ICV):

9.12.3.1 The analyst must document that the source of this standard is different than the calibration standard. The ICV Standard is purchased from AccuStandard Inc. It is run at the beginning of each run. The acceptance criteria: 90-110%.

9.12.3.2 The ICV Stock Standard is replaced annually.

9.12.3.3 Analytical solutions are diluted as needed.

9.12.4 Continuing Calibration Verification Standard (CCV):

9.12.4.1 The CCV is prepared daily with every calibration curve from the calibration standard. (Refer to Hg Standard Log.) CCV's are run every 10 samples and at the end of the analytical sequence. The acceptance criteria: 80- 120%.

9.12.4.2 The Calibration Stock Standard is replaced annually.

9.12.4.3 Analytical solutions are prepared fresh.

9.12.5 Reporting Limit (RL) Standard for Hg (concentration = 0.20µg/L).

9.12.5.1 The RL Standard is prepared daily with every calibration curve from the Calibration Standard. Refer to Mercury Standard Log (Attachment 1).

9.12.5.2 The Calibration Standard is replaced annually.

9.12.5.3 Analytical solutions are prepared as needed.

9.12.6 <u>TRACKING OF ANALYTICAL STANDARDS</u>

9.12.6.1 <u>Chemical Receipt</u>:

The receipt of all standards, neat compounds and reagents from commercial sources is documented in the Chemical Receiving Logbook by sample receiving personnel or designate. Each solution or compound is assigned a unique standard receipt ID number, the letter "A" and a four digit sequential number. The date received, source, lot number, expiration date and

disposal date are recorded. The expiration dates are provided from the manufacturer and the disposal dates are completed by AMRO employees when standards are used up or disposed as indicated in the SOP "Sample Management GL-1006".

9.12.6.2 Standards Preparation:

Standards are prepared as written in the respective SOPs. In order to assure the accuracy of standards the following general guidelines are used:

9.12.6.2.1 ACS reagent grade chemicals are used when the method warrants.

9.12.6.2.2 A certificate of analysis accompanies any stock standards that are purchased from the manufacturer.

9.12.6.3 Standard Tracking:

It is important to be able to track all analytical standards back to their sources. The following procedure is used by AMRO personnel to accomplish this:

9.12.6.3.1 Metals Standards

Hg Standards Log (PS200II)-Preparation and Standard ID's are listed in the Standard Log.
Standards include:
S1 (Calibration Blank, ICB, CCB),
S2 (0.20 µg/L Calibration Standard and RL Standard),
S3 (2.0 µg/L Calibration Standard),
S4 (4.0 µg/L Calibration Standard),
S5 (8.0 µg/L Calibration Standard) and
S6 (10.0 Calibration Standard),
CCV 6.0 µg/L Standard,
ICV (2.4 µg/L Independent Source QC Standard),
Stock Solutions for Matrix/LCS spike additions (Matrix/LCS spike addition = 4.0 µg/L).

The Solution ID is written as the ID followed by the date prepared (example: S1042798 is standard S1 prepared on 042798).

9.12.6.3.2 Wet Chemistry and Metals Reagent Log - Working reagents are made from reagents listed in the Chemical Receiving Log and are documented in the Reagent Log. The corresponding analysis, preparation date, reagent name, AMRO ID, initial concentration, amount used, final volume, final concentration, Solution ID, expiration date, storage location, and analyst initials are recorded. The initial concentration is obtained from the certificate received from the manufacturer. The Solution ID is written as an "R" followed by a 4 digit sequential number. The expiration of prepared reagents varies. Reagents should be used in accordance with method specifications and manufacturer's instructions as indicated in the SOP "Sample Management GL-1006".

10.0 PROCEDURE

10.1 Determination of Instrument Detection Limit (IDL):

10.1.1 Pour a calibration blank solution into seven autosampler tubes, and analyze as individual samples.

10.1.2 Determine the standard deviation for seven replicates.

10.1.3 The IDL = 3 x (standard deviations).

10.1.4 Provide all required information on the current Instrument Detection Limit study worksheet provided by the QA Department.

10.2 Determination of Method Detection Limit (MDL):

10.2.1 Digest seven individual aliquots of an MDL Solution using an appropriate digestion procedure which is 3-5 times the IDL or 20% of the AMRO reporting limit.

10.2.2 Determine the standard deviation for the seven digestions.

10.2.3 The MDL = 3.143 x (Standard Deviation). If eight samples re digested, use 2.998.

10.2.4 Provide all required information on the current Method Detection Limit study on the worksheet provided by the QA department.

10.2.5 The MDL must be performed annually.

10.3 Precision and Accuracy:

10.3.1 Run four LCS's. Acceptance limits are 80-120%. Precision and accuracy is done annually by each analyst for each matrix and analysis type.

10.4 Linear Range:

10.4.1 The highest concentration of mercury that can be analyzed which is the true value of the highest calibration standard. This must be determined initially and verified annually.

10.5 Calibration Curve:

10.5.1 Take clean, labeled 50mL tubes and make the 7 standards listed below by adding the amount of mercury standard listed for each one. Bring the volume to 25 mL with 5% nitric acid. Add 1.5mL of H_2SO_4, 1mL of HNO_3, 4mL of potassium permanganate, and 2mL of potassium persulfate.

Standard	Amount to add
0 (ICB)	0
0.2µg/L	100µL Hg Calibration Working Std
2.00µg/L	1.0mL Hg Calibration Working Std
4.00µg/L	2.0mL Hg Calibration Working Std
6.00µg/L (CCV)	3.0mL Hg Calibration Working Std
8.00µg/L	4.0mL Hg Calibration Working Std
10.00µg/L	5.0mL Hg Calibration Working Std
2.4µg/L (ICV)	100µL Hg ICV Working Std

10.5.2 Place tubes in water bath at 95°C (±2 °C) for 2 hours.

10.5.3 After cooling, add 2 mL of hydroxylamine hydrochloride to each tube and mix well by shaking..

10.5.4 Pour into labeled plastic calibration tubes.

10.5.5 Document preparation in the Mercury Standard Tracking Log.

10.6 Sample Digestion:

10.6.1 The digestion volume has been reduced from 100mL to 25mL. As a result of this, reagent volumes are also reduced but the volume is rounded up to the nearest whole number due to limitations of the pipettes and various other measuring devices used in the laboratory.

10.6.2 Transfer a 25mL aliquot of sample into appropriately labeled tube.

10.6.3 Prepare the digestion blank (MB) and LCS by adding 25mL DI water to the appropriately labeled tubes. For TCLP extracts: the blank and LCS are prepared using the TCLP Extraction Blank extracted the same day as the TCLP sample extracts. TCLP extracts are prepared by pipetting 5mL of leachate into a tube and diluting to a final volume of 25mL with DI water.

10.6.4 Add 1.5mL H_2SO_4 and 1.0mL of HNO_3 to each sample.

10.6.5 Add 200µL Working Mercury LCS Solution (Sec 9.10.3) to the appropriate commercial MS and MSD samples.

10.6.6 Add 200µL Working Mercury LCS Solution (Sec 9.10.3) to the LCS sample.

10.6.7 Add 4mL Potassium Permanganate, shake and add additional portions if necessary until purple color persists for at least 15 minutes.

10.6.8 Add 2mL Potassium Persulfate to all samples.

10.6.9 Loosely cap samples.

10.6.10 Place samples in water bath at 95°C (± 2 °C) for 2 hours.

10.6.11 Remove samples from water bath and allow to cool.

10.6.12 Add 2mL hydroxylamine hydrochloride to all samples to reduce the excess permanganate. Mix well.

10.6.13 Pour samples into appropriately labeled glass centrifuge tubes.

10.7 Instrument Start-up:

10.7.1 Switch on the spectrometer with the switch at the left-hand side of the spectrometer's front panel.

10.7.2 Switch on the computer and monitor with power switches on the front of each one.

10.7.3 Windows 95 will come up.

10.7.4 Double click AAWinLab folder on desktop. Instrument software will come up.

10.7.5 One the initial screen click Menus and Toolbar.

10.7.6 Put pump tubing in place, place reductant line in the Stannous Chloride and carrier line in 3% HCl.

10.7.7 Click on Auto Icon to open AA window. Select the correct methods by double clicking on an entry field in the Method column in the Automated Analysis window. The Open Method dialog appears. Use this dialog to select the methods that are required.

10.7.8 Display FIAS Control window by choosing FIAS on the tool bar.

10.7.9 Press the FIAS on/off button. Instrument will go into an internal test mode.

10.8 Creating and Modifying Sample Information Files:

10.8.1 The system uses this file to label the data from samples both on the printed log of the results and in the results file. Information in this file is also used by the system to calculate final concentrations. A sample information file is especially useful for other data handling programs to manipulate the data.

10.8.2 To create a new sample information file, click on New Sample Info File in the File menu. The Sample Information Editor will appear.

10.8.3 Enter the sample information including all IDs in the cup where the sample will be placed. The amount of information that is entered depends on how the analysis results are to be reported, in weight/weight units or weight/volume units. The first eight positions are dedicated to Standards and Instrument QC as follows:

Position No.	Sample ID
1	Cal Blank
2	Std 0.20 µg/L
3	Std 2.0 µg/L
4	Std 4.0 µg/L
5	Std 8.0 µg/L
6	Std 10.0 µg/L
7	ICV 2.4 µg/L
8	CCV 6.0 µg/L (Also IPC when needed)

The next nine positions are reserved for future QA/QC samples. Start analytical samples at Auto Sampler Position 17.

10.8.4 Save the sample information file by clicking on Save As Sample Info File in the File menu. The Save As dialog will appear. Type a name for the file (Mmmddyy for example, M031099A) and click on OK.

10.8.5 To modify a stored sample information file click on Open Sample Info File in the File menu.

10.8.6 In the Open dialog select the sample information file to be opened and click OK.

10.8.7 In the Tools menu, click on Sample Information Editor and enter the new sample information.

10.8.8 Save the sample information file by clicking on Save As Sample Info File in the File menu. The Save As dialog will appear.

10.8.9 In this dialog, type a name for the file and click OK.

10.9 Setting Up the Automated Analysis Window

10.9.1 Set a delay time between methods to allow the lamps to warm up before the system makes measurements by typing a value in the Delay column. This is not needed for mercury analysis.

10.9.2 Select the samples to be analyzed by using a sample information file or by selecting individual sample tray locations. To use a sample information file click on Open next to the Sample Information File entry field. Then Open Dialog appears. This dialog is used to select the name of the sample information file. In the Automated Analysis window, in the table, select the box in the Defined in Sample Info. File column. To select individual sample tray locations clear the box in the Defined in Sample Info. File column in the table in the Automated Analysis window. Type the locations of the samples in the Use Autosampler Locations Listed Below column. Type individual locations or a range of locations. Use commas to separate the locations and the ranges. Example: 10-15, 18,20,25-30 for the analyte addition technique, type only the locations of the pure sample solutions. If the locations of blanks, QC, checks or calibration solutions are typed in, they will be analyzed as if they were normal samples.

10.9.3 Select the data saving and print options by clicking Open next to the Results Data Set entry field. The Choose Results Data Set dialog will appear. Use this dialog to select the results data set. If the data set exists, new data will be added to it. Select the Save Data box to save the results in the selected data set. To print the results during the analysis, select the Print Log box.

10.9.4 Select items to switch off after the analysis by selecting the Off After Analyses options that are required.

10.10 Starting a Calibration Curve Analysis

There are two different options for performing a calibration curve analysis.

10.10.1 In the Automated Analysis Window, click on Analyze All. The system analyzes the calibration solutions first, immediately followed by the samples and any other solutions, for example, the QC and check samples.

10.10.2 In the Automated Analysis Window, click on Calibrate. The system will analyze the calibration solutions. If necessary edit the calibration curve. When the calibration curve is acceptable, click on Analyze Samples in the Automated Analysis window.

10.10.3 Following calibration, the instrument will print out a "Calibration data for Hg." The Correlation Coefficient MUST be better than 0.995, and it's usually better than 0.999. The Calculated Concentrations should be in good agreement with the True Values for the standards. The %RSD is usually less than 1.0%, with the possible exception of the 0.20 ug/L standard.

10.11 Loading the Autosampler Tray

10.11.1 Flow Injection autosampler – Make sure that the correct sample tray (Tray B) has been selected in the Method Editor on Calib. – Autosampler page. In the Automated Analysis window, click on the Analyze tab. Click on Load Tray. Place the loaded sample tray in the autosampler, or load the samples and other solutions into the sample tray in the autosampler. Make sure that the solutions are in the locations specified in the Method Editor, in the sample information file and in the Automated Analysis – Setup window. Click on Load Tray again.

10.12 Rinsing the Fluid System

10.12.1 Place the inlets of the pump tubes for the carrier, reductant and any other reagents in a container of the rinsing solution. (3% HCL)

10.12.2 Place the inlet of the sampling tube in a container of the first rinsing solution (3% HCL) or if the autosampler is being used, place a container of the first rinsing solution in the wash location of the autosampler. In the Automated Analysis window, click on Select Location. In the Autosampler dialog, select Go to wash. Click on OK.

10.12.3 In the FIAS Control window set a speed in 100 for the pump. Click on Pump # for each pump to start the pumps.

10.12.4 In the FIAS Control window, switch the FIAS-valve between the Fill and Inject positions a few times to rinse the inside of the valve.

10.12.5 Rinse the system for as long as necessary to remove all traces of the solution used previously.

10.12.6 If more than one rinsing solution is used, place the inlets of the pump tubes for the carrier, reductant and any other reagents in a container of the next rinsing solution.

10.12.7 Place the inlet of the sampling tube in a container of the next rinsing solution or in the Automated Analysis window, click on Probe Up/Down, and then place a container of the next rinsing solution in the wash location of the autosampler.

10.12.8 Repeat rinsing and setup for each rinsing solution.

10.12.9 After rinsing with the final rinsing solution, remove the inlets for the pump tubes from the rinsing solution. If the autosampler is used, in the Automated Analysis window, click on Probe Up/Down to raise the probe. Allow the pumps to run until the fluid system is empty. In the FIAS Control window, click on Pump # for each pump to stop the pumps.

10.13 Analysis Start up

10.13.1 When analysis is started, the system first checks for errors in the method and in the sample information file. If the system finds a fault that must be corrected before analysis can start, a message will appear and the fault must be corrected before the system will start the analysis.

10.13.2 When the button is clicked to start an analysis procedure, a green indicator will appear on the button and the other buttons will become inactive. The system uses the analytical conditions in the active method for each replicate. When all the solutions have been analyzed, the green indicator button disappears and the other buttons will become active.

10.13.3 The progress of the analysis is shown in the Automated- or Manual Analysis window.

10.14 Shutting Down the Flow Injection System

10.14.1 Prepare the correct rinsing solutions.

10.14.2 Rinse the fluid system with the correct rinsing solutions.(3% HCL then DI water)

10.14.3 Remove the lines and allow to pump dry for a few minutes.

10.14.3 Switch the FIAS pumps off by clicking on On/Off for each pump in the FIAS Control window.

10.14.4 Switch off the spectrometer with the switch at the left-hand side of the spectrometer's front panel.

10.14.5 Turn off the carrier gas supply

10.14.6 Release the pressure on the pump tubes. Swing the pressure levers away from the pump tube magazines.

10.14.7 Empty the waste bottle. Dispose of waste solutions correctly, according to the safety regulations.

10.14.8 Switch off the computer and printer.

11.0 CALCULATIONS

11.1 Instrument concentrations are in µg/L. To report in mg/L aqueous sample results must be divided by 1000. Water sample results must be multiplied by any dilutions performed. Reported Concentration (µg/L) = Determined concentration (mg/L) / 1000 x dilution.

11.2 % Recovery (%R) for LCS = Determined concentration/true value x 100.

11.3 % Recovery (%R) for MS and MSD = Determined concentration - sample concentration/true value x 100.

11.4 %RPD MS/MSD or DUP= sample – dup./((sample + dup.)/2) x 100. Use concentrations of each in calculations.

12.0 QUALITY CONTROL

12.1 Method Blank:

12.1.1 One Method Blank must be digested with every 20 samples. The acceptable criteria: < RL and <½ RL for Department of Defense (DoD) projects.

12.1.2 The Method Blank results above the reporting limit indicate contamination. The source of contamination will be investigated and corrected. If a sample is greater than the reporting limit and less than ten times the Method Blank results, the sample will be re-digested and re-analyzed.

12.2 Matrix Spike and Matrix Spike Duplicate

12.2.1 One matrix spike is required for every 20 samples for as long as matrix spike duplicate.

12.2.2 Samples must be selected for spiking at random and rotated among clients and sites from batch to batch. In some cases, the client may specify which sample is to used for MS/MSD; if not , the laboratory shall pick a representative sample based on the following:

A. MS/MSD shall not be performed on Trip Blank, Rinsate Blank or Field Blank.
B. Adequate sample volume.
C. Client requested QC deliverables

12.2.3 The concentration of the analyte in the unspiked sample aliquot should be no more than four times the amount added. If the sample result is greater than four times the amount added, the LCS is the only valid assessment of accuracy for the batch and the spike recovery is not evaluated for control. If the control limits are not met for Relative Percent Difference, the control limits for Percent Recovery in the Matrix Spike are not applicable, since sample heterogeneity is indicated and an inaccurate sample result used to calculate percent recovery is suspected. The acceptable criteria: % R=75-125%.

12.3 Sample Duplicate:

12.3.1 One sample duplicate is required for every 20 samples.

12.3.2 Duplicate samples are two aliquots of a sample, which are carried through the same sample preparation and analysis procedure to verify the precision of the method for that sample matrix. The RPD (Relative Percent Difference) is calculated from the original and the duplicate sample. If one sample result is above the reporting limit and one is less than five times the reporting limit the data is acceptable. An RPD can also be calculated between a matrix spike and matrix spike duplicate. The RPD is calculated using the concentration of the matrix spike and matrix spike duplicate. If the control limits are not met for Relative Percent Difference, the control limits for Percent Recovery in the Matrix Spike are not applicable, since sample heterogeneity is indicated and an inaccurate sample result used to calculate percent recovery is suspected. The control limits are ≤20%.

12.4 Laboratory Control Sample

12.4.1 One LCS is required for every 20 samples.

12.4.2 The %R control limit for the LCS is 80-120%.

12.4.3 If the Control limits which are not met for percent recovery in the LCS indicates inaccuracy during the procedure and requires re-digestion and re-analysis.

12.5 The following chart contains the frequency and control limits for QC required during the analytical run.

QC Sample	Frequency	Hg Action Level	Hg Action	Analyst Response
ICV	Once, after calibration	±10% of True Value for SW-846 Method 7470A	Stop	Correct problem and recalibrate
IPC	Once, after Calibration	±5% of True Value for EPA Method 245.1, Not applicable for SW-846 Method 7470A	Stop	Correct problem and recalibrate
ICB*	Once, after ICV	±RL	Stop	Correct problem and recalibrate
RL	Start & Finish	±20% of True Value	Flag Data	Use caution regarding low level samples
CCV	10% of analytical samples	±20% of True Value for SW-846 Method 7470A	Flag Data	Correct problem and reanalyze affected samples
CCB*	Following each CCV	± RL	Flag Data	Correct problem and reanalyze affected samples

* ±½ RL for Department of Defense (DoD) projects

12.6 Corrective Action for Batch QC:

12.6.1 The initial investigation of the problem involves:

12.6.1.1 Checking sample concentrations for being high compared to the spike or too low for the RPD limits.

12.6.1.2 Checking calculations and raw data transcriptions (both QC and sample).

12.6.1.3 Checking sample concentrations and analytical sequence for influences such as carryover and mislabeling.

12.6.1.4 Reviewing the notes in the Mercury Digestion worksheet (Attachment 2 and analytical notebook for signs of problems or heterogeneity. A conclusion of heterogeneity is not made as an afterthought.

12.6.2 When the control limits are not met for any batch QC, the batch QC is rerun to verify that the out-of-control result is not a function of analytical variability.

13.0 DATA REVIEW AND STORAGE

13.1 All related preparation information and observations will be noted in the digestion logbook.

13.2 All cross-outs must be a single line and should be initialed and dated. Analyst review is documented on the GFAA and CVAA Data Review Checklist (Attachment 3.

13.3 All data from each run will be properly labeled and placed in the central file in an appropriate storage area. Each central file will include a run log, sample digestion sheet, and all original data.

14.0 REFERENCES

14.1 SW846 method 7470A. Office of Solid and Hazardous Waste, Update II, 9/94.

14.2 40 CFR Part 136 Appendix B, 1984.

14.3 Department of Defense Quality systems Manual for Environmental Laboratories, Final Version 3, January 2006.

14.4 FIMS, Installation Maintenance System Description, Publication B3118.10, Release 1.1/June 1994.

14.5 Flow Injection Mercury Analysis, Setting Up and Performing Analyses, Publication B3118.20, Release 1.1/March 1994.

14.6 Flow Injection Mercury/Hydride Analyses, Recommended Analytical Conditions and General Information, Publication B3505, Release 4.0.

Attachment 1

Storage: Hg Hood

Standard ID	Manufacturer	Lot No.	Expiration Date	Stock Conc.	Analyst
				1000 µg/L	
Hg Calib. Stock ID				10,000 µg/L	
Hg ICV Stock ID				1000 µg/L	
Hg Calib. Stock ID				10,000 µg/L	
Hg ICV Stock ID				1000 µg/L	
Hg Calib. Stock ID				10,000 µg/L	
Hg ICV Stock ID				1000 µg/L	
Hg Calib. Stock ID				10,000 µg/L	
Hg ICV Stock ID				1000 µg/L	
Hg Calib. Stock ID				10,000 µg/L	
Hg ICV Stock ID				1000 µg/L	
Hg Calib. Stock ID				10,000 µg/L	
Hg ICV Stock ID				1000 µg/L	
Hg Calib. Stock ID				10,000 µg/L	
Hg ICV Stock ID				1000 µg/L	
Hg Calib. Stock ID				10,000 µg/L	
Hg ICV Stock ID				1000 µg/L	
Hg Calib. Stock ID				10,000 µg/L	
Hg ICV Stock ID				1000 µg/L	
Hg Calib. Stock ID				10,000 µg/L	
Hg ICV Stock ID				1000 µg/L	
Hg Calib. Stock ID				10,000 µg/L	
Hg ICV Stock ID				1000 µg/L	
Hg Calib. Stock ID				10,000 µg/L	
Hg ICV Stock ID				1000 µg/L	
Hg Calib. Stock ID				10,000 µg/L	
Hg ICV Stock ID				1000 µg/L	

AMRO Environmental
Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

Mercury Standard Log
Working Standards and Solutions

Matrix: Water

Storage: Hg Hood

Prep. Date/ Exp. Date	Standard ID	Stock Conc.	Amount Used (ml)	Final Vol. (ml)	Final Conc.	Hg Working Std. ID	Hg ICV Std. ID	LCS Std. ID:	HNO3 Lot No.	Prepared By
	Hg Calib. Int. Working	5,000 µg/L (Hg Calib. Solution)	1.00	100	50 µg/L					
	Hg ICV Int. Working	20,000 µg/L (Hg ICV Solution)	1.00	100	600 µg/L					
	LCS									
	0.0 Std	NA	0.00	25	0 µg/L					
	0.2 Std.	50 µg/L	0.10	25	0.2 µg/L					
	2.0 Std.	50 µg/L	1.00	25	2.0µg/L					
	4.0 Std.	50 µg/L	2.00	25	4.0µg/L					
	6.0 Std. (CCV)	50 µg/L	3.00	25	6.0 µg/L					
	8.0 Std	50 µg/L	4.00	25	8.0 µg/L					
	10.0 Std	50 µg/L	5.00	25	10.0 µg/L					
	2.4 ICV	600 µg/L	0.1	25	2.4 µg/L					
	Hg Calibration Working	5,000 µg/L (Hg Calib. Solution)	1.00	100	50 µg/L					
	Hg ICV Working	20,000 µg/L (Hg ICV Solution)	3.00	100	600 µg/L					
	LCS									
	0.0 Std	NA	0.00	25	0 µg/L					
	0.2 Std	50µg/L	0.10	25	0.2 µg/L					
	2.0 Std	50µg/L	1.00	25	2.0µg/L					
	4.0 Std	50µg/L	2.00	25	4.0 µg/L					
	6.0 Std. (CCV)	50µg/L	3.00	25	6.0 µg/L					
	8.0 Std	50µg/L	4.00	25	8.0 µg/L					
	10.0 Std	50µg/L	5.00	25	10µg/L					
	2.4 ICV	600 µg/L	0.1	25	2.4 µg/L					

AMRO Environmental
Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

Attachment 2

Mercury Digestion Logbook

Methods: EPA 245.1(IL-3028); SW846- 7470A (IL-3002); SW846- 7471A (IL-3005)

Weighed Date: _____
Digestion Date: _____
Digested By: _____
Curve Prep. Date: _____
Wk. Hg Cal. Sol. ID: _____
Wk. Hg ICV. Sol. ID: _____
WK. Hg Spike/LCS ID: _____
Bath Temp. In: _____
Time In: _____
Bath Temp. out: _____
Time out: _____

H2SO4 Lot No.: _____
SnCl2 Lot No.: _____
KMnO4 Lot No.: _____
K2SO4 Lot No.: _____
HNO3 Lot No.: _____
HCl Lot No.: _____
Hydroxylamine
HCl Lot No.: _____
LIMS Batch ID No.: _____

Water Bath Temp.= 93°C - 97°C

Lab. Sample ID	Sample Wt./ Vol. (g) or (ml)	Final Volume (ml)	Spike Amount (ml)	Spike Conc.	Comments

qc/qcmemos/forms/Hgdigestionlog Rev. 5 09/05/02

Attachment 3

AMRO Environmental
Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

GFAA and CVAA DATA REVIEW CHECKLIST

LAB ORDER: _____ CLIENT: _____

Method:

Analysis:

A.	GENERAL			
1.	Copy of Digestion Log?	Y	N	NA
2.	Copy of Instrument Run Log?	Y	N	NA
3.	All samples met digestion and/or analysis holding time criteria?	Y	N	NA
4.	Initial Calibration meets method criteria for GFAA, min. 3 std plus a blank? R >0.995	Y	N	NA
5.	Initial Calibration meets method criteria for CVAA, min. 5 std plus a blank? R >0.995	Y	N	NA
6.	Initial Calibration Verification (ICV) meets method criteria: ±10%?	Y	N	NA
7.	Is the RL1 check QC at ±20%?	Y	N	NA
8.	Initial Calibration Blank (ICB) free of contamination?(<½RL)	Y	N	NA
9.	Initial Performance Calibration(IPC) meets criteria: ±5% ?	Y	N	NA
10.	Continuing Calibration Verification(CCV) meets method criteria: ±10% ?	Y	N	NA
11.	Continuing Calibration Blank(CCB) free of contamination?(<½RL)	Y	N	NA
12.	Are CCV and CCB analyzed after every 10 samples ?	Y	N	NA
13.	Was post digestion performed? If yes was %R=85-115?	Y	N	NA
14.	Was the serial dilution performed? If yes was %R= 90-110?	Y	N	NA
15.	Method Blank contaminant free(<½RL)?	Y	N	NA
16.	Are all reported results within calibration range?	Y	N	NA
17.	LCS % Recovery criteria met for all compounds?	Y	N	NA
18.	MS/MSD %R's and %RPD's are met for all compounds?	Y	N	NA
19.	%RPD criteria met between sample and duplicate?	Y	N	NA

COMMENTS

Analyst (s) _____ DATE: _____

REVIEWER _____ DATE OF REVIEW: _____

qc/qcmemos/Forms/GFAACVAAchecklist Rev. 1 07/05/01

Attachment 4

AMRO Environmental
Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

QUALIFICATION CARD FOR SW-846 METHOD 7470A

Trainee: _____ Signature: _____

Trainer: _____ Signature: _____

I. Knowledge Factors:

SOP Title: _____ Revision Number/Date: _____

1. Did the Trainee read and understand the above SOP? Yes☐ No☐ NA☐
2. Was the Trainee instructed on how to properly fill out the documentation? Yes☐ No☐ NA☐
3. Has the Trainee been instructed on the proper procedures for addressing potential problems? Yes☐ No☐ NA☐

II. Practical Factors:

1. Has the Trainee completed a Precision and Accuracy Study? Yes☐ No☐ NA☐
2. Has the Trainee completed the maintenance schedule followed by a successful calibration? Yes☐ No☐ NA☐
3. Has the Trainee demonstrated the ability to review and document Instrument QC and Batch QC problems? Yes☐ No☐ NA☐

Completion Date: _____ Trainer's Signature: _____

I_____have read, understood and follow the above method/SOP, which is in use at AMRO Laboratories for the analysis of samples under the National Environmental Laboratory Accreditation Program, have met the Demonstration of Capability.

Section Manager/ Supervisor: _____ Date: _____

QA Manager: _____ Date: _____

qc/qcmemos/forms/7470Aqualcard Rev. 0 07/16/01

AnalyteType	Analyte	MDL ug/Kg	PQL ug/Kg
A	1,1,1,2-Tetrachloroethane	12.5	25
A	1,1,1-Trichloroethane	12.5	25
A	1,1,2,2-Tetrachloroethane	12.5	25
A	1,1,2-Trichloroethane	12.5	25
A	1,1-Dichloroethane	12.5	25
A	1,1-Dichloroethene	12.5	25
A	1,1-Dichloropropene	12.5	25
A	1,2,3-Trichlorobenzene	12.5	25
A	1,2,3-Trichloropropane	12.5	25
A	1,2,4-Trichlorobenzene	12.5	25
A	1,2,4-Trimethylbenzene	12.5	25
A	1,2-Dibromo-3-chloropropane	50	125
A	1,2-Dibromoethane	12.5	25
A	1,2-Dichlorobenzene	12.5	25
A	1,2-Dichloroethane	12.5	25
A	1,2-Dichloropropane	12.5	25
A	1,3,5-Trichlorobenzene	12.5	50
A	1,3,5-Trimethylbenzene	12.5	25
A	1,3-Dichlorobenzene	12.5	25
A	1,3-Dichloropropane	12.5	25
A	1,4-Dichlorobenzene	12.5	25
A	1,4-Dioxane	625	1250
A	2,2-Dichloropropane	12.5	25
A	2-Butanone	125	250
A	2-Chloroethyl vinyl ether	50	250
A	2-Chlorotoluene	12.5	25
A	2-Hexanone	125	250
A	4-Chlorotoluene	12.5	25
A	4-Isopropyltoluene	12.5	25
A	4-Methyl-2-pentanone	125	250
A	Acetone	125	250
A	Acrylonitrile	12.5	25
A	Benzene	12.5	25
A	Bromobenzene	12.5	25
A	Bromochloromethane	12.5	25
A	Bromodichloromethane	12.5	25
A	Bromoform	25	50
A	Bromomethane	25	50
A	Carbon disulfide	25	50
A	Carbon tetrachloride	12.5	25
A	Chlorobenzene	12.5	25
A	Chloroethane	25	50
A	Chloroform	12.5	25
A	Chloromethane	25	50
A	cis-1,2-Dichloroethene	12.5	25
A	cis-1,3-Dichloropropene	12.5	25
A	Cyclohexanone	12.5	25
A	Dibromochloromethane	12.5	25
A	Dibromomethane	12.5	25
A	Dichlorodifluoromethane	12.5	50
A	Dichlorofluoromethane	12.5	25
A	Diethyl ether	125	250

A	Diisopropyl ether	25	50
A	Ethyl Tertiary Butyl Ether	12.5	50
A	Ethylbenzene	12.5	25
A	Freon-113	12.5	25
A	Hexachlorobutadiene	25	50
A	Iodomethane	12.5	25
A	Isopropylbenzene	12.5	25
A	m,p-Xylene	12.5	25
A	Methyl methacrylate	12.5	25
A	Methyl tert-butyl ether	12.5	25
A	Methylene chloride	25	50
A	n-Butylbenzene	12.5	25
A	n-Propylbenzene	12.5	25
A	Naphthalene	25	50
A	o-Xylene	12.5	25
A	sec-Butylbenzene	12.5	25
A	Styrene	12.5	25
A	tert-Butylbenzene	12.5	25
A	Tertiary Amyl Methyl Ether	12.5	50
A	Tertiary Butanol	250	500
A	Tetrachloroethene	12.5	25
A	Tetrahydrofuran	125	250
A	Toluene	12.5	25
A	trans-1,2-Dichloroethene	12.5	25
A	trans-1,3-Dichloropropene	12.5	25
A	trans-1,4-Dichloro-2-butene	12.5	25
A	Trichloroethene	12.5	25
A	Trichlorofluoromethane	25	50
A	Vinyl acetate	50	250
A	Vinyl chloride	12.5	25
I	1,4-Dichlorobenzene-d4	0	0
I	Chlorobenzene-d5	0	0
I	Fluorobenzene	0	0
S	1,2-Dichloroethane-d4	0	25
S	4-Bromofluorobenzene	0	25
S	Dibromofluoromethane	0	25
S	Toluene-d8	0	25

AnalyteType	Analyte	MDL ug/L	PQL ug/L
A	1,1,1,2-Tetrachloroethane	0.5	2
A	1,1,1-Trichloroethane	0.5	2
A	1,1,2,2-Tetrachloroethane	0.5	2
A	1,1,2-Trichloroethane	0.5	2
A	1,1-Dichloroethane	0.5	2
A	1,1-Dichloroethene	0.5	1
A	1,1-Dichloropropene	0.5	2
A	1,2,3-Trichlorobenzene	0.5	2
A	1,2,3-Trichloropropane	0.5	2
A	1,2,4-Trichlorobenzene	0.5	2
A	1,2,4-Trimethylbenzene	0.5	2
A	1,2-Dibromo-3-chloropropane	1.25	5
A	1,2-Dibromoethane	0.5	2
A	1,2-Dichlorobenzene	0.5	2
A	1,2-Dichloroethane	0.5	2
A	1,2-Dichloropropane	0.5	2
A	1,3,5-Trichlorobenzene	0.5	2
A	1,3,5-Trimethylbenzene	0.5	2
A	1,3-Dichlorobenzene	0.5	2
A	1,3-Dichloropropane	0.5	2
A	1,4-Dichlorobenzene	0.5	2
A	1,4-Dioxane	25	50
A	2,2-Dichloropropane	0.5	2
A	2-Butanone	2.5	10
A	2-Chloroethyl vinyl ether	2	10
A	2-Chlorotoluene	0.5	2
A	2-Hexanone	2.5	10
A	4-Chlorotoluene	0.5	2
A	4-Isopropyltoluene	0.5	2
A	4-Methyl-2-pentanone	2.5	10
A	Acetone	2.5	10
A	Acrylonitrile	0.5	2
A	Benzene	0.5	1
A	Bromobenzene	0.5	2
A	Bromochloromethane	0.5	2
A	Bromodichloromethane	0.5	2
A	Bromoform	0.5	2
A	Bromomethane	0.5	2
A	Carbon disulfide	0.5	2
A	Carbon tetrachloride	0.5	2
A	Chlorobenzene	0.5	2
A	Chloroethane	1.25	5
A	Chloroform	0.5	2
A	Chloromethane	1.25	3
A	cis-1,2-Dichloroethene	0.5	2
A	cis-1,3-Dichloropropene	0.5	1
A	Cyclohexanone	0.5	2
A	Dibromochloromethane	0.5	2
A	Dibromomethane	0.5	2
A	Dichlorodifluoromethane	1.25	5
A	Dichlorofluoromethane	0.5	2
A	Diethyl ether	1.25	5

A	Diisopropyl ether	1	2
A	Ethyl Tertiary Butyl Ether	1	2
A	Ethylbenzene	0.5	2
A	Freon-113	0.5	2
A	Hexachlorobutadiene	0.5	2
A	Iodomethane	0.5	2
A	Isopropylbenzene	0.5	2
A	m,p-Xylene	0.5	2
A	Methyl methacrylate	0.5	2
A	Methyl tert-butyl ether	0.5	2
A	Methylene chloride	0.5	5
A	n-Butylbenzene	0.5	2
A	n-Propylbenzene	0.5	2
A	Naphthalene	1	5
A	o-Xylene	0.5	2
A	sec-Butylbenzene	0.5	2
A	Styrene	0.5	2
A	tert-Butylbenzene	0.5	2
A	Tertiary Amyl Methyl Ether	0.5	2
A	Tertiary Butanol	10	20
A	Tetrachloroethene	0.5	2
A	Tetrahydrofuran	2.5	10
A	Toluene	0.5	2
A	trans-1,2-Dichloroethene	0.5	2
A	trans-1,3-Dichloropropene	0.5	1
A	trans-1,4-Dichloro-2-butene	0.5	1
A	Trichloroethene	0.5	2
A	Trichlorofluoromethane	0.5	2
A	Vinyl acetate	0.5	2
A	Vinyl chloride	0.5	2
I	1,4-Dichlorobenzene-d4	0	0
I	Chlorobenzene-d5	0	0
I	Fluorobenzene	0	0
S	1,2-Dichloroethane-d4	0.5	2
S	4-Bromofluorobenzene	0.5	2
S	Dibromofluoromethane	0.5	2
S	Toluene-d8	0.5	2

AnalyteType	Analyte	MDL ug/Kg	PQL ug/Kg
A	1,2,4,5-Tetrachlorobenzene	50	250
A	1,2,4-Trichlorobenzene	50	250
A	1,2-Dichlorobenzene	50	250
A	1,2-Diphenylhydrazine (as Azobenzene)	50	250
A	1,3-Dichlorobenzene	50	250
A	1,4-Dichlorobenzene	50	250
A	1,4-Dioxane	0	0
A	2,4,5-Trichlorophenol	50	250
A	2,4,6-Trichlorophenol	50	250
A	2,4-Dichlorophenol	50	250
A	2,4-Dimethylphenol	50	250
A	2,4-Dinitrophenol	100	500
A	2,4-Dinitrotoluene	50	250
A	2,6-Dinitrotoluene	50	250
A	2-Chloronaphthalene	50	250
A	2-Chlorophenol	50	250
A	2-Methylnaphthalene	50	250
A	2-Methylphenol	50	250
A	2-Nitroaniline	100	500
A	2-Nitrophenol	50	250
A	3,3´-Dichlorobenzidine	50	250
A	3-Nitroaniline	100	500
A	4,6-Dinitro-2-methylphenol	100	500
A	4-Bromophenyl phenyl ether	50	250
A	4-Chloro-3-methylphenol	100	330
A	4-Chloroaniline	50	250
A	4-Chlorophenyl phenyl ether	50	250
A	4-Methylphenol	50	250
A	4-Nitroaniline	100	500
A	4-Nitrophenol	100	500
A	Acenaphthene	50	250
A	Acenaphthylene	50	250
A	Acetophenone	50	250
A	Aniline	50	250
A	Anthracene	50	250
A	Benz(a)anthracene	50	250
A	Benzidine	100	250
A	Benzo(a)pyrene	50	250
A	Benzo(b)fluoranthene	50	250
A	Benzo(g,h,i)perylene	50	250
A	Benzo(k)fluoranthene	50	250
A	Benzoic acid	100	500
A	Benzyl alcohol	100	500
A	Bis(2-chloroethoxy)methane	50	250
A	Bis(2-chloroethyl)ether	50	250
A	Bis(2-chloroisopropyl)ether	50	250
A	Bis(2-ethylhexyl)phthalate	50	250
A	Butyl benzyl phthalate	50	250
A	Carbazole	50	250
A	Chrysene	50	250
A	Di-n-butyl phthalate	50	250
A	Di-n-octyl phthalate	50	250

A	Dibenz(a,h)anthracene	50	250
A	Dibenzofuran	50	250
A	Diethyl phthalate	50	250
A	Dimethyl phthalate	50	250
A	Fluoranthene	50	250
A	Fluorene	50	250
A	Hexachlorobenzene	50	250
A	Hexachlorobutadiene	50	250
A	Hexachlorocyclopentadiene	50	250
A	Hexachloroethane	50	250
A	Indeno(1,2,3-cd)pyrene	50	250
A	Isophorone	50	250
A	N-Nitrosodi-n-propylamine	50	250
A	N-Nitrosodimethylamine	100	500
A	N-Nitrosodiphenylamine	50	250
A	Naphthalene	50	250
A	Nitrobenzene	50	250
A	Pentachloronitrobenzene	100	500
A	Pentachlorophenol	100	500
A	Phenanthrene	50	250
A	Phenol	50	250
A	Pyrene	50	250
A	Pyridine	100	500
I	1,4-Dichlorobenzene-d4	0	0
I	Acenaphthene-d10	0	0
I	Chrysene-d12	0	0
I	Naphthalene-d8	0	0
I	Perylene-d12	0	0
I	Phenanthrene-d10	0	0
S	1,2-Dichlorobenzene-d4	0	0
S	1-Methylnaphthalene-d10	0	0
S	2,4,6-Tribromophenol	50	50
S	2-Chlorophenol-d4	0	0
S	2-Fluorobiphenyl	50	50
S	2-Fluorophenol	50	50
S	4-Terphenyl-d14	50	50
S	Nitrobenzene-d5	50	50
S	Phenol-d5	50	50
S	Phenol-d6	0	0

AnalyteType	Analyte	MDL ug/L	PQL ug/L
A	1,2,4,5-Tetrachlorobenzene	1	5
A	1,2,4-Trichlorobenzene	1	5
A	1,2-Dichlorobenzene	1	5
A	1,2-Diphenylhydrazine (as Azobenzene)	1	10
A	1,3-Dichlorobenzene	1	5
A	1,4-Dichlorobenzene	1	5
A	2,4,5-Trichlorophenol	1	10
A	2,4,6-Trichlorophenol	1	10
A	2,4-Dichlorophenol	1	10
A	2,4-Dimethylphenol	1	10
A	2,4-Dinitrophenol	2	20
A	2,4-Dinitrotoluene	1	10
A	2,6-Dinitrotoluene	1	10
A	2-Chloronaphthalene	1	10
A	2-Chlorophenol	1	5
A	2-Methylnaphthalene	1	10
A	2-Methylphenol	1	10
A	2-Nitroaniline	2	20
A	2-Nitrophenol	1	10
A	3,3′-Dichlorobenzidine	1	10
A	3,3′-Dimethylbenzidine	1	5
A	3-Nitroaniline	2	20
A	4,6-Dinitro-2-methylphenol	2	20
A	4-Bromophenyl phenyl ether	1	10
A	4-Chloro-3-methylphenol	2	20
A	4-Chloroaniline	1	5
A	4-Chlorophenyl phenyl ether	1	10
A	4-Methylphenol	1	10
A	4-Nitroaniline	2	20
A	4-Nitrophenol	2	20
A	Acenaphthene	1	10
A	Acenaphthylene	1	10
A	Acetophenone	1	10
A	Aniline	2	5
A	Anthracene	1	10
A	Benz(a)anthracene	1	10
A	Benzidine	2	5
A	Benzo(a)pyrene	1	10
A	Benzo(b)fluoranthene	1	10
A	Benzo(g,h,i)perylene	1	10
A	Benzo(k)fluoranthene	1	10
A	Benzoic acid	2	20
A	Benzyl alcohol	2	20
A	Bis(2-chloroethoxy)methane	1	10
A	Bis(2-chloroethyl)ether	1	10
A	Bis(2-chloroisopropyl)ether	1	10
A	Bis(2-ethylhexyl)phthalate	1	5
A	Butyl benzyl phthalate	1	10
A	Carbazole	1	10
A	Chrysene	1	10
A	Di-n-butyl phthalate	1	10
A	Di-n-octyl phthalate	1	10

A	Dibenz(a,h)anthracene	1	10
A	Dibenzofuran	1	10
A	Diethyl phthalate	1	10
A	Dimethyl phthalate	1	10
A	Fluoranthene	1	10
A	Fluorene	1	10
A	Hexachlorobenzene	1	10
A	Hexachlorobutadiene	1	10
A	Hexachlorocyclopentadiene	2	10
A	Hexachloroethane	1	10
A	Indeno(1,2,3-cd)pyrene	1	10
A	Isophorone	1	10
A	N-Nitrosodi-n-propylamine	1	10
A	N-Nitrosodimethylamine	1	20
A	N-Nitrosodiphenylamine	1	5
A	Naphthalene	1	5
A	Nitrobenzene	1	5
A	Pentachloronitrobenzene	1	5
A	Pentachlorophenol	2	20
A	Phenanthrene	1	10
A	Phenol	1	10
A	Pyrene	1	10
A	Pyridine	2	20
I	1,4-Dichlorobenzene-d4	0	0
I	Acenaphthene-d10	0	0
I	Chrysene-d12	0	0
I	Naphthalene-d8	0	0
I	Perylene-d12	0	0
I	Phenanthrene-d10	0	0
S	2,4,6-Tribromophenol	1	1
S	2-Fluorobiphenyl	1	1
S	2-Fluorophenol	1	1
S	4-Terphenyl-d14	1	1
S	Nitrobenzene-d5	1	1
S	Phenol-d5	1	1

AnalyteType	Analyte	MDL mg/Kg	PQL mg/Kg
A	Aluminum	1.16	20
A	Antimony	0.78	4
A	Arsenic	0.96	5
A	Barium	0.05	20
A	Beryllium	0.004	0.25
A	Boron	1	25
A	Cadmium	0.01	0.5
A	Calcium	11.7	250
A	Chromium	0.05	1
A	Cobalt	0.21	5
A	Copper	0.28	2.5
A	Iron	1.7	10
A	Lead	0.61	5
A	Lithium	0	10
A	Magnesium	3.6	250
A	Manganese	0.146	1.5
A	Molybdenum	0.22	2.5
A	Nickel	0.24	4
A	Potassium	8.29	250
A	Selenium	1.11	12
A	Silver	0.057	1.4
A	Sodium	5.351	250
A	Strontium	0.025	1
A	Thallium	0.73	5
A	Tin	0.71	25
A	Titanium	0.3	10
A	Vanadium	0.276	5
A	Zinc	1.72	6

AnalyteType	Analyte	MDL ug/L	PQL ug/L
A	Aluminum	19	200
A	Antimony	5.24	20
A	Arsenic	3.11	50
A	Barium	1.51	200
A	Beryllium	0.106	4
A	Boron	29	250
A	Cadmium	0.1	4
A	Calcium	261.4	2500
A	Chromium	0.49	10
A	Cobalt	2.05	50
A	Copper	2.72	25
A	Iron	6.3	100
A	Lead	1.03	12.5
A	Lithium	20	100
A	Magnesium	14.73	2500
A	Manganese	0.593	15
A	Molybdenum	0.92	25
A	Nickel	1.56	40
A	Potassium	49.6	2500
A	Selenium	17.3	80
A	Silver	0.32	7
A	Sodium	29.9	2500
A	Strontium	0.421	10
A	Thallium	5.18	50
A	Tin	3.5	250
A	Titanium	0.53	100
A	Vanadium	0.605	50
A	Zinc	2.57	20

AMRO Environmental Laboratories Corp.

Date: 23-May-13

Test Code: FING_S
Test Number: SW8015B
Test Name: TPH by GC/FID (modified 8015B)
Matrix: Soil **Units:** mg/Kg

METHOD DETECTION / REPORTING LIMITS

Updated:

Type	Analyte	MDL	PQL
A	Diesel Fuel/Fuel Oil #2	50	50
A	Gasoline	50	50
A	Kerosene	50	50
A	Mineral Spirits	50	50
A	Motor Oil/Hydraulic Oil	100	100
A	Unidentified Hydrocarbons	100	100
S	o-Terphenyl	0	0

AMRO Environmental Laboratories Corp.

Date: 23-May-13

Test Code: FING_W
Test Number: SW8015B
Test Name: TPH by GC/FID (modified 8015B)
Matrix: Aqueous **Units:** mg/L

METHOD DETECTION / REPORTING LIMITS

Updated:

Type	Analyte	MDL	PQL
A	Diesel Fuel/Fuel Oil #2	0.05	0.05
A	Gasoline	0.05	0.05
A	Kerosene	0.05	0.05
A	Mineral Spirits	0.05	0.05
A	Motor Oil/Hydraulic Oil	0.1	0.1
A	Unidentified Hydrocarbons	0.1	0.1
S	o-Terphenyl	0	0

AMRO Environmental Laboratories Corp.

Date: 23-May-13

Test Code: 8082_SSOX
Test Number: SW8082
Test Name: EPA 8082 PCBS IN SOIL/SOLIDS
Matrix: Soil **Units:** µg/Kg

METHOD DETECTION / REPORTING LIMITS

Updated:

Type	Analyte	MDL	PQL
A	Aroclor 1016	25	50
A	Aroclor 1221	25	50
A	Aroclor 1232	25	50
A	Aroclor 1242	25	50
A	Aroclor 1248	25	50
A	Aroclor 1254	25	50
A	Aroclor 1260	25	50
A	Aroclor 1262	25	50
A	Aroclor 1268	25	50
S	Decachlorobiphenyl	0	0
S	Tetrachloro-m-xylene	0	0

AMRO Environmental Laboratories Corp.

Date: 23-May-13

Test Code: 8082_WX
Test Number: SW8082
Test Name: EPA 8082 PCBS IN WATER
Matrix: Aqueous **Units:** µg/L

METHOD DETECTION / REPORTING LIMITS

Updated:

Type	Analyte	MDL	PQL
A	Aroclor 1016	0.1	0.2
A	Aroclor 1221	0.1	0.2
A	Aroclor 1232	0.1	0.2
A	Aroclor 1242	0.1	0.2
A	Aroclor 1248	0.1	0.2
A	Aroclor 1254	0.1	0.2
A	Aroclor 1260	0.1	0.2
A	Aroclor 1262	0.1	0.2
A	Aroclor 1268	0.1	0.2
S	Decachlorobiphenyl	0	0
S	Tetrachloro-m-xylene	0	0

AMRO Environmental Laboratories Corp.

Date: 23-May-13

Test Code: Hg_7471
Test Number: SW7471A
Test Name: EPA 7471 MERCURY, Soil
Matrix: Soil **Units:** mg/Kg

METHOD DETECTION / REPORTING LIMITS

Updated:

Type	Analyte	MDL	PQL
A	Mercury	0.00192	0.05

AMRO Environmental Laboratories Corp.

Date: 23-May-13

Test Code: HG_7470
Test Number: SW7470A
Test Name: EPA 7470 MERCURY, Total
Matrix: Aqueous **Units:** µg/L

METHOD DETECTION / REPORTING LIMITS

Updated:

Type	Analyte	MDL	PQL
A	Mercury	0.0233	0.2

AMRO Environmental Laboratories Corp.

Date: 04-Jun-13

Test Code: Sb_7041
Test Number: SW7041
Test Name: EPA 7041 ANTIMONY, Total
Matrix: Aqueous **Units:** µg/L

METHOD DETECTION / REPORTING LIMITS

Updated:

Type	Analyte	MDL	PQL
A	Antimony	0.37	5

AMRO Environmental Laboratories Corp.

Date: 04-Jun-13

Test Code: AS_7060
Test Number: SW7060A
Test Name: EPA 7060 ARSENIC, Total
Matrix: Aqueous **Units:** µg/L

METHOD DETECTION / REPORTING LIMITS

Updated:

Type	Analyte	MDL	PQL
A	Arsenic	0.236	4

AMRO Environmental Laboratories Corp.

Date: 04-Jun-13

Test Code: Se_7740
Test Number: SW7740
Test Name: EPA 7740 SELENIUM, Total
Matrix: Aqueous **Units:** µg/L

METHOD DETECTION / REPORTING LIMITS

Updated:

Type	Analyte	MDL	PQL
A	Selenium	0.609	5

AMRO Environmental Laboratories Corp.

Date: 04-Jun-13

Test Code: Tl_7841
Test Number: SW7841
Test Name: EPA 7841 THALLIUM, Total
Matrix: Aqueous **Units:** µg/L

METHOD DETECTION / REPORTING LIMITS

Updated:

Type	Analyte	MDL	PQL
A	Thallium	0.509	2

AMRO Environmental Laboratories Corp.

Date: 21-Jun-13

Test Code: Sb_7041
Test Number: SW7041
Test Name: EPA 7041 ANTIMONY, Total
Matrix: Aqueous
Sample Type: LCSD

Control Limits

Type	Analyte	Lower Control Limit	Upper Control Limit	RPD Limit
A	Antimony	80	120	20

A = Target Analyte S = Surrogate

AMRO Environmental Laboratories Corp.

Date: 21-Jun-13

Test Code: AS_7060
Test Number: SW7060A
Test Name: EPA 7060 ARSENIC, Total
Matrix: Aqueous
Sample Type: LCSD

Control Limits

Type	Analyte	Lower Control Limit	Upper Control Limit	RPD Limit
A	Arsenic	80	120	20

A = Target Analyte S = Surrogate

AMRO Environmental Laboratories Corp.

Date: 21-Jun-13

Test Code: Se_7740
Test Number: SW7740
Test Name: EPA 7740 SELENIUM, Total
Matrix: Aqueous
Sample Type: LCSD

Control Limits

Type	Analyte	Lower Control Limit	Upper Control Limit	RPD Limit
A	Selenium	80	120	20

A = Target Analyte S = Surrogate

AMRO Environmental Laboratories Corp.

Date: 21-Jun-13

Test Code: Tl_7841
Test Number: SW7841
Test Name: EPA 7841 THALLIUM, Total
Matrix: Aqueous
Sample Type: LCSD

Control Limits

Type	Analyte	Lower Control Limit	Upper Control Limit	RPD Limit
A	Thallium	80	120	20

A = Target Analyte S = Surrogate

AMRO Environmental Laboratories Corp.

Date: 23-May-13

Test Code: 8260_MS
Test Number: SW8260B
Test Name: EPA 8260B VOLATILES by GC/MS, Medi
Matrix: Soil
Sample Type: LCSF

Control Limits

Type	Analyte	Lower Control Limit	Upper Control Limit	RPD Limit
A	1,1,1,2-Tetrachloroethane	63	113	20
A	1,1,1-Trichloroethane	59	131	20
A	1,1,2,2-Tetrachloroethane	64	133	20
A	1,1,2-Trichloroethane	72	121	20
A	1,1-Dichloroethane	70	122	20
A	1,1-Dichloroethene	51	134	20
A	1,1-Dichloropropene	71	130	20
A	1,2,3-Trichlorobenzene	74	139	20
A	1,2,3-Trichloropropane	64	134	20
A	1,2,4-Trichlorobenzene	80	132	20
A	1,2,4-Trimethylbenzene	75	127	20
A	1,2-Dibromo-3-chloropropane	41	129	20
A	1,2-Dibromoethane	73	122	20
A	1,2-Dichlorobenzene	75	128	20
A	1,2-Dichloroethane	65	126	20
A	1,2-Dichloropropane	81	125	20
A	1,3,5-Trimethylbenzene	76	127	20
A	1,3-Dichlorobenzene	74	129	20
A	1,3-Dichloropropane	78	130	20
A	1,4-Dichlorobenzene	77	129	20
A	2,2-Dichloropropane	59	145	20
A	2-Butanone	41	145	20
A	2-Chlorotoluene	72	127	20
A	2-Hexanone	39	131	20
A	4-Chlorotoluene	72	124	20
A	4-Isopropyltoluene	79	134	20
A	4-Methyl-2-pentanone	63	127	20
A	Acetone	25	130	20
A	Benzene	72	128	20
A	Bromobenzene	73	126	20
A	Bromochloromethane	71	123	20
A	Bromodichloromethane	51	110	20

A = Target Analyte S = Surrogate

AMRO Environmental Laboratories Corp.

Date: 23-May-13

Test Code: 8260_MS
Test Number: SW8260B
Test Name: EPA 8260B VOLATILES by GC/MS, Medi
Matrix: Soil
Sample Type: LCSF

Control Limits

Type	Analyte	Lower Control Limit	Upper Control Limit	RPD Limit
A	Bromoform	41	120	20
A	Bromomethane	53	151	20
A	Carbon disulfide	3.4	164	20
A	Carbon tetrachloride	45	127	20
A	Chlorobenzene	77	123	20
A	Chloroethane	41	132	20
A	Chloroform	70	122	20
A	Chloromethane	31	155	20
A	cis-1,2-Dichloroethene	72	123	20
A	cis-1,3-Dichloropropene	60	120	20
A	Dibromochloromethane	47	102	20
A	Dibromomethane	72	123	20
A	Dichlorodifluoromethane	6.3	179	20
A	Diethyl ether	46	123	20
A	Ethylbenzene	75	123	20
A	Hexachlorobutadiene	52	132	20
A	Isopropylbenzene	74	132	20
A	m,p-Xylene	78	124	20
A	Methyl tert-butyl ether	64	117	20
A	Methylene chloride	40	146	20
A	n-Butylbenzene	78	136	20
A	n-Propylbenzene	73	133	20
A	Naphthalene	71	135	20
A	o-Xylene	77	124	20
A	sec-Butylbenzene	76	137	20
A	Styrene	81	128	20
A	tert-Butylbenzene	75	133	20
A	Tetrachloroethene	77	132	20
A	Tetrahydrofuran	60	143	20
A	Toluene	70	127	20
A	trans-1,2-Dichloroethene	63	123	20
A	trans-1,3-Dichloropropene	56	113	20

A = Target Analyte S = Surrogate

AMRO Environmental Laboratories Corp.

Date: 23-May-13

Test Code: 8260_MS
Test Number: SW8260B
Test Name: EPA 8260B VOLATILES by GC/MS, Medi
Matrix: Soil
Sample Type: LCSF

Control Limits

Type	Analyte	Lower Control Limit	Upper Control Limit	RPD Limit
A	Trichloroethene	72	126	20
A	Trichlorofluoromethane	27	156	20
A	Vinyl chloride	51	160	20
S	1,2-Dichloroethane-d4	47	140	0
S	4-Bromofluorobenzene	44	135	0
S	Dibromofluoromethane	51	137	0
S	Toluene-d8	55	140	0

A = Target Analyte S = Surrogate

AMRO Environmental Laboratories Corp.

Date: 23-May-13

Test Code: 8260_W
Test Number: SW8260B
Test Name: EPA 8260B VOLATILES by GC/MS
Matrix: Aqueous
Sample Type: LCSF

Control Limits

Type	Analyte	Lower Control Limit	Upper Control Limit	RPD Limit
A	1,1,1,2-Tetrachloroethane	65	133	20
A	1,1,1-Trichloroethane	68	145	20
A	1,1,2,2-Tetrachloroethane	65	132	20
A	1,1,2-Trichloroethane	79	122	20
A	1,1-Dichloroethane	81	131	20
A	1,1-Dichloroethene	77	139	20
A	1,1-Dichloropropene	71	141	20
A	1,2,3-Trichlorobenzene	63	135	20
A	1,2,3-Trichloropropane	64	139	20
A	1,2,4-Trichlorobenzene	73	137	20
A	1,2,4-Trimethylbenzene	79	125	20
A	1,2-Dibromo-3-chloropropane	44	122	20
A	1,2-Dibromoethane	71	124	20
A	1,2-Dichlorobenzene	82	123	20
A	1,2-Dichloroethane	61	140	20
A	1,2-Dichloropropane	81	134	20
A	1,3,5-Trimethylbenzene	76	125	20
A	1,3-Dichlorobenzene	86	125	20
A	1,3-Dichloropropane	81	129	20
A	1,4-Dichlorobenzene	82	126	20
A	2,2-Dichloropropane	47	155	20
A	2-Butanone	47	141	20
A	2-Chlorotoluene	78	121	20
A	2-Hexanone	41	138	20
A	4-Chlorotoluene	82	122	20
A	4-Isopropyltoluene	66	132	20
A	4-Methyl-2-pentanone	54	124	20
A	Acetone	44	133	20
A	Benzene	75	129	20
A	Bromobenzene	82	119	20
A	Bromochloromethane	77	138	20
A	Bromodichloromethane	63	118	20

A = Target Analyte S = Surrogate

AMRO Environmental Laboratories Corp.

Date: 23-May-13

Test Code: 8260_W
Test Number: SW8260B
Test Name: EPA 8260B VOLATILES by GC/MS
Matrix: Aqueous
Sample Type: LCSF

Control Limits

Type	Analyte	Lower Control Limit	Upper Control Limit	RPD Limit
A	Bromoform	44	115	20
A	Bromomethane	53	128	20
A	Carbon disulfide	55	129	20
A	Carbon tetrachloride	58	130	20
A	Chlorobenzene	86	121	20
A	Chloroethane	65	138	20
A	Chloroform	69	132	20
A	Chloromethane	51	149	20
A	cis-1,2-Dichloroethene	78	128	20
A	cis-1,3-Dichloropropene	65	115	20
A	Dibromochloromethane	59	119	20
A	Dibromomethane	76	123	20
A	Dichlorodifluoromethane	25	168	20
A	Diethyl ether	73	121	20
A	Ethylbenzene	81	125	20
A	Hexachlorobutadiene	70	145	20
A	Isopropylbenzene	75	139	20
A	m,p-Xylene	81	125	20
A	Methyl tert-butyl ether	66	130	20
A	Methylene chloride	77	133	20
A	n-Butylbenzene	59	143	20
A	n-Propylbenzene	73	129	20
A	Naphthalene	67	128	20
A	o-Xylene	68	134	20
A	sec-Butylbenzene	69	132	20
A	Styrene	66	133	20
A	tert-Butylbenzene	69	129	20
A	Tetrachloroethene	87	137	20
A	Tetrahydrofuran	63	144	20
A	Toluene	81	123	20
A	trans-1,2-Dichloroethene	79	128	20
A	trans-1,3-Dichloropropene	55	126	20

A = Target Analyte S = Surrogate

AMRO Environmental Laboratories Corp.

Date: 23-May-13

Test Code: 8260_W
Test Number: SW8260B
Test Name: EPA 8260B VOLATILES by GC/MS
Matrix: Aqueous
Sample Type: LCSF

Control Limits

Type	Analyte	Lower Control Limit	Upper Control Limit	RPD Limit
A	Trichloroethene	81	129	20
A	Trichlorofluoromethane	56	157	20
A	Vinyl chloride	59	152	20
S	1,2-Dichloroethane-d4	73	135	0
S	4-Bromofluorobenzene	77	119	0
S	Dibromofluoromethane	82	122	0
S	Toluene-d8	82	117	0

A = Target Analyte S = Surrogate

AMRO Environmental Laboratories Corp.

Date: 23-May-13

Test Code: 8270_S
Test Number: SW8270C
Test Name: EPA 8270C SEMIVOLATILE ORGANICS,
Matrix: Soil
Sample Type: LCSDF

Control Limits

Type	Analyte	Lower Control Limit	Upper Control Limit	RPD Limit
A	1,2,4-Trichlorobenzene	33	89	50
A	1,2-Dichlorobenzene	31	86	50
A	1,2-Diphenylhydrazine (as Azobenzene)	43	106	50
A	1,3-Dichlorobenzene	30	83	50
A	1,4-Dichlorobenzene	31	82	50
A	2,4,5-Trichlorophenol	43	103	50
A	2,4,6-Trichlorophenol	41	100	50
A	2,4-Dichlorophenol	38	99	50
A	2,4-Dimethylphenol	38	92	50
A	2,4-Dinitrophenol	10	107	50
A	2,4-Dinitrotoluene	47	106	50
A	2,6-Dinitrotoluene	44	106	50
A	2-Chloronaphthalene	39	97	50
A	2-Chlorophenol	35	89	50
A	2-Methylnaphthalene	36	92	50
A	2-Methylphenol	38	92	50
A	2-Nitroaniline	46	103	50
A	2-Nitrophenol	34	94	50
A	3,3´-Dichlorobenzidine	40	94	50
A	3-Nitroaniline	43	99	50
A	4,6-Dinitro-2-methylphenol	19	111	50
A	4-Bromophenyl phenyl ether	42	106	50
A	4-Chloro-3-methylphenol	43	99	50
A	4-Chloroaniline	32	86	50
A	4-Chlorophenyl phenyl ether	42	100	50
A	4-Methylphenol	39	93	50
A	4-Nitroaniline	45	103	50
A	4-Nitrophenol	40	109	50
A	Acenaphthene	40	93	50
A	Acenaphthylene	39	93	50
A	Anthracene	44	104	50
A	Benz(a)anthracene	45	107	50

A = Target Analyte S = Surrogate

AMRO Environmental Laboratories Corp.

Date: 23-May-13

Test Code: 8270_S
Test Number: SW8270C
Test Name: EPA 8270C SEMIVOLATILE ORGANICS,
Matrix: Soil
Sample Type: LCSDF

Control Limits

Type	Analyte	Lower Control Limit	Upper Control Limit	RPD Limit
A	Benzo(a)pyrene	48	106	50
A	Benzo(b)fluoranthene	45	106	50
A	Benzo(g,h,i)perylene	47	105	50
A	Benzo(k)fluoranthene	47	106	50
A	Benzoic acid	10	55	50
A	Benzyl alcohol	34	94	50
A	Bis(2-chloroethoxy)methane	34	93	50
A	Bis(2-chloroethyl)ether	32	87	50
A	Bis(2-chloroisopropyl)ether	29	92	50
A	Bis(2-ethylhexyl)phthalate	44	110	50
A	Butyl benzyl phthalate	44	111	50
A	Carbazole	46	108	50
A	Chrysene	49	107	50
A	Di-n-butyl phthalate	45	107	50
A	Di-n-octyl phthalate	47	107	50
A	Dibenz(a,h)anthracene	49	105	50
A	Dibenzofuran	43	98	50
A	Diethyl phthalate	45	103	50
A	Dimethyl phthalate	44	100	50
A	Fluoranthene	45	107	50
A	Fluorene	42	98	50
A	Hexachlorobenzene	43	107	50
A	Hexachlorobutadiene	34	93	50
A	Hexachlorocyclopentadiene	21	89	50
A	Hexachloroethane	32	85	50
A	Indeno(1,2,3-cd)pyrene	46	106	50
A	Isophorone	36	91	50
A	N-Nitrosodi-n-propylamine	36	87	50
A	N-Nitrosodiphenylamine	43	105	50
A	Naphthalene	33	90	50
A	Nitrobenzene	35	92	50
A	Pentachlorophenol	32	99	50

A = Target Analyte S = Surrogate

AMRO Environmental Laboratories Corp.

Date: 23-May-13

Test Code: 8270_S
Test Number: SW8270C
Test Name: EPA 8270C SEMIVOLATILE ORGANICS,
Matrix: Soil
Sample Type: LCSDF

Control Limits

Type	Analyte	Lower Control Limit	Upper Control Limit	RPD Limit
A	Phenanthrene	44	101	50
A	Phenol	37	91	50
A	Pyrene	46	102	50
S	2,4,6-Tribromophenol	33	117	0
S	2-Fluorobiphenyl	26	100	0
S	2-Fluorophenol	21	102	0
S	4-Terphenyl-d14	40	116	0
S	Nitrobenzene-d5	19	107	0
S	Phenol-d5	25	106	0

A = Target Analyte S = Surrogate

AMRO Environmental Laboratories Corp.

Date: 23-May-13

Test Code: 8270_W
Test Number: SW8270C
Test Name: EPA 8270C SEMIVOLATILE ORGANICS,
Matrix: Aqueous
Sample Type: LCSDF

Control Limits

Type	Analyte	Lower Control Limit	Upper Control Limit	RPD Limit
a	1,2,4-Trichlorobenzene	45	104	50
A	1,2-Dichlorobenzene	33	103	50
A	1,2-Diphenylhydrazine	44	125	50
A	1,2-Diphenylhydrazine (as Azobenzene)	53	123	50
A	1,3-Dichlorobenzene	38	100	50
A	1,4-Dichlorobenzene	40	98	50
A	2,4,5-Trichlorophenol	58	115	50
A	2,4,6-Trichlorophenol	57	113	50
A	2,4-Dichlorophenol	54	106	50
A	2,4-Dimethylphenol	37	100	50
A	2,4-Dinitrophenol	29	112	50
A	2,4-Dinitrotoluene	58	116	50
A	2,6-Dinitrotoluene	56	116	50
A	2-Chloronaphthalene	49	110	50
A	2-Chlorophenol	51	98	50
A	2-Methylnaphthalene	48	103	50
A	2-Methylphenol	40	98	50
A	2-Nitroaniline	51	125	50
A	2-Nitrophenol	51	112	50
A	3,3´-Dichlorobenzidine	40	109	50
A	3-Nitroaniline	46	124	50
A	4,6-Dinitro-2-methylphenol	44	112	50
A	4-Bromophenyl phenyl ether	58	113	50
A	4-Chloro-3-methylphenol	51	112	50
A	4-Chloroaniline	43	106	50
A	4-Chlorophenyl phenyl ether	56	108	50
A	4-Methylphenol	34	91	50
A	4-Nitroaniline	47	119	50
A	4-Nitrophenol	20	57	50
A	Acenaphthene	54	106	50
A	Acenaphthylene	52	105	50
A	Anthracene	56	110	50

A = Target Analyte S = Surrogate

AMRO Environmental Laboratories Corp.

Date: 23-May-13

Test Code: 8270_W
Test Number: SW8270C
Test Name: EPA 8270C SEMIVOLATILE ORGANICS,
Matrix: Aqueous
Sample Type: LCSDF

Control Limits

Type	Analyte	Lower Control Limit	Upper Control Limit	RPD Limit
A	Benz(a)anthracene	57	115	50
A	Benzo(a)pyrene	53	114	50
A	Benzo(b)fluoranthene	54	116	50
A	Benzo(g,h,i)perylene	57	115	50
A	Benzo(k)fluoranthene	54	117	50
A	Benzoic acid	10	65	50
A	Benzyl alcohol	33	104	50
A	Bis(2-chloroethoxy)methane	46	113	50
A	Bis(2-chloroethyl)ether	47	106	50
A	Bis(2-chloroisopropyl)ether	36	115	50
A	Bis(2-ethylhexyl)phthalate	61	120	50
A	Butyl benzyl phthalate	45	129	50
A	Carbazole	56	117	50
A	Chrysene	55	116	50
A	Di-n-butyl phthalate	56	118	50
A	Di-n-octyl phthalate	58	121	50
A	Dibenz(a,h)anthracene	55	116	50
A	Dibenzofuran	56	108	50
A	Diethyl phthalate	41	115	50
A	Dimethyl phthalate	10	129	50
A	Fluoranthene	54	112	50
A	Fluorene	54	107	50
A	Hexachlorobenzene	58	114	50
A	Hexachlorobutadiene	32	112	50
A	Hexachlorocyclopentadiene	10	92	50
A	Hexachloroethane	29	107	50
A	Indeno(1,2,3-cd)pyrene	53	117	50
A	Isophorone	46	112	50
A	N-Nitrosodi-n-propylamine	48	110	50
A	N-Nitrosodiphenylamine	56	113	50
A	Naphthalene	41	105	50
A	Nitrobenzene	45	112	50

A = Target Analyte S = Surrogate

AMRO Environmental Laboratories Corp.

Date: 23-May-13

Test Code: 8270_W
Test Number: SW8270C
Test Name: EPA 8270C SEMIVOLATILE ORGANICS,
Matrix: Aqueous
Sample Type: LCSDF

Control Limits

Type	Analyte	Lower Control Limit	Upper Control Limit	RPD Limit
A	Pentachlorophenol	34	109	50
A	Phenanthrene	56	109	50
A	Phenol	16	54	50
A	Pyrene	58	115	50
S	2,4,6-Tribromophenol	54	127	0
S	2-Fluorobiphenyl	48	107	0
S	2-Fluorophenol	25	69	0
S	4-Terphenyl-d14	37	125	0
S	Nitrobenzene-d5	42	117	0
S	Phenol-d5	15	54	0

A = Target Analyte S = Surrogate

AMRO Environmental Laboratories Corp.

Date: 23-May-13

Test Code: 6010_SOIL
Test Number: SW6010B
Test Name: EPA 6010B ICP METALS, 3051/6010
Matrix: Soil
Sample Type: LCSD

Control Limits

Type	Analyte	Lower Control Limit	Upper Control Limit	RPD Limit
A	Aluminum	80	120	20
A	Antimony	80	120	20
A	Arsenic	80	120	20
A	Barium	80	120	20
A	Beryllium	80	120	20
A	Boron	80	120	20
A	Cadmium	80	120	20
A	Calcium	80	120	20
A	Chromium	80	120	20
A	Cobalt	80	120	20
A	Copper	80	120	20
A	Iron	80	120	20
A	Lead	80	120	20
A	Lithium	0	0	0
A	Magnesium	80	120	20
A	Manganese	80	120	20
A	Molybdenum	80	120	20
A	Nickel	80	120	20
A	Potassium	80	120	20
A	Selenium	80	120	20
A	Silver	80	120	20
A	Sodium	80	120	20
A	Strontium	80	120	20
A	Thallium	80	120	20
A	Tin	80	120	20
A	Titanium	80	120	20
A	Vanadium	80	120	20
A	Zinc	80	120	20

A = Target Analyte S = Surrogate

AMRO Environmental Laboratories Corp.

Date: 23-May-13

Test Code: 6010
Test Number: SW6010B
Test Name: ICP METALS, TOTAL
Matrix: Aqueous
Sample Type: LCSD

Control Limits

Type	Analyte	Lower Control Limit	Upper Control Limit	RPD Limit
A	Aluminum	80	120	20
A	Antimony	80	120	20
A	Arsenic	80	120	20
A	Barium	80	120	20
A	Beryllium	80	120	20
A	Boron	80	120	20
A	Cadmium	80	120	20
A	Calcium	80	120	20
A	Chromium	80	120	20
A	Cobalt	80	120	20
A	Copper	80	120	20
A	Iron	80	120	20
A	Lead	80	120	20
A	Lithium	80	120	20
A	Magnesium	80	120	20
A	Manganese	80	120	20
A	Molybdenum	80	120	20
A	Nickel	80	120	20
A	Potassium	80	120	20
A	Selenium	80	120	20
A	Silver	80	120	20
A	Sodium	80	120	20
A	Strontium	80	120	20
A	Thallium	80	120	20
A	Tin	80	120	20
A	Titanium	80	120	20
A	Vanadium	80	120	20
A	Zinc	80	120	20

A = Target Analyte S = Surrogate

AMRO Environmental Laboratories Corp.

Date: 23-May-13

Test Code: FING_S
Test Number: SW8015B
Test Name: TPH by GC/FID (modified 8015B)
Matrix: Soil
Sample Type: LCSD

Control Limits

Type	Analyte	Lower Control Limit	Upper Control Limit	RPD Limit
A	Diesel Fuel/Fuel Oil #2	40	140	40
S	o-Terphenyl	40	140	0

A = Target Analyte S = Surrogate

AMRO Environmental Laboratories Corp.

Date: 23-May-13

Test Code: FING_W
Test Number: SW8015B
Test Name: TPH by GC/FID (modified 8015B)
Matrix: Aqueous
Sample Type: LCSD

Control Limits

Type	Analyte	Lower Control Limit	Upper Control Limit	RPD Limit
A	Diesel Fuel/Fuel Oil #2	42	119	40
S	o-Terphenyl	31	131	0

A = Target Analyte S = Surrogate

AMRO Environmental Laboratories Corp.

Date: 23-May-13

Test Code: 8082_SSOX
Test Number: SW8082
Test Name: EPA 8082 PCBS IN SOIL/SOLIDS
Matrix: Soil
Sample Type: LCSD

Control Limits

Type	Analyte	Lower Control Limit	Upper Control Limit	RPD Limit
A	Aroclor 1016	70.9	125	50
A	Aroclor 1260	60.1	126	50
S	Decachlorobiphenyl	30	150	0
S	Tetrachloro-m-xylene	30	150	0

A = Target Analyte S = Surrogate

AMRO Environmental Laboratories Corp.

Date: 23-May-13

Test Code: 8082_WX
Test Number: SW8082
Test Name: EPA 8082 PCBS IN WATER
Matrix: Aqueous
Sample Type: LCSD

Control Limits

Type	Analyte	Lower Control Limit	Upper Control Limit	RPD Limit
A	Aroclor 1016	40	140	50
A	Aroclor 1260	40	140	50
S	Decachlorobiphenyl	30	150	0
S	Tetrachloro-m-xylene	30	150	0

A = Target Analyte S = Surrogate

AMRO Environmental Laboratories Corp.

Date: 23-May-13

Test Code: Hg_7471
Test Number: SW7471A
Test Name: EPA 7471 MERCURY, Soil
Matrix: Soil
Sample Type: LCSD

Control Limits

Type	Analyte	Lower Control Limit	Upper Control Limit	RPD Limit
A	Mercury	80	120	20

A = Target Analyte S = Surrogate

AMRO Environmental Laboratories Corp.

Date: 23-May-13

Test Code: HG_7470
Test Number: SW7470A
Test Name: EPA 7470 MERCURY, Total
Matrix: Aqueous
Sample Type: LCSD

Control Limits

Type	Analyte	Lower Control Limit	Upper Control Limit	RPD Limit
A	Mercury	80	120	20

A = Target Analyte S = Surrogate

Eurofins Lancaster Laboratories

Environmental Quality Policy Manual

Prepared by

Amy L. Doupé, QA Principal Specialist — Date: 01/23/2012

Approvals

Harolyn Clow, Manager, Environmental Microbiology — Date: 01/23/2012

Duane Luckenbill, Director, Environmental Chemistry — Date: 1/24/2012

Timothy Oostdyk, President — Date: 1/31/2012

J. Wilson Hershey, Chairman of the Board — Date: 1/25/2012

Kathleen M. Loewen, Quality Assurance Director — Date: 2/3/2012

Uncontrolled Copy

Table of Contents

1. INTRODUCTION 6

1.1. Our Unique Promise of Value 6
1.2. Mission Statement 6
1.3. Quality Policy 6
1.4. Statement of Values 7
1.5. Sample Flow-Through Diagram 8
1.6. Certifications, Accreditations, and Registrations 9

2. ORGANIZATION AND PERSONNEL 9

2.1. Company Overview and History 9
2.2. Organizational Structure 10
2.3. Management Responsibilities 10
2.4. Overview of the Quality Assurance Program 10
2.5 Quality Assurance Responsibilities 11
2.6. Communication of Quality Issues to Management 12
2.7. Personnel Qualifications and Responsibilities 12
2.8. Relationship of Functional Groups and the Quality Assurance Program 13
2.9. Balancing Laboratory Capacity and Workload 13
2.10. Identification of Approved Signatories 14
2.11. Personnel Training 14
2.12. Regulatory Training 15
2.13. Employee Safety 15
2.14. Client Services/Project Management Responsibilities 16
2.15. Confidentiality 17
2.16. Business Conduct 17
2.17. Operational Integrity 17

3. BUILDINGS AND FACILITIES 18

3.1. Facility 18
3.2. Security 19
3.3. Disaster Recovery 19
3.4. Environmental Monitoring 19
3.5. Water Systems 20
3.6. Housekeeping/Cleaning 20
3.7. Insect & Rodent Control 20
3.8. Emergency Power Supply 21
3.9. Facility Changes 21

4. DOCUMENT CONTROL 21

4.1. Hierarchy of Internal Operating Procedures 21
4.2. Document Approval, Issue, Control, and Maintenance 24
4.3. Client-Supplied Methods and Documentation 24
4.4. Laboratory Notebooks, Logbooks, and Forms 25
4.5. Control of External Documents 25

5. SAMPLE HANDLING 26

5.1. Sample Collection 26
5.2. Sample Receipt and Entry 27
5.3. Sample Identification and Tracking 28
5.4. Sample Storage 28

Uncontrolled Copy

5.5. Sample Return/Disposal 28
5.6. Chain of Custody 29
5.7. Representativeness of Samples 29

6. TECHNICAL REQUIREMENTS – TRACEABILITY OF MEASUREMENTS 29

6.1. Reagents and Solvents 29
6.2. Media 30
6.3. Calibration Standards 30
6.4. Equipment and Instrumentation 31
6.5. Computerized Systems and Computer Software 33
6.6. Change Control 36
6.7. Labware Cleaning 36

7. PURCHASING EQUIPMENT AND SUPPLIES 37

7.1. Procurement 37
7.2. Supplier Evaluation 37

8. ANALYTICAL METHODS 38

8.1. Scope of Testing 38
8.2. Analytical Test Methods 39
8.3. Client Supplied Methods 39
8.4. Method Validation 40
8.5. Procedural Deviations 40

9. INTERNAL QUALITY CONTROL CHECKS 41

9.1. Laboratory Quality Control Samples and Acceptance Criteria 41
9.2. Quality Control Sample Frequency and Corrective Action 42
9.3. Quality Control Charts 43
9.4. Measurement Uncertainty 43

10. ASSURING QUALITY OF TEST RESULTS 44

10.1. Data Management 44
10.2. Data Documentation 46
10.3. Data Calculations 47
10.4. Reporting Limits 47
10.5. Data Review 47
10.6. Data Qualification 48
10.7. Data Reporting 48
10.8. Data Storage, Security, and Archival 49

11. AUDITS AND INSPECTIONS 50

11.1. Internal Quality Assurance Audits 50
11.2. Review of the Quality Assurance Program 50
11.3. Good Laboratory Practice Critical Phase Inspections 51
11.4. Client Audits 51
11.5. Agency Inspections 52
11.6. Proficiency Testing 53

12. CORRECTIVE AND PREVENTIVE ACTION 54

12.1. Laboratory Investigations and Corrective Action 54
12.2. Investigation Processes 55
12.3. Client Feedback 55

Uncontrolled Copy

12.4. PREVENTIVE ACTIONS 56

13. SERVICE TO CLIENTS 57

13.1. SERVICE TO CLIENTS 57
13.2. REVIEW OF WORK REQUESTS, TENDERS, AND CONTRACTS 57
13.3. TIMELY DELIVERY 58
13.4. SUBCONTRACTING 58
13.5. USE OF NELAP AND A2LA LOGO 58

Appendix A – Procedure Cross Reference List
Appendix B – Certifications, Accreditations, Registrations, and Contracts
Appendix C – Organizational Charts, Personnel to Sign Reports
Appendix D – Personnel Qualifications and Responsibilities
Appendix E – SOPs and Analytical Methods
Appendix F – Instrument and Equipment List
Appendix G – Preventive Maintenance Schedule
Appendix H – Calibration Schedules
Appendix I – NELAP Scope of Testing
Appendix J – Quality Control Types, Frequency, and Corrective Action
Appendix K – Microbiological Testing

Uncontrolled Copy

Revision Log:

Revision: 11		Effective Date:	This version
Section	**Justification**		**Changes**
Revision Log	Formatting requirements per LOM-SOP-LAB-201		Removed revision logs up to the previous version.
Entire Document	Logo changed		Updated company logo

Revision: 10		Effective Date:	10/05/11
Section	**Justification**		**Changes**
Revision Log	Formatting requirements per LOM-SOP-LAB-201		Removed revision logs up to the previous version.
Entire Document	Title changes		Changed President to Chairman of the Board
1.4	Thermo-Fisher language		Removed the reference to the "Four 'I's"
1.5	To reflect current practice		Updated diagram
2.1	Change in ownership		Updated to include sale to Eurofins
2.2	Title Changes		Added Chairman of the Board and Vice Presidents to Vice President
2.3	To reflect current practice		Added responsibility of assigning deputies for key personnel
2.4	Change in ownership		Revised reference from being wholly owned subsidiary of Thermo Fisher to Eurofins Scientific
2.17	To reflect current practice		Added that all employees sign the ethics statement on the first day of employment.
10.1 Sample Flow Table	To reflect current practice		Deleted microfilmed
12.3	To include all client feedback		Changed section title from Client Complaints to Client Feedback
12.3	To reflect current practice		Added that client concerns are tracked in the LIMS
12.3	To reflect current practice		Added description of the client survey

Uncontrolled Copy

1. INTRODUCTION

This *Quality Policy Manual* is based upon Lancaster Laboratories' overall business and management philosophies, mission, and goals. This manual was written to present the policies employed by the Environmental Division of Lancaster Laboratories as well as the support departments that serve the environmental laboratories and to comply with the requirements of the National Environmental Laboratory Accreditation Program and ISO 17025. These policies define the "what" we do with emphasis on management's responsibilities and commitment to quality. Governing SOPs are in place within the organization, to ensure the proper execution of this policy document (refer to Appendix A). The most recent and up-to-date *Quality Policy Manual* and all referenced documents are available to all laboratory personnel who work in or support the Environmental Division. Lancaster Laboratories actively strives for continuous improvement of its quality systems to better serve our clients.

1.1. Our Unique Promise of Value

The global leader in the National Environmental Laboratory Accreditation Program (NELAP) for accredited environmental laboratory services; Lancaster Laboratories provides unmatched regulatory compliance, capacity, and technical expertise for an outstanding service experience to environmental clients worldwide.

1.2. Mission Statement

Lancaster Laboratories offers analytical and consulting services in the chemical and biological sciences with comprehensive expertise in environmental and pharmaceutical laboratory applications. The company mission statement describes the corporate philosophy:

At Lancaster Laboratories, we are people working together to serve the health and environmental needs of society through science and technology. We strive to be the recognized leader in all that we do.

Our mission is to provide independent laboratory services in the chemical and biological sciences with excellent quality and service. As a corporate community, we:

- Deliver quality by fully understanding and always meeting the requirements of those we serve.
- Live our values by relating to our clients, coworkers, shareholders, suppliers, and community in a fair and ethical manner.
- Manage our growth and financial resources so we can serve our clients well, provide a satisfactory return to shareholders, and maintain our meaningful and enriching workplace.

1.3. Quality Policy

The Executive Management Group recognizes quality as a key element of the laboratory's standard of service. The group supports the laboratory's commitment to quality as defined by NELAP and ISO 17025 through the strict adherence to the Quality Policy Statement. The Quality Assurance Officer wrote the Quality Policy Statement, with final approval from the Chairman of the Board. The policy can not be revised without the Chairman of the Board and Quality Assurance Officer's approval.

Uncontrolled Copy

The Quality Policy Statement gives employees clear requirements for the production of analytical data. Employees are trained on the components of the Quality Policy Statement during their first day of orientation. Each employee signs the statement as agreement to implement the policy in all aspects of their work. The statement is as follows:

We strive to provide the highest quality data achievable by:

- Describing clearly and accurately all activities performed; documenting "real time" as the task is carried out; understanding that it is never acceptable to "back date" entries and should additional information be required at a later date, the actual date and by whom the notation is made must be documented.
- Providing accountability and traceability for each sample analyzed through proper sample handling, labeling, preparation, instrument calibration/qualification, analysis, and reporting; establishing an audit trail that identifies date, time, analyst, instrument used, instrument conditions, quality control samples (where appropriate and/or required by the method), and associated standard material.
- Emphasizing a total quality management process and commitment to continuous improvement which provides accuracy, and strict compliance with agency regulations and client requirements, giving the highest degree of confidence; understanding that meeting the requirements of the next employee in the work flow process is just as important as meeting the needs of the external client.
- Providing thorough documentation and explanation to qualify reported data that may not meet all requirements and specifications, but is still of use to the client; understanding this occurs only after discussion with the client on the data limitations and acceptability of this approach.
- Responding immediately to indications of questionable data, out-of-specification occurrences, equipment malfunctions, and other types of laboratory problems, with investigation and applicable corrective action; documenting these activities completely, including the reasons for the decisions made.
- Providing a work environment that ensures accessibility to all levels of management and encourages questions and expression of concern on quality issues to management.

We each take personal responsibility to provide this quality product while meeting the company's high standards of integrity and ethics, understanding that improprieties, such as failure to conduct the required test, manipulation of test procedures or data, or inaccurate documentation will not be tolerated. Intentional misrepresentation of the activities performed is considered fraud and is grounds for termination.

1.4. Statement of Values

As a corporate community, we embrace our heritage of integrity and strive to live by the following principles:

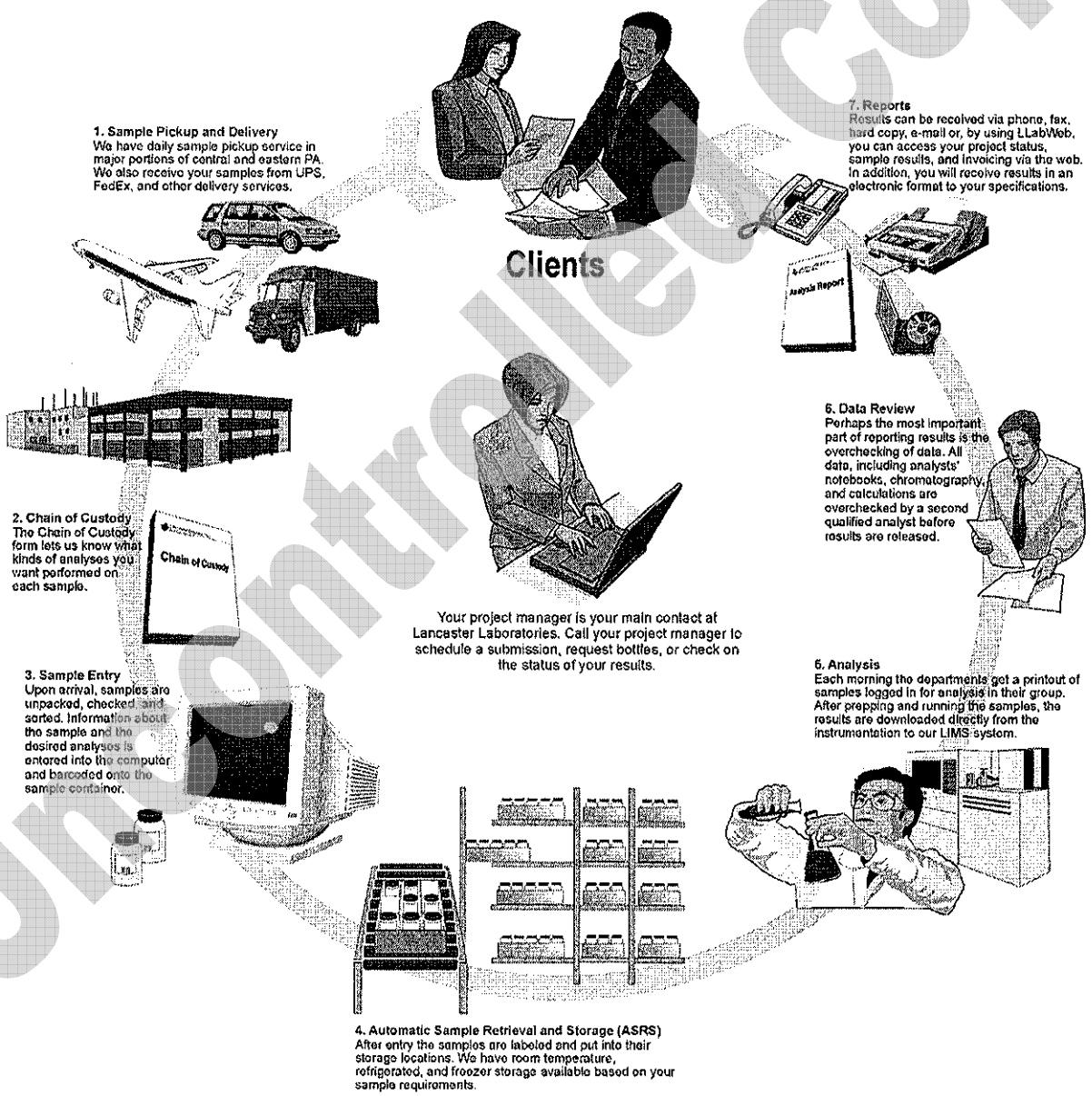
- Fairness and honesty in all our relationships
- Mutual trust
- A respect for ourselves and others
- A sense of caring that leads us to act responsibly toward each other and society, now and in the future
- Loyalty to our clients and one another

Uncontrolled Copy

- A spirit of open-mindedness as we deal with all
- Dedication to service
- Good stewardship of our resources
- A commitment to flexibility and continuous improvement

We each take personal responsibility to live these values in all of our dealings, knowing full well our pledge may involve difficult choices, hard work, and courage.

1.5. Sample Flow-Through Diagram



Uncontrolled Copy

1.6. Certifications, Accreditations, and Registrations

Accreditation/Certification is the process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications and/or standards. It is the one generally accepted method by which a laboratory such as ours can demonstrate its capability of generating acceptable, professional, quality test results in those areas in which it claims competence. To this end, we have actively sought accreditation by organizations offering it in those areas relevant to our technical expertise. We strive to ensure that the facilities, equipment, procedures, records, and methods used by Lancaster Laboratories in the testing of environmental samples are in compliance with the requirements of these standards.

Although organizations offering accreditation differ somewhat in the details of their programs, they generally evaluate laboratories in four basic areas: personnel (adequate staffing, education, training, and experience), physical facilities, instrumentation/equipment, and quality assurance program. This evaluation is performed by one or more of the following procedures: periodic on-site inspections of the laboratory by assessors experienced in technical operations and management, periodic testing of proficiency test samples, and periodic updating of the laboratory's file to reflect changes in personnel, equipment, or services offered. Some states offer reciprocity with other state programs.

Appendix B lists accreditations, registrations, and contracts held by Lancaster Laboratories, Inc. in support of environmental work. Current copies of all scopes of accreditation are kept on file in the Quality Assurance Department.

2. ORGANIZATION AND PERSONNEL

2.1. Company Overview and History

Lancaster Laboratories was founded in 1961 by Dr. Earl Hess in response to a need for high quality technical services by the agricultural and industrial communities in southeastern Pennsylvania. Nourished in a culture of quality and caring about all those associated with the business, the corporation became an industry leader known for innovative business practices and people-friendly policies. The company was independently owned until the retirement of Dr. Hess in 1995. At that time, LLI was acquired by a publicly held company, Thermo TerraTech, Inc., a Thermo Electron company. Ownership changed in September 2000, when Lancaster Laboratories was acquired by Goldner, Hawn, Johnson, and Morrison, Inc. (GHJ&M), a private equity investment firm. In August 2005, LLI was acquired by Fisher Scientific under their BioPharma Division. On November 9, 2006, Thermo Electron and Fisher Scientific merged to form Thermo Fisher Scientific. In April 2011, Thermo Fisher Scientific sold Lancaster Laboratories to Eurofins Scientific. Lancaster Laboratories continues to operate as an independent laboratory and is incorporated by the State of Minnesota.

Lancaster Laboratories provides a wide array of laboratory services to clients working in the pharmaceutical and environmental industries. We strive to offer high quality technical services in the chemical and biological sciences with personal attention to client needs. These services include chemical analyses, microbiological testing, biopharmaceutical testing, and analytical method development. We are, therefore, a technical service company and do not manufacturer or distribute goods. Our "product" is accurate and timely technical information and our continued existence depends on the quality of the services we offer and efficiency with which we deliver them.

Uncontrolled Copy

2.2. Organizational Structure

The Chairman of the Board of Lancaster Laboratories, J. Wilson Hershey, Ph.D., is responsible for the daily operations of the Environmental Division of the laboratory.

The Executive Management Group is defined as Lancaster Laboratories' Chairman of the Board, President and Vice President.

Senior Management is defined as directors and above, including the Quality Assurance Director.

The management staff includes directors, managers and group leaders. Organizational charts are presented in Appendix C of this manual. A list of key personnel is also provided.

2.3. Management Responsibilities

Management/supervisor is defined as group leaders, managers, directors, and above.

Laboratory management duties are outlined for supervisory personnel using a job plan format, which details each individual's responsibilities along with expected results. Typically, management duties include, but are not limited to:

- Personnel hiring and training
- Supervision of personnel
- Ensuring quality of data produced
- Resource allocation
- Directing daily work operations, including scheduling of work
- Maintaining awareness of technical developments and regulatory requirements
- Assessing laboratory capacity and workload
- Contributing to the continuous improvement of the laboratory operation
- Providing resources to ensure a safe work environment
- Providing resources to ensure a work environment free of undue pressures
- Communicating problems and concerns to Senior and Executive Management to enlist a higher level of support for corrections and continuous improvements.
- Ensuring compliance with the requirements of ISO 17025 and NELAP.
- Ensuring that corrective actions are carried out in an appropriate and agreed time-frame.

The Chairman of the Board and Director of Quality Assurance are responsible for appointing deputies for all key personnel.

The Technical Director ensures that the laboratory's policies and objectives for quality of testing services are documented in this quality manual. The Technical Director must assure that the manual is communicated to, understood, and implemented by all personnel concerned.

2.4. Overview of the Quality Assurance Program

Quality Assurance (QA) is responsible for developing planned activities whose purpose is to provide assurance to all levels of management that a quality program is in place within the laboratory, and that it is functioning in an effective manner that is consistent with ISO 17025 and the requirements of NELAP. Although LLI is a wholly owned subsidiary of Eurofins Scientific, the Quality Assurance and Quality Systems operations described in this manual are specific to LLI.

Uncontrolled Copy

The administration of the QA program is the responsibility of the QA Director in cooperation with all levels of management.

2.4.1. Quality Assurance Director

The Quality Assurance Director ensures that the quality system is followed at all times. The QA Director reports directly to the Chairman of the Board, thus ensuring corrective actions to quality issues are taken promptly and are separate from business decisions. The QA Director has no direct supervisory responsibility for the generation of technical data to avoid any conflict of interest in administrating the QA program. The QA Director has the final authority to stop work that compromises our integrity or data quality. The situation must be investigated and appropriate corrective action must be put in place before the QA Director will authorize the resumption of work. The specific duties of the QA Director are communicated in job plan format.

The QA program, as directed by executive management, was established to:

- Ensure accountability, accuracy, and traceability of all analytical data generated.
- Ensure that current regulatory, agency, and client requirements are being met.
- Ensure that operating procedures are in place to minimize the possible loss, damage, and tampering with data, in addition to ensuring that raw data is stored in a secured area and is maintained by designated archivists and/or system administrators.
- Ensure that curriculum vitae (CVs) and training records are maintained to document that staff members have the necessary education, training, and experience to perform their job responsibilities and functions.
- Ensure that regulatory training is provided to applicable employees on a routine and ongoing basis.
- Ensure that all procedures are available, controlled, and current.
- Ensure that all equipment and instrumentation is qualified, maintained, and calibrated, as appropriate, in accordance with written standard operating procedures.
- Ensure that all significant laboratory problems are investigated and corrective action is put in place as documented
- Ensure that an internal audit program is in place to confirm that laboratory personnel are adhering to standard operating procedures and applicable regulations.
- Ensure that quality issues are brought to the attention of management in a timely manner.
- Communicate (within 30 days) to the relevant state authorities when there are management or facility changes that impact the environmental division.

2.5 Quality Assurance Responsibilities

Responsibilities within the QA Department are divided between divisions and assigned in accordance with the regulations the business unit of interest is required to follow (i.e., Food and Drug Administration [FDA], Environmental Protection Agency [EPA]). The QA Director assigns tasks with input from the company Chairman of the Board. The primary responsibilities of QA in support of the Environmental Division include, but are not limited to the following:

Uncontrolled Copy

- Oversee the laboratories' internal audit program which consists of various audit types and applies to all laboratory activities (technical and administrative).
- Review and approve standard operating procedures and LLI analytical methods.
- Review and approve validation documentation.
- Review non-conforming quality control data and approve laboratory investigation and corrective action reports.
- Perform tracking and trending of quality measurements and investigation report issues.
- Ensure that appropriate corrective actions are implemented as needed in response to quality issues or audit findings.
- Host client and regulatory agencies during facility audits and follow-up to any cited deficiencies.
- Provide regulatory guidance to the laboratory.
- Monitor GLP regulatory activities.
- Communicate quality issues to management.
- Provide and/or coordinate on-going regulatory training (e.g., Good Laboratory Practice [GLP], Good Manufacturing Practice [GMP]).
- Participate in the vendor and supplier approval process, including subcontractors.
- Review analytical data.
- Prepare and review QA project plans (QAPPs) as required by EPA and client projects.
- Maintain and update this *Quality Policy Manual*.
- Administer proficiency test sample programs, both single and double blinds.

2.6. Communication of Quality Issues to Management

The QA Department is responsible for preparing reports to Senior Management to keep them apprised of outstanding quality issues. Reports to management foster communication, review, and refinement of QA activities to ensure that the QA program is adequate to meet regulatory and Lancaster Laboratories' quality objectives. The following reports are used to communicate quality issues and include, but are not limited to:

- Internal, client, and agency audit reports and corrective action plans
- Proficiency test reports
- Investigation and corrective action reports
- Monthly and quarterly quality status reports
- Plans for corrective action

2.7. Personnel Qualifications and Responsibilities

Full resumes and responsibilities of key personnel are provided in Appendix D.

Due to the number of analysts on staff, entry level chemists, technicians, and support personnel are not included in the resume section. However, all employees have job plans that define their responsibilities. Duties for these personnel typically include:

Uncontrolled Copy

- Sample storage
- Sample preparations
- Performance of tests
- Calibration, operation, and maintenance of instruments
- Data entry
- Standard and reagent preparation
- Glassware preparation
- Data package preparation

2.8. Relationship of Functional Groups and the Quality Assurance Program

In addition to this *Quality Policy Manual*, aspects of the QA program are documented in a series of standard operating procedures that support the proper execution of this document. Technical operation procedures with required quality components are also in place. A list of the titles of relevant SOPs is provided in Appendix E. There are a variety of mechanisms used to communicate requirements and verify compliance with the QA program, including:

- Management requires that all employees read and be trained in the policies and SOPs that are pertinent to their jobs.
- Employee job plans define individual responsibilities. All job plans include QA aspects, and performance is reviewed annually.
- Laboratory audit findings are circulated to management and require a response and follow-up to items needing corrective action.
- Cross-functional meetings, including representatives from QA, Client Services, Marketing, management, and technical operations are held regularly to review specific projects and quality issues.

2.9. Balancing Laboratory Capacity and Workload

Evaluating laboratory capacity to perform specific projects is the responsibility of the Chairman of the Board, the lead Technical Director and the Director of the Client Services/Project Management Group. These responsibilities are documented in the individual job plans for these positions.

The laboratory facilities and staff size are very large compared to other laboratories serving the environmental industry. Many analysts are cross-trained to perform a variety of tests, and there is redundant equipment available in case of malfunctions. This minimizes the need to evaluate small and medium size projects against capacity available to complete them. Large projects are reviewed against capacity estimates before bids are submitted to ensure that the client's analysis schedule is met.

Regularly scheduled meetings are held with upper management, laboratory middle management, Client Services and QA personnel to review progress with current projects, as well as special requirements of new work scheduled for the laboratory.

Laboratory capacity and backlog is tracked on a continuous basis using information from the sample management system, including turnaround time, and work in-house.

Uncontrolled Copy

2.10. Identification of Approved Signatories

Approved signatories for laboratory reports are defined in the SOP on final review of laboratory generated reports. Directors, managers, group leaders, and other designated employees (such as project managers and senior technical staff) are designated to sign reports. Request for approval of an employee to review/sign reports must be made through the QA Department. Approved signatories are designated with an asterisk in the personnel list provided in Appendix C.

2.11. *Personnel Training*

The experience and training received by personnel is of great importance to our clients and regulatory agencies. CVs and on-going training documentation are available to demonstrate how personnel have been prepared for the tasks they routinely perform. To ensure the highest quality of services at Lancaster Laboratories, training programs and plans are developed to match skills with job functions. Accurate training documentation is the responsibility of both the employee and their supervisor. On a routine basis, the supervisor reviews and signs training documentation to verify that it is complete and current.

Training requirements can be met through education, prior job experience, internal and external training classes, on-the-job training, TRN training modules, procedure reading, or any combination thereof, to enable the person to perform assigned job functions and meet regulatory compliance.

Each analyst training to perform a new analysis is required to perform an initial demonstration of capability and meet the requirements for accuracy and precision before working independently on the test method. Typically, this is accomplished by the successful analysis of four known samples. However, there are certain tests performed that are not required by the mandated test method or regulation to perform the above procedure (i.e., EPA 1010, 9095). In this case, the analyst's documentation of proficiency is satisfied by the sign-off of having read, understood, and agreed to follow the SOP as written and observation by a senior analyst.

Management personnel are responsible for planning ongoing professional growth and development activities for an employee through on-the–job training and/or internal and external training courses so an employee can maintain a current skill set to match job responsibilities.

An annual performance review based on job accountabilities, objective measures, and pre-defined standards is completed by management personnel for each employee. This assessment is documented and maintained. Input is obtained from other managerial personnel as needed.

2.11.1. New Hire Training

New employees are oriented as part of a year-long process that is designed to make the employee feel welcome and comfortable by defining our culture, traditions, philosophies, and work practices. During the orientation process an employee learns about personnel and safety policies and business strategies in addition to quality, ethics, and customer satisfaction expectations through a formal process administered by our Human Resources Department.

Uncontrolled Copy

New employees are required to attend a "core" technical orientation as applicable, which can entail the participation in training module exercises, short session attendance, and/or other skill training specific to their assigned department or job function. Additional job-specific training required for an employee is based upon their assigned duties and is identified by their supervisor. Technical orientation occurs during the first few weeks of employment.

The orientation process is designed to enable employees to initiate and take responsibility for their personal and professional career growth at Lancaster Laboratories. The orientation process is conducted without regard to employee race, color, creed, national origin, sex, age, or disability in accordance with LLI's Employee Equal Opportunity (EEO) policy.

2.11.2. Ongoing Training

Refresher and ongoing training occurs through various means, which include but are not limited to, training in or independently review new/updated LLI standard operating procedures and TRN training procedures; on-going regulatory training; in-house or off-site classes or seminars. The goal of this training is to ensure that employees remain current with changes to laboratory systems and practices, as applicable to their job function. Retraining and re-qualification activities occur as directed by procedures or regulations. Employees are retrained if an issue or investigation warrants that retraining is a necessary corrective action. Management directs when employee re-training is required, and the extent of the re-training.

2.12. Regulatory Training

The QA Department is responsible for coordinating and conducting initial and ongoing regulatory training (i.e., GMP, GLP) for all applicable laboratory and support personnel. It is the responsibility of management within each department to ensure that personnel attend the required training sessions.

The choice of training format and topics covered for ongoing regulatory training is left to the discretion of QA and the trainer. All training sessions reinforce the concepts in the regulations as they are relevant to Lancaster Laboratories.

Whenever possible, after training is completed, a demonstration of proficiency of the training topic is given. The demonstration of proficiency is generally in the form of a quiz although other demonstrations of proficiency are acceptable depending on the scope and content of the training. If necessary, training is presented and/or repeated one-on-one with individuals who do not demonstrate proficiency in the training topic. This is performed by QA in conjunction with applicable laboratory management personnel.

2.13. Employee Safety

Lancaster Laboratories, being mindful of its responsibilities as an employer and active corporate citizen, has established the following objectives of its safety program:

- Provide a safe environment for its employees, visitors, and the community surrounding its place of business.
- Provide ongoing safety training for employees.

Uncontrolled Copy

- Provide all necessary facilities and equipment to ensure the safety of its employees and to minimize all chemical exposure during the normal performance of their required tasks, and to take all necessary precautions to safeguard the surrounding environment.
- Provide periodic health physicals for employees.
- Foster and encourage safe operations and a proper safety attitude on the part of our employees through general operations and systems, training, and the *Chemical Hygiene Plan* (CHP).

The *Lancaster Laboratories Chemical Hygiene Plan* addresses various aspects of our safety program in greater detail.

A Safety Committee works to enhance our overall safety program. The committee meets on a routine and ongoing basis and its specific responsibilities are detailed below:

- Review accident and incident reports. Make recommendations for methods of prevention to eliminate further accidents.
- Promote safety awareness and distribute safety information by various means (e.g., posters, videotapes, pamphlets, and books). Use internal communication channels to promote safety awareness.
- Enhance and recommend safety-training programs for all employees, as necessary.
- Maintain up-to-date information on employee concerns that are safety related. Offer input and information to the Chemical Hygiene Officer and/or Safety Officer, as needed.

2.14. Client Services/Project Management Responsibilities

Members of the Environmental Client Services/Project Management Group are responsible for organizing and managing client projects. Clients are assigned a project manager who serves as their primary contact at LLI. It is the project manager's responsibility to act as the client advocate by communicating client requirements to laboratory personnel and ensuring that clients provide complete information needed by the laboratory to meet those requirements. All client verbal communications are documented by the project manager in a controlled notebook. In addition to information management, Project Management responsibilities include:

- Coordinating and preparing proposals in conjunction with technical staff.
- Confirming certification status.
- Hosting client visits and audits.
- Coordinating and communicating turnaround time (TAT) requirements for high priority samples/projects.
- Answering common technical questions, facilitating problem resolution.
- Providing clients with sample status report or results prior to receipt of hardcopy analytical reports (e.g., fax, e-mail, phone).
- Scheduling sample submissions, sample containers, and sample pick-up via LL courier service.
- Informing the client of deviation from their contract.

Uncontrolled Copy

2.15. Confidentiality

Strict confidentiality is maintained in all of our dealings with clients. Confidentiality agreements, therefore, are willingly provided. Clients are promptly notified any time their data is subpoenaed or requested by a regulatory or legal body.

All employees are required to protect company technical data, including client names and test results from disclosure to any third party. This policy, as described in the *Lancaster Laboratories Personnel Manual*, is provided and presented to employees during their orientation period.

Intellectual property associated with the testing that we perform under contract for a client is the property of the client.

In an attempt to ensure the confidentiality of our systems and procedures within our laboratory, it is our policy to restrict the distribution of our internal procedures to clients. Clients are permitted to review our procedures while on-site as part of an audit or visit. Based on this policy, we would request that any documents viewed would not be shared or made available to any third parties without the permission of Lancaster Laboratories.

2.16. Business Conduct

Our business conduct policy applies to all operations of the company. All employees must avoid any relationship with other individuals or organizations (including Eurofins Scientific sister companies) that might impair, or even appear to impair, the proper performance of their company-related responsibilities. Employees must avoid any situation that might affect their independence of judgment with respect to any business dealings between the company and any other organization or individual. Any employee who believes that they have such a conflict, whether actual or potential, or who is aware of any conflict involving any other employee must report all pertinent details to the President of the company or Chairman of the Board. The company's management vigorously enforces this policy and takes prompt and appropriate action, including termination, against any employee found to be in violation.

2.17. Operational Integrity

All employees sign an Employee Ethics Statement on their first day of employment. Employees responsible for generating, handling, or reviewing laboratory data understand that Lancaster Laboratories mission is to perform all work with the highest level of integrity. Under no circumstances are shortcuts or generating results to suit a client's purpose rather than good scientific practice considered acceptable. Any violation of the laboratory ethics policy results in a detailed investigation that could lead to termination.

All levels of management consider the following activities unacceptable:

- Knowingly recording inaccurate data.
- Fabrication of data without performing the work needed to generate the information. This includes creating any type of fictitious data or documentation.
- Time travel or adjusting clocks on computerized systems to make it appear that data was acquired at some time other than the actual time.
- Manipulation of data for the express purpose of passing system suitability or quality control criteria.

Uncontrolled Copy

- Selective use of data generated, or not using data that was legitimately generated and has an impact on the outcome of the test.
- Executing significant deviations from approved test methods and procedures without prior approval from Lancaster Laboratories management and/or the client.

If an issue does arise which could compromise data integrity, personnel are instructed to perform the following activities:

- Clearly document the situation and maintain all data generated. There is a big difference between poor judgment and fraud. Fraud usually involves intent to conceal an action taken. Therefore, the more documentation that is maintained, the less likely an action is considered fraudulent if further scrutinized.
- When out-of-specification results or quality type issues are detected, all supporting data and relative background information must be documented and presented for management review. Problem resolution and client contact, as applicable, must also be documented.
- Review any questionable situations and decisions with a supervisor.
- Bring a questionable or uncomfortable issue directly to the QA Director or a member of the QA Department as part of our QA open door policy.
- Utilize the company's Ethics Committee. See Section 12.4 of this manual.

3. BUILDINGS AND FACILITIES

3.1. Facility

Lancaster Laboratories is located at 2425 New Holland Pike (Route 23), Lancaster, PA 17601. The facility consists of three primary buildings (A, B, and C). Building A and B are connected by a pedestrian bridge spanning Route 23.

Building A resides on a commercial plot measuring 13.6 acres on the north side of Route 23. Building A is a three-story building of concrete and steel construction. It is approximately 116,000 square feet and consists of approximately 62,000 square feet of laboratory space; 25,000 square feet of office space; and 29,000 square feet of storage, mechanical, and service space. On this plot, adjacent to Building A, sits a 1000 square foot chemical storage building (Building I) (solvent, acid and gas cylinder storage) and an 8000 square foot storage building which also houses stability chambers (referred to as Building J). The bottles packing area, which includes preservation of bottles being sent to clients for sampling, is located in a separate 3000 square foot building (referred to as Building K). In addition, there are two other buildings on the north side of Route 23 that include 1200 square feet for supply storage, 600 square feet for recycling, and 3500 square feet for shop and facilities maintenance areas.

Building B resides on a commercial plot measuring 13.7 acres on the south side of Route 23. Building B is a three-story building of steel and concrete construction. It is approximately 55,000 square feet and consists of approximately 15,000 square feet of laboratory space; 18,000 square feet of office space; and 22,000 square feet of storage, mechanical, and service space.

Building C is also located on the south side of Route 23, connected to Building B. Building C is a three-story building of steel and concrete construction providing approximately 50, 000 square feet of space used for Biopharmaceutical and Analytical Development testing laboratories. The first floor houses the main lobby, visitor's entrance, and conference rooms.

Uncontrolled Copy

An automatic fire alarm monitors the entire facility. The system is monitored by the central dispatch station. Building B, Building C, and Building J are fully protected by sprinklers for fire suppression. High-risk areas of Building A are protected by sprinklers as well. The entire campus and all exterior doors are monitored by video surveillance.

3.2. Security

Lancaster Laboratories is considered a secure facility. All outside doors except the main lobby entrance are kept locked during normal business hours to prevent unauthorized entry. An attendant monitors these entrances at all times.

During evenings, weekends, and holidays, all doors are locked and Security personnel are on site to prevent unauthorized entry into the building. Video cameras are utilized by Security personnel to monitor the facility grounds.

Every employee is issued a photo ID badge, which also serves as a building access card. This badge must be worn at all times while on laboratory property so that employees are easily identified. Access to secured/designated areas within the building is limited to only applicable employees through the building security system. This system is administered by Security staff.

All visitors must register with the lobby attendant and are issued a visitor badge. A staff person must accompany visitors while in the facility. Additional visitor rules are outlined in the *Visitor Security and Safety Rules* pamphlet, which is provided to all guests.

Building access cards are issued on a temporary basis to contractors or service technicians (e.g., electricians and plumbers) who need access to the building to work on a project. These cards provide the contractor with limited access during the normal workday and must be returned when the work is complete.

3.3. Disaster Recovery

A disaster recovery plan is in place to provide direction for situations where normal operations of the laboratory are not possible. In the event that the building would be severely challenged, a designated disaster recovery team, which includes Physical Services, Maintenance, Safety, Corporate Management, Public Relations, and other applicable personnel depending on the scope of the disaster, would assemble at a designated area to assess the situation and formulate a plan.

The plan addresses, in general terms, how to approach the following issues: electrical failures, heating/air conditioning failures, fire/building evacuation, computer failures, hazardous material spills, injury to employees, pandemic flu, disruption of phone service, and stability chamber failures.

3.4. Environmental Monitoring

The air handling system for the main laboratory is specially designed to protect sensitive instruments from harmful vapors to ensure that samples are not contaminated. The Physical Services/Maintenance Group is responsible for maintaining the HVAC and exhaust hood systems. This is particularly important in our instrumentation rooms and computer center where a controlled environment, positive pressure system is maintained.

Uncontrolled Copy

Most refrigerators, freezers, incubators, and ovens used for analysis are monitored by a computerized system equipped with stationary thermometer temperature probes linked to a master panel that is accessed through a computer in the Plant Engineer's office. If a unit is outside of a predefined temperature range for a specified period of time, the system alarms. Units not on the computerized system must be monitored manually by recording thermometer temperature readings twice daily.

The laboratory is set up so that there is effective separation between neighboring areas in which there is potential for contamination. Laboratory storage blanks are also used to evaluate conditions under which samples for volatile analysis are stored to monitor for cross-contamination potential. QA provides oversight of the environmental monitoring system.

3.5. Water Systems

Well water and the public sewer system service the facility. The water system is monitored to meet the permit requirements of the Pennsylvania Department of Environmental Protection.

Quality control of laboratory analyses involves the control and quality of laboratory water available to analysts for preparation, dilutions, and rinsing of glassware. Two reverse-osmosis deionized water systems deliver highly purified water to a sealed fiberglass storage tank. From the storage tank the water is delivered to an ion-exchange-carbon filter system for further polishing. The water is also exposed to an in-line ultraviolet sterilization lamp before being circulated to taps throughout the laboratory.

Daily monitoring and preventive maintenance for the system is the responsibility of the Maintenance Department. Monthly and annual testing is performed as required by regulatory guidance. QA provides oversight of the water system monitoring. In addition, method blanks are tested with each batch (≤20) of samples.

3.6. Housekeeping/Cleaning

Lancaster Laboratories is dedicated to providing a clean workplace. A third party professional cleaning service provides routine cleaning of "common areas" that include lavatories, drinking fountains, floors, and windows. Technical staff are responsible for the cleaning (or the contract of cleaning) of specific laboratory work areas.

Detergents used for cleaning contain no to very low levels of metals, pesticides/herbicides/ fungicides, or volatile solvents.

3.7. Insect & Rodent Control

Steps are taken to prevent, monitor, and control insect and rodent infestation. The coordination of this program is the responsibility of the Physical Services Department under the direction of QA. An outside service firm is contracted to perform routine and ongoing monitoring of the facility to ensure that preventive measures which are in place are effective and are working as intended.

No insect or rodent control chemical agents in a liquid or vapor form are applied or sprayed in any laboratory building, unless there is no other option, in which case department management must be contacted for approval.

Uncontrolled Copy

3.8. Emergency Power Supply

The laboratory is located at the junction of two power grids that supply electrical service to the facility. If one of the power grids fails, we have the ability to work with the power company to have service switched to the other grid. Various types of diesel and natural gas generators are also available on a standby basis to supply power to selected areas of the laboratory in case of a power outage.

To reduce spikes and spurious line voltage changes to laboratory instruments that can affect results or damage electronic equipment, "conditional power" is fed to these sensitive instruments. All essential computer systems are on uninterrupted power supply (UPS) which is a battery system that provides continuous conditional power for a limited time period in the event of a short power outage.

3.9. Facility Changes

Procedures are in place to manage change, ensure communication, and to minimize negative consequences through active participation of personnel involved in a facility change. The goal is to ensure that physical and environmental condition changes are adequately evaluated for impact and reduction of risk to quality, safety, health, employee, environment, property, analytical services, and business operations before and after the change is implemented.

4. DOCUMENT CONTROL

The administration of the document control system including tracking, filing, updating, distribution of new procedures, and archiving of historical copies is the responsibility of the Office Services (OS) Department.

It is our policy to restrict the distribution of our internal procedures to clients and we discourage the distribution of company confidential documents outside of the facility. Clients are permitted to review our procedures while on-site as part of an audit or visit. Any documents that are distributed are only sent with the approval of QA.

The goals of the document control process are:

- Format documents according to consistent and defined standards
- Review and approve new documents
- Schedule review of existing documents
- Control of document versions and effective dates
- Review and approval of document changes
- Control document distribution and return of obsolete documents
- Archive and protect obsolete documents

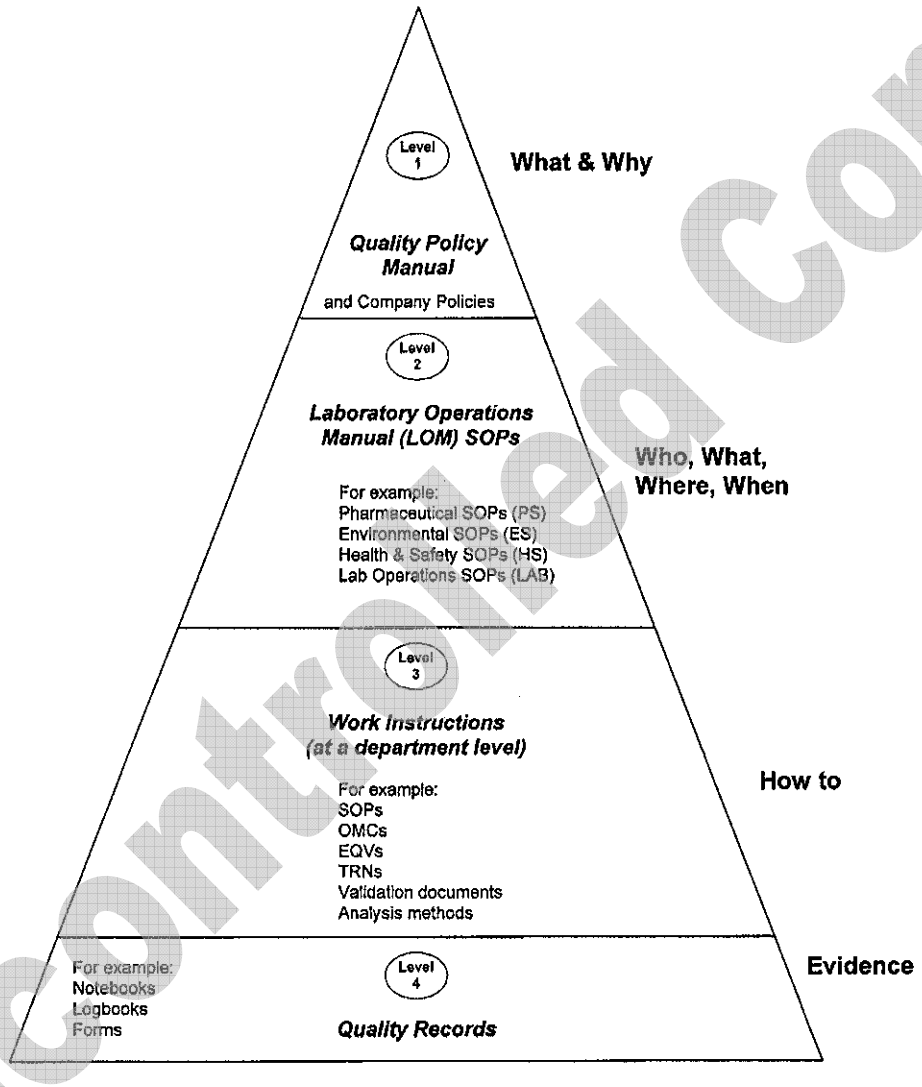
4.1. Hierarchy of Internal Operating Procedures

The hierarchy of controlled procedures at Lancaster Laboratories is defined in the following pyramid diagram. These procedures and documentation are made available to promote consistency throughout the organization and to meet regulatory requirements. A list of relevant methods and procedures is located in Appendix E. The development of new procedures and the updating and reclassification of current procedures is an ongoing project.

Uncontrolled Copy

Lancaster Laboratories
2425 New Holland Pike • Lancaster, PA 17601

Controlled Documentation Hierarchy



3608.03

Uncontrolled Copy

4.1.1. Level 1 – *Quality Policy Manual* and Company Policies

The intent of these documents is to define "what" we do with emphasis on Executive and Senior Management's responsibility for quality.

The purpose of the *Quality Policy Manual* is to provide a framework to outline the quality systems at Lancaster Laboratories. Organizational charts, list of SOPs, a list of equipment, instrumentation, and personnel resumes are included as attachments to this manual.

- Executive Management is responsible for ensuring adequate personnel, resources, and support are available to carry out the requirements of this *Quality Policy Manual*.
- Senior Management is responsible for ensuring that SOPs or other appropriate documents are written and available to personnel to define the practices and systems which support these policies.
- All employees are responsible for conducting business in a manner, which is compliant with quality and company policies and associated SOPs or other appropriate documents. Review of these policies and procedures must be documented.

Additional company policies are written to support and expand upon this *Quality Policy Manual*. These policies contain more detailed information about a subject with approval signatures executed at the Executive and/or Senior Management level.

4.1.2. Level 2 – Laboratory Operations Manual (LOM) SOPs

The intent of these standard operating procedures is to define "who, what, where, and when." These procedures provide specific information for a process or topic so that the requirements outlined in this *Quality Policy Manual* and company policies can be achieved. The review and approval of these SOPs is performed at the director/manager/group leader level, including QA review and signoff, and the responsibility of these SOPs lies with the area or person directing the operation.

SOPs are organized into different categories dependent on subject matter and area to which they apply within the company. They can apply across the entire company, across a division, or a specific operating area. Some examples of areas addressed at this level are:

LAB – Laboratory Section
HS – Health and Safety
ES – Environmental Sciences

4.1.3. Level 3 – Work Instructions (at a departmental level)

The intent of these procedures or documents is to define in greater detail the specific "how to". The level of detail in these documents must be sufficient so any appropriately trained person can perform the task accurately. Examples include, but are not limited to standard operating procedures (SOPs); operation, maintenance and calibration (OMC) procedures; equipment, qualification, and validation (EQV) procedures; validation documents; and Lancaster Laboratories'

Uncontrolled Copy

analytical methods. Departmental level procedures/documents are reviewed and approved at the manager or group leader level including QA review and signoff.

4.1.4. Level 4 – Quality Records

The intent of these documents is to provide documented evidence to support our quality systems and operations. Examples include but are not limited to, data notebooks/logbooks, and preformatted data recording forms.

4.2. Document Approval, Issue, Control, and Maintenance

The document control process ensures that documents are approved and adequate for use. It ensures that documents are readily available to personnel and at locations where essential operations are performed. Distribution of each document is controlled to ensure that analysts are working with the correct version.

Controlled policies, procedures, and work instructions are reviewed and approved by appropriate individuals and are formally issued and administered through the Office Services Group. Each document is uniquely identified and includes an effective date, revision identification, and page numbering (totaling number of pages). All documents are indexed and identified on a "master list." Each procedure has a unique file record that contains pertinent information used in the tracking process.

The original signed hard copy of the procedure is maintained in a secure area while in the active status. Electronic copies of each procedure are stored in a secure directory that is accessible only to designated personnel. Office Services also monitors the number of copies of each procedure in the laboratory.

Procedures are reviewed to ensure they remain accurate and current. The frequency of review is either annual or biennial, depending on the procedure. Upon the receipt of new or updated documents, all copies of obsolete documents are removed from service and destroyed. The original historical copy of each outdated/obsolete procedure is clearly identified as a historical version and maintained in a permanent archive file separate from any current versions. (Note: OH EPA is required to review all revised documents applicable to its certification).

Company policies and corporate level procedures are available in electronic form on the company's intranet site. Electronic copies are made available to enhance communication across the company. Electronic copies are scanned-in versions of the most recent hard copy of the document. These procedures cannot be printed from this system. The Office Services Group maintains this system in a current and accurate state.

4.3. Client-Supplied Methods and Documentation

Client documentation to support environmental testing at Lancaster Laboratories is maintained in a centralized area. This information is organized by client/project in the Client Services/Project Management Group. Client documentation includes the following information depending on project size and scope:

- Client supplied analyte lists
- Client supplied project plans
- Client contract quality manuals with specified limits, QC criteria, etc.

Uncontrolled Copy

- Communication/correspondence records which relate to testing requirements, interpretation of results, or reporting formats

4.4. Laboratory Notebooks, Logbooks, and Forms

Procedures are in place to ensure that all data is traceable, authentic, complete, and retrievable. The following general requirements outline our system for the issuing, control, and archival of laboratory notebook and logbooks.

- The administration of notebooks and logbooks is controlled by the Office Services Group. They maintain a master index to uniquely number and identify each book distributed.
- Notebooks and logbooks can contain blank or preformatted pages.
- Notebooks and logbooks are bound, uniquely identified and have sequentially pre-numbered pages.
- If notebooks or logbooks contain preprinted laboratory form pages:
  - A unique identification number is assigned to each form
  - Forms are approved by appropriate management personnel before they are put into production use
  - Forms are reviewed on a routine basis to ensure they are still accurate and current
- Completed notebooks are returned to an archivist. Incomplete books are returned to Document Control:
  - when an employee leaves the company
  - when an employee transfers to another division
  - when the project for which it was used is complete
  - at a defined time line from the issue date
- Office Services verifies the status and location of any notebook or logbook which has been signed out for longer than two (2) years.
- In specific situations, records are bound to create books at the time of archival (e.g., temperature charts).
- At the time of archival any page(s) in the notebook or logbook that does not contain data documentation is crossed-out or a statement is written on the last page used to note that the book is complete to prevent data from being entered at a later date.
- Notebooks and logbooks identified as requiring permanent archival are assigned a designated qualifier.

4.5. Control of External Documents

Hard copy versions of external documents are controlled through the form system.

External documents such as copies of the 40 CFR and ASTM methods are stored exclusively in the QA Department. QA also keeps applicable agency documents on file, these include, but are not limited to, the TNI (The NELAC Institute) and ISO 17025 standards.

Uncontrolled Copy

Environmental methods from the EPA or Standard Methods are available in the QA Department, but the technical areas also have copies that pertain to the tests that they perform. Any external document that is maintained in these areas must be inventoried and listed on a controlled form. Some methods are available on-line and are accessed through the Internet. Regulatory methods are used as references by the laboratory and testing is performed as per written SOPs that fall under our existing document control system and have scheduled reviews. It is the laboratory's understanding that the need to control external documents is to ensure that the most current version of a method is referenced or appropriate manual is being used. While using the most current version of an analytical method is our typical practice, there are specific client needs and accreditation rules that require previous versions of a method be used. Our scheduled review of SOPs is used to ensure that the proper version of a method is referenced.

The technical areas are responsible for ensuring that all manufacturer's manuals are current and available to analysts. The vendor provides instrument manuals when new equipment is purchased or existing instruments are updated. These manuals are kept with the instruments to which they are associated. The laboratory labels the instrument books with the corresponding identification number of the instrument. Logbooks, which fall under the document control system also include the title and date/version of the instrument manual.

5. SAMPLE HANDLING

5.1. Sample Collection

In order for meaningful analytical data to be produced, the samples analyzed must be representative of the system from which they are drawn.

It is the responsibility of the client to send us representative and/or homogeneous and properly preserved samples of the system from which they are drawn. Lancaster Laboratories assumes that all multiple sample containers with the same designator/description and bottle type contain a homogeneous, representative sample. We also assume that it is acceptable to deplete one container and move to the next, without implications unless otherwise indicated by the client.

The laboratory provides the appropriate sample containers, required preservative, chain-of-custody forms, shipping containers, labels, and seals. The laboratory also provides trip blanks and analyte-free water for field blanks. Preparation of methanol containers for field preservation of volatile soil samples is available.

Sample containers are purchased pre-cleaned by the supplier. Special containers with traceability documentation are available upon request. For pre-preserved bottles, each lot of preservative is checked for contaminants before use and this testing is documented.

The laboratory provides instructions with all bottle orders that define how to sample, preserve, store, and ship the samples prior to their delivery at Lancaster Laboratories. These instructions inform the client of the importance of proper sampling and advise them that non-compliant samples are rejected or reported with a qualifier.

If samples are collected by Lancaster Laboratories personnel, applicable sampling methods are in place to perform the sampling operation.

Uncontrolled Copy

As samples are analyzed at Lancaster Laboratories, there are times when additional sample volume is necessary to complete testing or perform retesting. If this situation arises, "additional sample" is requested by Lancaster Laboratories and/or submitted by a client to supplement current work being performed within our facility. Additional sample received is either assigned a new Lancaster Laboratories sample ID number and/or a comment noted on the final report to state that additional sample was received, depending on the situation. It is our goal to provide accurate traceability between sample submission and when testing is performed.

5.2. Sample Receipt and Entry

5.2.1. Sample Receipt

Samples can be received at the laboratory 24 hours a day, 7 days a week, 365 days of the year. Receipt can occur in one of three ways:

- Lancaster Laboratories courier services (i.e., Transportation Department)
- Personal delivery
- Commercial courier

All samples received for testing are delivered to the Sample Administration Department immediately upon arrival. This group is responsible for the unpacking and organizing of the samples. This process includes checking custody seals if present, paperwork agreement, signing the chain of custody, recording cooler temperatures, documenting the condition of containers, accounting for all sample bottles, and observing any safety hazards, and reporting any problems to Client Services for communication to the client. This receipt process is documented.

5.2.2. Sample Entry

As soon as practical after sample receipt, all samples are entered into our laboratory information management system (LIMS). Samples awaiting log-in are stored in temporary holding areas, at appropriate storage conditions to maintain sample integrity. If there is doubt about the suitability of items received or if items do not conform to the description provided or the testing required is not clear or specified, the client is contacted and the conversation documented.

At the time of entry, the LIMS assigns a unique Lancaster Laboratories' sample number to each sample. This number is sequentially assigned and a label is generated and is attached to the sample container.

Samples are tracked to the minute upon arrival. This allows the client to see exactly how long it took the samples to pass through receipt, unpacking, and entry.

A sample acknowledgement prints from the LIMS per sample delivery group (SDG). This notification is sent to the client to confirm sample receipt and entry on the day following sample log-in. Internally, appropriate personnel audit all applicable sample entry and client paperwork.

Uncontrolled Copy

5.2.3. Sample Preservation Check

Support personnel check and document preservation of non-volatile liquid samples after the samples have been entered into the LIMS and before they are placed into storage. Any checks of volatile samples are performed at the time of analysis and documented.

5.2.4. Sample Rejection Policy

Any time a sample is received in a condition that does not meet the method requirements, the condition of the sample is clearly documented on a sample administration documentation log or sample problem form. These forms are forwarded to the project manager and the client is contacted to discuss the best course of action. The client is given the option to resample or have the sample analyzed and reported with a comment.

5.3. Sample Identification and Tracking

A sample label is generated for each sample and; in addition to the assigned Lancaster Laboratories' sample number; the following information is printed on the label: client name, sample identification assigned by the client, sample collection information, storage area, bottle code ID, analyses requested, and any applicable notes to laboratory personnel.

To ensure accountability of results, the unique sample number assigned is used to identify the sample in all laboratory data documentation, including notebooks, instrument printouts, and final reports. The sample number is also used to identify additional containers of the sample that are created during sample preparation and analysis (e.g., subsamples, extracts, digests).

5.4. Sample Storage

After sample entry, samples are placed in an assigned and identified storage location until needed for analysis. Room temperature, refrigerated, and freezer storage are available and samples are stored in accordance with regulatory, method, or client direction. The LIMS is used to assign storage locations, which assists in the orderly storage of samples. Sample storage locations are secured and monitored for accurate temperature control.

The central locked storage facility contains 3430 square feet of refrigerated space, including 2740 square feet equipped for automated sample retrieval. Samples are stored in the laboratory's automated storage and retrieval system (ASRS) or other assigned storage locations (separate volatiles areas) within the laboratory until completion of all analytical work.

When a sample is scheduled for analysis, the analyst retrieves it from the storage area. To maintain the integrity and security of the sample(s), the amount needed for analysis is removed and the sample(s) returned to storage as soon as possible

5.5. Sample Return/Disposal

Samples remain in the storage area following analysis until the testing results have been authorized and the analysis report has been generated. On a regular basis, a list is printed from the LIMS that summarizes samples that can be removed from the storage area. Samples are either returned to the client or disposed of in accordance with local, state, and federal regulations.

Uncontrolled Copy

Due to the variety of waste generated at Lancaster Laboratories, several general categories of wastes and waste streams have been identified. Identification of waste occurs through information provided by the client, historical information, and/or analytical testing. Lancaster Laboratories uses a sophisticated, computerized sample management system, which includes programming to assist in the identification of hazardous wastes at time of discard.

For reasons of environmental liability, client confidentiality, proprietary product formulation protection, etc., wastes generated by Lancaster Laboratories are disposed of via incineration at EPA licensed facilities. The three exceptions include bulk neutralized acid waste, COD analysis waste, and lab pack waste containing mercury. None of these exceptions involve containers with client information.

5.6. Chain of Custody

Samples being tested for litigation require locked storage and documentation of the time and personnel responsible when the sample was not in storage. Procedures to define these activities are in place and include the following:

- A chain-of-custody document is initiated for each bottle type submitted by the client.
- The chain of custody is signed each time the sample is stored, removed from storage, or changes hands.
- Clients requesting internal chain-of-custody documentation receive the completed forms after the analysis is complete.

5.7. Representativeness of Samples

Each analytical method provides specific procedures for ensuring that a representative aliquot of the sample is used for testing. These procedures include shaking water samples and mixing solid samples. Analysts are instructed in sampling techniques that prevent contamination of samples.

6. TECHNICAL REQUIREMENTS – TRACEABILITY OF MEASUREMENTS

6.1. Reagents and Solvents

The reliability of our analytical results can be directly affected by the quality of reagents used in the laboratory. Procedures are in place to address labeling, storing, and evaluation of these materials. Reagents and solvents include acids, bases, indicators, buffer solutions, colorimetric solutions (CS), test solutions (TS), and volumetric solutions (VS). *The Lancaster Laboratories' Chemical Hygiene Plan* provides safety information in regard to the storage and handling of laboratory chemicals.

Each analytical method includes a list of reagents needed to perform the test. Reagents are fully described, including chemical name, purity, and description of preparation. Where applicable, shelf life and storage conditions are also listed. The laboratory is responsible for checking that new supplies meet the method requirements. These checks are documented and maintained.

Uncontrolled Copy

Departmental management ensures that an adequate inventory of reagents needed to perform testing is maintained. Reagents received at the laboratory funnel through the Shipping and Receiving Department and deliveries are verified and labeled with the date of receipt. Large volume reagents (e.g., solvents, acids) are stored in a building outside of the laboratory until needed for use.

In addition to the name and concentration of the reagent, all reagents are labeled with the manufacturer/vendor, storage conditions, the date opened, and an expiration or re-evaluation date. Before using any reagent, the analyst must ensure that the material was properly stored and labeled. If a reagent has passed its expiration date or shows signs of deterioration, the material is not to be used in the laboratory and must be discarded. If a re-evaluation date is reached before a reagent is completely consumed, the reagent will be inspected by physical observation for signs of degradation. Physical signs include, but are not limited to, color changes, clumping or other texture changes for solids and formation of precipitate in solutions. This evaluation is performed by an experienced chemist or microbiologist.

Subsequent reagent solutions or mixtures prepared at the laboratory are fully documented in a logbook and labeled to include: unique name, concentration, date prepared, name of analyst preparing or reference to the logbook, storage conditions, and expiration/re-evaluation date. The information recorded allows these solutions to be traced to the original stock solution.

All reagent certificates and MSDSs are retained by the laboratory.

6.2. Media

Within the microbiology laboratory, procedures are in place to address preparation, labeling, storage, expiration, documentation, and quality/sterility evaluation requirements for these materials. These procedures are described in Appendix K of this manual.

6.3. Calibration Standards

Written calibration procedures are required, where applicable, for all instruments and equipment used in the laboratory. The source and accuracy of standards used for calibration purposes are integral to obtaining quality data. Requirements for calibration are provided in each analytical method including specifications for the standards used. Calibration measurements made by the laboratory must be traceable to national standards of measurement (e.g., NIST) where available. C of As are maintained for each material, as applicable.

Standards are usually purchased from commercial supply houses either as neat compounds or as solutions with certified concentrations. The accuracy and quality of these purchased standards is documented on a C of A and these certificates are maintained on file in the laboratory. Upon receipt at Lancaster Laboratories, material must be labeled with a date of receipt and stored appropriately.

Most solutions and all neat materials require subsequent dilution to an appropriate working range. Records of all standard preparations include the dilution(s) made and a reference to the original and any intermediate mixtures. Solutions are labeled according to laboratory procedures and assigned unique names or code numbers that provide traceability to the original components and stored appropriately. Each new preparation of standard is tested for integrity by comparison to standards from another source or previously prepared solutions. Standards are not to be used in the laboratory past their expiration date.

Uncontrolled Copy

6.4. Equipment and Instrumentation

The laboratory is equipped with all equipment and instrumentation required for testing the scope of work which it supports. All equipment and instrumentation is maintained in proper working order. A master list of our equipment is maintained by our accounting department and includes the date that the instrument was received and the condition at receipt (new v. used). Our major equipment capabilities are summarized within Appendix F of this manual. In addition, we have numerous other instruments including pH meters and analytical balances along with support equipment such as ovens, incubators, muffle furnaces, centrifuges, etc.

6.4.1. General Requirements

- Equipment/instrumentation is assigned a unique designation. This unique number or system identification is used to track the piece of equipment within data documentation.
- An equipment logbook is established in conjunction with installation and is readily available to document all incidents that pertain to the equipment as they occur.
- All test, measuring, and inspection of laboratory systems, equipment, and instrumentation used at Lancaster Laboratories is routinely calibrated and maintained in accordance with applicable standard operating procedures.
- A member of the technical group, or designated individual, performs routinely scheduled maintenance and calibration of laboratory equipment as required by laboratory procedures. These activities are documented.
- If appropriate standards or expertise for calibration or maintenance are not available in-house, the operation is conducted by an outside service firm. Certificates or other data generated by the service firm are reviewed by applicable Lancaster Laboratories personnel to verify acceptability. This information is maintained on file.
- All equipment taken out of service is tagged "DO NOT USE". The following minimum information is documented:
  - Date taken out of service
  - Employee who took the equipment out of service
  - Reason for tag-out
- The date that the instrument is returned to service, the corrective action taken, and performance checks performed must be documented.

6.4.2 Standard Operating Procedures

Information regarding operation, maintenance, and calibration of equipment and instrumentation are found in respective SOPs. The procedures include a routine schedule for preventive maintenance and calibration as applicable, along with acceptance criteria and remedial action to be taken in the event of failure. These procedures are maintained in the document control system and reviewed on a regular basis to verify they remain current and accurate. Equipment manuals are also available to provide additional information in regard to operation and maintenance.

Uncontrolled Copy

6.4.3. Maintenance

- Equipment maintenance is performed as either a preventive or corrective operation.
- Preventive maintenance procedures and schedules are developed for each piece of equipment, where applicable. Preventive maintenance operations are performed by an analyst, equipment maintenance specialist, or contracted (manufacturer's representative or service firm personnel). Documentation is maintained for the procedure(s) performed as part of the preventive maintenance operation. It is the responsibility of departmental management to ensure that a preventive maintenance schedule is addressed by a procedure where appropriate and is followed.
- Corrective maintenance is performed by an analyst, equipment maintenance specialist, or contracted (manufacturer's representative or service firm personnel) in response to indications of equipment malfunctions. The unit must be clearly tagged as out of service. All corrective actions taken to bring the unit back into service are documented. After repair, a notation is made in the logbook to note whether the function has been fixed. Calibration activities are performed as applicable, before the instrument is placed back into service.
- A supply of commonly needed replacement parts is maintained by the laboratory.
- A preventive maintenance schedule for major instruments is given in Appendix G. Maintenance of equipment used in microbiological testing is documented in Appendix K of this manual

6.4.4. Calibration

- Calibration is the establishment of, under specified conditions, the relationship between the values/response indicated by a measuring instrument or system and the corresponding known/certified values associated with the standards used. Some types of calibrations are performed with a set frequency (e.g. daily), while others provide intermediate checks to ensure that the instrument response has not changed significantly.
- All measuring and testing equipment having an effect on the accuracy, precision, or validity of calibrations and tests are calibrated and/or verified on an on-going and routine basis. Methods for calibration of instruments and equipment vary widely with the nature of the device and the direction given by analytical procedures, departmental procedures, or manufacturer recommendations. Frequency of calibration can also depend on additional factors including ruggedness of the instrument or equipment and the frequency of use.
- Departmental management is responsible for developing or acquiring written calibration procedures for the types of relevant equipment and instruments employed within their area, as applicable. Procedures address the following aspects: description of the calibration method, frequency/schedule for calibration, acceptance criteria, and corrective actions if failure occurs.

Uncontrolled Copy

- Calibration information is recorded in a logbook that is associated with the instrument/equipment and/or a calibration certificate is maintained and/or data printouts are generated to document the activity.
- Calibration measurements are traceable to national standards of measurement (e.g., NIST) where available. Physical standards, such as NIST certified weights or thermometers, are re-certified on a routine basis. Calibration certificates are maintained on file, where applicable, to indicate the traceability to national standards of measurement. These physical standards are used for no other purpose than calibration.
- Calibration failures are documented in the logbook for the instrument and/or within the data printouts from the instrument. Management personnel perform an evaluation and review of failures and assess any potential impact the failure might have on previously generated data. Lancaster Laboratories utilizes "real-time" controls to ensure the accuracy of the data. These controls are used to assist in assessing the impact of the situation.
- After repair, adjustments, or relocation that could affect instrument response, calibration/verification activities are performed, as applicable, before the unit is returned to service.
- Analytical data is not reported from instrumentation or equipment that fails to meet calibration requirements.
- A summary of the calibrations for most major equipment is given in Appendix H.
- Procedures for calibration of equipment used in microbiological testing are documented in Appendix K of this *Quality Policy Manual*.

6.5. Computerized Systems and Computer Software

6.5.1. Computer Usage

Lancaster Laboratories provides computer equipment for employees to use as a tool in performing their work. Computer equipment is the property of LLI and used in accordance with defined terms and conditions. Our goal is to provide standard hardware and software that meets the needs of the user. The majority of desktop PCs in use are standardized using cloning software.

6.5.1.1. Physical security of computer systems – It is company policy to protect computer hardware, software and data documentation from misuse, theft, unauthorized access and environmental hazards. The corporate computer area and computer "Hot-Site" is locked and requires identification/building card access. All vendors, contractors, or other visitors must be escorted into this area. Controlled access of the laboratory buildings is outlined in Section 3.2.

6.5.1.2. Passwords – Passwords are important for the security of company data and resources. Lancaster Laboratories' primary network operating system is Windows and each employee must have a user ID and password combination to access the system. Other computer systems within the Environmental Division also require a user ID password combination for access. The following procedures apply regardless of what system(s) is being utilized:

Uncontrolled Copy

- Passwords must be kept confidential
- Users must log-out of a system when not in use to prevent unauthorized access.
- Forgotten passwords can only be reset by the Computer Systems Department or by an appropriate System Administrator.
- Network passwords automatically expire every 90 days. The computer prompts a user to change the password when the expiration date nears.

6.5.1.3. Computer viruses – Lancaster Laboratories centrally and continuously monitors the computer network for computer viruses. Employees are prohibited from using the company's computer equipment to propagate any virus. Anti-virus software is employed to detect viruses on the Windows network. A notification is sent when there is a particularly dangerous or virulent data destructive program that employees need to be aware of. However, employees are reminded to always be cautious and observant even if there are no current warnings. Employees must report any virus concerns to the anti-virus administrator or Computer Service Management as soon as possible. Employees who share files between their home computer and the laboratory should install anti-virus software on their home computer. If an employee does not have such software, the laboratory can suggest various no-cost anti-virus software products.

6.5.1.4. Internet and e-mail system – The e-mail system is used primarily for Lancaster Laboratories' business purposes. The *Lancaster Laboratories' Personnel Manual* provides additional information in regard to system usage. Employee access to the Internet is restricted to those employees who have a business need for it. All employees have access to e-mail. Access to the internet is configured through a user's Windows network account. All internet and e-mail activity is subject to monitoring. All messages created, sent or received over the internet are the property of LLI and can be regarded as public information. E-mail and website filtering software is utilized.

6.5.1.5. Lancaster Laboratories' Intranet (LabLinks) – The Lancaster Laboratories' Intranet is designed to be a useful tool for employees to acquire company information and to provide a company communication system. The *Lancaster Laboratories' Personnel Manual* provides additional information in regard to usage.

6.5.1.6. Software policy

- Copyright laws protect software, and Lancaster Laboratories' intent is to abide by all software agreements.
- Software purchases must be formally requested and approved by management and/or validation personnel, as necessary.
- All software is used in accordance with applicable license agreements.
- Employees are not to install any software on computer(s) unless authorized by the Computer Systems Department.

Uncontrolled Copy

- Software upgrades must occur in accordance with applicable change control procedure
- Employees must not give software to outsiders (e.g., clients, contractors), unless approval is granted by management.
- Users must not make copies of any licensed software or related documentation without permission. Any user that illegally reproduces software is subject to civil and criminal penalties including fines and imprisonment.

6.5.1.7. Computer system backup, data restoration, and data archival – Mission critical data is stored on several computers throughout the laboratory. These computers are connected through the local area network. Selected files on these computers are backed up using an enterprise-level backup software program. The objective of this backup is to have the ability to restore data after a total loss (e.g., theft, fire, natural disaster). Procedures are in place to perform data backups and restores.

6.5.1.8. Remote access to computer systems – Employees are able to remotely connect to the laboratory computer systems through an encrypted (SSL) login. When logging in, users are authenticated with their Windows Active Directory account and password.

6.5.2. System and Software Verification – Before a new computer system or significant modification of an existing system is implemented in our laboratory, it is necessary to meet the following documents:

- Requirements documents – Describe the required system functionality and specifications
- Design documents – System overview, screen design, report layout, data description, system configuration, file structure and module design
- Testing documentation for system development/verification – Structural testing of the internal mechanisms and user testing of the installation and system qualification
- Standard operating procedures and/or manuals

6.5.3. CROMERRR – The laboratory has reviewed and evaluated EPA's proposed Cross-Media Electronic Reporting and Record-keeping Rule. We monitor the rules progress; and the laboratory will wait to make any definitive changes in response to the rule until it is clear what direction the agency plans to take and within what timeline. Working with FDA's 21 CFR Part 11 regulation in our Pharmaceutical Division has given the laboratory a head start in understanding the demands of CROMERRR.

Uncontrolled Copy

6.6. Change Control

Procedures are in place to define how to maintain processes, instrumentation, equipment, computerized systems, and computer software in a validated or controlled state through a plan of change control. Successful changes require a thorough evaluation and testing for potential consequences prior to implementation. Planning, authorizing, testing, and reviewing of proposed changes are documented throughout the change process. Changes are planned or could be made in response to an emergency situation. The following "general" elements apply to changes, as appropriate:

- Request to perform a change
- Evaluation of a change
- Authorization of a change request
- Preparation for an authorized change
- Execution and testing of the change
- Documentation of the change
- Approval of the change
- Change implementation and follow-up (Documentation is required to summarize the change and to reflect the outcome of the change. Formal approval of the change is performed by designated responsible individuals and QA.)

6.7. Labware Cleaning

Dedicated washroom personnel are in place to support the laboratory operations in regard to labware preparation, washing, rinsing, and drying. Labware can include, but is not limited to glassware, plasticware, utensils, and pipettes. Procedures are in place to outline the washing process for each type of labware. Most labware is cleaned using a Miele glass washing machine. Some labware is still washed by hand and either air-dried or dried in specifically designed ovens.

Most of the labware used in the laboratory is "common or non-dedicated" labware (common to a department), but some of the labware used in the laboratory is identified as "dedicated" labware. Dedicated labware is exclusively used for certain analyses. Examples of dedicated labware include glassware used for MBAS and Ortho (acid washed) and "oils" glassware. This labware is isolated and cleaned only with "like" labware.

All glassware is type A and 100% visually inspected for breakage (e.g., cracks, chips), cleanliness, and dryness before being returned to the laboratory for use.

Generally, each test has controls in place to ensure that results were not negatively affected by unclean labware. These controls include blanks to detect positive interferences and controls to detect negative interferences.

Uncontrolled Copy

7. PURCHASING EQUIPMENT AND SUPPLIES

7.1. Procurement

It is the responsibility of management personnel within each department to ensure that the appropriate supplies are available and/or ordered with sufficient lead-time to perform analytical testing or to provide support to the testing areas. The individual technical departments have trained personnel who enter the supply order into the company's requisition software system. The selection of these products is based on technical input at the analyst level and authorized by technical departmental management. The Purchasing Department maintains an ordering system in which purchase requisitions are managed. Common laboratory items (e.g., beakers, flasks, reagents) are ordered directly through the Purchasing Department. Purchase orders over a specified dollar amount require verification from the appropriate member(s) of the Executive Management Group before an order can be placed.

Upon receipt of an order, the Purchasing Department checks the order to ensure that all items were received as specified. Products that have specific storage requirements are taken to the technical area upon receipt. It is the technical area's responsibility to ensure that the product is stored in the appropriate manner. Any checks on the quality of the materials received for use in a specific test are the responsibility of the laboratory using them. This is based upon the experience of the laboratory with the usability of the product. Generally, each test has controls in place to ensure that test results are not negatively affected by the materials.

Any problems encountered when using a material in the laboratory must be brought to the attention of the Purchasing Department and/or Quality Assurance as applicable, to ensure that follow-up and corrective action occur.

7.2. Supplier Evaluation

Procedures are in place to evaluate vendors who supply us with: new equipment, instrumentation, computerized systems and computer software; commercially purchased glassware, including sample bottleware, reagents, chemicals, solvents, gases, media, and standards; and contracted and subcontracted services.

Lancaster Laboratories strives to ensure our suppliers continually improve their quality systems and we reserve the right to purchase from suppliers of our choice in order to best fulfill the needs of our clients and our business. When directed by a client to purchase from a specific supplier, we will do so. In this instance it is the client's responsibility to "qualify" the specified supplier. We attempt to purchase from businesses that we have an established purchase history or have previously acquired information regarding the supplier's quality programs.

Lancaster Laboratories does not evaluate every supplier. Risk assessment is taken into consideration when making this decision. The risk assessment analysis includes system, material, services, and number of samples or operations the purchase may affect or support. Evaluations are not required for computer operating systems, utilities, toolsets, or systems software. They also are not required for any off-the-shelf configurable software package that has an extensive market performance history (e.g., Microsoft Word, Excel, Access).

Additional quality systems are also in place within the laboratory to further verify and support the materials used:

Uncontrolled Copy

- C of A for every lot of purchased prepared microbiological media and for purchased chemicals, where available, are reviewed and maintained on file.
- For many chemical analyses (e.g., HPLC, GC, IC) a blank is routinely run which serves as real time suitability testing of the reagent being used.
- Microbiological testing often employs positive and negative controls, which serve as real time control checks.

8. ANALYTICAL METHODS

8.1. Scope of Testing

Samples are analyzed in accordance with client-supplied methodology, official published methods, standard methods, or validated in-house methods. We recognize the importance of providing verifiable results and, therefore, use methods accepted and approved by a broad range of federal and state regulatory agencies. In order to meet the needs of our clients as well as regulatory agencies, the laboratory sometimes needs to support different versions of the same method (i.e. SW-846 8081A and 8081B). The laboratory can also assist in developing and validating analytical methods for specific products and matrices. All methods submitted for our review, as well as all analytical results, are considered confidential.

The laboratory performs a wide variety of environmental testing in support of the Safe Drinking Water Act (SDWA); Clean Water Act (CWA); Resource Conservation and Recovery Act (RCRA); Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA/Superfund); and the Clean Air Act (CAA). Standard methods approved by ASTM are also used in testing. Potable water, wastewater, soil, sediment, sludge, oils, biota, tissue, soil gas and air are among the matrices typically analyzed.

Our areas of expertise include:

• Gas Chromatography (GC) • Gas Chromatography/mass spectrometry (GC/MS) • High Performance Liquid Chromatography (HPLC) • High Resolution Gas Chromatography/High Resolution Mass Spectrometry (HRGC/HRMS) • Liquid Chromatography/mass spectrometry/mass spectrometry (LC/MS/MS) • Ion Chromatography (IC) • Purge and Trap • Selected Ion Monitoring (SIM) • Atomic absorption spectrophotometry (CVAA) • Cold vapor atomic fluorescence spectrometer (CVFA) • Inductively coupled spectrophotometry (ICP) • Inductively coupled spectrophotometry/mass spectrometry (ICP/MS) • Autoanalyzer • UV/VIS spectrophotometry • Fourier transform spectrophotometry (FTIR)	• TOC Analyzer • Water Quality and inorganic analysis • Summa Canister & Tedlar Bag Air analysis • Microbiology • Full range of petroleum analysis/UST (including state-specific methods such as AK-101, AK-102, AK-103, CT ETPH, FL PRO, MA VPH, MA EPH, NW-DX/GX, NW-HCID, NY STARS, OA-1&2, QAM 025, TX-1005, TX-1006, WI DNR GRO, WI DNR DRO) • Method development • Data Package deliverables • Electronic data deliverables • QAPP development • Consulting services

Uncontrolled Copy

A list of tests covered under the laboratory's NELAP accreditation can be found in Appendix I. A complete list of the tests routinely performed by the laboratory can be found in the *Schedule of Services*.

8.2. Analytical Test Methods

Each laboratory is required to establish and maintain an analytical methods manual containing current copies of all the methods used for standard testing. The sources for these methods include the most recent versions of these compendia:

- Test Methods for Evaluating Solid Waste, SW-846
- Standard Methods for the Examination of Water and Waste
- Code of Federal Regulations, Chapter 40
- EPA 100 through 600 and 1600 series methods
- Contract Laboratory Program Statement of Work

Most of the test methods used are re-written into a laboratory standard format, which provides consistency in content and allows the analysts to locate the information they need quickly. Procedures are in place to define the format, required approvals, and the control system for these method documents. The format requirements include:

- Uniquely assigned method number, which is used extensively for scheduling and documentation purposes.
- Reference to the original source of the method (e.g. SW-846)
- Scope
- Basic Principles
- Apparatus and Reagents
- Personnel Training and Qualifications
- Safety and Waste Disposal
- Detailed procedure (including any method modifications)
- Calculations
- QA/Quality Control
- Revision Log
- Approval signatures from technical, management, and QA personnel

Analytical methods are maintained as controlled documents to ensure that analysts are always working with the most current version and are reviewed periodically for accuracy.

8.3. Client Supplied Methods

Most of the client-supplied method requirements presented to us involve achieving specific quality control criteria or limits of quantitation using standard EPA methods. These requirements would be communicated to the appropriate technical groups prior to the project start up. Each technical group would evaluate the scope of work and the requirements to assure the criteria can be met using the standard EPA method. They would also monitor the data to assure the criteria are met throughout the project. A client service representative would notify the client if there is a more appropriate method available or if the client's criteria could not be achieved on a certain sample matrix (i.e., due to matrix or dilutions). Occasionally, we are asked to transfer a non-standardized method from a client into our lab or to develop a new method, when one is not available. In the case of a method transfer, we would set up the client's method and perform some initial

Uncontrolled Copy

evaluation. After the initial evaluation, we may make recommendations on how to improve method performance. If the method appears to be adequate, we would determine linearity, specificity, precision, accuracy, LOD, and LOQ by performing calibrations, analyzing method blanks, and carrying out method detection limit and quad studies. In the case of method development, we would work with the client and/or data user to determine the level of validation required ensuring that the method meets its intended purpose. In addition to the elements above, we also determine standard and sample stability and robustness depending on the scope of the project. Typically, a standard operating procedure would be written and submitted to the client along with the results of the validation. These steps would be completed prior to analysis of field samples. Data related to the set up of the method would be archived at Lancaster Laboratories.

8.4. Method Validation

Before new or revised analytical methods are authorized for routine use in the laboratory, validation data is required to demonstrate that the method and analysts performing it are capable of meeting data quality objectives for precision and accuracy. A procedure is in place to outline this process.

Many methods published by USEPA include instructions for performing an initial demonstration of capability, which typically consist of determining the method detection limit and analyzing fortified samples in quadruplicate. This demonstration is performed and compared to acceptance limits for precision, accuracy, and detection limits, when available.

Methods that do not include specific validation requirements are validated by analyzing fortified samples or standard reference materials in replicate. The results of these analyses are used to assess accuracy and precision. Results of validation studies are documented and subject to review and approval.

8.5. Procedural Deviations

Analysts are required to follow a documented method for all tests performed. Procedures are in place to ensure that deviations from analytical methods are documented, approved, and justified in an appropriate and consistent manner (Note: Deviation from the OH EPA approved SOPs is not permitted). We classify method deviations as either being a planned deviation or an unplanned deviation. "In general," the following information is captured to document both types of situations:

- Description of the deviation
- Reason or justification for the deviation
- Impact the deviation had on the testing
- Signature/date of analyst performing test involved
- Signature/date of LL director approving the deviation
- Signature/date of client approval, if necessary

Deviations to written procedures are documented in raw data notebooks or through the ICAR (Investigation and Corrective Action Report) system. Both types of documentation require management review and approval.

Uncontrolled Copy

9. INTERNAL QUALITY CONTROL CHECKS

9.1. Laboratory Quality Control Samples and Acceptance Criteria

Quality control (QC) samples are analyzed with each batch of samples to demonstrate that all aspects of the analysis are in control within established limits of precision and accuracy. As required in the procedure on written methods, each analytical method specifies (or cross-references another procedure) the type of QC sample, frequency of analysis, acceptance criteria for QC sample results, and corrective action to be taken if QC sample results fall outside of the *acceptable range*.

The types of QC samples and the information each provides are discussed in the following paragraphs.

Quality control checks used for microbiological tests can be found in Appendix K of this *Quality Policy Manual*.

9.1.1. Blanks - A blank is a designated sample designed to monitor for sample contamination during the analysis process. A volume of deionized laboratory water is typically used to monitor water sample analysis, while solid sample analysis blanks consist of a purified solid matrix or just the reagents used in the test. The blank and field samples are treated with the same reagents, internal standards, and surrogate standards and carried through the entire analytical procedure. Ideally, blanks demonstrate that no artifacts were introduced during the analysis process. The specific acceptance criteria for each test is given in the analytical method and is usually based on the required reporting limit.

9.1.2. Surrogates - Surrogates are organic compounds, which are chemically similar to the analytes of interest, but are not naturally occurring, in environmental samples. When required by the analytical method, surrogates are spiked into all the field and QC samples to monitor analytical efficiency by measuring recovery on an individual sample basis. The percent recovery is determined and compared to the acceptance criteria. Acceptance criteria limits are set as required by the method or based on a statistical determination from laboratory data.

9.1.3. Matrix Spikes - A matrix spike sample is created by fortifying a second aliquot of a water or soil sample with some or all of the analytes of interest. The concentration added is known and compared to the amount recovered to determine percent recovery. Matrix spike recoveries provide information about the accuracy of the method in light of the matrix analyzed. The acceptance criteria are given in the analytical method and limits are set as required by the method or based on a statistical determination from laboratory data.

9.1.4. Laboratory Control Samples - Laboratory control samples (LCS) are samples of known composition that are analyzed with each batch of samples to demonstrate laboratory accuracy. The samples either naturally contain the analytes of interest or are clean samples fortified with known concentrations. Laboratory fortified blank is another term used to describe a LCS. Percent recovery is calculated and compared to acceptance criteria, which are set as required by the method or based on a statistical determination from laboratory data.

Uncontrolled Copy

9.1.5. Duplicates and Matrix Spike Duplicates and Laboratory Control Sample Duplicates - A duplicate is a second aliquot of a sample that is treated identically to the original to determine precision of the test. To compare the values for each compound, the relative percent difference (RPD) is calculated by dividing the difference between the numbers by their average. Precision for analytes that are not typically found in environmental samples (i.e., organic contaminants) is determined by analyzing a pair of matrix spike duplicates, defined as two spiked samples and comparing the RPD for the spiked compounds. The acceptance criteria are described as a maximum for the RPD value, which are set as required by the method or based on a statistical determination from laboratory data.

9.1.6. Internal Standards - Internal standards are organic compounds, which are chemically similar to the analytes of interest, but are not naturally occurring in environmental samples. When required by the method, internal standards are added to every field and QC sample after extraction but prior to analysis. Comparison of the peak areas of the internal standards is used for quantitation of target analytes. Internal standard peak area and retention time also provide a check for changes in the instrument response. The acceptance criteria is stipulated in the analytical method.

9.1.7. Serial Dilutions - A serial dilution is the dilution of a sample with sufficiently high concentration by a factor of five to check for the influence of interferents. This QC check is performed for inorganics analyzed by ICP or ICP-MS. When corrected by the dilution factor, the diluted sample result must agree with the original sample within specified limits.

9.1.8 Interelement Correction Standard – Analyzed to verify interelement and background correction factors. A solution containing both interfering and analyte elements of known concentration is analyzed at the beginning and end of each analysis run or a minimum of twice per 8 hours.

9.1.9. Second Source Check - A second source check is analyzed using either the LCS and/or an ICV (Initial Calibration Verification). The second source is a standard that is made from a solution or neat purchased from a different vendor than that used for the calibration standards. For some organic custom mixes, the same vendor but a different lot and preparation is used. This ensures that potential problems with a vendor supply would be evident in the analysis. Some areas of the lab use the continuing calibration verification standards as a second source from the initial calibration.

9.2. Quality Control Sample Frequency and Corrective Action

Each analytical method defines the frequency for the required QC samples. A summary is provided in Appendix J. The corrective action required when a QC result fails to meet the acceptance criteria is also given.

Uncontrolled Copy

The QC acceptance criteria are available to analysts in the laboratory. If the method reference requires the use of specific limits, such as in Contract Laboratory Program methods, the laboratory uses the published limits that are documented as part of the analytical method. Many methods require that each laboratory determine their own acceptance criteria based on statistics from performance of the method. In these cases, the limits are available to the analysts and are entered into the laboratory's computerized QC system described below. Statistically determined acceptance criteria are frequently subject to change as the laboratory recalculates its control limits. Due to their dynamic nature, acceptance criteria are not included in this manual.

The results of all quality control samples are entered into the computer in the same way as the results of client samples. The LIMS compares the individual values with the acceptance limits (statistically determined or method specified) and identifies quality control sample results that are out of specification. If the results are not within the acceptance criteria, corrective action suitable to the situation must be taken. This includes, but is not limited to, checking calculations, examining other quality control analyzed with the same batch of samples, qualifying results with a comment stating the observed deviation, and reanalysis of the samples in the batch. In addition, computerized reports on the results for all quality control analyses including mean and standard deviation are generated monthly. These statistical analyses are used by the QA Department to check for trends that indicate method bias.

The laboratory allows for marginal exceedances based on the number of analytes in the LCS. The exceedances are carefully monitored so that any systemic problems would be identified and corrective action taken. If the LCS is being reported based on the marginal exceedance allowance, a comment is printed on the analytical report.

9.3. Quality Control Charts

Quality control results entered into the computer are used to generate control charts that are plotted via computer and can be accessed at any time by all analysts and Quality Assurance. The system charts results from surrogates, matrix spike/matrix spike duplicates, duplicates, and laboratory control samples. These charts provide a graphical method for monitoring precision and bias over time. They can be used to detect quality problems by observation of patterns. The computerized quality control system is used to report QC data to clients and to collect data for assessment of precision and accuracy statistical limits.

9.4. Measurement Uncertainty

(ISO 17025) "All uncertainty components which are of importance in a given situation shall be taken into account using appropriate methods of analysis" (5.4.6.3). This means the laboratory must determine the uncertainty contribution of all steps in the testing process such as equipment, calibration, standards, reagents, preparation, cleanups, etc. Since, in most methods, the laboratory control sample (LCS) goes through the entire process of preparation to analysis; all factors that would contribute to uncertainty is evident through the LCS results. LCSs are performed with every batch of samples where appropriate for the method.

Measurement uncertainty is calculated as two times the standard deviation of the LCS recoveries for the group and date range of data points selected for all applicable methods. This is reported as a percentage.

Tests that do not have LCSs (e.g. TCLP and paint filter test), are evaluated on a case-by-case basis by taking into account the uncertainty of each of the steps taken to perform the test.

Uncontrolled Copy

Reports for uncertainty are generated and submitted to QA on an annual basis. At this point, it is not necessary to apply or report the uncertainty determination with sample results. When a client requests the measurement uncertainty it is applied by multiplying the determined analyte concentration by the uncertainty percentage.

10. ASSURING QUALITY OF TEST RESULTS

10.1. Data Management

At a minimum, data management is initiated when Lancaster Laboratories receives the samples from the client. More often the process begins with client communication of their needs and requirements for a specific project and/or testing. The client service representatives/project managers are responsible for entering the information in the sample set up function of the LIMS. Upon receipt of the samples the unique tracking number is generated based on this information. At this point, computer technology becomes an integral part of tracking the samples through laboratory operations. The flow of data from the time samples enter the laboratory until the data is reported is summarized in the following table:

Uncontrolled Copy

Sample and Data Flow

Action	Personnel Involved
Sample received at Lancaster Labs • Unpacked and reconciled against the client paper work or Chain of Custody • SA Documentation log completed	Sample Administration
Sample is entered into sample management system • Lab ID number assigned • Analyses entered • Chain of custody started • Storage location assigned • Electronic record of sample number • Labels generated • Acknowledgement printed (record of samples received and analysis entered)	Sample Administration
Sample stored in assigned location (refrigerator, freezer, etc) • Electronic record of sample #, bottle code, and location	Sample Support
Acknowledgment sent to client	Sample Administration
Sample removed from storage for analysis • Electronic requisition of sample number by bottle code • Necessary aliquot taken • Sample returned to storage	Technical Personnel
Analysis is performed according to selected analytical method • Raw data recorded • Reviewed • Transferred to computer by chemist or technician* (This is tracked by the unique sample number and batch number.)	Technical Personnel
Computer performs calculations as programmed according to methods	Data Processing
Second chemist or supervisor verifies raw data	Technical Personnel
Generation/signing of reports	Billing and Reporting Group, technical report signers
Data package deliverables are assembled	Data Package Group
Electronic Data Deliverables (EDDs) are generated	EDD Group
Data packages are reviewed prior to sending to client	QA, Data Package Personnel, and Laboratory Management
Data packages are scanned Hard copy of batch raw data is archived Electronic files are backed up and archived	Data Package Personnel, Office Services

*Analyses requiring the chemist's interpretation may involve manual data reduction before entry into the computer.

Uncontrolled Copy

10.2. Data Documentation

Analytical data generated in the laboratory is collected on printouts from the instruments or associated data system or is manually documented in bound notebooks. Analysts review data as it is generated to determine that the instruments/systems are performing within specifications. If any problems are observed during an analytical run or the testing process, corrective action is taken and documented.

Procedures are in place to ensure that all data is traceable, authentic, and complete. The following general requirements outline our system for notebook, logbook, and documentation recording:

- Observations, data, and calculations are recorded at the time they are made and are identifiable to the specific task
- Entries are legible, signed, and dated
- Errors are corrected in a manner that does not obliterate the original entry, initialed and dated
- Blank pages or substantial portions of pages which are left blank are crossed-out to eliminate the possibility of data entry at a later date
- Notebook pages and instrument printouts are signed/dated to indicate second party data review
- At periodic intervals a supervisor or data reviewer checks equipment/instrument logbook entries and temperature recordings for completeness, legibility, and conformance to procedures.
- At a minimum, the following information is recorded as part of data documentation:
    - Date of analysis/operation
    - Signature/date of analyst performing test/operation
    - Identification of client sample(s) and material(s) analyzed
    - Materials, reagents, standards used to perform the testing/operation
    - Method used to perform testing/operation (including version number and/or effective date)
    - Equipment/instrumentation used to perform testing/operation
    - Calculations and how they were derived
    - Departures, planned or unplanned, from the analytical method
    - Signature/date of person reviewing data documentation
- For computer generated data, the following information is recorded:
    - Sample(s) analyzed/operations performed
    - Date of analysis/operation
    - Unique instrument identification
    - Name/date of person operating the instrument
    - Name/date of person reviewing data
    - Any manual notations or interpretations made on instrument printouts are signed, dated, and reviewed

Uncontrolled Copy

10.3. Data Calculations

Most instruments either include or are connected to a data system programmed to perform calculations needed to reduce the raw data to a reportable form. All calculations are maintained in the instrument manuals and/or as part of the analytical method.

In many cases, the data from the local instrument system are uploaded directly to the laboratory information management system for review and reporting. This direct upload eliminates the need to retype data and an associated source of transcription errors from the analytical scheme.

Some instruments report data that require application of additional factors before the data is in final form. For example, an extract concentration may be reported by the instrumental data system, but additional dilution and preparation factors may be needed before the result represents the concentration of analyte in the sample. Analysts input these additional factors into the laboratory sample management system, where final calculations are performed.

Analysts type manually collected data, such as pH and titration data, into the laboratory sample management system, which is programmed to perform calculations for final reporting. Documentation of the programming for each calculation performed by the sample management system is maintained.

10.4. Reporting Limits

It is important to ascertain the limit of quantitation that can be achieved by a given method, particularly when the method is commonly used to determine trace levels of analyte. The Environmental Protection Agency has set forth one method for determining method detection limits (MDLs) from which limits of quantitation (LOQs) can be extrapolated which is summarized in a laboratory procedure.

MDLs are verified or determined annually on each instrument and are the basis for the LOQ used in the default reporting format. Because MDLs change each time they are re-evaluated, they are not included in this manual, but are available in each laboratory and available to clients upon request.

The reporting limit used to determine whether a result is significant and reported as detectable is dependent upon agency and client requirements. A variety of formats are available and include use of the MDL, LOQ, method specified limits, and project specific limits. The MDL and LOQ for each analyte are programmed into LIMS for reporting purposes.

10.5. Data Review

Final review and verification of the data is performed by a trained analyst using the sample results and quality control information entered into the laboratory sample management system. A second analyst or supervisor knowledgeable in the test, other than the employee responsible for performing the test, reviews the data. The review includes checks for correct transcription, calculations, passing calibrations, and quality control results that meet acceptance criteria. Any errors identified during this stage are corrected and reviewed with the responsible person.

After determining that all necessary requirements for valid data are met, the reviewer electronically approves the data by changing the status of the data from "complete" to "verified". The computer is programmed with a list of approved reviewers for each test, and the system is password protected to ensure that only qualified individuals verify the data.

Uncontrolled Copy

10.6. Data Qualification

Data qualifiers are used to provide additional information about the results reported. The most typical use for data qualifiers is for results that fall below the quantitation limit, in the region where it becomes more difficult to distinguish a positive result from the background instrument signal. The data systems used to generate and report results are programmed to flag values in this range as estimates.

Other qualifiers are applied to advise data users of any validation issues associated with the data. The laboratory makes every effort to meet all of the requirements for generation of data. Occasionally, generation of data that does not meet all the method requirements occurs due to sample matrix or other analytical problems. If the test can not be repeated or reanalysis would not yield better quality data, qualified data is reported. Qualifiers can be in the form of comments on the analytical report or flags applied to the results.

10.7. Data Reporting

When all analyses are completed, reviewed and verified, a report is generated. The client receives a copy of the report containing the results of the analysis, plus comments added by the analyst, where necessary. To avoid ambiguity in interpreting results, the reverse side of the client's copy of the report contains an explanation of all symbols and units used in reporting data. Copies of reports and associated supporting raw data are retained in our archives. The report contains the signatures of the people who reviewed the final report. Since each result was previously reviewed, the final report review provides a last look for obvious typographical errors and ensures that the results are consistent with each other. Personnel responsible to review and sign reports are noted in the key personnel list provided in Appendix C.

Lancaster Laboratories offers a variety of data levels and formats, from a basic report of results only, to a comprehensive data package of quality control information and raw data. The client and any agency involved direct the selection of report type. A summary of report formats and data packages types is provided in the laboratory *Schedule of Services*. Various electronic formats are also available formatted to client-specified file structure and sent via e-mail, direct upload, web-site access (LLabWeb), or common courier.

Client confidentiality of LLabWeb data is ensured by the use of a secured firewall internet environment coupled with the use of a user ID and password to gain login access to the system. User accounts are configured to only allow access to specific data associated with the user's Lancaster Laboratories business account number.

Amendments to a final report after issue are in the form of an additional document or data transfer and will include a reference to the original report. When a completely new final report is required, it is uniquely identified and includes a reference to the original report it replaces. A letter is sent with each revised report that clearly identifies the reason for the revision.

Uncontrolled Copy

10.7.1. Reporting the Results

Analytical reports are printed with a cover page that summarizes all samples in that group. This page lists the Lancaster Laboratories' assigned sample number and the corresponding client description. The cover page identifies the laboratory contact person's name and phone number if there is a question about the report. Within this package, each page is uniquely identified and paginated. Analytical test results for methods listed on the laboratories' accreditation scope meet all requirements of NELAP accreditation and ISO 17025 unless noted otherwise. Ohio EPA VAP requires that a signed, notarized affidavit accompany each analytical report.

10.8. Data Storage, Security, and Archival

Lancaster Laboratories has documented procedures and instructions for the identification, collection, access, indexing, filing, storage, maintenance, and disposition of data records. Records are in the form of hard-copy paper records, electronic data files, magnetic tape, and CD-ROMs.

Data records are legible and identifiable to the samples or operations to which they apply. Lancaster Laboratories maintains records to demonstrate conformance to specified requirements and the effective operation of the quality system. Records are stored and maintained in such a way that they are readily retrievable in facilities that provide a suitable environment to minimize deterioration or damage and to prevent loss. Retention time for records is in accordance with specific procedures or instructions. At the end of Lancaster Laboratories defined archival period, the client is notified if requested and asked to provide the laboratory with instruction regarding whether the data on file are to be disposed of or whether the documentation is to be returned to the client.

If specified in client contract(s), archived records are transferred according to their instructions in the event of a change in laboratory ownership or if the laboratory go out of business. If not specified by the client, the sale agreement must require that archived records be maintained as scheduled by the new owners. In the case of bankruptcy, appropriate regulatory and state legal requirements concerning laboratory records must be followed.

The laboratory maintains all documentation which is necessary for historical reconstruction of data:

- Analysis reports
- Data notebooks
- Data logbooks
- Instrument printouts
- Correspondence and client files
- Instrument and equipment logbooks
- QA records
- Corporate documents
- Electronic records

Uncontrolled Copy

11. AUDITS AND INSPECTIONS

11.1. Internal Quality Assurance Audits

The QA Department, which is independent of laboratory activities, performs routine and on-going system, traceability, and observation audits to objectively review current systems, operations, and procedures as well as automated data integrity audits of electronic data records. The goal of the audits is to ensure that the quality system activities are effective and in compliance with regulatory, including NELAP and ISO 17025, as well as internal policies and procedures. Audits are documented and tracked in a QA database.

Audits are scheduled and conducted following a predefined schedule, based on criticality of operation and prior audit results, with the goal of evaluating systems and technologies across the operation. If warranted, additional audits are performed to follow up on promised corrective action or areas of concern.

Results of an audit are documented in a report format and distributed to applicable management personnel responsible for the area(s) under audit. Management is responsible to address all non-conformances found during an audit.

Audit reports and responses are circulated to Management to communicate the outcome of the audit and the proposed plan(s) for corrective action, if warranted. If any of the audit findings cast doubt on the validity of the results, the clients must be notified within three business days of the investigation.

All records maintained as part of an audit are kept on file.

On an annual basis, an audit of the QA Department is performed as directed by the company Chairman of the Board. The auditors assigned to carry out this operation are qualified staff members independent of the QA Department.

The specific content and findings of internal audits are not shared with clients.

11.2. Review of the Quality Assurance Program

All levels of management are continually updated on the status of quality and compliance by circulation of pertinent documents. Management review is documented by signatures on the route list, along with any comments or request for additional follow-up. The types of documents circulated real-time include:

- Internal, client, and agency audit reports
- Plans for corrective action
- Proficiency test results
- Investigation and corrective action reports
- Monthly and quarterly QA status reports

Executive management reviews the elements of the total QA program on an annual basis to ensure its continuing suitability and effectiveness in meeting the stated objectives outlined in Section 2.4 of this manual. The evaluation entails review of reports to management, all audit findings, client complaints, laboratory investigations, staff adequacy and training, and projected

Uncontrolled Copy

growth in workload. Patterns or trends in any of these areas are reviewed as a means to continually improve the quality system. This review also includes an evaluation of any audit

findings resulting from the audit of the QA Department. At the conclusion of this quality system review, executive management determines the need to introduce changes or improvements into the quality systems at Lancaster Laboratories. The minutes from the meeting and any recommendations for improvement are documented and a copy is forwarded to the QAU for review and follow-up.

11.3. Good Laboratory Practice Critical Phase Inspections

Any project that is subject to Good Laboratory Practice (GLP) regulations is audited by the QA Department at intervals adequate to ensure the integrity of the study, as required by the regulations. Inspections of a GLP project include direct observation of analysts as they perform various phases of the study. Documentation is reviewed as part of the inspection. The purpose of this type of audit is to ensure that there are no deviations from written methods, procedures, or study protocols.

Results of inspections are documented in a report format and distributed to applicable management personnel responsible for the area(s) under audit. Management is responsible to address all non-conformances found during an inspection. Inspection reports and responses are circulated to applicable Lancaster Laboratories management and an off-site study director, as applicable, to communicate the outcome of the inspection and the proposed plan(s) for corrective action, if warranted.

All records maintained as part of an inspection are kept on file.

11.4. Client Audits

Because clients place great importance on compliance with applicable regulations, data quality, and project requirements, they may audit our facility as assurance that their objectives are being met. QA, Project Management, and the analytical laboratories play a key role in these audits. Visits by clients can range anywhere from a tour (to verify laboratory facilities and instrumentation) to an intensive inspection of technical operations, procedures, regulatory compliance, and/or review of specific project(s).

- Audits are scheduled directly with the Environmental Project Management Group or QA. The request to audit is communicated to all applicable laboratory departments.
- In accordance with our policy on client confidentiality, a client is permitted to review only data and results that apply to their work, or which have been approved by Lancaster Laboratories' personnel.
- An escort (Lancaster Laboratories' employee) remains with an auditor at all times.

The following responsibilities are assigned to the following groups in regard to client audits:

11.4.1. QA Department

- Research previous audit reports and laboratory responses to past deficiencies.

Uncontrolled Copy

- Follows-up with the applicable analytical laboratory areas to ensure follow-up items were completed from the last audit, as necessary.
- Function as an escort during the audit
- Answer questions the auditor has in regard to laboratory and quality systems.
- Take notes of areas where corrective action or suggestions are recommended during the audit.
- Communicate audit issues to management at the completion of the audit.
- Respond to client audit reports.
- Ensure follow-up to cited items are performed in a timely manner.

11.4.2. Project Management

- Work with client to set audit agenda.
- Gather and organize relevant information (e.g., client correspondences, analysis/project requests, copies of analytical data from archives).
- Be knowledgeable about client-specific project requirements and issues.
- Function as an escort during the audit.
- Communicate issues/problems to appropriate personnel.

11.4.3. Laboratories

- Gather and organize laboratory data and documentation in preparation for client review.
- Assure corrective action was implemented from past audit findings, if necessary.
- Be prepared to discuss project data/testing results during the audit.
- Be familiar with client-specific project requirements and be prepared to answer client questions.
- Be familiar with the location of routine laboratory information and equipment (e.g., SOPs, data notebooks, calibration data, etc.).
- Be prepared to answer specific technical questions in regards to laboratory procedures and instrumentation within the area.
- Functions as an audit escort within the department during the audit.

11.5. Agency Inspections

It is Lancaster Laboratories' policy to cooperate to the fullest extent and maintain cordial relations with all government agencies. The QA Department is assigned the responsibility of hosting and working with agency representatives. Their role includes, escorting the investigator(s); ensuring all questions are answered, promptly and accurately; making note of all unresolved issues; informing management of the audit status and outcome; responding to the audit report and ensuring that appropriate corrective action is completed.

Uncontrolled Copy

Inspections can be performed by investigators or auditors from the FDA, DEA, United States Department of Agriculture (USDA), EPA, states, third-party accreditors (A2LA), or other regulatory agencies outside of the United States.

Government agencies have the right to investigate and inspect Lancaster Laboratories during normal business hours and permission to inspect is granted by Executive Management.

Clients are notified if their data or projects are being reviewed as part of an agency inspection.

Designated members of the QA Department are primary contacts for announced inspections. The QA Director is the primary contact for all unannounced agency inspections. If the QA Director is unavailable, the Chairman of the Board is notified, in addition to a designated member of the QA Department. The QA Director, or their designee, must obtain evidence of the investigator's authority either in the form of a letter or examination/explanation of credentials.

Inspections include the examination of records or the inspection of facilities. Investigators are usually concerned only with the records relating to their responsibilities. As a general rule, they are given copies of records and documents, if requested. All copied records taken by an investigator must be stamped as being confidential material. Lancaster Laboratories must make and keep duplicate copies of all items taken by an investigator.

Investigators must be escorted through the laboratory. The laboratory is not obligated to show an investigator the following types of information: sales, financial or pricing information, or any personnel data other than training or qualification documentation. On a case-by-case basis, internal QA audit reports and investigation reports that address internal problems, are made available for agency review. Investigators can not use recording devices and photographs must not be taken. Any questions or doubts about a request made by an investigator in regard to recording devices or photographs must be reviewed with legal counsel.

Lancaster Laboratories' personnel are not permitted to sign affidavits. If an affidavit is presented during an inspection, all personnel are directed not to sign it, read it, nor listen to it being read. The only document that is acceptable to sign is an acknowledgement that an inspection report has been received. If there is any doubt as to what should be signed, legal counsel must be consulted.

11.6. Proficiency Testing

Many of the organizations that certify our laboratory to perform various analyses require proof of our competency. Laboratory performance is checked regularly by participation in a variety of proficiency testing programs. When available, blind samples are obtained from vendors that are accredited to provide PT samples for NELAP for all test and matrices routinely tested in the Environmental Division at Lancaster Laboratories. In addition, some individual certification programs require analysis of specific sets of proficiency samples, and the laboratory also chooses to participate in a double blind program.

Generally, the proficiency test programs consist of samples or ampulated spiking solutions used to fortify laboratory water samples. Some studies provide spiked air and soil samples. The laboratories analyze the samples in the same manner as a client sample and the data is sent to the agency or vendor for evaluation. After the study results are returned to the laboratory, any data falling outside the acceptance criteria is investigated and corrective action is implemented, if needed. Results are circulated to management and communicated to the analyst. No proficiency testing samples or portion of a proficiency test sample are sent to another laboratory for analysis.

Uncontrolled Copy

Double blind samples are submitted to the laboratories by the Client Services Department using a fictitious client name so that the analysts are not aware that the samples are proficiency tests. The samples are submitted quarterly with the scope of testing alternating between organic and inorganic tests. The acceptance criteria for these double blind samples are developed statistically using data from participating laboratories, providing a source of inter-laboratory comparison. Results are reviewed and investigated as needed and circulated to management.

If a trend in PT failures is identified, additional blind samples are ordered for that specific test as corrective action.

Clients routinely submit blind and double blind samples to evaluate the laboratory's performance. If a report is issued to the laboratory, it is handled in the same manner as a scheduled PT study evaluation and follow-up.

12. CORRECTIVE AND PREVENTIVE ACTION

12.1. Laboratory Investigations and Corrective Action

Due to the technical nature of laboratory work and the encompassing nature of our QA program, a wide variety of laboratory issues can require investigations, documentation, and corrective action. Prompt investigation and implementation of corrective action ensure that only data of known quality are reported and prevent the reoccurrence of errors. The following list provides "examples" of the type of issues that warrant investigation:

- Out-of-specification QC results
- Failed performance evaluation samples
- Reporting incorrect results
- Contamination issues
- Client technical complaints
- Procedural errors
- Missed holding times
- Systematic problems that compromise the accuracy or compliance of the data generated
- Problems with instrumentation and equipment which could compromise the data generated

Depending on the situation, system, and severity of the issue, Lancaster Laboratories uses a number of procedures to investigate laboratory problems. A "common" investigation and documentation format, which is outlined below, applies to each of the various types of investigations that need to be performed:

- Identification of the problem
- Steps taken to investigate the problem
- Explanation of probable cause(s) of the problem
- Steps taken to prevent future occurrence
- Determination of samples or systems affected by the problem

Management is informed of problem situations and the QA Department tracks documentation and the status of the investigation activities. The goal is to identify root cause, have the corrective action implemented promptly, and to the degree appropriate for the magnitude and risk of the problem. Corrective action issues are subject to follow up by the QA Department. Tracking and trending of laboratory issues is performed by the QA Department and reported to management on a monthly and quarterly basis.

Uncontrolled Copy

12.2. Investigation Processes

All results from quality control (QC) samples are logged into the computerized quality control system, which is programmed to alert analysts to unacceptable results. Analysts are required to review the results and determine the source of the problem. The source of the problem and proposed corrective action must be documented. Corrective action may include, but is not limited to, re-analysis, re-extraction or re-digestion, instrument maintenance, or re-calibration. If these actions do not yield compliant data within the required hold time, a Nonconformance Form is initiated to document actions and communication with the client. The original form is archived with the associated raw data. Nonconformance Forms are reviewed by the technical department's management, or designee. A copy of the form is reviewed by QA.

Missed holding times are investigated and documented according to a procedure specific to this issue. A standard form is used for documenting this type of incident and signed by a representative of all areas involved, in addition to management and QA. Clients are informed of any problems involving holding time.

Other types of problems having the potential for impact on the quality of data are investigated and documented using a form titled Investigation and Corrective Action Report (ICAR). This process was developed to ensure that laboratory problems are investigated, documented, and corrective action is put into place to prevent reoccurrence. Any employee can initiate an ICAR to document a laboratory problem. Once initiated, the QA Department is notified to assign a unique tracking number and the due date for the investigation. The QA Department reviews and approves the completed ICAR then monitors the corrective action.

If a laboratory error is identified from the outcome of the investigation that impacts client data, the client must be immediately notified in writing of the situation. If the root cause of the problem has affected any other client sample results, all affected clients are notified immediately of the problem.

12.3. Client Feedback

Lancaster Laboratories is in the business of providing high quality analytical testing services. The data that we supply to our clients must be technically complete, accurate, and compliant with applicable regulations. Complaints can be received via letter, phone call, fax, e-mail, or face-to-face meeting.

When a complaint is received, it is our responsibility to determine, to the best of our ability, the extent of the issues and what data is in question. The person receiving the complaint documents this information and promptly forwards it to the appropriate management personnel where the work in question was performed. If a transcription or calculation error is discovered, the final report and/or data must be regenerated with the correct value(s).

The Client Service Representative is responsible for entering client concerns into the LIMS and an automated summary report is sent to QA weekly for review. In many cases, an investigation is initiated to address and document the situation.

On an annual basis, the Client Services and Business Development Groups send a client satisfaction survey to all clients. The results of these surveys are compiled and used to identify areas of improvement for the laboratory.

Uncontrolled Copy

12.4. Preventive Actions

Various training courses are provided to all employees to assist with building quality and efficiency into their daily jobs. They stress a proactive approach/environment to problem solving and to review quality systems and operational efficiencies.

- "Making Quality a Science" is an introductory TQM course required for all employees to teach why quality is important and to explain the Lancaster Laboratories' quality philosophy and processes, and how to apply quality thinking and techniques on the job. Topics discussed include: communication, teamwork, serving the client, measurement, quality tools, and continuous process improvement. To foster continuous improvements of laboratory systems, MOS process improvement teams are formed, as needed, if an employee needs help in solving a problem or addressing an issue. The goal of these groups is to have representation from various areas of the laboratory work together to look at a problem, evaluate the need for a temporary fix, brainstorm root causes, plan process improvement, implement the process improvement, evaluate and follow-up to the corrective action.

- "Putting our Values to Work" is a seminar required for all employees to teach the Lancaster Laboratories Statement of Values by examining how it translates to our everyday jobs and ethical decision making. Topics discussed include: Statement of Values, ethical paradigms, and ethical decision making. Mandatory ethics training refresher seminars are offered on an annual basis.

  Lancaster Laboratories has an Ethics Committee that meets on a regular basis to discuss and handle ethical issues or situations that cause concern or make employees feel uncomfortable. The mission of this group is to promote sharing of concerns on ethical issues; encourage and maintain commitment among employees to our core ethical values; and to maintain an environment that ensures open access to committee members and all levels of management and the confidential handling of ethical issues.

- The laboratory also utilizes a formal program to encourage preventive action called, Practical Process Improvement (PPI). PPI embodies three principles: logical simplicity, practical methods & tools, and involve everyone. Using proven hands-on methodology, teams of employees learn the tools and immediately apply them to a real business problem in their functional area. Measurable results are key to process improvement therefore, the teams collect data, analyze it to find a solution, and then test the results, using metrics. Once the solution has been proven effective, the team implements it and then monitors the solution to ensure that the results are sustained.

- The Quality Assurance Group prepares monthly and quarterly program status reports for management. The reports include a variety of metrics and graphs which are used to evaluate trends in laboratory performance across all quality and compliance areas. Management responds to any negative trends by developing a corrective action plan.

- Employees are encouraged to communicate to their supervisor area(s) or operation(s) they feel could be streamlined, make their job easier, would provide a quality improvement, or could provide a cost savings to the company.

Uncontrolled Copy

13. SERVICE TO CLIENTS

13.1. Service to Clients

We value our client relationships and support these partnerships through the following principles:

- Honesty and Fairness – Our corporate culture is founded on the principles of professionalism and high ethical standards in dealing with our clients. This may mean declining to provide the service requested (if we are convinced that to do so would be meaningless) or it may mean referring clients outside of our Lab if we believe that another company can better meet their needs.

- Complete Service – We will give our clients full value on every service provided. We will provide detailed information on our methods, procedures, and QA programs if requested, and take a personal interest and initiative in helping solve our client's problems within the area of our professional expertise.

- Trustworthiness – All data and information developed for a client will be held confidential and not disclosed to a third party except on written request of the client. If information is subpoenaed, we must, by law, release it, but the client will be informed of the release.

- Commitment to Quality – We constantly strive to improve our service in quality, flexibility, and dependability, to keep our competitive edge. We will achieve this through: meeting the requirements of those we serve, staying apprised of regulatory and industry expectations, and providing prompt responses to client concerns.

- Basics of Superlative Service – Our focus is on our client's success. Through proactive collaborative communication, our leadership ensures we understand our client's expectations and strives to exceed them. We foster a service culture in our training, reward and recognition, and performance management process so each employee takes ownership to deliver superlative service to our clients. Feedback from clients, whether positive or negative, is an important part of our continuous improvement system. Ways in which feedback is gathered can include, but is not limited to: customer satisfaction surveys, client audits, and the customer complaint system, which is described within section 12.3.

We also view our fellow employees as our clients since they frequently receive the results of our labor. Meeting the requirements of the next employee in the workflow process is just as important as meeting the needs of an external client.

13.2. Review of Work Requests, Tenders, and Contracts

Lancaster Laboratories places great importance on understanding client requirements for a project. We ensure, to the best of our ability, that client/project requirements are identified, including accreditations held by the laboratory, inconsistencies clarified, and nonstandard work requests are discussed and addressed with both the client and the technical laboratories before the project is accepted and samples arrive. This can be achieved in various ways, including the review of analytical methods, protocols, business contracts, and quality agreements. Project kick-off meetings can also be arranged through the Business Development and/or the Environmental Project Management Group. These meetings allow the client and key technical personnel to discuss project issues and requirements prior to project initiation.

Uncontrolled Copy

A key client contact is assigned to oversee the project and review all results in a timely manner. Communication between the client and LL technical staff is available and is coordinated through the Environmental Project Management Group.

As a project continues, the Environmental Project Management Group provides continuous communication and status reports about the project to the client. This group relays any project changes or modifications to the technical groups. They also relay issues encountered by the technical laboratories back to the client.

13.3. Timely Delivery

Evaluating laboratory capacity and ability to perform specific projects is a joint responsibility between the Technical Director , Business Development, and the laboratory managers. We recognize that one of the most important aspects of the service we offer is turnaround time.

Many analysts are cross-trained to perform a variety of tests, and there is redundant equipment available in the laboratory area creating operation flexibility for routine work. Larger projects are reviewed against capacity estimates before bids are submitted to ensure that the client's schedule is met. Turnaround time is continually measured.

Regularly scheduled meetings are held with senior management, technical and support management, and project management personnel to review progress with current projects, as well as special requirements of new work scheduled for the laboratory.

Management receives a daily report of the status of all samples in the lab, including a printout of those with priority status or those that have exceeded a preset turnaround time. This is of inestimable value in planning and organizing the workload through efficient scheduling.

Any changes to the established timeline by the client or the laboratory must be communicated to the client or laboratory as soon as possible. Upon communication of changes, a new timeline is established and agreed upon by both parties. If a client requires a change in the scope of the project (e.g., number of samples submitted, change in analyses, revised protocol) the laboratory must be informed in writing and a new timeline and cost estimate is be provided.

Verified results are available by phone, fax, diskette, direct access (modem and password), or hardcopy report.

13.4. Subcontracting

Occasionally, Lancaster Laboratories subcontracts tests to other laboratories if the requested testing is not routinely performed in our laboratory or when backlog is high. Testing is only subcontracted with the client's knowledge and approval. Subcontract laboratories are selected based on their qualifications and review of their QA information. If tests require a specific agency certification, only another appropriately certified laboratory must be used.

Data obtained from subcontract laboratories is clearly marked as such when reported by Lancaster Laboratories.

13.5. Use of NELAP and A2LA logo

It is not laboratory policy to use these logos on any company letterhead, including analytical reports.

Uncontrolled Copy

eurofins | Lancaster Laboratories

Environmental Quality Policy Manual

Appendix A
Procedure Cross Reference List

Current as of October 05, 2011
5 Total Pages (including this coversheet)

Uncontrolled Copy

Procedure Cross Reference List

Section #	Title	Procedure(s)
1	Introduction	
1.1.	Vision Statement	Personnel Manual
1.2.	Mission Statement	Personnel Manual
1.3.	Quality Policy	Personnel Manual
1.4.	Statement of Values	Personnel Manual
1.6.	Certifications, Accreditations, and Registrations	Form 2528
2	Organization and Personnel	
2.2.	Organizational Structure	Organization Charts
2.3.	Management Responsibilities	PMDs (Performance Management & Development)
2.4.	Overview of the Quality Assurance Program	SOP-QC-024
2.5.	Quality Assurance Responsibilities	SOP-QC-024 “QC” SOP Series
2.6.	Communication of Quality Issues to Management	SOP-QC-022 SOP-QC-025
2.7.	Personnel Qualifications and Responsibilities	LOM-SOP-LAB-231 PMDs Task Specific Training
2.8.	Relationship of Functional Groups and the Quality Assurance Program	Quality Orientation “QC” SOP series TQM Training PMDs
2.9.	Balancing Laboratory Capacity and Workload	PMDs
2.10.	Identification of Approved Signatories	LOM-SOP-ES-218
2.11.	Personnel Training	LOM-SOP-LAB-231 PMDs Task Specific Training
2.12.	Regulatory Training	LOM-SOP-LAB-204
2.13.	Employee Safety	Analytical Methods Chemical Hygiene Plan Policy #0010 “EHS”/”HS” SOP Series
2.14.	Client Services/Project Management Responsibilities	“CL” SOP Series
2.15.	Confidentiality	Personnel Manual LOM-SOP-LAB-205 SOP-QC-010 SOP-CL-005
2.16.	Business Conduct	Personnel Manual
2.17.	Operational Integrity	Policy #0001 Policy #0007 LOM-SOP-LAB-226 LOM-SOP-ES-232
3	Buildings and Facilities	
3.1.	Facility	Floor Plans
3.2.	Security	LOM-SOP-LAB-212
3.3.	Disaster Recovery	LOM-SOP-HS-212

Uncontrolled Copy

Section #	Title	Procedure(s)
3.4.	Environmental Monitoring	LOM-SOP-ES-205 LOM-SOP-ES-210
3.5.	Water Systems	LOM-SOP-LAB-214
3.6.	Housekeeping/Cleaning	LOM-SOP-LAB-221
3.7.	Insect & Rodent Control	LOM-SOP-LAB-213
3.8.	Emergency Power Supply	LOM-SOP-HS-212
3.9.	Facility Changes	LOM-SOP-LAB-209
4	Document Control	
4.1.	Hierarchy of Internal Operating Procedures	LOM-SOP-LAB-201
4.2.	Document Approval, Issue, Control, and Maintenance	LOM-SOP-LAB-202 LOM-SOP-ES-226
4.3.	Client-Supplied Methods and Documentation	LOM-SOP-ES-221 SOP-QC-030 SOP-CL-007
4.4.	Laboratory Notebooks, Logbooks, and Forms	LOM-SOP-LAB-202 LOM-SOP-LAB-220
5	Sample Handling	
5.1.	Sample Collection	"FS" SOP Series SOP-TR-001 SOP-TR-003
5.2.	Sample Receipt and Entry	"SA" SOP Series
5.3.	Sample Identification and Tracking	"SA" SOP Series
5.4.	Sample Storage	"SS" SOP Series
5.5.	Sample Return/Disposal	LOM-SOP-HS-219 SOP-EHS-006
5.6.	Chain of Custody	LOM-SOP-ES-212
5.7.	Representativeness of Samples	Analytical Methods SOP-SS-009
6	Technical Requirements - Traceability of Measurements	
6.1.	Reagents and Solvents	LOM-SOP-ES-225 Analytical Methods
6.3.	Calibration Standards	LOM-SOP-ES-225 Analytical Methods
6.4.	Equipment and Instrumentation	LOM-SOP-ES-222 LOM-SOP-LAB-208 LOM-SOP-ES-208 Technical SOPs, MCs and OMCs
6.5.	Computerized Systems and Computer Software	LOM-SOP-LAB-206 LOM-SOP-ES-219 SOP-CS-031 Personnel Manual
6.6.	Change Control	LOM-SOP-VAL-205
6.7.	Labware Cleaning	Technical SOPs
7	Purchasing Equipment and Supplies	
7.1	Procurement	LOM-SOP-LAB-218 SOP-PU-005
7.2	Supplier Evaluation	LOM-SOP-LAB-218 LOM-SOP-ES-204
8	Analytical Methods	
8.1.	Scope of Testing	Schedule of Services

Uncontrolled Copy

Section #	Title	Procedure(s)
8.2.	Analytical Test Methods	LOM-SOP-ES-226
8.3.	Client Supplied Methods	LOM-SOP-ES-221
8.4.	Method Validation	LOM-SOP-ES-226
8.5.	Procedural Deviations	LOM-SOP-ES-230
9	Internal Quality Control Checks	
9.1.	Laboratory Quality Control Samples and Acceptance Criteria	LOM-SOP-ES-207 LOM-SOP-ES-213 Analytical Methods
9.2.	Quality Control Sample Frequency and Corrective Action	LOM-SOP-ES-209 LOM-SOP-ES-213 Analytical Methods
9.3.	Quality Control Charts	LOM-SOP-ES-213
9.4.	Measurement Uncertainty	LOM-SOP-ES-207
10	Assuring Quality of Test Results	
10.1.	Data Management	LOM-SOP-LAB-220
10.2.	Data Documentation	LOM-SOP-LAB-220 LOM-SOP-ES-224
10.3.	Data Calculations	LOM-SOP-ES-224 Analytical Methods
10.4.	Reporting Limits	LOM-SOP-ES-203
10.5.	Data Review	LOM-SOP-LAB-220 LOM-SOP-ES-218 LOM-SOP-ES-224
10.6.	Data Qualification	LOM-SOP-ES-209
10.7.	Data Reporting	LOM-SOP-ES-218 LOM-SOP-ES-224 LOM-SOP-ES-227
10.8.	Reporting Data from Subcontract Laboratories	LOM-SOP-ES-215
10.9.	Data Storage, Security, and Archival	LOM-SOP-LAB-203
10.10.	Investigation of Nonconforming Work	LOM-SOP-ES-218 LOM-SOP-ES-230 LOM-SOP-ES-231
11	Audits and Inspections	
11.1.	Internal Quality Assurance Audits	SOP-QC-006 SOP-QC-021 SOP-QC-032
11.2.	Review of the Quality Assurance Program	SOP-QC-022 SOP-QC-025
11.3.	Good Laboratory Practice Critical Phase Inspections	SOP-QC-032
11.4.	Client Audits	Personnel Manual SOP-QC-010
11.5.	Agency Inspections	Personnel Manual SOP-QC-008
11.6.	Proficiency Testing	LOM-SOP-ES-216 SOP-QC-003 SOP-QC-007
12	Corrective and Preventive Action	
12.1.	Laboratory Investigations and Corrective Action	LOM-SOP-ES-209 LOM-SOP-ES-230 LOM-SOP-ES-231

Uncontrolled Copy

Section #	Title	Procedure(s)
12.2.	Investigation Processes	LOM-SOP-ES-223 LOM-SOP-ES-230
12.3.	Client Technical Complaints	LOM-SOP-ES-231
12.4.	Preventive Actions	Corporate Training
13	Service to Clients	
13.1.	Service to Clients	Personnel Manual TQM Training
13.2.	Review of Work Requests, Tenders, and Contracts	SOP-CL-007 SOP-QC-030
13.3.	Timely Delivery	SOP-CL-005 SOP-CL-010 TAT Tracking Report
13.4.	Subcontracting	LOM-SOP-ES-215 SOP-QC-023

Uncontrolled Copy

eurofins | Lancaster Laboratories

Environmental Quality Policy Manual

Appendix B
Certifications, Accreditation, Registrations, and Contracts

Current as of October 05, 2011
4 Total Pages (including this coversheet)

NOTE: Current certification status information maintained by QA Department.

Uncontrolled Copy

eurofins | Lancaster Laboratories

Certifications, Accreditations, Registrations, and Contracts

Agency	Parameter	Applicable Matrices	Lab ID No. Certificate No.
Federal Programs:			
American Association for Laboratory Accreditation (A2LA)	Various testing technologies in the environmental field using EPA methods, client specific methods, ISO 17025, DoD QSM 4.1	Nonpotable water, solid and hazardous waste, air, tissue and tobacco	0001.01
USDA Quarantine Soil Permit	All	All	S-50452
State Programs:			
State of Alaska, Department of Environmental Conservation	Organics, inorganics, UST analysis	Nonpotable water, solid and hazardous waste	UST-061
State of Arkansas, Department of Environmental Quality	Organics, inorganics	Nonpotable water, solid and hazardous waste	88-0660
State of California, Department of Health ELAP	Organics, inorganics	Potable water, nonpotable water, solid and hazardous waste	2501
State of California, Department of Health NELAC	Dioxin and NDMA	Nonpotable water, solid and hazardous waste	10276CA
State of Colorado, Department of Health	Organics, inorganics	Potable water	None
State of Connecticut, Department of Public Health	Organics, inorganics	Potable water, nonpotable water, solid and hazardous waste	PH-0746
State of Delaware, Health and Social Services	Organics, inorganics, micro	Potable water	None
[3]State of Florida, Department of Health	Organics, inorganics	Potable water, nonpotable water, solid and chemical materials, air and emissions	E87997
[3]State of Illinois, Environmental Protection Agency	Organics, inorganics	Nonpotable water, solid and chemical materials	002445
State of Indiana, Department of Health	Organics, inorganics	Potable water	C-PA-02
State of Iowa, Department of Natural Resources	Organics, inorganics, UST analysis	Nonpotable water, solid and hazardous waste	361
[3]State of Kansas, Department of Health and Environment	Organics, inorganics	Potable water, nonpotable water, solid and chemical materials	E-10151
[4]State of Kentucky, Division of Environmental Services	Organics, inorganics	Potable water	90088
State of Kentucky, Department for Environmental Protection – UST Branch	Organics, inorganics	UST	89
[3]State of Louisiana, Department of Environmental Quality	Organics, inorganics	Nonpotable water, solid and chemical materials, air and emissions	02055
State of Maine, Department of Health and Human Services	Organics, inorganics, micro., UST analysis	Potable, nonpotable water, solid and chemical materials	2010033
State of Maryland, Department of the Environment	Organics, inorganics, micro	Potable water	100
Commonwealth of Massachusetts, Department of Environmental Protection	Organics, inorganics	Potable water, nonpotable water	M-PA009

Uncontrolled Copy

eurofins | Lancaster Laboratories

Certifications, Accreditations, Registrations, and Contracts

Agency	Parameter	Applicable Matrices	Lab ID No. Certificate No.
State of Michigan, Department of Public Health	Organics, inorganics	Potable water	9930
NELAP Primary AA: Air and Emissions [2]NELAP Primary AA: Potable Water, Nonpotable water, solid and chemical materials [3]NELAP Secondary AA [4]Approval for UST work by A2LA			
State of Montana, Department of Environmental Quality	UST analysis	Nonpotable water, solid and chemical materials	None
[3]State of Nevada, Division of Environmental Protection	Organics, inorganics	Nonpotable water, solid and chemical materials	PA00009007A
[3]State of New Hampshire, Department of Environmental Services	Organics, inorganics	Potable water, nonpotable water, solid and chemical materials	2730
[1,3]State of New Jersey, Department of Environmental Protection (NJDEP)	Organics, inorganics, micro	Potable water, solid and chemical materials, air and emissions (direct accreditation)	PA011
[3]State of New York, Department of Health	Organics, inorganics	Nonpotable water, potable water, solid and chemical materials, air and emissions, Analytical Services Protocol	10670
State of North Carolina, Department of Environment and Natural Resources,	Organics, inorganics	Nonpotable water	521
North Carolina, Department of Health and Human Services	Volatile Organic Chemicals	Potable water	42705
State of Ohio, Environmental Protection Agency (Voluntary Action Program)	Organics, inorganics, UST analysis	Nonpotable water, solid and hazardous waste, air and emissions	CL0070
State of Oklahoma, Department of Environmental Quality	Organics, inorganics	Nonpotable water, solid and hazardous waste	9804
[3]State of Oregon, Public Health Laboratory	Organics, inorganics	Nonpotable water, solid and chemical materials, air and emissions	PA200001
[2]Commonwealth of Pennsylvania, Department of Environmental Protection (Bureau of Laboratories)	Organics, inorganics, micro	Potable water, nonpotable water, solid and chemical materials	36-00037
State of Rhode Island, Department of Health Laboratory	Organics, inorganics	Potable water, nonpotable water	None
State of South Carolina, Department of Health and Environmental Control	Organics, inorganics	Potable water, nonpotable water, solid and hazardous waste	89002002
State of Tennessee, Department of Health	Organics, inorganics	Potable water	TN02838
[2]State of Texas, Commission on Environmental Quality	Organics, inorganics	Potable water, nonpotable water, solid and chemical materials, biological tissue (direct accreditation), air and emissions	T104704194-10-04
[3]State of Utah, Department of Health	Organics, inorganics	Nonpotable water, solid and chemical materials	LANC

Uncontrolled Copy

eurofins | Lancaster Laboratories

Certifications, Accreditations, Registrations, and Contracts

Agency	Parameter	Applicable Matrices	Lab ID No. Certificate No.
State of Vermont, Department of Health Laboratory	Organics, inorganics	Potable water	VT 36-037
Commonwealth of Virginia, Department of General Services	Organics, inorganics	Potable water	00187
State of Washington, Department of Ecology	Wet chem, metals, organics, inorganics	Nonpotable water, solid and hazardous waste, air and emissions	C574
State of West Virginia, Department of Health	Organics, inorganics	Potable water	9906C
State of West Virginia, Division of Environmental Protection	Organics, inorganics	Nonpotable water	055
State of Wisconsin, Department of Natural Resources	Organics, inorganics	Nonpotable water, solid and hazardous waste	998035060

NOTE: This list accurately reflects the certifications, accreditations, registrations, and contracts held at the time of publication and is subject to change. Check with your account manager on the status of any certification needed for a specific project.

Uncontrolled Copy

eurofins | Lancaster Laboratories

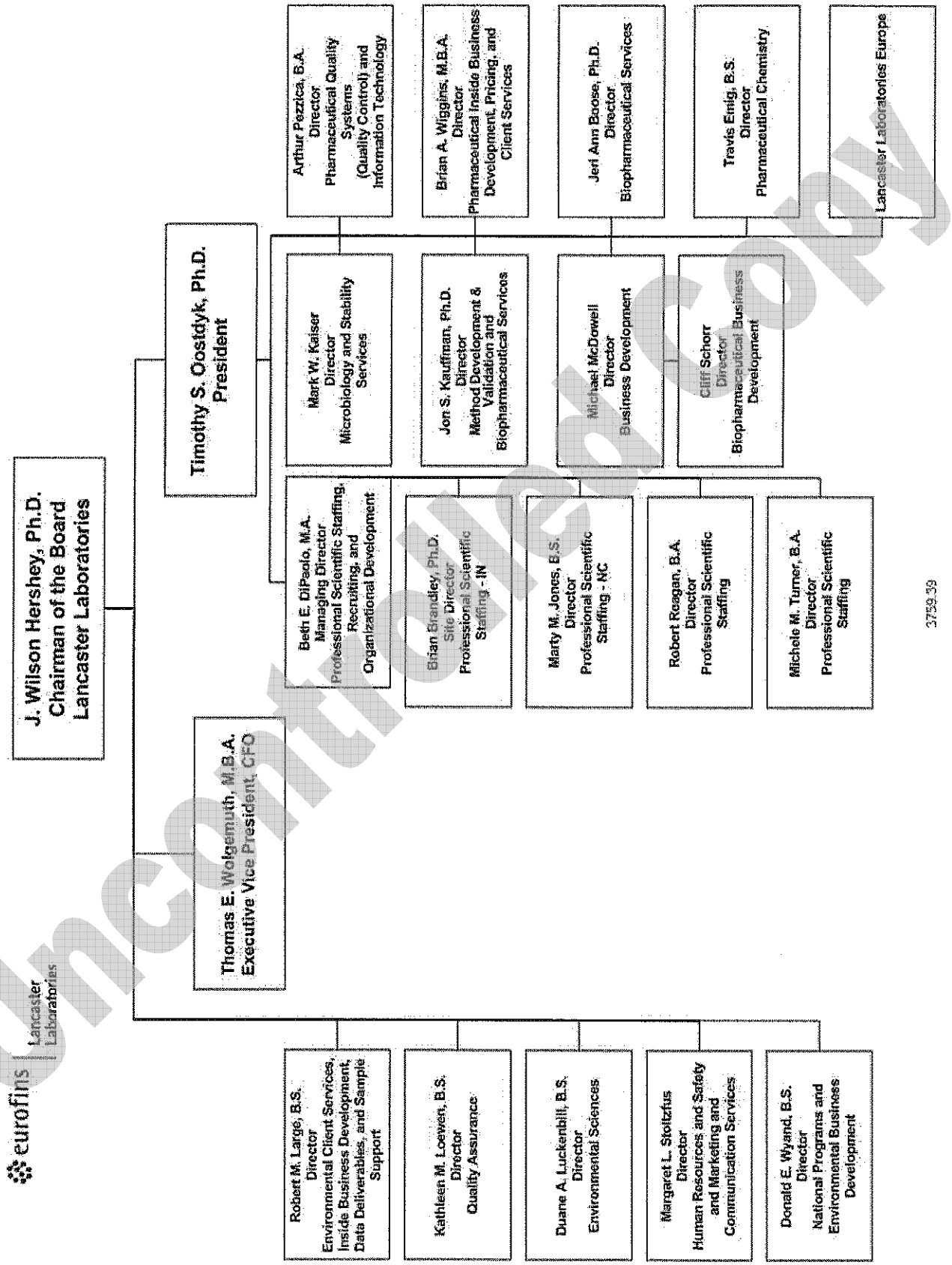
Environmental Quality Policy Manual

Appendix C
Organizational Charts
Personnel to Sign Reports

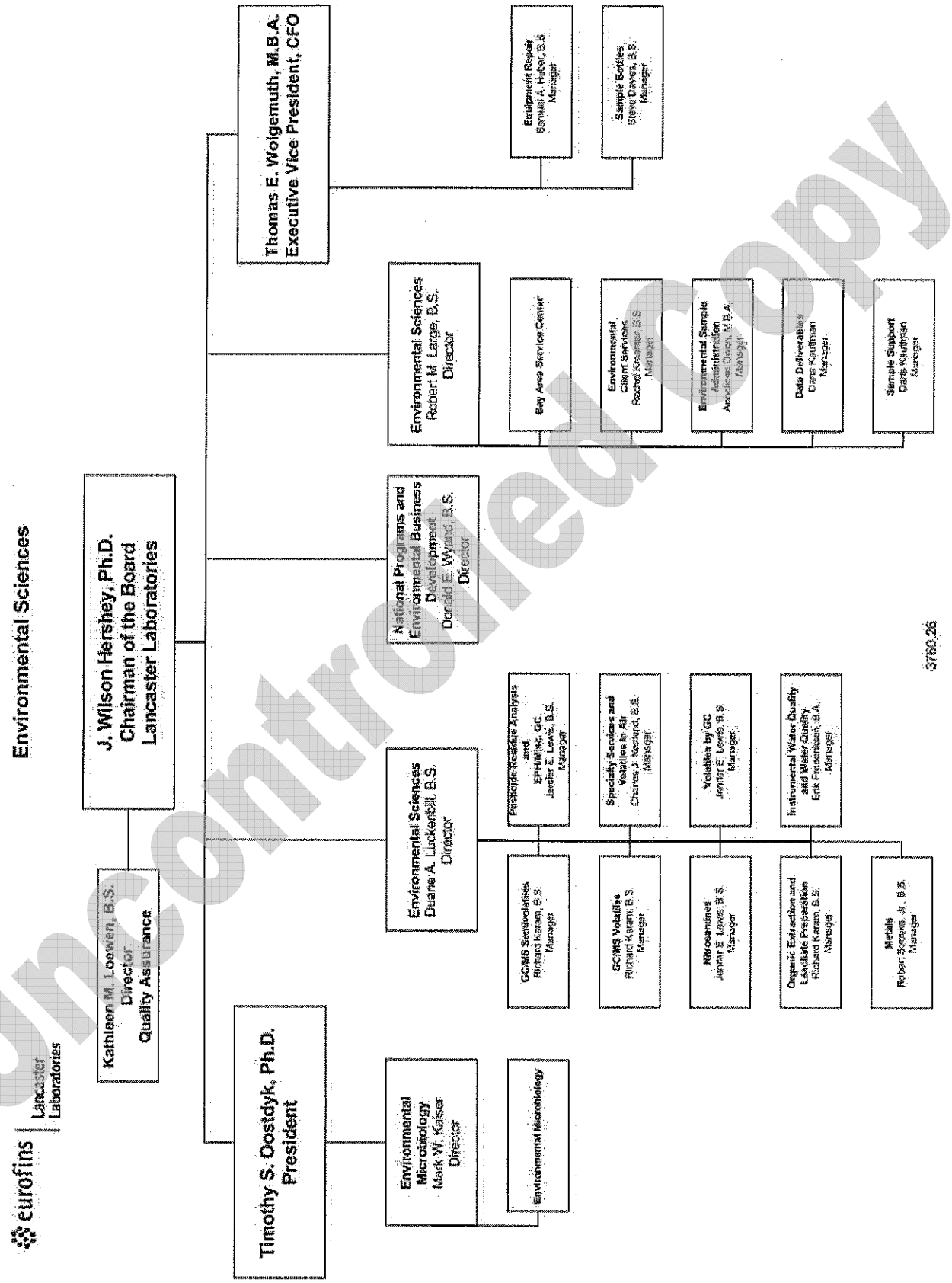
Current as of October 05, 2011
12 Total Pages (including this coversheet)

Uncontrolled Copy

NOTE: Current organizational charts available from Document Control. Current personnel to sign reports available in QA.



Uncontrolled Copy



Uncontrolled Copy

Name	Degree	Title
Corporate Services		
J. Wilson Hershey	Ph.D.	Chairman of the Board
Timothy Oostdyk	Ph.D.	President
Quality Assurance		
Kathleen Loewen	B.S.	Quality Assurance Officer
Dorothy Love*	B.S.	Principal Specialist Group Leader
Kathryn Brungard		Senior Specialist
Amy Doupe*	B.S.	Principal Specialist
M. Louise Hess	B.S.	Principal Specialist
Martina Janke	B.S.	Senior Specialist
Laura Judy	B.S.	Principal Specialist
Barbara Reedy*	B.S.	Senior Specialist
Joann Schweitzer	B.A.	Senior Specialist
Gary Siko	M.S.	Principal Specialist
Jill Sproat	B.S.	Senior Specialist
Alicia Staz	B.S.	Senior Specialist
Lee Ulmer	A.A.S.	Senior Specialist
Environmental Sciences		
Donald Wyand	B.S.	Director
Christine Jampo	M.S.	Senior Specialist
Kevin Moran	M.B.A.	Senior Specialist
Client Services/Business Development		
Robert Large	B.S.	Director
Rachel Kreamer	B.S.	Manager
Lynn Frederiksen	B.S.	Principal Specialist Group Leader
Wendy Kozma	B.S.	Principal Specialist Group Leader
Nicole Maljovec	M.S.	Senior Specialist Group Leader
Nancy Bornholm	B.S.	Principal Specialist
Marianne Bragg	B.S.	Principal Specialist
Loran Carter	B.S.	Specialist
Teresa Cunningham	B.S.	Principal Specialist
Irene Dodd	M.S.	Principal Specialist
Katherine Klinefelter	M.S.	Principal Specialist
Natalie Luciano	B.A.	Specialist
Angela Miller	B.S.	Specialist
Megan Moeller	B.S.	Senior Specialist
Jill Parker	B.S.	Senior Specialist
Tara Spaide		Senior Specialist
Barbara Weyandt	M.S.	Specialist
Susan Wike	A.S.	Senior Specialist
Additional support personnel in this group: 1		
Data Deliverables		
Robert Large	B.S.	Director
Dana Kauffman		Manager
F. Bradley Ayars		Senior Specialist Group Leader
Grace Salm		Specialist Group Leader

Uncontrolled Copy

Name	Degree	Title
Luz Torres		Senior Specialist Group Leader
Jessica Baron		Specialist
Judi Brown		Specialist
Kathy Fair		Specialist
M. Susan Kreider		Senior Specialist
Raymond Longacre		Specialist
Patricia Madrigal-Kauffman	A.S.	Specialist
Audrey McClune		Specialist
Tina McNeil		Specialist
Betsy Menefee	B.S.	Senior Specialist
Sandra Miller		Specialist
Tracy Pang-Ward		Specialist
Nancy Saunders	B.S.	Specialist
Elizabeth Smith	B.S.	Specialist
Lydia Steinke	B.S.	Specialist
Christiane Sweigart	B.S.	Senior Specialist
Michelle Tuel	B.S.	Specialist
Betty Umble		Specialist
Additional support personnel in this group: 6		
Bay Area Service Center		
Robert Large	B.S.	Director
Elizabeth Leonhardt	M.S.	Senior Specialist Group Leader
Additional support personnel in this group: 2		
Environmental Microbiology		
Mark Kaiser		Director
Harolyn Clow	M.S.	Manager
Jeffrey Groff*	B.S.	Microbiologist Group Leader
Hannah Conner	B.S.	Microbiologist
Martha Helwig*	B.S.	Senior Microbiologist
Keith Hoover*	B.S.	Microbiologist
Amy MacKay*	B.S.	Principal Microbiologist
Kimberly Small	B.A.	Senior Microbiologist
Extractable Petroleum Hydrocarbons (EPH)/Miscellaneous GC		
Duane Luckenbill	B.S.	Director
Jenifer Hess*	B.S.	Manager
Robert Brown		Principal Chemist Group Leader
Tracy Cole*		Senior Specialist
Melissa McDermott*	B.A.	Senior Chemist
Dustin Underkoffler	B.S.	Chemist
Heather Williams	B.S.	Senior Chemist
Additional support personnel in this group: 1		
Field Sampling		
Duane Luckenbill	B.S.	Director
Samuel Huber*	B.S.	Manager
Jeffrey Allen		Specialist Group Leader
Timothy Hauck		Specialist

Uncontrolled Copy

Name	Degree	Title
Flexible Staffing		
Kimberly Davies	M.B.A.	Manager
Andrew Agnew	B.S.	Chemist
Joseph Anderson	B.S.	Senior Chemist
Elizabeth Appleman	B.S.	Scientist
Audrey Baker		Senior Administrator
Catherine Cammauf		Specialist
Barton Conner	B.S.	Senior Chemist
Suzette Lehman		Specialist
Stacie Powroznik	B.S.	Senior Chemist
Douglas Seitz	B.S.	Principal Scientist
Christopher Smith	B.S.	Scientist
Holly Weller	B.S.	Microbiologist
Matthew Woods	B.S.	Chemist
Additional support personnel in this group: 2		
GC/MS Semivolatiles		
Duane Luckenbill	B.S.	Director
Richard Karam*	B.S.	Manager
Rachel Cochis*	B.A.	Senior Specialist Group Leader
Chad Moline*	B.S.	Senior Chemist Group Leader
Matthew Barton*	B.S.	Senior Specialist
Ryan Byrne	B.S.	Senior Chemist
Mark Clark	B.S.	Principal Chemist
Gregory Drahovsky	B.S.	Senior Chemist
Joseph Gambler	B.S.	Senior Chemist
Brian Graham	B.A.	Senior Chemist
Linda Hartenstine	B.A.	Senior Chemist
Mark Ratcliff	B.A.	Senior Specialist
Jennifer Riggs	B.S.	Chemist
Dale Stoneroad	B.S.	Senior Chemist
Andrew Strebel		Principal Chemist
GC/MS Volatiles		
Duane Luckenbill	B.S.	Director
Richard Karam	B.S.	Manager
Kenneth Boley	B.S.	Senior Chemist Group Leader
Susan Goshert*	B.S.	Principal Specialist Group Leader
Roy Mellott	B.S.	Senior Chemist Group Leader
Kathrine Muramatsu	B.S.	Chemist Group Leader
Ryan Nolt	B.S.	Principal Chemist Group Leader
Holly Berry	B.S.	Senior Chemist
Anita Dale		Chemist
Christine Dulaney*	B.S.	Senior Specialist
Chelsea Eastep	B.S.	Chemist
Daniel Heller	B.S.E.	Chemist
Sara Johnson	B.S.	Senior Chemist
Kelly Keller		Chemist

Uncontrolled Copy

Name	Degree	Title
Laura Krieger	B.S.	Chemist
Kerri Legerlotz	B.S.	Chemist
Jason Long	B.S.	Senior Chemist
Marla Lord*	B.S.	Senior Specialist
Linda Pape	B.A.	Senior Chemist
Kristen Pelliccia	B.S.	Chemist
Nicholas Rossi	B.S.	Chemist
Robin Runkle*	B.S.	Senior Specialist
Stephanie Selis	B.S.	Senior Chemist
Angela Sneeringer	B.S.	Chemist
Kevin Sposito	B.S.	Chemist
Emily Styer	B.S.	Chemist
Lawrence Taylor*	B.S.	Senior Specialist
Lauren Temple	B.S.	Senior Chemist
Abraham Uysal	M.E.	Senior Specialist
Frank Valla, Jr.	M.S.	Chemist
Additional support personnel in this group: 3		
Instrumental Water Quality		
Duane Luckenbill	B.S.	Director
Erik Frederiksen*	B.A.	Manager
Nicole Kepley		Senior Chemist Group Leader
Ashley Adams	B.S.	Chemist
Elyse Brunstetter	B.S.	Chemist
K. Robert Caulfeild-James	M.S.	Chemist
William Hamaker		Chemist
James Mathiot		Chemist
Additional support personnel in this group: 5		
Metals		
Duane Luckenbill	B.S.	Director
Robert Strocko*	B.S.	Manager
Debra Bryan		Specialist Group Leader
Nina Haller*		Senior Specialist Group Leader
David Beck	B.S.	Chemist
Eric Eby	B.S.	Senior Chemist
John Hook	B.S.	Senior Chemist
Deborah Krady	B.S.	Specialist
Parker Lindstrom*	B.S.	Senior Chemist
Nelli Markaryan	B.S.	Chemist
Jennifer Moyer	B.S.	Senior Specialist
Max Snavely*	B.S.	Senior Specialist
Tara Snyder	B.S.	Chemist
Choon Tian	B.A.	Chemist
Damary Valentin		Chemist
John Yanzuk	B.S.	Chemist
Additional support personnel in this group: 5		
Nitrosamines		
Duane Luckenbill	B.S.	Director

Uncontrolled Copy

Name	Degree	Title
Jenifer Hess	B.S.	Manager
John Perkins		Chemist
Organic Extraction		
Duane Luckenbill	B.S.	Director
Richard Karam	B.S.	Manager
Joseph Feister		Chemist Group Leader
David Hershey		Chemist Group Leader
Wanda Oswald		Chemist Group Leader
Kelli Barto		Chemist
Maria Davenport		Chemist
Kerrie Freeburn	B.S.	Chemist
Heidi Ortenzi	B.S.	Senior Chemist
Edwin Ortiz		Chemist
Robert Vincent	B.S.	Principal Chemist
Darin Wagner	B.A.	Chemist
Additional support personnel in this group: 22		
Pesticide Residue Analysis		
Duane Luckenbill	B.S.	Director
Jenifer Hess*	B.S.	Manager
Michele Hamilton*	B.S.	Senior Chemist Group Leader
Jamie Brillhart	B.S.	Senior Chemist
James Place	B.S.	Senior Chemist
Lisa Reinert	B.S.	Chemist
Richard Shober	B.S.	Principal Chemist
Sarah Snyder*	B.A.	Senior Specialist
Specialty Services Group		
Duane Luckenbill	B.S.	Director
Charles Neslund*	B.S.	Manager
Paul Cormier	B.A.	Principal Specialist
Ginelle Haines		Chemist
Nelson Risser	M.B.A.	Principal Chemist
Michele Smith*	B.S.	Senior Specialist
Timothy Trees	A.S.	Principal Chemist
Meng Yu	M.S.	Principal Chemist
Deborah Zimmerman		Chemist
Volatiles by GC		
Duane Luckenbill	B.S.	Director
Jenifer Hess*	B.S.	Manager
Valerie Tomayko*	B.S.	Senior Specialist Group Leader
Tyler Griffin	B.S.	Chemist
Marie John	B.S.	Chemist
Elizabeth Marin	B.S.	Chemist
Carrie Miller	B.S.	Chemist
Volatiles in Air		
Duane Luckenbill	B.S.	Director
Charles Neslund*	B.S.	Manager
Jeffrey Smith	B.A.	Senior Chemist Group Leader

Uncontrolled Copy

Name	Degree	Title
Florida Cimino	B.S.	Senior Chemist
Christine Ratcliff	B.S.	Principal Specialist
Michael Ziegler	B.S.	Chemist
Water Quality		
Duane Luckenbill	B.S.	Director
Erik Frederiksen*	B.A.	Manager
Kenneth Bell*	B.S.	Senior Chemist Group Leader
Yolunder Bunch		Chemist
Susan Engle		Chemist
Michele Graham	B.S.	Chemist
Robert Heisey*	B.A.	Senior Specialist
Susan Hibner	B.S.	Chemist
Michelle Lalli		Chemist
Hannah Royer	B.A.	Chemist
Additional support personnel in this group: 3		
Accounting & Finance		
Thomas Wolgemuth	M.B.A.	Executive Vice President Chief Financial Officer
Tammy Robinson	B.B.A.	Senior Specialist Group Leader
Jeffrey Cooper	A.S.B.	Specialist
Lindsay Fisher	B.S.	Specialist
Marjorie Hollinger		Senior Specialist
Administration		
Katiria Agosto		Specialist
Gerry Hershey		Principal Specialist
Billing & Reporting		
Thomas Wolgemuth	M.B.A.	Executive Vice President Chief Financial Officer
Beatrice Stauffer*		Manager
Adrienne Kuhl*		Senior Specialist Group Leader
Amanda Chao	A.A	Specialist
Jaime Ferguson*	A.S.	Senior Specialist
Shirley Habalar		Specialist
Lauren Kready	A.S.B.	Specialist
Jacqueline Miller		Specialist
Victoria Zacharias		Specialist
Additional support personnel in this group: 3		
Computer Applications Development		
Art Pezzica	B.A.	Director
Gordon Beitzel	B.S.	Manager
Holly Trego	B.S.	Manager
Tiffany Betz	B.S.	Senior Specialist
Catherine Holt	B.S.	Principal Specialist
Chadwick Hershey	B.S.	Senior Specialist
Kevin Lasher	B.S.	Principal Specialist
S. Scott Paist	B.A.	Specialist
Harry Thompson	B.A.	Principal Specialist
Timothy Weaver	B.A.	Senior Specialist

Uncontrolled Copy

Name	Degree	Title
Andy Whang	B.S.	Senior Specialist
Jon Wright	B.S.	Principal Specialist
Computer Systems		
Art Pezzica	B.A.	Director
Cynthia Ayars	M.B.A.	Manager
Shawn Beamenderfer	B.S.	Senior Specialist
James Butler		Senior Specialist
Justin Risser	B.S.	Senior Specialist
Emiley Rodak	B.A.	Specialist
Lee Seats	M.B.A.	Principal Specialist
Susan Shorter	B.S.	Senior Specialist
Destry Usner	B.S.	Senior Specialist
Thomas Wise	B.S.	Principal Specialist
Edward Zeigler	A.A	Senior Specialist
Additional support personnel in this group: 1		
Environmental Sample Administration		
Robert Large	B.S.	Director
Anneliese Owen	M.B.A.	Manager
Carolyn Cyms	B.S.	Senior Specialist Group Leader
Deborah Neslund		Senior Specialist Group Leader
Traci Bedard	B.S.	Specialist
Katie Hartlove		Specialist
Tamara Helsel		Senior Specialist
Christine Knoedler	B.A.	Specialist
Katherine Metzger	B.A.	Specialist
Kristin Zeigler	B.S.	Specialist
Additional support personnel in this group: 4		
Equipment Maintenance & Repair		
Thomas Wolgemuth	M.B.A.	Executive Vice President Chief Financial Officer
Samuel Huber	B.S.	Manager
Robert Allison		Senior Specialist
Human Resources		
Beth DiPaolo	B.S.	Director
Margaret Stoltzfus		Director
Jodi Ho	B.A.	Senior Specialist Group Leader
Cindy Weiser		Senior Specialist Group Leader
Jeanette Beisel		Principal Specialist
William Gambler	B.S.	Specialist
Matthew Gehman	B.S.	Senior Specialist
Melanie Nixon-Stillman	B.A.	Senior Specialist
Beth Rich		Senior Specialist
Jill Wilson	B.S.	Senior Specialist
Corporate Training		
Kimberly Davies	M.B.A.	Manager
Harry Ward	Ph.D.	Principal Specialist Group Leader
Dennis Urban	M.S.	Principal Specialist

Uncontrolled Copy

Name	Degree	Title
Barbara Weaver	M.S.	Principal Specialist
Marketing & Communication Services		
Margaret Stoltzfus		Director
Lisa Bamford	B.S.	Principal Specialist
Sherri Harlan	M.B.A.	Principal Specialist
Office Services		
Thomas Wolgemuth	M.B.A.	Executive Vice President Chief Financial Officer
Denise Splain		Manager
Maureen Caputo	A.S.	Specialist Group Leader
Dana Defibaugh	A.S.	Senior Specialist Group Leader
April Gibson		Principal Specialist Group Leader
Raymond Bowen		Specialist
Nancy Broderick		Specialist
Nicole Hanna		Specialist
Carol Martin		Specialist
Marta Rodriguez Rivera		Specialist
Lee Ann Ressler		Specialist
Jazzire Sierra	A.A.S.	Specialist
Tracey Salkeld		Specialist
Mary Stem		Specialist
Michele White		Specialist
Additional support personnel in this group: 4		
Physical Services		
Samuel Huber	B.S.	Manager
Gerald Clipper		Principal Specialist Group Leader
Mark Allison		Principal Specialist
Robert Bishop		Specialist
Traci Bowman		Specialist
Barry Gehman		Senior Specialist
Edward Huegel		Specialist
Robert Hufford		Principal Specialist
Ronald Hufford		Senior Specialist
Thomas Koller		Specialist
Ronald Reed		Specialist
David Splain		Specialist
Additional support personnel in this group: 2		
Purchasing		
Thomas Wolgemuth	M.B.A.	Executive Vice President Chief Financial Officer
Charles Kurtz		Senior Specialist Group Leader
Thomas Dull	A.S.	Senior Specialist
Adam Huegel		Specialist
Lester Metzger		Specialist
Sample Bottles		
Steven Davies	B.S.	Manager
Jeffrey Moyer	B.S.	Senior Specialist Group Leader
Theresa Carlson	A.S.	Specialist

Uncontrolled Copy

Name	Degree	Title
Samantha DeFalcis		Specialist
Karen Guito		Specialist
Sandra Muckle		Specialist
Sample Support		
Robert Large	B.S.	Director
Dana Kauffman*		Manager
Lisa Cooke		Chemist Group Leader
Chad Wettig		Chemist Group Leader
Stephanie Sanchez		Chemist
Additional support personnel in this group: 9		
Transportation		
Steven Davies	B.S.	Manager
Tony Luque		Specialist
L. Kenneth Miller		Specialist
Timothy Miller		Specialist
Christopher Winters		Specialist
Leon Wolf		Specialist On-Call
Additional support personnel in this group: 13		

*Denotes those employees that sign reports for Environmental Sciences.

Uncontrolled Copy

eurofins | Lancaster Laboratories

Environmental Quality Policy Manual

Appendix D
Personnel Qualifications and Responsibilities

Current as of October 05, 2011
50 Total Pages (including this coversheet)

Uncontrolled Copy

Joseph D. Anderson, B.S., Senior Chemist, Flexible Staffing

Education:

B.S. General Science, Pennsylvania State University (2004)

Professional Experience:

ALSI, GC GC/MS Analyst (2004-2010)
Responsibilities included preparing, running, and reviewing samples according to client and industry methods using various instrumentation including GC and GC/MS; performing analysis for various departments as determined by work volume and staffing needs; reviewing and reporting data within client specified criteria
With Lancaster Laboratories since 2010
Senior Chemist, Flexible Staffing (2010)
Responsibilities include preparing, running, and reviewing samples according to client, compendia, and industry methods using various wet chemistry techniques and instrumentation, which may include but is not limited to, gas chromatography, liquid chromatography, IC, and TOC instrumentation; performing analysis for various departments as determined by work volume and staffing needs

F. Bradley Ayars, Senior Specialist Group Leader, Data Deliverables

Continuing Education:

Environmental Law & Policy, Franklin & Marshall College (1991)

Professional Experience:

With Lancaster Laboratories since 1988
Client Services Specialist (1992)
Environmental Project Management (1994)
Senior Specialist Coordinator, Electronic Data Deliverables (1997)
Responsibilities included supervising EDD staff; developing and maintaining EDD formats; overchecking lab data for EDDs; primary contact for EDD issues
Senior Specialist Group Leader, Electronic Data Deliverables (2005)
Responsibilities include supervising EDD staff; developing and maintaining EDD formats; overchecking lab data for EDDs; primary contact for EDD issues

Cynthia A. Ayars, M.B.A., Manager, Computer Systems

Education:

B.S. Chemistry, Shippensburg University (1987)
M.B.A., Penn State University (1994)

Continuing Education:

Lancaster Labs University of Education: Hazardous Waste/Chemical Transfer, DOT: Safe Transport of Hazardous Materials, Respiratory Protection.
Unix Database Administration, Lawson Software (1998)
Unix System Administration, Lawson Software (1998)
Unix Technical Foundations, Lawson Software (1998)
Oracle 8 Backup and Recovery Workshop, Oracle (2000)
Software Quality Engineering – Systematic Software Testing (2004)

Professional Experience:

With Lancaster Laboratories since 1987
Chemist (06/87-10/89)
Client Service Specialist I (10/89-11/91)
Group Leader II, Sample Support (11/91-08/98)
Senior Specialist, Computer Applications Development (1998)
Responsibilities included Oracle based administrating, Lawson system administrating, and participating in development of Parallax system
Senior Specialist/Coordinator, Computer Applications Development (2002)
Responsibilities included developing software quality documentation and coordination of software quality effort for both Parallax and Nautilus
Manager, Computer Applications Development (2005)
Responsibilities included developing software quality documentation and coordination of software quality effort and database administration for both Parallax and Nautilus

Uncontrolled Copy

Manager, Computer Systems (2008)
Responsibilities include developing software quality documentation and coordination of software quality effort and database administration for both Parallax and Nautilus

Matthew Rusty E. Barton, B.S., Senior Specialist, GC/MS Semivolatiles

Education:

B.S. Biochemistry, East Stroudsburg University (1991)

Professional Experience:

With Lancaster Laboratories since 1991
Senior Chemist (1998)
Senior Chemist/Coordinator (1999)
Responsibilities included: supervise personnel; schedule lab work; perform purge and trap gas chromatography testing; operate O.I. 4560/4551, Tekmar 3000, Archon 5100, and HP5890 Series II OC instruments; review and approve data; and developing and evaluating new methods.
Senior Chemist, Nitrosamines (2003)
Responsibilities included: Analysis of nitrites in tobacco samples
Senior Chemist, EPH/Misc. GC (2004)
Responsibilities include: Analysis of environmental samples for diesel range organics via gas chromatography
Senior Specialist, GC/MS Semivolatiles (2008)
Responsibilities include: audit and upload of departmental data

Shawn Beamenderfer, B.S., Senior Specialist, Computer Systems

Education:

A.A.S. Computer Networking, Thaddeus Stevens College (2003)
B.S. Computer Info System, Alvernia College (2006)

Professional Experience:

With Lancaster Laboratories since 2006
Software Quality Specialist, Computer Applications Development (2006)
Responsibilities included creating and executing test plans for pharmaceutical software
Specialist, Computer Systems (2007)
Responsibilities included creating and executing test plans for pharmaceutical software
Senior Specialist, Computer Systems (2009)
Responsibilities include creating and executing test plans for pharmaceutical software

Awards, Citations, Honorary Societies, and Publications:

Dean's List, Alvernia College (2003-2006)
Certified Tester, Foundation Level – ASTQB

Gordon Beitzel, B.S., Manager, Computer Applications Development

Education:

B.S. Electrical Engineering, Pennsylvania State University (1987)

Continuing Education:

Microsoft Solutions Framework, Microsoft Consulting Services (1997)
Mastering Visual Basic 6 Development, Productivity Point International (1999)

Professional Experience:

Lancaster Laboratories, Inc., Computer Systems Specialist (1988-1994)
Data Pipeline Systems, Inc., Software Developer (1994-1996)
CDS Solutions Group, Project Manager (1996–1998)
With Lancaster Laboratories since 1998
Manager (previously titled Group Leader), Application Development (1998)
Responsibilities include management of various software development projects. This involves personnel management, coordinating the timelines, systems analysis, and communication of project progress and status.

Uncontrolled Copy

Memberships & Appointments:

Microsoft Certified Solution Developer (1997)

Kenneth A. Bell, B.S., Senior Chemist Group Leader, Water Quality

Education:

B.S. Chemistry, Millersville University (1997)

Professional Experience:

Johnsons Chemical, Laboratory Assistant (1989-1992)
Responsibilities included collecting samples and performing testing on raw material
With Lancaster Laboratories since 1994
Senior Laboratory Technician, Water Quality (1994)
Responsibilities included routinely performing analytical testing using wet chemistry methods
Chemist/Coordinator, Water Quality (1994)
Responsibilities included performing wet chemistry analyses, sample verification, and coordinating workflow
Senior Chemist/Coordinator, Water Quality (1994)
Responsibilities included coordinating workflow, performing sample verification, back-up report signing, training new employees, revising standard operating procedures, writing annual job plans and reviews
Senior Chemist Group Leader, Water Quality (2005)
Responsibilities include coordinating workflow, performing sample verification, back-up report signing, training new employees, revising standard operating procedures, writing annual job plans and reviews

Holly Berry, B.S., Senior Chemist, GC/MS Volatiles

Education:

B.S. Forensic Chemistry, Buffalo State College (SUNY) (2006)

Professional Experience:

New York State Police, Toxicology Intern (2005-2006)
Responsibilities included performing analysis of alternative medicines using FPIA, SPE, GC/NPD, and GC/MS
With Lancaster Laboratories since 2006
Chemist, GC/MS Volatiles (2006)
Responsibilities included analyzing soils and waters for VOAs using purge and trap and GC/MS instrumentation
Senior Chemist, GC/MS Volatiles (2010)
Responsibilities include analyzing performing GC/MS analysis of water and soil samples along with other matrices by various analytical methods such as EPA 624, 8260B, and CLP; evaluating analytical data generated; calibrating and troubleshooting GC/MS instrumentation; assisting other employees with any questions that may arise and helping to train new employees

Memberships and Appointments:

Emergency Response Team (Hazmat technician) – LLI (2006-present)

Tiffany D. Betz, B.S., Senior Specialist, Computer Applications Development

Education:

B.S. Computer Science, Millersville University (2001)

Continuing Education:

Oracle Exam #1Z0-007, Introduction to Oracle 9i: SQL (May 17, 2004)
Oracle Exam #1Z0-147, Oracle 9i: Program with PL/SQL (August 4, 2004)

Professional Experience:

With Lancaster Laboratories since 2000
Specialist, Computer Applications Development (2000)
Responsibilities included computer applications development and maintenance.
Senior Specialist, Computer Applications Development (2006)
Responsibilities include computer applications development and maintenance.

Uncontrolled Copy

Kenneth L. Boley, Jr., B.S., Senior Chemist Group Leader, GC/MS Volatiles

Education:

B.S. Chemistry, Messiah College (1995)

Professional Experience:

Heritage Custom Kitchens, Inc., Face Frame Assembler (1997–2001)
Responsibilities included reading and interpreting job orders; overseeing daily production of department; performing various manufacturing duties daily; member of the safety committee, first aid team, and security team
With Lancaster Laboratories since 2001
Chemist, GC/MS Volatiles (2001)
Responsibilities included analyzing samples and QC by purge and trap GC/MS; generating and reviewing raw data; performing maintenance on GC/MS, purge and traps, and various autosamplers; following methods and SOPs
Senior Chemist, GC/MS Volatiles (2005)
Responsibilities included performing routine and non-routine analyses; diagnosing and solving technical problems; maintaining and troubleshooting instrumentation; writing and revising SOPs; training new analysts; auditing and uploading data as work load deems necessary
Senior Chemist Group Leader, GC/MS Volatiles (2009)
Responsibilities include maintaining GC/MS instrumentation; tuning and calibrating instrument daily; analyzing quality control and client samples; reviewing and assembling data in an efficient manner with a high degree of quality; evaluating current organizational and analytical systems; suggesting and implementing corrective action and system improvements when necessary; performing all duties with minimal supervision; working on special assignments; diagnosing complex problems and offering solutions with a high degree of independence; assisting in "brainstorming" client problems and projects; completing assigned projects on time; researching new and emerging technologies; producing written and oral reports on research activities; performing both technical and personnel aspects of group operations; performing work within the department or other areas as required; acting as a technical resource, trainer, and troubleshooter to specific department; making recommendations for operational and/or technical improvements; communicating effectively within the group; coaching and developing direct reports; planning and monitoring workflow

Nancy J. Bornholm, B.S., Principal Specialist, Environmental Client Services

Education:

B.S. Chemistry (magna cum laude), Muhlenberg College (1981)

Continuing Education:

Instrumental Analysis of Paints and Polymers, FBI Academy (1984)
Analytical Chemistry of Contaminants in Surface and Groundwater, ACS Short Course (1986)

Professional Experience:

University of Connecticut Health Center, Laboratory Technician (1977-1980)
Institute for Cancer Research, Research Technician (1981)
Baltimore City Crime Laboratory, Mobile Crime Unit Trainee (1981-1982)
Maryland State Police Crime Laboratory, Forensic Chemist III (1982-1985)
With Lancaster Laboratories since 1985
Senior Specialist, Environmental Client Services (1987)
Responsibilities included project management; audit sample entries; answer client questions; communicate client requirements to lab areas; and schedule sample submissions and provide sampling containers
Principal Specialist, Environmental Client Services (2004)
Responsibilities include project management; audit sample entries; answer client questions; communicate client requirements to lab areas; and schedule sample submissions and provide sampling containers

Awards, Citations, Honorary Societies, and Publications:

Quarterly Impact Award (2008)
Superlative Service President's Award (2008)

Marianne L. Bragg, B.S., Principal Specialist, Environmental Business Development

Education:

B.S. Biology, Millersville University (1987)

Uncontrolled Copy

Professional Experience:

With Lancaster Laboratories since 1985
Coordinator
Group Leader (1990)
Principal Specialist (1994)
Responsibilities included: advise clients on testing; provide price quotes and proposals; answer client questions; schedule sample submissions and provide sampling containers; communicate client requirements to lab areas; and assist with client visits to the lab.
Principal Specialist/Coordinator, Environmental Business Development (2002)
In addition to the responsibilities listed above, manage workload and workflow among business development staff.
Principal Specialist/Group Leader, Environmental Business Development (2005)
In addition to the responsibilities listed above, manage workload and workflow among business development staff.
Principal Specialist, Environmental Business Development (2007)
Responsibilities include: advise clients on testing; provide price quotes and proposals; answer client questions; schedule sample submissions and provide sampling containers; communicate client requirements to lab areas; and assist with client visits to the lab.

Jamie L. Brillhart, B.S., Senior Chemist, Pesticide Residue Analysis

Education:

B.S. Physical Science, York College of Pennsylvania (2003)

Professional Experience:

B-H Laboratories Inc./Analytical Laboratory Services Inc., Inorganic Laboratory Technician/Inorganic Chemist (2003-2005)
Responsibilities included performing wet chemistry testing on drinking waters and waste water; being responsible for analyses included fluoride, cyanide, phosphorus, nitrate/nitrite, cadmium reduction, and grease and oil testing when needed; prepping and analyzing for mercury on a mercury analyzer; analyzing for various metals on a graphite furnace; prepping leachates; prepping standards as needed
Hercon Laboratories, Inc., QC Analyst I (2005-2007)
Responsibilities included performing Quality Control Testing on Transdermal Systems; performing assays, dissolutions, degradation, residual solvents, and raw material testing; prepping necessary standards and performing instrument maintenance as needed
With Lancaster Laboratories since 2007
Chemist, Pesticide Residue Analysis (2007)
Responsibilities included analyzing soils for PPL Pesticides using 5890 and 6890 GCs with ECD detectors; performing instrument maintenance; prepping standards; auditing calibrations as necessary; being able to analyze for OPPAs, ACMOs, EDBs, PCBs, and Herbicides as needed
Senior Chemist, Pesticide Residue Analysis (2011)
Responsibilities include analyzing soils for PPL Pesticides using 5890 and 6890 GCs with ECD detectors; performing instrument maintenance; prepping standards; auditing calibrations as necessary; being able to analyze for OPPAs, ACMOs, EDBs, PCBs, and Herbicides as needed

Robert Brown, Principal Chemist Group Leader, EPH/Misc. GC

Education:

Attended 2.5 years at Pennsylvania State University towards B.S. in Microbiology (1988)
Completed 20 credits towards B.S. in Environmental Biology, Millersville University (1993)

Professional Experience:

With Lancaster Laboratories since 1988
Chemist (1993)
Senior Chemist (1997)
Responsibilities included: perform extractable petroleum testing; operate multiple Hewlett-Packard gas chromatographs (GC) instruments; data interpretation and entry; and developing and evaluating new methods.
Principal Chemist (2004)
Responsibilities included: perform extractable petroleum testing; operate multiple Hewlett-Packard gas chromatographs (GC) instruments; data interpretation and entry; and developing and evaluating new methods. Serve as primary technical contact for client service representatives and their clients.
Principal Chemist Group Leader, EPH/Misc. GC (2005)
Responsibilities include: perform extractable petroleum testing; operate multiple Hewlett-Packard gas chromatographs (GC) instruments; data interpretation and entry; and developing and evaluating new methods. Serve as primary technical contact for client service representatives and their clients.

Uncontrolled Copy

Kathryn A. Brungard, Senior Specialist, Quality Assurance

Continuing Education:

Clinical Laboratory Science, Temple University (1984-1988)

Professional Experience:

Environmental Partners, Inc., Environmental Technician/Health and Safety Coordinator (2003-2005)
Responsibilities included determining personnel health and safety risks on each work site and determining appropriate measures to be taken for personal protection; maintaining and servicing sampling equipment; calibrating meters and analytical equipment; collecting and processing representative samples at each monitoring site following state mandated procedures; routinely measuring field water and soil quality parameters; performing product recovery as part of site remedial measures; evaluating and reporting upon trends and/or results that were out-of-range
Maxwell House Coffee/Kraft Foods, Quality Assurance Technician (2004-2005)
Responsibilities included conducting hourly audits on operating production lines which included weight of product, oxygen content, density, caffeine level by HPLC, moisture content, inspection for foreign or incidental materials, and packaging compliance; performing weekly water testing for level of chlorine and microbial contamination; producing result spreadsheets and accurate logs; notifying upper management of all results in a timely manner
Columbia Analytical Services, Inc, Quality Assurance Program Manager (2005-2009)
Responsibilities included being responsible for the overall coordination of the NELAP certified environmental laboratory program; monitoring laboratory quality systems through audits; identifying potential problem areas, recommending corrective actions, and providing technical assistance and training as necessary; informing management of potential problems and recommending remedial measures in a timely basis both orally and by written communication; maintaining performance evaluation records; maintaining accreditations for regulatory agencies and client programs; providing audit responses and initiating changes in procedures; maintaining the calibration of all weights, balances, and thermometers
With Lancaster Laboratories since 2010
Senior Specialist, Quality Assurance (2010)
Responsibilities include ensuring quality of data being produced in the laboratories by performing data review, auditing laboratories, and reviewing written procedures; ensuring laboratory adherence to government regulations and client requirements; reviewing client and government documents for requirements outside our usual laboratory practices; setting up and testing new analysis in the laboratory sample management system as required by the departments

Memberships and Appointments:

Florida Society of Environmental Analysts (2005-2009)

Ryan P. Byrne, B.S., Senior Chemist, GC/MS Semivolatiles

Education:

B.S. Biology, College/University (2003)

Professional Experience:

With Lancaster Laboratories since 2003
Chemist, GC/MS Semivolatiles (2003)
Responsibilities include preparing standards; performing maintenance and calibration of GC/MS systems; responding to audits
Senior Chemist, GC/MS Semivolatiles (2007)
Responsibilities include performing analysis and review of all departmental analyses; responding to audits

Florida A. Cimino, B.S., Senior Chemist, Volatiles in Air

Education:

B.S. Chemistry, Shippensburg University (2004)

Professional Experience:

With Lancaster Laboratories since 2005
Chemist, Flexible Staffing (2005)
Responsibilities included preparing, running, and reviewing samples according to client, compendia, and industry methods using various wet chemistry techniques and instrumentation including, but not limited to, gas chromatography, liquid chromatography, IC and TOC instrumentation; performing analysis for various departments as determined by work volume and staffing needs
Senior Chemist, Flexible Staffing (2008)
Responsibilities included preparing, running, and reviewing samples according to client, compendia, and industry methods using various wet chemistry techniques and instrumentation including, but not limited to, gas chromatography, liquid chromatography, IC and TOC instrumentation; performing analysis for various departments as determined by work volume and staffing needs

Uncontrolled Copy

Senior Chemist, Volatiles in Air (2010)
Responsibilities include maintaining instrumentation; tuning and calibrating instrument daily; analyzing quality control and client samples; reviewing and assembling data in an efficient manner with a high degree of quality; evaluating current organizational and analytical systems; diagnosing complex problems and offering solutions with a high degree of independence; suggesting and implementing improvements to maximize quality and productivity; acting as technical resource for internal problems and projects; assisting in "brainstorming" client problems and projects; training new employees in all aspects of instrumentation; researching new and emerging technologies

Awards, Citations, Honorary Societies, and Publications:

Girl Scout Gold Award (2000)
Who's Who Among College Students (2001-2004)

Mark A. Clark, B.S., Principal Chemist, GC/MS Semivolatiles

Education:

B.S. Biochemistry, Millersville University (1986)

Professional Experience:

With Lancaster Laboratories since 1985
Senior Chemist, GC/MS Semivolatiles (1985)
Responsibilities included performing GC/MS semivolatiles testing; operating GC/MS instruments; performing data Interpretation and entry; developing and evaluating new methods; calibrating and repairing instruments
Principal Chemist, GC/MS Semivolatiles (2001)
Responsibilities include performing PAH by HPLC analysis and assisting with GC/MS operations on third shift

Gerald L. Clipper, Principal Specialist Group Leader, Physical Services

Continuing Education:

Electrical Engineering, West Virginia University, Morgantown, WV (1965-1967)
Basic Electronics, US Navy, Great Lakes, IL
Advanced Electronics, US Navy, Bainbridge, MD
Radar and Special Circuits, Weapons Direction Equipment, US Navy, Dam Neck, VA
Telemetry, US Navy, San Francisco, CA
IBM-MRP MAPIC I and II
SMART CAM and CNC Programming
Industrial and Commercial Power Distribution, Energy Efficient Commercial Buildings, Power Quality
Data Communications for Engineers and Technicians
R&D Facilities: Concepts for Cost Effective Buildings
Raising FM Performance and Cutting Costs
Advanced Level Laboratory Ventilation, Laboratory Remodeling and New Lab Buildings
Fume Hood: Selection, Design, and Certifying
Engineering Calculations for Heat Load and Equipment Selection
Proportional Controls for HVAC Systems
Andover System Programming
Contingency Planning for Equipment and Machinery

Professional Experience:

US Navy, Vietnam Veteran (1967-1971)
Responsibilities included maintaining all electronic missiles test and telemetry equipment onboard ship; performing function tests on all missiles onboard on a periodic basis; periodically assigned as an observer on other ships during drills to analyze performance
Donnelly Printing, Apprentice Assistant Pressman (1971-1973)
Responsibilities included supervising crew in operation and maintenance of press
Redman Industries, Production Supervisor (1973-1974)
Responsibilities included supervising employees in assembly and finishing of homes; controlling inventories of materials; supervising repair crews; supervising testing and inspection; hiring, reviewing, and firing
Anderson Bakeries, Packaging Supervisor (1974-1977)
Responsibilities included supervising maintenance and machine set up for baggers, sealers, and carton machinery; scheduling production for shift; supervising packaging and storage of materials; hiring, training, review, and firing
Liberty Homes, Production Supervisor (1977-1981)
Responsibilities included managing employees in assembly and finishing of homes; inventory control; supervising repair crews, testing, and inspection; hiring, review, and firing

Uncontrolled Copy

High Energy Corporation, Plant Manager/Product Manager (1981-1987)
Responsibilities included scheduling all production; managing employees in electro-mechanical assembly operations (pressing, soldering, welding, testing, etc.); developed automated equipment, fixtures, and dies for improved productivity; managed machine shop in production of assemblies and subassemblies to support production lines; designed and supervised design of capacitors; consulted with clients on applications for new designs and replacement parts; developed and produced new products; established annual budget; managed maintenance staff in equipment and building maintenance; made sales calls to major clients and helped to negotiate annual contracts; established work rates, hired, reviewed, and fired; CAM system design and CNC programming for automatic lathe

With Lancaster Laboratories since 1987
Senior Specialist, Physical Services (1987)
Principal Specialist, Physical Services (1998)
Principal Specialist Group Leader, Physical Services (2001)
Responsibilities include physical plant operations; evaluation and selection of building systems and services; short and long range expansion planning; laboratory and office layout and design (new and renovations); contracting/coordination of new projects; develop solutions to problems relating to safety, equipment, building, and services; manage technical maintenance staff; engineering support for parent company labs; facility energy management; equipment design for laboratory use; evaluate and market used lab equipment; interview and train new employees of the HVAC group to perform required duties; serve as a technical source for all departments; maintain, repair, and trouble shoot the building's control system; monitor, trouble shoot, and upgrade the programming as needed for the security system; manage (based on cost effectiveness and high quality standards) all new equipment being purchased by the Physical Services department to ensure compatibility with our current systems (i.e., HVAC, electrical, plumbing, etc.); maintain, implement, and update preventative maintenance program on all facility equipment; review and assist in the design of new or remodeled space to ensure high quality and cost savings

Harolyn M. Clow, M.S., SM (NRCM), Manager, Pharmaceutical Microbiology

Education:

B.S. Microbiology, Colorado State University (1986)
M.S. Quality Assurance/Regulatory Affairs, Temple University (1995)

Continuing Education:

Laboratory Identification of Gram Positive Bacteria, Colorado Association for Continuing Medical Laboratory Education (1989)
Enterobacteriaceae, Colorado Association for Continuing Medical Laboratory Education (1990)
Laboratory Management: Quality Assurance/Quality Control, Colorado Association for Continuing Medical Laboratory Education (1990)
Current Issues in the Pharmaceutical Microbiology Laboratory Seminar/Workshop, Applied Analytical Industries, Inc. (1992)
Entry Level Management, Lancaster Laboratories (1993)
MIDI Microbial Identification System Training (1993)
Moving Pharmaceutical Microbiology into the 21st Century, Seminar/Workshop, Applied Analytical Industries, Inc. (1997)
Bacteriology, Colorado Association for Continuing Medical Laboratory Education (2001)
Principles of Biosafety/ BBP Exposure Control Plan, LLU (2003)
ISPE Baseline Guide Series: Biopharmaceuticals Guide, Interphex (2004)
Drinking Water Laboratory Training (2007)

Professional Experience:

Benedict Nuclear Pharmaceuticals, Inc., Supervisor of Quality Control (1987-1990)
Responsibilities included managing Quality Control laboratory; supervising operations related to quality assurance and GMP compliance

Cell Technology, Inc., Quality Assurance/Quality Control Analyst (1990-1991)
Responsibilities included developing and implementing environmental monitoring programs; evaluating systems for GMP compliance and performing testing of finished product

With Lancaster Laboratories since 1991
Microbiologist II, Pharmaceutical Microbiology (1991)
Responsibilities included writing/revising operating procedures for sterility testing, microbial limit testing, and related operations; performing sterility testing, endotoxin testing, microbial limit testing, environmental monitoring, and related testing associated with process/facility validation; performing data entry, data verification, and equipment maintenance
Microbiologist III, Pharmaceutical Microbiology (1992)
Responsibilities included coordinating scheduling for microbial limit testing, performing sterility testing, and tests associated with support of process validation and facility validation
Coordinator, Pharmaceutical Microbiology (1993)
Responsibilities included managing and scheduling of personnel and verification of data; supervising daily laboratory operations; coordinating and conducting client method transfers; evaluating compliance of operations with corporate requirements and GMP regulations; performing duties related to support of client facility validations and process validations/method development
Group Leader, Pharmaceutical Microbiology (1996)
Responsibilities included managing daily operations of pharmaceutical microbiology department including personnel; performing quality assurance and regulatory compliance functions to maintain departmental operations in accordance with corporate requirements and GMP regulations; being responsible for management of the Facility Validation group and Media Preparation group within the department

Uncontrolled Copy

Manager, Pharmaceutical Microbiology (2005)
Responsibilities include managing daily operations of pharmaceutical microbiology department including personnel; performing quality assurance and regulatory compliance functions to maintain departmental operations in accordance with corporate requirements and GMP regulations; being responsible for management of the Facility Validation group and Media Preparation group within the department

Awards, Citations, Honorary Societies & Publications:

Specialist Microbiologist in Consumer and Industrial Microbiology, National Registry of Certified Microbiologists of the American Academy of Microbiology
Publication: Lingenfelter, E.A., H.L. Evans, W.B. Atkins, and H.M. Clow. How to Improve Cleaning Processes. Pharmaceutical Formulation & Quality magazine. (June 2009)

Memberships & Appointments:

American Society for Microbiology
National Registry of Certified Microbiologists

Rachel R. Cochis, B.A., Senior Specialist Group Leader, GC/MS Semivolatiles

Education:

B.A. Science, Pennsylvania State University (1992)

Continuing Education:

Introduction to Mass Spec Interpretation, Hewlett-Packard (1995)
Gas Chromatography Principles & Practices (1994)

Professional Experience:

With Lancaster Laboratories since 1993
Chemist (1994), GC/MS Semivolatiles (1993)
Responsibilities included performing semvolatiles analysis on water and soil samples
Senior Chemist Coordinator, GC/MS Semivolatiles (1996)
Responsibilities included scheduling lab work; performing data interpretation and entry; reviewing and approving data; revising and updating SOPs and analytical methods; monitoring turnaround time; communicating client requirements to lab areas
Senior Specialist Group Leader, GC/MS Semivolatiles (2005)
Responsibilities include scheduling lab work; performing data interpretation and entry; reviewing and approving data; revising and updating SOPs and analytical methods; monitoring turnaround time; communicating client requirements to lab areas

Tracy A. Cole, Senior Specialist, EPH/Miscellaneous GC

Continuing Education:

Gas Chromatography: Principles and Practice, LLU (1997)

Professional Experience:

With Lancaster Laboratories since 1991
Laboratory Technician, Volatiles in Air (1991)
Responsibilities included preparing samples and standards; washing glassware; loading samples on instruments
Senior Technician, Volatiles in Air and EPH/Miscellaneous GC (1994)
Responsibilities included analyzing routine samples and QC by Gas Chromatography for DRO and miscellaneous organic compounds; preparing direct injection samples for analysis; preparing standards; reviewing chromatography data and uploading to the LIMS
Chemist, EPH/Miscellaneous GC (1999)
Responsibilities included analyzing routine and nonroutine samples and QC by Gas Chromatography for various organic analyses including DRO, TPH, and other petroleum related methods and miscellaneous organic compounds by direct injection; reviewing chromatography data and uploading to the LIMS; performing instrument maintenance; calibrating instruments for various methods
Senior Specialist, EPH/Miscellaneous GC (2008)
Responsibilities include reviewing/verifying data for technical correctness including raw chromatography data, initial calibrations, and analytical reports; ensuring that method and project requirements were followed and entry into the LIMS is correct; acting as a technical resource for the department; assisting in reviewing/writing SOPs and other technical documents

Uncontrolled Copy

Uncontrolled Copy

Paul R. Cormier, B.A., Principal Specialist, Specialty Services Group

Education:

B.S. Microbiology, Virginia Tech (1984)
B.A. Chemistry, Virginia Tech (1984)

Continuing Education:

Hewlett-Packard GC/MS Advance Operations/System Manager Course (1990)
Mass Spectral Interpretation, Finnigan MAT Institute (1991)
Technical Training, OI Analytical (1995)

Professional Experiences:

Environmental Testing & Certification (1985-1989)
Analytikem, Inc. (1989-1990)
With Lancaster Laboratories since 1990
- Senior Chemist (1990)
  - Responsibilities included: operate GC/MS instruments; data interpretation; review and approve data; repairing instruments; and train other analysts.
- Senior Specialist (2005)
  - Responsibilities included: operate GC/MS instruments; data interpretation; review and approve data; repairing instruments; and train other analysts.
- Principal Specialist, GC/MS Volatiles (2006)
  - Responsibilities include: operate GC/MS instruments; data interpretation; review and approve data; repairing instruments; and train other analysts.
- Principal Specialist, Specialty Services Group (2010)
  - Responsibilities include acting as technical resource within the environmental division; developing and validating analytical protocols; troubleshooting and solving analytical chemistry problems; optimizing instrument configuration and performance; evaluating and interpreting analytical results; writing SOPs; assisting in responding to and eliminating ICARs, assisting in optimizing procedures in prep lab; communicating effectively within department; performing routine work as required

Memberships & Appointments:

American Chemical Society

Teresa L. Cunningham, B.S., Principal Specialist, Environmental Client Services

Education:

B.S. Biology, St. Joseph's University (1999)

Continuing Education:

Chemical Monitoring Assistance Program, Pennsylvania Rural Water Association (2000)
How to Deliver Exceptional Customer Service, Fred Pryor Seminars (2000)
Organizational Behavior, Penn State University (2005)

Professional Experience:

With Lancaster Laboratories since 1999
- Specialist, Environmental Client Services (1999-2000)
- Senior Specialist, Environmental Client Services (2001)
- Senior Specialist Coordinator, Environmental Client Services (2001)
  - Responsibilities included serving as project manager for clients with petroleum-related testing accounts; coordinating client requests with laboratory groups to ensure that the client's needs are met; scheduling bottle shipments and sample pickups; preparing quotations; coordinating staff
- Senior Specialist Group Leader, Environmental Client Services (2005)
  - Responsibilities included serving as project manager for clients with petroleum-related testing accounts; coordinating client requests with laboratory groups to ensure that the client's needs are met; scheduling bottle shipments and sample pickups; preparing quotations; coordinating staff
- Manager, Environmental Client Services (2006)
  - Responsibilities included overseeing implementation of new projects; coordinating client requests with laboratory groups to ensure that the client's needs are met; coordinating staff
- Principal Specialist, Environmental Client Services (2008)
  - Responsibilities include performing project management; training new client service representatives; auditing sample entry; answering client questions; communicating client requirements to lab areas

Carolyn M. Cyms, B.S., Senior Specialist Group Leader, Environmental Sample Administration

Education:

B.S. Secondary Education/Chemistry, Bloomsburg University of Pennsylvania (1993)
Post Baccalaureate Certificate, Biology and MS Math, Millersville University (2002)

Continuing Education:

Accounting I, HACC (1996)
Introduction to the Internet, PC Focus (1996)
Self-Discipline & Emotional Control, Franklin-Covey (1997)
Child Growth & Development, HACC (1998)
Cell Biology, Millersville University (2000)
Botany; Genetics; Zoology; Biochemistry; Ecology, and Ecology Lab, Millersville University (2001)
Immunology; Animal Behavior; Teaching Biological Issues; Entomology, Millersville University (2002)
Introduction to Computer Programming, Millersville University (2003)

Professional Experience:

Lancaster Theological Seminary, Field Education Assistant-Special Project Coordinator (1996-1999)
Responsibilities included assisting with mailings, organization of the field education program; creating and preparing a student field education manual for the ministerial studies program; acting as liaison between Field Ed Professor, Field Ed sites, and students; preparing all written correspondences for the field ed office; organizing and preparing materials for meetings; tracking student progress through the program; assisting with other special projects requiring computer skills of PageMaker, WordPerfect, Quattro Pro, and Envoy
Self-Employed, Tutor (1994-2005)
Responsibilities included tutoring HACC students in Introduction to Chemistry, Chemistry, Biology, and Algebra
Millersville University – Biology Department, Assistant (2003)
Responsibilities included preparing Power Point presentations for a stream restoration monitoring program; photographing various stages of the project
With Lancaster Laboratories since 1994
Administrator III, Environmental Sample Administration (1994)
Responsibilities included receiving samples, entering samples, auditing, filing, noting discrepancies, and unpacking samples
Administrator III/Coordinator, Environmental Sample Administration (1995)
Responsibilities included relaying technical/client information when it became available; answering questions from clients/technical areas when CSR was unavailable; coordinating/prioritizing entry; supervising and evaluating work of 2nd Shift Environmental Entry Staff; training new personnel in the entry/interpretation process; preparing Job Plans on an as-needed basis
Specialist I, Environmental Sample Administration (1996)
Responsibilities included receiving samples; entering samples; auditing; filing; noting discrepancies; unpacking samples; acting as project coordinator on an as-needed basis
Senior Specialist, Environmental Sample Administration (2000)
Responsibilities included receiving samples; entering samples; auditing; filing; noting discrepancies; unpacking samples; acting as project coordinator on an as-needed basis; training; preparing resource materials; working on special projects as needed
Senior Specialist Coordinator, Environmental Sample Administration (2004)
Responsibilities included receiving samples; entering samples; auditing; filing; noting discrepancies; unpacking samples; acting as project coordinator on an as-needed basis; training; preparing resource materials; working on special projects as needed
Senior Specialist Group Leader, Environmental Sample Administration (2005)
Responsibilities include receiving samples; entering samples; auditing; filing; noting discrepancies; unpacking samples; acting as project coordinator on an as-needed basis; training; preparing resource materials; working on special projects as needed

Awards, Citations, Honorary Societies & Publications:

Residential Life Award of Merit (1990)
Bloomsburg University Dean's List 6 of 8 semesters, graduated cum laude (1990-1993)
Kappa Delta Phi (National Co-Ed Honor Society) (1994)
Spirit of LLI (2001)

Memberships & Appointments:

Elizabethtown Fire Company (1993-present)
Safety Committee (1994-1998)
Alpha Phi Omega (National Co-Ed Service Fraternity) (1991-1993)
NSTA (2000-2008)
Kappa Delta Phi (1994, 2001-2003)

Uncontrolled Copy

Kimberly A. Davies, M.B.A., Manager, Flexible Staffing

Education:

B.S. Biology, Shippensburg University of Pennsylvania (1991)
M.B.A., Pennsylvania State University (1999)

Professional Experience:

Polybac Corporation, Technical Services (1991-1992)
Upper Saucon Township Wastewater Treatment Plant, Technician (1992-1993)
With Lancaster Laboratories since 1993
- Client Services Senior Specialist (1996)
- Senior Specialist/Coordinator, Pharmaceutical Project Management (1998)
- Principal Specialist/Coordinator, Pharmaceutical Project Management (2000)
- Group Leader, Pharmaceutical Project Management and Data Support (2001)
  - Responsibilities included managing pharmaceutical project management and data support staff; facilitating group meetings to communicate with staff; supporting company and division policies and provide information to department; supporting employee development and acknowledge innovative ideas; promoting group and department teamwork and collaboration
- Manager (previously titled Group Leader), Pharmaceutical Project Management (2003)
  - Responsibilities included managing pharmaceutical project management staff; facilitating group meetings to communicate with staff; supporting company and division policies and provide information to department; supporting employee development and acknowledge innovative ideas; promoting group and department teamwork and collaboration
- Manager, Flexible Staffing (2005)
  - Responsibilities included managing labor resources across departments and divisions, coordinating continuous improvement activities including Management Operating System (MOS) audits, new management MOS training, and MOS tool maintenance
- Manager, Flexible Staffing and Technical Training (2006)
  - Responsibilities included managing labor resources across departments and divisions, coordinating continuous improvement activities including Management Operating System (MOS) audits, new management MOS training, and MOS tool maintenance; managing the technical training staff responsible for designing and facilitating technical training
- Manager, PPI Process and Flexible Staffing (2008)
  - Responsibilities include managing labor resources across departments and divisions, coordinating continuous improvement activities including Management Operating System (MOS) audits, new management MOS training, and MOS tool maintenance; managing the technical training staff responsible for designing and facilitating technical training; qualified Practical Process Improvement process manager responsible for facilitating PPI project team training and PPI efforts within LLI

Steven C. Davies, B.S., Manager, Transportation and Sample Bottles

Education:

B.S. Elementary Education, Lancaster Bible College (1987)

Professional Experience:

With Lancaster Laboratories since 1990
- Transportation Coordinator (1991)
- Transportation Group Leader (1994)
- Transportation and Sample Bottles Group Leader (1998)
  - Responsibilities included supervise personnel; schedule lab work; manage financial resources; answer client questions; communicate client requirements to lab areas; and schedule sample submissions and provide sampling containers.
- Transportation and Sample Bottles Manager (2005)
  - Responsibilities include supervise personnel; schedule lab work; manage financial resources; answer client questions; communicate client requirements to lab areas; and schedule sample submissions and provide sampling containers.

Irene Lynn Dodd, M.B.A., Principal Specialist, Environmental Business Development

Education:

B.A. Chemistry, Washington & Jefferson College (1988)
M.B.A. Pennsylvania State University (1993)

Uncontrolled Copy

Continuing Education:

Mass Spectral Interpretation Course (1991)
High Impact Communication Skills (1992)
GC Troubleshooting Course (1993)
Selected courses at Millersville University (1996)
Effective Technical Communication (2000)
Business Writing for Results (2002)
Signature Service (2002)
The Counselor Salesperson (2004)
Pennsylvania Chamber Annual Environmental Laws and Regulations Conference (2004, 2005, 2006, 2007)
Conceptual Selling (2009)
Intermediate II and Advanced Excel (2011)

Professional Experience:

Stauffer Chemical Company, Food Chemist (1987-1988)
With Lancaster Laboratories since 1988
Chemist (1991)
Senior Chemist (1995)
Senior Specialist (1997)
Principal Specialist, Environmental Business Development (2003)
Responsibilities include: project management; review and approve data; consult with clients regarding testing needs; work with external auditors; assist with client visits to the lab, advise clients on testing; provide price quotes; monitoring turnaround time; audit sample entry; answer client questions; communicate client requirements to lab areas; provide status reports, including results, to clients; provide sampling containers; and schedule sample submissions.

Memberships and Appointments:

American Chemical Society
National Society of Collegiate Journalists
American Business Women's Association
President (1998-1999); Vice President (1994-1995, 1997-1998); Secretary (2000-2001); Newsletter Chair (1993-1994, 2001-2003); Business Associate Night Chair (2000); Woman of the Year (1999, 2004); Thelma Farley Memorial Award (1995); Hospitality Chair (2003-2004) with Wheatland Conestoga Chapter
Vice President of Communications (2006-2007, 2007-2008) and Formation committee (2006-2007); Woman of the Year (2007) for Lancaster Area Express Network; Regional and National Newsletter Award Winner (2008)
Girl Scouts in the Heart of Pennsylvania
Leader (2008-Present)

Amy L. Doupé, B.S., Principal Specialist, Quality Assurance

Education:

B.S. Environmental Studies, Allegheny College (1989)

Professional Experience:

With Lancaster Laboratories since 1994
Senior Technician, Volatiles by GC (1994)
Responsibilities included performing sample pre-screening.
Senior Administrator, Quality Assurance (1995)
Responsibilities included performing administrative and certification support
Specialist, Quality Assurance (1997)
Responsibilities include maintaining documentation of agency certifications
Senior Specialist, Quality Assurance (2003)
Responsibilities included maintaining documentation of agency certifications
Principal Specialist, Quality Assurance (2009)
Responsibilities include maintaining documentation of agency certifications

Memberships & Appointments:

The NELAC Institute (TNI) Proficiency Testing Board
The NELAC Institute (TNI) Proficiency Testing Committee
Pennsylvania Association of Accredited Laboratories (1997-present)
Maryland Environmental Laboratory Association (1999-present)
Florida Society of Environmental Analysts (2010-present)

Uncontrolled Copy

Gregory J. Drahovsky, B.S., Senior Chemist, GC/MS Semivolatiles

Education:

B.S. Forensic Science, Alvernia College (2006)

Professional Experience:

With Lancaster Laboratories since 2006
- Chemist Title, GC/MS Semivolatiles (2006)
  - Responsibilities included analyzing data for various methods; maintaining instrumentation including GC/MS (5890/5971) (5890/5972) (6890/5973) (6890/5975) (TRACE GC Ultra/DSQII); making standards for various types of methods; calibrating departmental syringes
- Senior Chemist, GC/MS Semivolatiles (2011)
  - Responsibilities include analyzing data for various methods; maintaining instrumentation including GC/MS (5890/5971) (5890/5972) (6890/5973) (6890/5975) (TRACE GC Ultra/DSQII); making standards for various types of methods; emptying waste in designated shed; training others on different analyses; calibrating departmental syringes

Awards, Citations, Honorary Societies, and Publications:

Berks County Undergraduate Research Conference Publication (2004)
Beta Kappa Chi science honors society (2006)

Christine M. Dulaney, B.A., Senior Specialist, GC/MS Volatiles

Education:

B.A. Biology, Meredith College (1984)

Continuing Education:

Waters Fundamentals of HPLC, Compuchem Laboratories (1989)

Professional Experience:

Compuchem Laboratories (1984-1998)
- Extraction Technician (1984-1986)
  - Responsibilities included performing extraction of various environmental matrices for pesticide GC analysis and semivolatile GC/MS analysis; extracting quarterly PE samples
- GC Technician (1986-1989)
  - Responsibilities included performing analysis of environmental extracts for pesticides, PAHs, and volatile organic compounds using GC, HPLC, and purge and trap, respectively; performing routine instrument maintenance
- Senior Chemist, Pesticide Review (1990-1995, 1996-1998)
  - Responsibilities included performing qualitative and quantitative review of pesticide, PAH, and volatile organic data; reviewing instrument maintenance and standard logbooks

With Lancaster Laboratories since 1998
- Chemist, Pesticide Residue (1998)
  - Responsibilities included reviewing GC pesticide residue data packages; responding to client inquiries and ICARs
- Project Management Specialist, Pharmaceutical Client Services (2003)
  - Responsibilities included managing details of various pharmaceutical client accounts using the laboratory information management system; acting as liaison between the client and internal laboratory personnel
- Senior Specialist, GC/MS Volatiles (2005)
  - Responsibilities include auditing data for various GCMS volatile analyses; verifying data within the laboratory information management system; reviewing standard preparation logbooks; signing final analytical reports

Eric L. Eby, B.S., Senior Chemist, Metals

Education:

B.S. Biology, Millersville University (1988)

Continuing Education:

OSHA 40-hour Hazardous Waste Management, Phoenix Safety Associates (1991)
DX500 Maintenance and Troubleshooting, Dionex (1996)
The Chemistry Behind the Techniques, EAS, Inc. (1996)
Cleaning Validation Strategies, Applied Analytical Industries, Inc. (1997)
Gas Chromatography Practical Theory and Applications, Lancaster Laboratories (1998)

Uncontrolled Copy

Professional Experience:

With Lancaster Laboratories since 1988
- Associate Chemist (1993)
  - Responsibilities included environmental wet chemistry testing and field sampling.
- Chemist (1997)
- Senior Chemist, Pharmaceutical Raw Materials (1998)
  - Responsibilities included IC, TOC analysis, IC maintenance, USP purified water testing, raw materials testing, USP <661> container closure testing.
- Senior Chemist, Pharmaceutical Product Testing (2000)
  - Responsibilities included pharmaceutical product testing per client specific methods, IC and HPLC maintenance.
- Senior Chemist, Metals (2005)
  - Responsibilities include ICP analysis for environmental testing and ICP instrument maintenance.

Jaime L. Ferguson, A.S., Senior Specialist, Billing & Reporting

Information not available at time of printing.

Erik J. Frederiksen, B.A., Manager, Water Quality and Instrumental Water Quality

Education:

B.A. Chemistry, University of Virginia (1990)

Continuing Education:

Infrared Spectral Interpretation (1993)

Professional Experience:

With Lancaster Laboratories since 1990
- Chemist/Coordinator (1993)
- Group Leader (1994)
  - Responsibilities included supervising personnel; managing laboratory operations; project management; managing financial resources; reviewing and approving data
- Manager, Water Quality and Instrument Water Quality (2005)
  - Responsibilities include supervising personnel; managing laboratory operations; project management; managing financial resources; reviewing and approving data

Lynn Frederiksen, B.S., Principal Specialist Group Leader, Environmental Client Services

Education:

B.S. Conservation and Resource Development, University of Maryland (1981)

Professional Experience:

University of Missouri, Senior Research Lab Technician (1982 – 1984)
GPU Nuclear Corporation, Data Analyst (1985 – 1989)
With Lancaster Laboratories since 1989
- Senior Specialist (1989)/Team Leader, Environmental Client Services (2006)
  - Responsibilities included: consult with clients regarding testing needs; revise and update SOPs; provide price quotes; audit sample entry; answer client questions; communicate client requirements to lab areas; provide status reports, including results, to clients; schedule sample submissions and provide sampling containers; assist Group Leader with training of new employees and delegating new projects.
- Senior Specialist Group Leader, Environmental Client Services (2007)
  - Responsibilities included: managing a team of client service representatives, training of new employees, setting up and delegating new projects, serving as primary project manager for several large petroleum clients and consultants.
- Principal Specialist Group Leader, Environmental Client Services (2011)
  - Responsibilities include serving as the primary contact or back-up with the laboratory for a number of assigned clients requiring specialized testing or complex projects; understanding and communicating technical information and client requirements to laboratory personnel, helping to ensure that requirements are met; leading broad-based complex projects to a satisfactory conclusion according to client technical and schedule requirements; developing strong relationships with major accounts resulting in additional sales; advising and training other members of the department; serving as a technical resource both internally and externally; proactively assisting Outside Business Development with client visits, presentations, and internal audits for assigned clients; participating on PPI teams

Uncontrolled Copy

Joseph M. Gambler, B.S., Senior Chemist, GC/MS Semivolatiles

Education:

B.S. Chemistry, Millersville University (1996)

Professional Experience:

Wyeth, Biological Manufacturing Technician (1996)
With Lancaster Laboratories since 1996
Senior Chemist, GC/MS Semivolatiles (1996)
Responsibilities includes training new hires, maintaining GC/MS systems, preparing standards/stocks/spikes, maintaining Helium supply system, data interpretation, ordering supplies, auditing, and crosstrained in Pesticides Department.

Matthew R. Gehman, B.S., Senior Specialist, Environmental Health and Safety Officer, Human Resources

Education:

B.S. Occupational Safety and Environmental Health, Millersville University (2002)

Continuing Education:

24-Hour Emergency Response (HAZWOPER), Lancaster Laboratories (2004)
IATA/DOT 49 CFR, DGI Training Center (2004)
American Red Cross First Aid/CPR/AED certified, Lancaster Laboratories, Inc. (2004)
Advanced RCRA, Environmental Resource Center (2004)
In-depth Environmental Compliance, PA Chamber (2005)
In-depth Environmental Compliance, PA Chamber (2006)
National Incident Command System, Command School, Inc. (2006)
Life Safety Code, NFPA (2006)
International Conference on Biocontainment Facilities, Tradeline (2006)
In-depth Environmental Compliance, PA Chamber (2007)

Professional Experience:

United States Army Reserve, Military Police, Staff Sergeant (1996-2004)
Responsibilities included supporting joint FBI and military intelligence operations in the Iraq Theater (2003); supervising law enforcement and force protection activities in support of Operation Noble Eagle (2002); ensuring team members met training standards; monitoring health and welfare of team members
With Lancaster Laboratories since 2004
Senior EHS Specialist, Environmental Health and Safety, Human Resources (2004-2007)
Responsibilities included employee health program administration; maintaining current and developing new safety programs; managing environmental compliance program
Senior Specialist, Environmental Health and Safety Officer, Human Resources (2007)
Responsibilities include managing employee health programs; maintaining current and developing new safety programs; managing environmental compliance program

Memberships and Appointments:

Central PA section of American Industrial Hygiene Association (AIHA)
Member (2004-present)
VFW, Post 7362
Member (2004-present)
American Biological Safety Association (ABSA)
Member (2007-present)

Susan M. Goshert, B.S., Principal Specialist Group Leader, GC/MS Volatiles

Education:

B.S. Chemistry, Juniata College (1988)

Continuing Education:

Advanced Aquarius Report Training, Hewlett-Packard (1989)
How to Handle People with Tact and Skill, Harrisburg Area Community College (1992)
Positive Attitude and Peak Performance, Harrisburg Area Community College (1992)

Uncontrolled Copy

Professional Experience:

With Lancaster Laboratories since 1988
- Chemist (1990)
- Senior Chemist Coordinator (1997)
  - Responsibilities include: supervise personnel; review and approve data; and monitoring turnaround time.
- Senior Specialist Group Leader, EPH/Misc. GC (2005)
  - Responsibilities include: supervise personnel; review and approve data; and monitoring turnaround time.
- Principal Specialist Group Leader, GC/MS Volatiles (2008)
  - Responsibilities include: supervise personnel; review and approve data; and monitoring turnaround time.

Brian K. Graham, B.A., Senior Chemist, GC/MS Semivolatiles

Education:

B.A. Mathematics, Millersville University (1996)

Professional Experience:

With Lancaster Laboratories since 1989
- Chemist, GC/MS Semivolatiles (1989-2006)
- Senior Chemist, GC/MS Semivolatiles (2006)
  - Responsibilities include maintaining GC/MS Instrumentation; tuning and calibrating GC/MS; analyzing samples by GC/MS; reviewing and assembling all supporting GC/MS data; preparing standards for calibrations; training new analysts

Nina C. Haller, Senior Specialist Group Leader, Metals

Continuing Education:

State Dairy Lab Cert., State of PA (1993)
Butterfat Testing License, State of PA (1995)
Seminar ICP/ICPMS, Fisons Instruments (1995)
Three-day ICP Trace Training Course, Thermo Jarrell Ash, MA (1996)

Professional Experience:

Hazelton Research Products, Lab Technician (1981-1984)
- Responsibilities included rabbit production facility, removal of ovaries, care, and maintenance

With Lancaster Laboratories since 1987
- Technical Associate, Foods (1987)
  - Responsibilities included coordinating Listeria Testing Program; performing data entry and verification
- Chemist, Metals (1993)
  - Responsibilities included performing daily tracking of rushes; operating and maintaining ICP instrumentation; reviewing and verifying of ICP data, data package review
- Specialist Group Leader, Metals (2003)
  - Responsibilities included overseeing the ICP/ICPMS personnel and instrumentation workflow; verifying ICP/ICPMS/GFAA/Hg data
- Senior Specialist Group Leader, Metals (2006)
  - Responsibilities included overseeing the ICP/ICPMS personnel and instrumentation workflow; verifying ICP/ICPMS/GFAA/Hg data
- Senior Specialist Group Leader, Metals (2007)
  - Responsibilities include overseeing metals instrument and verification personnel and instrumentation workflow; verifying metals data

Michele D. Hamilton, B.S., Senior Chemist Group Leader, Pesticide Residue Analysis

Education:

B.S. Chemistry, Temple University (1990)

Continuing Education:

Gas Chromatography: Practical Theory and Applications for LL (1993)
Practice of Modern HPLC, LC Resources (1996)

Uncontrolled Copy

Professional Experience:

With Lancaster Laboratories since 1991
Senior Chemist (1997)
Senior Chemist/Coordinator (2000)
Responsibilities included supervising personnel; coaching and developing new employees; sample tracking; reviewing rush request; communicating client requirements; operating GC and HPLC instruments; data interpretation and entry; calibrating; repairing instruments and verifying data
Senior Chemist Group Leader, Pesticide Residue Analysis (2005)
Responsibilities include supervising personnel; coaching and developing new employees; sample tracking; reviewing rush request; communicating client requirements; operating GC and HPLC instruments; data interpretation and entry; calibrating; repairing instruments and verifying data

Sherri L. Harlan, M.B.A., Principal Specialist, Marketing & Communication Services

Information not available at time of printing.

Linda M. Hartenstine, B.A., Senior Chemist, GC/MS Semivolatiles

Education:

B.A. Chemistry, Millersville University (1994)

Professional Experience:

With Lancaster Laboratories since 1994
Associate Chemist (1994)
Chemist (1997)
Senior Chemist, GC/MS Semivolatiles (1998)
Responsibilities include performing GC/MS semivolatiles testing; operating GC/MS instruments; data interpretation; developing and evaluating new methods; calibrating and repairing instruments; preparing standards; revising and updating SOPs and analytical methods; training other analysts

Robert G. Heisey, Jr., B.A., Senior Specialist, Water Quality

Education:

B.A. Chemistry, Millersville State College (1972)

Professional Experience:

RCA Corp., Engineering Technician (1972-1987)
With Lancaster Laboratories since 1988
Chemist Coordinator (1989)
Senior Chemist Coordinator (1997)
Responsibilities included: supervise personnel; schedule lab work; review and approve data; develop and evaluate new methods; prepare test standards.
Senior Chemist Group Leader (2005)
Responsibilities included: supervise personnel; schedule lab work; review and approve data; develop and evaluate new methods; prepare test standards.
Senior Specialist, Water Quality (2006)
Responsibilities include: review and approve data; develop and evaluate new methods; prepare test standards; order laboratory supplies; maintain department's chemical inventory.

Tamara J. Helsel, Senior Specialist, Environmental Sample Administration

Professional Experience:

Willow Valley Retirement Communities, Certified Nursing Assistant (2000-2001)
Responsibilities included assisting nursing home residents with their daily activities and personal hygiene
Bayada Nurses, Certified Nursing Assistant (2000-2001)
Responsibilities included assisting people with disabilities in their homes with their personal hygiene and daily activities

Uncontrolled Copy

With Lancaster Laboratories since 2001
Senior Administrator, Environmental Sample Administration (2001)
Responsibilities included performing sample receipt, interpretation, and entry
Specialist, Environmental Sample Administration (2001)
Responsibilities included performing sample receipt, interpretation, and entry
Senior Specialist, Environmental Sample Administration (2007)
Responsibilities include performing sample receipt, interpretation, and entry

Memberships and Appointments:

Lancaster Laboratories Safety Committee (2003-2007)

J. Wilson Hershey, Ph.D., Chairman of the Board, Lancaster Laboratories

Education:

B.A. Chemistry, Millersville State College (1972)
M.S. Chemistry, Villanova University (1983)
Ph.D. Analytical Chemistry, Villanova University (1985)
M.B.A., Villanova University (1991)

Professional Experience:

With Lancaster Laboratories since 1972
Director of Environmental Sciences (1986)
Executive Vice President (1991)
President (1995)
Responsibilities included presiding over all support and technical operations of Lancaster Laboratories; managing resources; establishing priorities to ensure the continued success of our business
Chairman of the Board (2011)
Responsibilities include reporting operational and financial to senior leadership of parent company; ensuring the continued success of Lancaster Laboratories

Awards, Citations, Honorary Societies & Publications:

12 publications in analytical chemistry and laboratory management

Jenifer E. Hess, B.S., Manager, Pesticide Residue Analysis, EPH/Misc. GC, Nitrosamines, Volatiles by GC

Education:

B.S. Chemistry, University of Delaware (1984)

Continuing Education:

21 credits towards M.B.A., University of Delaware

Professional Experience:

J. M. Huber Corporation, Research Chemist (1984-1985)
With Lancaster Laboratories since 1985
Chemist/Coordinator, Pesticide Residue Analysis (1989)
Group Leader, Pesticide Residue Analysis (1992)
Responsibilities included supervising personnel; managing laboratory operations and financial resources; project management; reviewing and approving data; consulting with clients regarding testing needs
Manager, Pesticide Residue Analysis (1992)
Responsibilities included supervising personnel; managing laboratory operations and financial resources; project management; reviewing and approving data; consulting with clients regarding testing needs
Manager, Pesticide Residue Analysis, EPH/Misc. GC (1996)
Responsibilities included supervising personnel; managing laboratory operations and financial resources; project management; reviewing and approving data; consulting with clients regarding testing needs
Manager, Pesticide Residue Analysis, EPH/Misc. GC, Nitrosamines (1998)
Responsibilities included supervising personnel; managing laboratory operations and financial resources; project management; reviewing and approving data; consulting with clients regarding testing needs
Manager, Pesticide Residue Analysis, EPH/Misc. GC, Nitrosamines, Volatiles by GC (2005)
Responsibilities include supervising personnel; managing laboratory operations and financial resources; project management; reviewing and approving data; consulting with clients regarding testing needs

Uncontrolled Copy

John P. Hook, B.S., Senior Chemist, Metals

Education:

B.S. General Science, Pennsylvania State University (2002)

Continuing Education:

ICP/ICP-MS Seminar, Perkin-Elmer (2003)
ICP-MS Seminar, Agilent (2004)
ICP-MS training, Perkin-Elmer (2005)
PPI Team Training, Lancaster Laboratories (2008)
Facilitator Training, ThermoFisher Scientific (2009)

Professional Experience:

Sony Technology Corporation, Manufacturing Staff (2002-2003)
Responsibilities included assembly, final inspection, and packaging of television sets
ALCOA Primary Metals, Laboratory Technician (2003)
Responsibilities included observation and maintenance of aluminum production pilot test operation; analysis of product
With Lancaster Laboratories since 2003
Chemist, Metals (2003)
Senior Chemist, Metals (2006)
Responsibilities include performing setup, analysis, and review of ICP, ICP-MS runs; maintenance and troubleshooting of ICP, ICP-MS instruments; yearly, quarterly and start-up ICP instrument qualifications including IECs, IDLs, MDLs, and LDRs; maintaining adequate laboratory supply inventory; disposing of acid waste; writing SOPs

Samuel A. Huber, B.S., Manager, Physical Services/Equipment Maintenance & Repair

Education:

B.S. Biology, Lebanon Valley College (1988)
Certificate of Business Administration, Penn State University (1995)

Continuing Education:

24-hour HAZWOPER (spill response) (1995-2004)
40-hour HAZWOPER (2005-present)
DOT/IATA training (2004-present)
Incident Command System IS-00100 (2006)
National Incident Management System IS-00700 (2006)
Total Productive Maintenance (2007)
Basic Electricity for the Non-Electrician (2009)
Air Conditioning and Refrigeration (2010)

Professional Experience:

With Lancaster Laboratories since 1988
Environmental department responsibilities (1988-2007)
Responsibilities included supervising personnel; scheduling lab work; managing laboratory operations and financial resources; project management; supervising method development
Manager, Physical Services/Equipment Maintenance & Repair (2007)
Responsibilities include overseeing facilities staff and operation of physical plant and grounds; growth planning; overseeing security functions

Awards, Citations, Honorary Societies & Publications:

Dawson-Grundmann Innovation Award, Lancaster Laboratories (1999)
Design and oversee installation of bulk solvent delivery system for organic extractions; annual savings in waste reduction and labor costs of greater than $12,000
Organizing the Laboratory to Efficiently and Accurately Process Soil Samples, Pittcon poster session (2006)
NFPA Industrial Fire Protection Section Member (2009-present)

Christine M. Jampo, M.S., Senior Specialist, Environmental Business Development/Sales

Education:

B.S. Chemistry/Biology, West Chester University (1987)
M.S. Environmental Health, West Chester University (1996)

Uncontrolled Copy

Professional Experience:

ERM, QA/Chemist/Consultant (1987-1997)
Responsibilities included QA chemistry, client/lab/field liaison, data validation/technical review, project management
Self Employed/Consultant, Environmental Consultant (1997-2001)
Responsibilities included data interpretation and analysis; QA/QC of field and laboratory data
Prudential Fox & Roach Realtors, Realtor/Sales Professional (2004-2010)
Responsibilities included residential real estate sales including buyer, seller and relocation services
With Lancaster Laboratories since 2010
Senior Specialist, Environmental Business Development/Sales (2010)
Responsibilities include developing new business revenue for LL by performing account management duties for existing accounts and prospects in the commercial and DOD markets; identifying and securing sales opportunities through phone calls, sales visits, presentations, team selling, quotes, and proposals; generating new business opportunities consistent with our operational capabilities and capacity

Sara E. Johnson, B.S., Senior Chemist, GC/MS Volatiles

Education:

B.S. Chemistry, Biochemistry option, Millersville University (2006)

Professional Experience:

With Lancaster Laboratories since 2006
Chemist, Flexible Staffing (2006)
Responsibilities included flexing to various departments as needed and performing analysis ranging from GC/MS to SDS-PAGE Electrophoresis with colloidal blue or silver staining
Chemist, GC/MS Volatiles (2008)
Responsibilities included performing GC/MS analysis of water and soil samples along with other matrices by various analytical methods such as EPA 624, 8260B, and CLP; evaluating analytical data generated; calibrating and troubleshooting GC/MS instrumentation
Senior Chemist, GC/MS Volatiles (2010)
Responsibilities include performing GC/MS analysis of water and soil samples along with other matrices by various analytical methods such as EPA 624, 8260B, and CLP; evaluating analytical data generated; calibrating and troubleshooting GC/MS instrumentation; assisting other employees with any questions that may arise and helping to train new employees

Mark Kaiser, Director; Pharmaceutical and Environmental Microbiology; Biopharmaceutical Services; Stability Services

Education:

Elizabethtown College, Biology 120 credits (1983)

Continuing Education:

Fundamentals of D, Z, and F Valves, PDA (1989)
Viable and Nonviable Environmental Monitoring, PDA (1990)
Validation in the Pharmaceutical Microbiology Laboratory, Applied Analytical Laboratories (1993)
Introduction to Capillary GC, Hewlett-Packard (1993)
HP5890 GC Troubleshooting and Maintenance, Hewlett-Packard (1993)
Design and Validation of Sterilization Processes, PDA (1998)
Introduction to Basic Laboratory Techniques in Biotechnology, PDA (1999)
Microbiology and Engineering of Sterilization Processes, PDA (2000)

Professional Experience:

With Lancaster Laboratories since 1983
Technician, Food Microbiology (1983)
Responsibilities included performing microbiological testing of food and feed products
Senior Technician, Bioassays (1984)
Responsibilities included performing antibiotic bioassays, schedule testing, supervise analysts, review and approve results, technical contact for clients
Group Leader, Bioassays, Environmental Microbiology (1986)
Responsibilities included managing technical operations, quality, regulatory compliance, and financial performance of bioassays and environmental microbiology; developing new assays and services; acting as technical contact for clients
Group Leader, Pharmaceutical Microbiology and Environmental Microbiology (1989)
Responsibilities included establishing pharmaceutical microbiology services at Lancaster Laboratories; developing and validating services for sterile and non-sterile product testing as well as support for facility validation and monitoring; establish GMP and compliance systems; managing technical operations, quality, regulatory compliance, and financial performance; acting as technical contact for clients; marketing new services to prospects and clients

Uncontrolled Copy

Manager, Pharmaceutical Microbiology and Pharmaceutical Sample Storage (1996)
Responsibilities included managing technical operations, quality, regulatory compliance, and financial performance for pharmaceutical microbiology; acting as technical and marketing contact for clients and prospects; managing centralized storage systems and facilities for pharmaceutical samples
Manager, Pharmaceutical and Environmental Microbiology, Stability Services, Pharmaceutical Sample Storage (2001)
Responsibilities included managing technical operations, quality, regulatory compliance, and financial performance for pharmaceutical and environmental microbiology and stability services; acting as technical and marketing contact for clients and prospects; managing centralized storage systems and facilities for pharmaceutical samples
Director (previously titled Manager), Pharmaceutical and Environmental Microbiology, Biopharmaceutical Services, Stability Services, Pharmaceutical Sample Storage (2004)
Responsibilities included managing technical operations, quality, regulatory compliance, and financial performance for pharmaceutical and environmental microbiology and stability service; acting as technical and marketing contact for clients and prospects; managing centralized storage systems and facilities for pharmaceutical samples; establishing biopharmaceutical services at Lancaster Laboratories; managing the development, set up, and validation of molecular, cell, and viral service offerings for the biopharmaceutical industry; establishing GMP and compliance systems; managing technical operations, quality, regulatory compliance, and financial performance for biopharmaceuticals
Director, Pharmaceutical and Environmental Microbiology, Biopharmaceutical Services, Stability Services, Pharmaceutical Sample Storage, Pharmaceutical Sample Entry (2006)
Responsibilities include managing technical operations, quality, regulatory compliance, and financial performance for pharmaceutical and environmental microbiology and stability service; acting as technical and marketing contact for clients and prospects; managing centralized sample entry, storage systems and facilities for pharmaceutical samples; establishing biopharmaceutical services at Lancaster Laboratories; managing the development, set up, and validation of molecular, cell, viral, and mycoplasma service offerings for the biopharmaceutical industry; establishing GMP and compliance systems; managing technical operations, quality, regulatory compliance, and financial performance for biopharmaceuticals

Memberships & Appointments:

PDA, Delaware Valley Chapter, Past Vice President
PDA, Delaware Valley Chapter, Program Committee
PDA, Microbiology Interest Group
PDA, Container/Closure Task Force
Pharmaceutical Stability Discussion Group (PSDG) (2001)

Richard H. Karam, B.S., Manager, Organic Extraction/Leachate Preparation/GC/MS Volatiles/GC/MS Semivolatiles

Education:

B.S. Environmental Studies, Green Mountain College (2000)

Professional Experience:

Severn Trent Laboratories (2000-2006)
Project Manager (2005-2006)
Responsibilities included managing environmental projects; writing case narratives; project set up
Analytical Chemist (2000-2005)
Responsibilities included analyzing environmental samples for various general chemistry parameters, metals by ICP/ICPMS, pesticides/PCBs/herbicides by GC, and semivolatiles by GC/MS
With Lancaster Laboratories since 2006
Group Leader, GC/MS Semivolatiles (2006)
Responsibilities included coordinating production in GC/MS Semivolatiles; reviewing and signing reports
Manager, GC/MS Semivolatiles (2007)
Responsibilities included ensuring the accuracy and acceptability of all data generated by the GC/MS Semivolatiles group; coordinating daily prioritization of workload and monitoring the holding time and turnaround time status of samples; responding to client questions regarding GC/MS Semivolatiles data and methods and communicating technical issues or concerns about samples to project managers for clarification or resolution with the client
Manager, Organic Extraction/Leachate Preparation/GC/MS Volatiles/GC/MS Semivolatiles (2008)
Responsibilities include ensuring the accuracy and acceptability of all data generated by the groups; coordinating daily prioritization of workload and monitoring the holding time and turnaround time status of samples; responding to client questions regarding data and methods and communicating technical issues or concerns about samples to project managers for clarification or resolution with the client

Dana M. Kauffman, Manager, Sample Support and Data Deliverables

Continuing Education:

Introduction to Electronics, Lancaster County Career & Technology Center, Brownstown (1994)
AC/DC Electronics, Lancaster County Career & Technology Center (1995)
Gas Chromatography: Principles and Practices, Lancaster Labs University (2003)

Uncontrolled Copy

Professional Experience:

With Lancaster Laboratories since 1994
- Lab Technician (1995)
- Senior Technician (1996)
- Sample Support Coordinator (1997)
- Group Leader, Sample Support (1999); Group Leader, Volatiles by GC (2002)
  - Responsibilities included supervising personnel; managing laboratory operations; project management; sample preparation; developing and evaluating new methods; reagent preparation; revising and updating SOPs; ordering supplies; training other analysts; running the automated storage and retrieval system; lab cleaning and maintenance; monitoring laboratory activities; performing internal audits; enforcing regulatory compliance requirements; maintaining required certifications; communicating client requirements to lab areas
- Manager, Sample Support and Data Deliverables (2005)
  - Responsibilities include overseeing all upfront sample handling requirements including storage, preservation, homogenization, moisture determination, volatile prescreen, and volatile soil prep; supervising group leader personnel; project management; revising and updating SOPs; performing internal audits; enforcing regulatory compliance requirements; maintaining required certifications; communicating client requirements to lab areas; data package and EDD TAT monitoring; overseeing all data package processes including data assembly, review, and processing; Practical Process Improvement (PPI) process manager responsible for facilitating PPI project team training and PPI efforts within LLI

Nicole M. Kepley, B.S., Senior Chemist Group Leader, Instrumental Water Quality

Education:

AA Psychology, Harrisburg Area Community College (1997)
B.S. Psychobiology, Lebanon Valley College (2000)

Professional Experience:

With Lancaster Laboratories since 2000
- Senior Technician, Instrumental Water Quality (2000)
  - Responsibilities included various prep analyses, data entry, TOC and TOX analyses.
- Chemist, Instrumental Water Quality (2003)
  - Responsibilities included performing various analyses, verification, and review and revise SOPs.
- Senior Chemist, Instrumental Water Quality (2006)
  - Responsibilities include performing various analyses, method development, verification, and review and revise SOPs.
- Senior Chemist Group Leader, Instrumental Water Quality (2009)
  - Responsibilities include performing various analyses, method development, verification, and review and revise SOPs; acting as a technical resource, trainer, and troubleshooter; making recommendations for operational and/or technical improvements; coaching and developing direct reports; planning and monitoring workflow.

Awards, Citations, Honorary Societies, and Publications:

Phi Theta Kappa National Honor Society (Alpha Nu Omega) (1996-2000)

Katherine A. Klinefelter, M.S., Principal Specialist, Environmental Client Services

Education:

B.S. Chemistry, Rutgers University (1983)
M.S. Physiology, Rutgers University (1985)

Continuing Education:

Additional graduate work in Physiology, Rutgers University (1985-1989)
Practical Process Improvement (Team Member Training), Lancaster Labs University (2009)

Professional Experience:

Rutgers University, Research and Teaching Assistant (1984-1989)
M. S. Hershey Medical Center of Penn State University, Senior Research Technician (1990-1993)
With Lancaster Laboratories since 1993
- Environmental Project Management
- Senior Specialist, Environmental Client Services (1993)
- Senior Specialist/Coordinator, Environmental Client Services (1996)
- Senior Specialist, Environmental Client Services (2000)
- Principal Specialist, Environmental Client Services (2007)
  - Responsibilities include project management; training new client service representatives; auditing sample entry; answering client questions; communicating client requirements to lab areas

Uncontrolled Copy

Awards, Citations, Honorary Societies & Publications:

Dean's Graduate Student Dissertation Research Award, Rutgers University
Dean's Graduate Student Travel Award, Rutgers University
Steinetz Memorial Fund Award, Department of Biological Sciences, Rutgers University
10 abstracts and 3 scientific papers on membrane transport physiology
4 presentations on membrane transport physiology
Quarterly Impact Award for Practical Process Improvement (2009)

Wendy A. Kozma, B.S., Principal Specialist Group Leader, Environmental Client Services

Education:

B.S. Environmental Science, Allegheny College (1991)

Professional Experience:

Roy F. Weston, Inc. (1992-1993)
With Lancaster Laboratories since 1993
Senior Specialist, Environmental Client Services (1996)
Responsibilities included performing project management; advising clients on testing; providing price quotes; monitoring turnaround time; auditing sample entries; answering client questions; communicating client requirements to lab areas; providing status reports, including results, to clients; scheduling sample submissions; ordering sampling containers
Principal Specialist, Environmental Client Services (2004)
Responsibilities included performing project management; advising clients on testing; providing price quotes; monitoring turnaround time; auditing sample entries; answering client questions; communicating client requirements to lab areas; providing status reports, including results, to clients; scheduling sample submissions; ordering sampling containers
Principal Specialist Group Leader, Environmental Client Services (2006)
Responsibilities include performing project management; advising clients on testing; providing price quotes; monitoring turnaround time; auditing sample entries; answering client questions; communicating client requirements to lab areas; providing status reports, including results, to clients; scheduling sample submissions; ordering sampling containers

Rachel L. Kreamer, B.S., Manager, Environmental Client Services

Education:

B.S. Biology, Eastern Mennonite College (1980)

Continuing Education:

Financial Accounting, Penn State (2005)
Behavioral Science in Business, Penn State (2006)
Price and Markets, Penn State (2006)

Professional Experience:

With Lancaster Laboratories since 1987
Client Services Specialist, Environmental Client Services (1990)
Environmental Project Manager, Environmental Client Services (1994)
Coordinator, Environmental Client Services (1996)
Group Leader, Environmental Client Services (1996)
Responsibilities included: supervise personnel; training; revise and update SOPs; and monitoring turnaround time.
Manager, Environmental Client Services (2005)
Responsibilities included: supervise personnel; training; revise and update SOPs; and monitoring turnaround time.
Manager, Pharmaceutical Client Services (2005)
Responsibilities included: supervise personnel; revise and update SOPs; training.
Director, Professional Scientific Staffing – VA (2007)
Responsibilities included: managing all aspects of the PSS group in VA.
Director, Bay Area Service Center (2008)
Responsibilities included: managing all aspects of the bay area service center.
Manager, Environmental Client Services (2009)
Responsibilities include: managing all aspects of the environmental client services group.

Awards, Citations, Honorary Societies & Publications:

Senior Leadership Group Achievement Award (1996)

Uncontrolled Copy

M. Susan Kreider, Senior Specialist, Data Deliverables

Continuing Education:

Chemistry and Psychology courses, F&M College

Professional Experience:

General Cigar Co., R&D Center, Laboratory Technician (1963-1966)
Responsibilities included testing tobacco products; smoke analysis; nicotine and tar analysis; preparing samples for gas chromatography
Company F. Weaver, Inc., Laboratory Technician (1966-1967)
Responsibilities included performing microbiological testing of food products, both raw materials and finished products; training factory employees in sterile food handling
Microbiological Associates, Inc., Stock Line/Sterile Technician (1968-1969)
Responsibilities included performing cancer research; dissection of animal and human tissue for cell line production; freezing of live cells; all phases of sterile lab work
Warner Lambert Co., Assistant Microbiologist/Organic Chemistry Technician (1970-1975)
Responsibilities included performing microbiological and chemical testing of raw material and finished products
Julia Winifred & Co. (Jacks III), Sales Clerk (1982-1983)
Responsibilities included retail sales; preparing windows and displays in store
With Lancaster Laboratories since 1983
Laboratory Technician, ExpressLAB (1983)
Responsibilities included performing sample prep and analyses
Senior Technician, ExpressLAB (1986)
Responsibilities included performing sample prep and analyses
Chemist, ExpressLAB (1988)
Responsibilities included performing sample prep and analyses
Specialist, Pesticide Residue Analysis (1998)
Responsibilities included performing sample prep and analyses
Specialist, EPH/Misc. GC (2003)
Responsibilities included performing sample prep and analyses
Specialist, Data Deliverables (2005)
Responsibilities included validating and sending data deliverables
Senior Specialist, Data Deliverables (2006)
Responsibilities include validating and sending data deliverables

Robert M. Large, B.S., Director, Environmental Client Services/Inside Business Development/Sample Administration/Data Deliverables/Sample Support/Bay Area Service Center

Education:

B.S. Zoology, Pennsylvania State University (1973)

Continuing Education:

Chromatography/Mass Spectral Interpretation, Finnigan MAT Institute (1981)
Foundations of Management, Gilbert Associates (1982)
M.B.A. Program, St. Joseph's University (1984-1987)
How to Market Professional Services, ACIL (1990)

Professional Experience:

Gilbert Associates, Inc., Program Manager (1977-1984)
Spotts, Stevens, & McCoy, Director of Client Services (1984-1990)
With Lancaster Laboratories since 1990
Marketing Specialist, Environmental Client Services (1990)
Group Leader, Environmental Client Services (1994)
Manager, Environmental Client Services (1995)
Responsibilities included: supervise personnel; project management; various office tasks; interpret QC implications to data quality; and advise clients on testing. Set up and managed the Bay Area Service Center in Richmond, CA (2001). Manage Environmental Sample Administration (2002). Manage Inside Business Development (2003).
Director, Environmental Client Services/Business Development/Sample Administration/Bay Area Service Center (2005)
Responsibilities include: supervise personnel; project management; various office tasks; interpret QC implications to data quality; and advise clients on testing. Set up and managed the Bay Area Service Center in Richmond, CA (2001). Manage Environmental Sample Administration (2002). Manage Inside Business Development (2003). Assisted setting up Professional Scientific Staffing (PSS) for a major biotech client (2004). Manage Data Deliverables and Sample Support (2010).

Uncontrolled Copy

Elizabeth Leonhardt, M.E.M., Senior Specialist Group Leader, Bay Area Service Center

Education:

A.S. Biology, Santa Rosa Junior College (2000)
B.S. Animal Physiology & Neuroscience, University of California, San Diego (2002)
M.E.M. Natural Resource Management, University of Queensland, St. Lucia (2004)

Continuing Education:

DOT/IATA certified (2002)
Japanese Language, Diablo Valley College (2009)

Professional Experience:

MEC Analytical, Benthic Laboratory Technician (2002–2003)
Responsibilities included benthic invertebrate assessment; water quality monitoring; field sampling; stormwater monitoring; rapid stream bioassessment; freshwater crustacean taxonomy; provided assistance in microbiology and bioassay laboratories
With Lancaster Laboratories since 2005
Project Manager, Bay Area Service Center (2005)
Responsibilities included working as a liaison between the client and laboratory, as well as within the laboratory's departments, to ensure that projects are completed in a timely fashion and that the proper analyses are performed; provides technical and regulatory assistance to clients as needed; provides verbal and written quotations to clients; coordinates the efforts of assigned employees to provide coverage for all areas of responsibility; assists in packing and shipping as needed
Senior Specialist Group Leader, Bay Area Service Center (2006)
Responsibilities include working as a liaison between the client and laboratory, as well as within the laboratory's departments, to ensure that projects are completed in a timely fashion and that the proper analyses are performed; providing technical and regulatory assistance to clients as needed; providing verbal and written quotations to clients; coordinating the efforts of assigned employees to provide coverage for all areas of responsibility; assisting in packing and shipping as needed; assisting in EnCore preparation as needed; managing the bottle order operation for the Bay Area Service Center

Parker D. Lindstrom, B.S., Senior Chemist, Metals

Education:

B.S. Chemical Oceanography, Millersville University (2002)

Continuing Education:

Comprehensive Gas Chromatography Seminar, RESTEK (2002)
Comprehensive GC/MS Seminar, RESTEK (2002)
Statistics at Lancaster Laboratories, LLU (2005)
24-hour HAZWOPER, LLU (2006)

Professional Experience:

Fred Fiorentino, Assistant Laborer (1997-2002
Responsibilities included roofing, painting, general construction, clean-up, installation of windows, doors, stairs, decking
Dr. Kerper, Office Assistant (2000-2002)
Responsibilities included filing, cataloging children's books
Millersville University IMC/IMS, Media/Education Assistant (2000-2002)
Responsibilities included assisting teachers in creating media for the classroom, editing video and audio projects
With Lancaster Laboratories since 2002
Associate Chemist/Senior Chemist, GC/MS Volatiles (2002)
Responsibilities included running purge and trap and GC/MS to analyze samples and QC for VOCs; performing purge and trap and GC/MS maintenance
Senior Chemist, Metals (2006)
Responsibilities included running ICP/MS; verifying samples; performing maintenance; prepping samples; general troubleshooting for metals department; installation, maintenance and operation of CVAF low level Mercury; providing general computer help to Computer Services department
Senior Chemist Metrology, Metals (2009)
Responsibilities include helping the instrument (Metrology) group maintain and qualify HPLCs, GCs, and other pharmaceutical instruments; helping with other qualifications as needed (hoods, storage units, etc); for a short time in 2009 verifying data in Water Quality department

Memberships and Appointments:

Emergency Response Team (Spill Team), Lancaster Laboratories (2006)

Uncontrolled Copy

Kathleen M. Loewen, B.S., Director, Quality Assurance

Education:

B.S. Biology, West Virginia Wesleyan College (1969)

Continuing Education:

Environmental Analytical Quality, Hewlett Packard (1988)
Environmental Analytical Laboratory Services, NUS (1989)
Symposium on Waste Testing and Quality Assurance, USEPA (1990-1996 annual attendance)
RCRA Quality Assurance Workshop, USEPA (1990)
Quality Assurance Workshop, USEPA (1991)
Environmental Seminar Series on SPE, GPC, and HPLC, Millipore (1992)
Conference on Quality Assurance in Environmental Monitoring (1993)
Solid Phase Micro Extraction, Supelco (1994)
Analytical Strategy for the RCRA Program, USEPA (1995)
Guidance Course on SW-846 Chapter One, IAETL (1995)
The Environmental Regulation Course, Executive Enterprises (1996)
GMPs Today & Tomorrow, University of Rhode Island (1997)
Complying with Laboratory cGMP Requirements, American Society for Quality (1997)
The Management of Change, Society of Quality Assurance (1997)
Leadership Conference, James Madison University (1998)
Training the Trainer, Society of Quality Assurance (1998)
Advanced QA Techniques for Facility Inspections, Society of Quality Assurance (1998)
Auditing Computer Validation, Society of Quality Assurance (1999)
Required Quality Records (Under Critical Elements & NELAC) PAAEL (2000)
Advanced 'concepts in Computer Validation – "Maintaining the Validated State" SQACVC (2000)
ISO 17025: The New Standard for Laboratory Quality A2LA (2000)
Measurement Uncertainty A2LA (2000)
Application of ISO/IEC 17025: Uncertainty & Traceability, ILAC (2000)
Assuring Ethical Practices in the Laboratory, ACIL (2001)
Computer Validation, Part 11, Stelex University (2001)
Part 11 Meets CROMERRR, SQA (2001)
GAMP Computer Validation Initiative, SQA (2001)
Laboratory cGMP Compliance, FDA/PQI (2001)
Good Clinical Practices, SQA (2002)
Digging Deeper into Validation, SQA (2002)
Managing Process Deviation and Failure Investigations, CPT (2002)
Quality Responsibilities of Management, SQA (2003)
New Horizons in the Life of a GLP Auditor, SQA (2003)
FDA Inspection Etiquette, FDI (2004)
Biotechnology (Intro, Auditing Techniques, Data Review SQA (2004)
Change Control revisited, PDA (2005)
Analytical Instrument Qualification USP <1058>, LabCompliance (2005)
FDA/EU Compliance for Analytical Laboratories, LabCompliance (2005)
GMP Regulations for GLP Auditors, SQA (2006)
Preparing your Organization for the 'New' part 11, LabCompliance (2006)
FDA's Expectations for cGMPs for QC Laboratories, Analysts/Process Chemists, Compliance Solutions, LLC (2006)
Value Added Auditing, SQA (2007)
Bioanalytical-PK, Biomarkers, Method Validation; Valve-added Auditing, SQA (2007)
Investigating OOS Test Results for Pharmaceutical Production, Ben Astrum (2007)
Advanced Good Laboratory Practice, SQA (2008)
Environmental QA/QC Requirements, Association of Public Health Laboratories (2008)
Successfully Using the One-Page Manager, QA Edge (2008)
The New TNI Lab Accreditation Standard, NY/PAAAEL (2010)
Disney Customer Service: Improve Your Quality & Raise Expectations, Progressive Business (2011)
Internal Audits: Meeting FDA Expectations, FOI (2011)
10 Essential Audit Questions, Paton (2011)

Professional Experience:

Microbiological Associates, Biology Laboratory Technician (1969-1970)
Schuyler Laboratories, Laboratory Technician (1970-1971)
Victor F. Weaver, Inc., Labeling Specifications Supervisor/Liaison with USDA (1985-1988)

Uncontrolled Copy

With Lancaster Laboratories since 1988
Quality Assurance Specialist (1988)
Quality Assurance Senior Specialist/Coordinator (1991)
Quality Assurance Director, previously titled Officer (1996)
Responsibilities include supervising the Quality Assurance Unit which includes monitoring of current GLP and GMP activities, review of procedures and analytical data, work with client and agency audits and correspondence, enforcement of regulatory compliance requirements, regulatory and client document review, quality improvement, QA policy development and maintenance, and prompt follow-up of any quality or corrective action issues

Memberships & Appointments:

American Society of Quality (ASQ)
Institute of Validation Technology (IVT)
Mid-Atlantic Region Society of Quality Assurance (MARSQA)
Computer Validation Committee
PDA
Society of Quality Assurance (SQA)

Jason M. Long, B.S., Senior Chemist, GC/MS Volatiles

Education:

B.S. Chemistry, Shippensburg University (2004)

Professional Experience:

EA Engineering Science & Technology, Lab Tech (2004)
Responsibilities included setting up and running tests in toxicology lab; cleaning glassware used in performing tests; titrating for alkalinity and pH of water samples
With Lancaster Laboratories since 2004
Chemist, GC/MS Volatiles (2004)
Responsibilities included analyzing water and soil samples by purge and trap GC/MS; generating and reviewing raw data; performing maintenance on GC/MS, purge and traps, and various autosamplers
Senior Chemist, GC/MS Volatiles (2007)
Responsibilities include analyzing water and soil samples by purge and trap GC/MS; generating and reviewing raw data; performing maintenance on GC/MS, purge and traps, and various autosamplers; troubleshooting problems on GC/MS, purge and traps, and autosamplers

Marla S. Lord, B.S., Senior Specialist, GC/MS Volatiles

Education:

B.S. Industrial Hygiene, Purdue University (2000)

Continuing Education:

OSHA 8-Hour (2000)
Comprehensive GC/MS Seminar, Restek (2002)
Practical Process Improvement Facilitator Training (2010)

Professional Experience:

ALCOA, Industrial Hygiene Intern (1999)
Responsibilities included performing air sampling for a variety of substances; conducting noise survey including area and personal sampling; testing plant environment for heat stress and evaluated reports; assisting in formulation of written program
BP-Amoco Refinery/Orr Professional Services, Industrial Hygiene Technician (2000)
Responsibilities included performing air sampling to reevaluate Benzene Exposure Surveillance Program; conducting noise surveys including area and personal monitoring to reevaluate Hearing Conservation Program
With Lancaster Laboratories since 2000
Senior Technician, Volatiles by GC (2000)
Responsibilities included performing prescreen analysis, sample prep, GC maintenance, and data review
Chemist, GC/MS Volatiles (2001)
Responsibilities included analyzing samples and QC by purge and trap GC/MS; generating and reviewing raw data; performing maintenance on GC/MS, purge and traps, and various autosamplers
Senior Specialist, GC/MS Volatiles (2006)
Responsibilities include performing GC/MS volatile data interpretation; reviewing and approving data; signing reports; analyzing samples; generating raw data; sample verification; SOP revisions and updates

Uncontrolled Copy

Dorothy M. Love, B.S., Principal Specialist Group Leader, Quality Assurance

Education:

B.S. Environmental Health, Indiana University of Pennsylvania (1981)

Professional Experience:

Sun Transport, Inc., Safety Assistant (1980-1981)
Texas A & M University, Research Assistant (1982-1984)
Texas Water Commission, Chemist (1984-1986)
GHR Analytical, Chemist (1986-1987)
Clean Harbors, Inc., Senior Chemist (1987-1989)
With Lancaster Laboratories since 1989
- Senior Specialist (1989)
- Senior QA Specialist (1998) Coordinator (2000)
- Principal Specialist/Coordinator, Quality Assurance (2003)
  - Responsibilities included supervise personnel; train other QA staff; revise and update analytical methods; monitor laboratory activities and corrective action for quality issues; perform internal audits; work with external auditors; review lab data and procedures; enforce regulatory compliance requirements; and review/write client/lab Quality Assurance Project Plans (QAPP).
- Principal Specialist Group Leader, Quality Assurance (2005)
  - Responsibilities include supervise personnel; train other QA staff; revise and update analytical methods; monitor laboratory activities and corrective action for quality issues; perform internal audits; work with external auditors; review lab data and procedures; enforce regulatory compliance requirements; and review/write client/lab Quality Assurance Project Plans (QAPP).

Duane A. Luckenbill, B.S., Director, Environmental Sciences

Education:

B.S. Chemistry, Clarion University of PA (1989)

Continuing Education:

Introduction to Mass Spectral Interpretation, Hewlett-Packard (1995)
Technical Training, OI Analytical (1995)

Professional Experience:

ATEC Associates, Inc., GC/MS Analyst (1989)
With Lancaster Laboratories since 1989
- Chemist (1991)
- Chemist/Coordinator (1993)
- Group Leader (1997)
- Manager (2001)
  - Responsible for client satisfaction, safety and quality systems administration, and all aspects of financial, personnel, and operations management of the GC/MS Volatiles and GC/MS Semivolatiles groups.
- Director (2005)
  - Responsible for client satisfaction, safety and quality systems administration, and all aspects of financial, personnel, and operations management of the GC/MS Volatiles, GC/MS Semivolatiles, Volatiles in Air, Organic Extraction, Leachate Preparation, Field Sampling, Pesticide Residue Analysis, Volatiles by GC, and EPH/Miscellaneous GC groups.

Awards, Citations, Honorary Societies & Publications:

Undergraduate Award in Analytical Chemistry, American Chemical Society (1988)
Department of Chemistry Competitive Award, Clarion University (1988 – 1989)
Outstanding Senior Chemistry Award, American Institute of Chemists Foundation (1989)
Senior College Award for Chemistry, Society for Analytical Chemists of Pittsburgh (1989)
1 publication on mass spectrometry

Nicole L. Maljovec, M.S., Senior Specialist Group Leader, Environmental Client Services

Education:

B.S. Chemistry, St. Bonaventure University (2004)
M.S. Adolescence Education, D'Youville College (2005)

Professional Experience:

CYTEC Industries, Industrial Hygiene Internship (2003-2004)
- Responsibilities included performing air monitoring and sampling; complying with OSHA standards; assisting R/D lab with the identification of unknown chemicals and wastes

Uncontrolled Copy

Niagara Wheatfield, Environmental Science Teacher (2005-2006)
Responsibilities included teaching chemistry, chemistry lab, and environmental science; developing special education plans to assist students with learning disabilities
With Lancaster Laboratories since 2006
Specialist, Environmental Client Services (2006)
Responsibilities included performing project management; advising clients on testing; providing price quotes; monitoring turnaround time; auditing sample entries; answering client questions; communicating client requirements to lab areas; providing status reports, including results, to clients; scheduling sample submissions; ordering sampling containers
Senior Specialist Group Leader, Environmental Client Services (2007)
Responsibilities include performing project management; advising clients on testing; providing price quotes; monitoring turnaround time; auditing sample entries; answering client questions; communicating client requirements to lab areas; providing status reports, including results, to clients; scheduling sample submissions; ordering sampling containers; managing a team of client service representatives and administrative assistants, training of new employees, setting up and delegating new projects, serving as primary project manager for several large clients and consultants

Melissa McDermott, B.A., Senior Chemist, EPH/Misc. GC

Education:

B.A. Biology, Millersville University (1992)
Elementary Education Certification, PA (May 2009)
Middle School Science Certification, PA (July 2009)

Continuing Education:

Gas Chromatography Principles and Practices (1995)
Conflict Resolution and Confrontation Skills Seminar (1996)
Coaching Skills for Supervisors Seminar (1996)
Waste Testing and Quality Assurance Symposium (1996)
Entry Level Management (1997)
How to Deliver Exceptional Customer Service Seminar (1997)
Statistics at Lancaster Laboratories (2006)

Professional Experience:

With Lancaster Laboratories since 1992
Chemist, EPH/Misc. GC (1993)
Responsibilities included performing analysis of environmental samples for metals by AA flame and cold vapor generation; assembling client data packages
Chemist Coordinator, EPH/Misc. GC (1996)
Responsibilities included coordinating rush work; communicating with client service representatives regarding sample status; answering client questions; generating employee job plans; conducting employee evaluations
Senior Chemist, EPH/Misc. GC (1997)
Responsibilities included performing analysis of environmental samples for DRO and interpretive TPH analyses; verifying analyses performed by other analysts; preparing standards; revising departmental SOPs; method development; reviewing data packages
Senior Specialist, Environmental Client Services (1997)
Responsibilities included auditing sample entry; answering client questions; communicating client requirements to lab areas; providing status reports, including results, to clients; scheduling sample submissions and providing sampling containers
Senior Chemist, EPH/Misc. GC (2002)
Responsibilities included reviewing and approving data; writing departmental methods; reviewing and approving data packages; acting as technical resource within department; answering client questions; monitoring and performing QA metrics
Senior Specialist, Environmental Client Services (2007)
Responsibilities included acting as technical resource between client services and laboratories; scheduling sample submissions and providing sampling containers; communicating client requirements to lab areas
Senior Chemist, EPH/Misc. GC (2009)
Responsibilities include reviewing and approving data; writing departmental methods; reviewing and approving data packages; acting as technical resource within department; answering client questions; monitoring and performing QA metrics

Roy R. Mellott Jr., B.S., Senior Chemist Group Leader, GC/MS Volatiles

Education:

B.S. Biology, Millersville University (1993)

Uncontrolled Copy

Continuing Education:

Hazardous Waste Disposal, LLU (1996)
GC: Principles & Practices, LLU (1997)
GC/MS: Applications/Troubleshooting Seminar, ECS/MDL Systems, Inc. (1999)
GLP Training, LLU (1999)
Introduction to Interpretation of Mass Spectra, LLU (2005)
Interpretation of Mass Spectra, Intermediate, LLU (2005)

Professional Experience:

With Lancaster Laboratories since 1995
- Senior Lab Tech I, GC/MS Volatiles (1995)
  - Responsibilities included requisitioning samples; performing sample storage, prescreening, discard, hazardous waste disposal; tracking down missing samples by various means
- Chemist/Auditor, GC/MS Volatiles (1996)
  - Responsibilities included performing analysis of waters, soils, and other matrices for VOCs via various analytical methods; evaluation of analytical data; calibrating and trouble shooting various GC/MS equipment; evaluation/review of analyst-generated data; corresponding with analysts about possible trends (whether analyst- or system-related) in generated data; evaluation/review of corrections of problems with generated data
- Senior Chemist, GC/MS Volatiles (2002)
  - Responsibilities included performing analysis of waters, soils, and other matrices for VOCs via various analytical methods; evaluation of analytical data; setting up, calibrating, and trouble shooting various GC/MS equipment; evaluation/review of analyst-generated data; corresponding with analysts about possible trends (whether analyst- or system-related) in generated data; evaluation/review of corrections of problems with generated data; updating/correcting SOPs and laboratory and analytical procedures; preparation, tracking and documentation of analytical standards used in the laboratory; training of new employees to the department
- Senior Chemist Group Leader, GC/MS Volatiles (2005)
  - Responsibilities include performing analysis of waters, soils, and other matrices for VOCs via various analytical methods; evaluation of analytical data; setting up, calibrating, and trouble shooting various GC/MS equipment; evaluation/review of analyst-generated data; corresponding with analysts about possible trends (whether analyst- or system-related) in generated data; evaluation/review of corrections of problems with generated data; updating/correcting SOPs and laboratory and analytical procedures; preparation, tracking and documentation of analytical standards used in the laboratory; training of new employees to the department

Memberships & Appointments:

Nature Conservancy (1998-present)
Lancaster Laboratories Ethics Committee (1999-2003)
Lancaster Herpetological Society, President (2005-present)

Betsy S. Menefee, B.S., Senior Specialist, Data Deliverables

Education:

B.S. Chemistry (cum laude), Salem College (1958)

Continuing Education:

Service Operations Process Optimization, Penn State University (1993)
Group Discussions (Management Course), Penn State University (1994)

Professional Experience:

Duke University, Research Assistant (1958-1959)
With Lancaster Laboratories since 1980
- Senior Chemist, Metals (1985)
- Senior Specialist, Metals (1999)
  - Responsibilities included reviewing data packages for accuracy, preparing inorganic data packages, and assisting with electronic deliverables
- Senior Specialist, Data Deliverables (2006)
  - Responsibilities include reviewing data packages for accuracy, preparing inorganic data packages, and assisting with electronic deliverables

Awards, Citations, Honorary Societies & Publications:

2 scientific publications in analytical chemistry

Uncontrolled Copy

Megan A. Moeller, B.S., Senior Specialist, Environmental Client Services

Education:

B.S. Environmental Science, University of Delaware (1999)

Professional Experience:

With Lancaster Laboratories since 1999
Sample Administration/Client Service Specialist, Environmental Client Services (2003)
Responsibilities included Interpretation and entry of incoming samples. Route samples to the correct locations. Assist Client Service representatives with auditing, reviewing reports, and reviewing invoices.
Specialist, Environmental Client Services (2004-2006)
Responsibilities included managing projects, prepare quotations, audit sample entries, answer client questions, communicate client requirements to lab areas, schedule sample submissions, and provide sample containers.
Senior Specialist, Environmental Client Services (2006)
Responsibilities include managing projects, prepare quotations, audit sample entries, answer client questions, communicate client requirements to lab areas, schedule sample submissions, and provide sample containers.

Chad A. Moline, B.S., Senior Chemist Group Leader, GC/MS Semivolatiles

Education:

B.S. Environmental Studies, Slippery Rock University (1998)
Teaching Certification, Secondary Education, Millersville University (2003)

Professional Experience:

Centre Analytical Laboratories, Lab Technician (1999-2000)
Responsibilities included running various wet chemistry analyses
Lancaster Laboratories, Chemist/Senior Chemist (2000-2005)
Responsibilities included maintaining GC/MS instrumentation
Warwick School District, Science Teacher (2005-2006)
Responsibilities included teaching chemistry and physics to 8th grade students
Conestoga Valley School District, Science Teacher (2006-2007)
Responsibilities included teaching chemistry and earth science to 8th grade students
With Lancaster Laboratories since 2007
Senior Chemist Group Leader, GC/MS Semivolatiles (2007)
Responsibilities include monitoring workflow; meeting client turnaround times

Kevin T. Moran, M.B.A., Senior Specialist, Environmental Business Development/Sales

Education:

B.S. Marine Engineering, U.S. Merchant Marine Academy (1972)
M.B.A. Marketing, Babson College (1981)

Professional Experience:

SAIC, Regional Sales Manager (1994-1999)
Responsibilities included selling process treatment equipment for groundwater remediation to environmental consulting companies and industrial end users; managing a staff of seven engineers and technicians engaged in operating and constructing groundwater treatment systems.
Mantech Environmental, Marketing Manager (1999-2000)
Responsibilities included developing strategy to target industrial customers with multiple sites for an innovative groundwater remediation technology.
Hazleton Environmental, Marketing Manager (2000-2003)
Responsibilities included developing marketing strategy for sales of process treatment equipment to industrial and municipal users; aiding company in breaking into DOD market for treatment equipment.
With Lancaster Laboratories since 2003
Senior Specialist, Environmental Business Development/Sales (2003)
Responsibilities include managing and growing revenue at assigned industrial accounts; using selling skills to add new industrial and environmental consulting firms for analytical services in New York, New Jersey, and New England.

Uncontrolled Copy

Jeffrey S. Moyer, B.S., Senior Specialist Group Leader, Sample Bottles

Education:

B.S. Environmental Resource Management, Penn State University (1977)

Professional Experience:

Joseph A. Kodak, Carpenter's Helper (1977-1978)
Responsibilities included performing construction
BP Oil, Inc., Operations Supervisor (1978-1979)
Responsibilities included working on special projects in the regional operations office
Koch Hydrocarbon Company, Terminal Manager (1979-1997)
Responsibilities included managing the operation of a 24 hr/day, 365 day/year propane storage facility; coordinating inventory storage, product quality control, maintenance, safety, and personnel staffing and training; additional responsibilities included facility upgrades and expansion projects
With Lancaster Laboratories since 1997
Specialist, Environmental Sample Administration (1997)
Responsibilities included entering environmental samples for analysis; coordinating projects with client services; updating standard forms; filing client bottle orders; tracking change forms and forwarding updated info to SA department; tracking short hold/rush list; processing gold forms
Specialist, Environmental Client Services (1999)
Responsibilities included acting as technical resource for clients and SA entry; preparing quotes for clients; preparing bottle orders; scheduling sample pickups; auditing acknowledgements and client paperwork; troubleshooting client problems; updating standard forms; processing bottle orders, lab reports, acknowledgements, and COCs; handling reprint requests; preparing SDG reports
Senior Specialist Group Leader, Sample Bottles (2004)
Responsibilities include managing bottles department; coordinating projects with client services; updating bottle code and preservation sheets; updating SOPs; working with purchasing to ensure inventory levels are adequate; backing up transportation coordination

Jennifer L. Moyer, B.S., Senior Specialist, Metals

Education:

B.S. Chemistry, Lock Haven University (2000)

Professional Experience:

Lock Haven University, Lab Tech (1996-1998)
Responsibilities included setting up labs; stocking and setting up stock rooms; helping professors with projects
Croda Inc., Process Development Chemist (1998-2000)
Responsibilities included developing and improving procedures on existing products
With Lancaster Laboratories since 2000
Chemist, Metals (2000)
Responsibilities included running and maintaining ICP instruments
Chemist, Metals (2002)
Responsibilities included running and maintaining Graphite Furnace Atomic Absorption instruments
Group Leader/Specialist, Metals (2003)
Responsibilities included overseeing Graphite Furnace Atomic Absorption and Mercury analysts
Senior Specialist, Metals (2007)
Responsibilities include verifying ICP, GFAA, Mercury, and ICP-MS

Charles J. Neslund, B.S., Manager, Volatiles in Air and Specialty Services Group

Education:

B.S. Chemistry, University of Pittsburgh (1982)

Continuing Education:

Graduate studies in organic chemistry, University of Pittsburgh (1983)

Uncontrolled Copy

Professional Experience:

- Lancaster Laboratories (1984-1996)
  - Chemist (1986)
  - Group Leader (1987)
  - Chemist (1991)
- OI Analytical, Sales Representative (1996)
- With Lancaster Laboratories since 1997
  - Group Leader, GC/MS Semivolatiles (1997)
    - Responsibilities included: supervise personnel; schedule lab work; manage laboratory operations and financial resources; project management; data interpretation; review and approve data; developing and evaluating new methods; consult with clients regarding testing needs; and revise and update SOPs and analytical methods.
  - Manager, GC/MS Semivolatiles and Volatiles in Air (2005)
    - Responsibilities included: supervise personnel; schedule lab work; manage laboratory operations and financial resources; project management; data interpretation; review and approve data; developing and evaluating new methods; consult with clients regarding testing needs; and revise and update SOPs and analytical methods.
  - Manager, Volatiles in Air and Specialty Services Group (2007)
    - Responsibilities include: supervise personnel; schedule lab work; manage laboratory operations and financial resources; project management; data interpretation; review and approve data; developing and evaluating new methods; consult with clients regarding testing needs; and revise and update SOPs and analytical methods: market specialty services capabilities, technical presentations

Awards, Citations, Honorary Societies & Publications:

- Dawson-Grundmann Innovation Award (1995)

Memberships & Appointments:

- American Chemical Society (ACS)
- Chromatography Forum of the Delaware Valley (CFDV)
  - Past member of Executive Committee of the Chromatography Forum of the Delaware Valley
- Air & Waste Management Association (A&WMA)
- Society of Environmental Toxicology and Chemistry (SETAC)
- Sediment Management Workgroup (SMWG)

Deborah A. Neslund, Senior Specialist Group Leader, Environmental Sample Administration

Professional Experience:

- Lancaster General Hospital, Phlebotomist (1976-1977)
- Fairfax Hospital, LPN (1978)
- Lancaster General Hospital, Phlebotomist/EKG Technician (1980-1986)
- With Lancaster Laboratories since 1986
  - Senior Specialist Coordinator
    - Responsibilities included: Supervise personnel; direct flow of samples to include prioritization to meet hold times and standards set for rush and other samples; develop and improve systems for efficiency within SA; represent SA in communications with Technical Groups, Client Services, and other support areas; log-in samples.
  - Senior Specialist Group Leader (2005)
    - Responsibilities include: Supervise personnel; direct flow of samples to include prioritization to meet hold times and standards set for rush and other samples; develop and improve systems for efficiency within SA; represent SA in communications with Technical Groups, Client Services, and other support areas; log-in samples.

Ryan V. Nolt, B.S., Principal Chemist Group Leader, GC/MS Volatiles

Education:

- B.S. Chemistry, Millersville University (1997)

Professional Experience:

- With Lancaster Laboratories since 1996
  - Clerk II, Sample Support (1996)
    - Responsibilities included performing ASRS operations, preserving incoming samples, homogenizing samples, packing bottle orders, and performing sample discard.
  - Senior Technician, ExpressLAB (1997)
    - Responsibilities included performing sample dilutions, preparing standards, prepping samples, and setting up new instruments.
  - Chemist, GC/MS Volatiles (1998)
    - Responsibilities included performing purge and trap and GC/MS maintenance; tuning and calibrating GC/MS system; analyzing samples; reviewing, working up, and assembling all supporting data; and preparing new standards.

Uncontrolled Copy

Senior Chemist Coordinator, GC/MS Volatiles (2000)
Responsibilities included performing routine and non-routine laboratory analysis; diagnosing and solving technical problems; implementing improvements to maximize quality; maintaining and troubleshooting instruments; writing and revising standard operating procedures; validating new methods and equipment; assigning new work to instrument groups and monitoring productivity; and training new analysts.
Principal Chemist Group Leader, GC/MS Volatiles (2005)
Responsibilities include performing routine and non-routine laboratory analysis; diagnosing and solving technical problems; implementing improvements to maximize quality; maintaining and troubleshooting instruments; writing and revising standard operating procedures; validating new methods and equipment; assigning new work to instrument groups and monitoring productivity; and training new analysts.

Timothy Oostdyk, Ph.D., President, Lancaster Laboratories

Education:

B.A. Chemistry (cum laude), Franklin and Marshall College (1985)
Ph.D. Analytical Chemistry, Villanova University (1993)

Continuing Education:

ICP Seminar (1985)
ASMS Interpretation of Mass Spectra (1989)
Service Operations Process Optimization, Pennsylvania State University (1992)
Global Leadership Program, Thermo Fisher Scientific (2008)

Professional Experience:

Nabisco Brands Technology Center, Technician (Summer 1983)
With Lancaster Laboratories since 1985
Chemist/Coordinator (1986)
Group Leader (1988)
Manager (1990)
Director (1995)
Executive Vice President, COO (2000)
Responsibilities included supervising personnel and managing laboratory operations and financial resources
President (2011)
Responsibilities include presiding over all support and technical operations of Lancaster Laboratories; managing resources; establishing priorities to ensure the continued success of LL

Awards, Citations, Honorary Societies, and Publications:

Spirit of LL Award (1989)
Phi Beta Kappa, Franklin and Marshall College
Sigma Xi
10 scientific publications in analytical chemistry

Heidi L. Ortenzi, B.S., Senior Chemist, Organic Extraction

Education:

B.S. Environmental Science/Biology, Kutztown University (1996)

Continuing Education:

P.E. Spectroscopy Seminar, Perkin Elmer (1998)
Statistics, LLU (1999)
Pharm. Calc. Class, LLU (1999)
LLI Leadership Training (2000)
Practical Process Improvement Team Member Training (2008)
Practical Process Improvement Facilitator Training (2010)

Professional Experience:

M.J. Reider Associates, Lab Technician (1996-1997)
Responsibilities included organics prep/method development for HEM/various wet chemistry analyses.
With Lancaster Laboratories since 1997
Chemist, Metals (1998)
Responsibilities included performing metals analyses, maintenance of instruments, verification of analyses, analyzed GMP samples, administered quad studies, MDL studies, IDL studies.

Uncontrolled Copy

Coordinator, Metals (1999)
Responsibilities included coordination of GFAA/FAA/Hg group, verification of analyses, instrument maintenance and operation, updating of SOPs, training records, quad studies, MDLs, and IDLs, performed GMP analyses.
Coordinator/Specialist, Environmental Client Services (2001)
Responsibilities included supervising Commercial Account Team and administrators, handle miscellaneous and homeowner calls, prepare bottle orders, audit sample paperwork, monitor sample progress, and handle client concerns.
Group Leader/Senior Specialist, Environmental Client Services (2005)
Responsibilities included supervising Account Management Team and administrator, work with team members on continual process improvement, manage several large client accounts, prepare bottle orders, audit sample paperwork, monitor sample progress, and handle client concerns.
Senior Chemist, Organic Extraction (2007)
Responsibilities include performing non-routine extractions, scheduling prep work, verification of prepped batches, processing MOS reports, managing projects for tobacco analyses, point person for project rollouts.

Awards, Citations, Honorary Societies, and Publications:

Senior Leadership Group Award, Lancaster Laboratories (2001, 2005, 2007)
Superlative Service Award, Lancaster Laboratories (2004, 2010)

Memberships and Appointments:

Ethics Committee, Lancaster Laboratories (1998)
MOS Process Improvement Team, Lancaster Laboratories (2005)

Anneliese H. Owen, M.B.A., Manager, Environmental Sample Administration

Education:

B.S. Molecular and Cell Biology, Pennsylvania State University (1986)
M.B.A. Pennsylvania State University (1993)

Professional Experience:

With Lancaster Laboratories since 1986
Coordinator (1987)
Client Services Specialist (1988)
Business Development Specialist (1990)
Group Leader, Environmental Sample Administration (1992)
Responsibilities included: supervise personnel; manage laboratory operations and financial resources; sample interpretation and entry; and monitor corrective action for quality issues.
Manager, Environmental Sample Administration (2005)
Responsibilities include: supervise personnel; manage laboratory operations and financial resources; sample interpretation and entry; and monitor corrective action for quality issues.

Linda C. Pape, B.A., Senior Chemist, GC/MS Volatiles

Education:

B.A. Business Administration, Milsaps College (1985)

Professional Experience:

Rite Aid Pharmacy, Store Manager (1985-1989)
Responsibilities included being responsible for overall maintenance and security of merchandise, store, and property; ordering and display of all merchandise; auditing daily cash and inventory reports; scheduling employees; payroll accounting; training of new and prospective personnel
With Lancaster Laboratories since 1993
Chemist, Volatiles by GC (1993)
Responsibilities included analyzing client-submitted samples and their associated quality control samples by purge-and-trap gas chromatography; reviewing and uploading the corresponding data in an efficient manner with a high degree of accuracy and quality; evaluating current organizational and analytical systems; suggesting and implementing necessary corrective action to ensure the above can be performed in alignment with client and/or regulatory requirements; initiating and leading technical projects to a timely, accurate, and efficient conclusion while meeting client and/or regulatory requirements with a high degree of quality
Chemist, Water Quality (2000)
In addition to responsibilities listed above performed CN distillation, PO_4 digestion, and phenol distillation during a 3-month time frame

Uncontrolled Copy

Senior Chemist, Volatiles by GC (2007)
Responsibilities included analyzing client-submitted samples and their associated quality control samples by purge-and-trap gas chromatography; reviewing and uploading the corresponding data in an efficient manner with a high degree of accuracy and quality; performing final review (verification) of data for clients (adding appropriate comments as necessary); evaluating current organizational and analytical systems; suggesting and implementing necessary corrective action to ensure the above can be performed in alignment with client and/or regulatory requirements; initiating and leading technical projects to a timely, accurate, and efficient conclusion while meeting client and/or regulatory requirements with a high degree of quality; training new employees in Volatiles by GC soils
Senior Chemist, Volatiles by GC/MS (2008)
Responsibilities included analyzing client-submitted samples and their associated quality control samples by purge-and-trap gas chromatography/mass spectrometry; reviewing and uploading the corresponding data in an efficient manner with a high degree of accuracy and quality; performing final review (verification) of data for clients (adding appropriate comments as necessary); evaluating current organizational and analytical systems; suggesting and implementing necessary corrective action to ensure the above can be performed in alignment with client and/or regulatory requirements; initiating and leading technical projects to a timely, accurate, and efficient conclusion while meeting client and/or regulatory requirements with a high degree of quality; training new employees
Senior Chemist, GC/MS Volatiles (2009)
Responsibilities include analyzing client-submitted samples and their associated quality control samples; reviewing and uploading the corresponding data in an efficient manner with a high degree of accuracy and quality; performing final review (verification) of data for clients (adding appropriate comments as necessary); evaluating current organizational and analytical systems; suggesting and implementing necessary corrective action to ensure the above can be performed in alignment with client and/or regulatory requirements; initiating and leading technical projects to a timely, accurate, and efficient conclusion while meeting client and/or regulatory requirements with a high degree of quality; training new employees

Jill M. Parker, B.S., Senior Specialist, Environmental Client Services

Information not available at time of printing.

James H. Place, B.S., Senior Chemist, Pesticide Residue Analysis

Education:

B.S. Physical Science, York College of Pennsylvania (1997)

Professional Experience:

AMZ Corporation, Laboratory Technician (1998-2000)
Responsibilities included performing analysis and maintenance of chemical compositions pertaining to electroplating baths
Nichia America Co., Laboratory Technician (2000-2001)
Responsibilities included performing analysis of phosphorus for composition of pigments; performing sample screening and AA analysis
AMZ Corporation, Laboratory Technician (2001-2003)
Responsibilities included performing analysis and maintenance of chemical compositions pertaining to electroplating baths; conducting inventory and ordering chemicals
With Lancaster Laboratories since 2003
Chemist, Pesticide Residue Analysis (2003)
Responsibilities include performing routine and non-routine instrumental analyses of QC and clients' samples for pesticides, PCBs, herbicides, and other related compounds in accordance with departmental methods and SOPs; achieving quality results within the time-frame expected by our clients with minimal daily supervision; maintaining the GCs or HPLCs used for routine analyses; identifying and correcting common instrument or QC problems
Senior Chemist, Pesticide Residue Analysis (2008)
Responsibilities include performing routine and non-routine instrumental analyses of QC and clients' samples for pesticides, PCBs, herbicides, and other related compounds in accordance with departmental methods and SOPs; assisting in implementing special client requests; identifying and offering solutions to correct instrument problems and causes of QC problems; reviewing data for accuracy and completeness (for both routine and non-routine analyses, reports, or data packages); serving as a technical resource for the department

Christine M. Ratcliff, B.S., Principal Specialist, Volatiles in Air

Education:

B.S. Chemistry, Shippensburg University (1988)

Continuing Education:

Mass Spectral Interpretation, Finnigan MAT Institute (1990)

Uncontrolled Copy

Professional Experience:

With Lancaster Laboratories since 1988
- Chemist (1991)
- Coordinator (1994)
- Group Leader (1996)
- Senior Chemist/Coordinator (1997)
- Senior Chemist (2002)
  - Responsibilities included reviewing and approving data; revising and updating SOPs and analytical methods; reviewing lab data
- Senior Specialist, GC/MS Semivolatiles (2005)
  - Responsibilities included reviewing and approving data; revising and updating SOPs and analytical methods; reviewing lab data
- Principal Specialist, GC/MS Semivolatiles (2009)
  - Responsibilities included reviewing and approving data; revising and updating SOPs and analytical methods; reviewing lab data; performing technical audit of GC/MS semivolatiles data in a timely manner
- Principal Specialist, Volatiles in Air (2009)
  - Responsibilities include reviewing and approving data; revising and updating SOPs and analytical methods; reviewing lab data; performing technical audit of Volatiles in Air, GC/MS semivolatiles, and GC/MS volatiles data in a timely manner
- Principal Specialist, Volatiles in Air (2009)
  - Responsibilities include reviewing and approving data; revising and updating SOPs and analytical methods; reviewing lab data; performing technical audit of Volatiles in Air, GC/MS semivolatiles, GC/MS volatiles, and dioxans and furans data in a timely manner

Mark A. Ratcliff, B.A., Senior Specialist, GC/MS Semivolatiles

Education:

B.A. Physics, Franklin & Marshall College (1988)

Continuing Education:

Finnegan Mass Spectral Interpretation Course (1991)

Professional Experience:

With Lancaster Laboratories since 1989
- Chemist (1992)
- Senior Chemist (1996)
  - Responsibilities included: perform GC/MS semivolatiles testing; operate GC/MS instruments; data interpretation; calibrating and repairing instruments; prepare standards; revise and update SOPs; and train other analysts.
- Senior Specialist, GC/MS Semivolatiles (2005)
  - Responsibilities include: perform GC/MS semivolatiles testing; operate GC/MS instruments; data interpretation; calibrating and repairing instruments; prepare standards; revise and update SOPs; and train other analysts.

Barbara F. Reedy, B.S., Senior Specialist, Quality Assurance

Education:

B.S. Environmental Biology, Millersville University (1993)

Continuing Education:

Environmental GC Analysis Seminar, Restek (2001)
The Internet Audit A Quality Tool, PaAAEL (2001)
Advanced Gas Chromatography Mass Spectroscopy Seminar, PaAAEL (2002)
LC/MS/MS System Seminar, Applied Biosystems (2006)
Introduction to Root Cause Analysis, Patton Professional (2007)
When to Initiate Corrective Action, Patton Professional (2007)
Practical Process Improvement Training in the role of Team Member (2008)
GC Pesticide/PCB's Analysis Training Seminar (2008)
NY/PAAAEL Annual Meeting - Internal & Electronic Audits: Satisfying Regulatory Requirements, Corrective and Preventive Actions, Ethics and Data Integrity Training (2009)

Professional Experience:

Department of Environmental Resources, Division of Rivers and Wetlands, Scientific Intern (1993)
- Responsibilities included reviewing wetland permits applications; inspecting and photographing wetland mitigation sites; determining hydrology, soil type, and the consistency of the mitigation with the approved project plans; researching records of the sites

Uncontrolled Copy

With Lancaster Laboratories since 1993
Associate Chemist/Chemist, Volatiles by GC (1993)
Responsibilities included calibrating Capillary, VOA, BTEX, and FID instruments; performing routine maintenance; interpreting, reviewing, and uploading data
Senior Chemist, Volatiles by GC (1999)
Responsibilities included being primary verifier for the majority of data for Volatiles by GC for the ELCD/PID and FID for both waters and soils; signing of analytical reports; generating statistically determined QC windows; training new analysts to review and upload data into the LIMS
Senior Specialist, Quality Assurance (2001)
Responsibilities include ensuring quality of data being produced in the laboratories by performing data review, auditing laboratories, and reviewing written procedures; ensuring laboratory adherence to government regulations and client requirements; reviewing client and government documents for requirements outside our usual laboratory practices; setup and testing new analysis in the laboratory sample management system as required by the departments

Nelson H. Risser, M.B.A., Principal Chemist, Specialty Services Group

Education:

B.A., Chemistry, Shippensburg University (1977)
M.B.A., Pennsylvania State University (1995)

Continuing Education:

Quality Management College, Philip Crosby Associates (1989)
Validation of Computerized Systems for the Pharmaceutical Industry, PDA (1995)
Lab Equipment Qualification and Validation, Barnett International Conference Group (1999)
PreCovery Disaster Recovery Software, SunGard (1999)
Practical Process Improvement – Team Member Training (2009)
TSQ Quantum Vantage Operations, Thermo Scientific Training Institute (2009)
DFS High Resolution Magnetic Sector Mass Spectrometer Operations, Thermo Scientific (2009)

Professional Experience:

Frederick Cancer Research Center, Analytical Chemist (1977-1979)
Responsibilities included developing analytical methods to support cancer research efforts
Lancaster Laboratories, Technical Associate-Director (1979-2007)
Responsibilities included performing a broad scope of analytical tests utilizing manual wet chemistry, atomic absorption, purge and trap concentration, gas chromatography, ion chromatography, mass spectrometry, and other instrumental analyzers; managing staff chemists in the Environmental Services Division in analyzing water and soil for volatile organics using gas chromatography/ mass spectrometry; supervising laboratory and support operations; supervising Computer Services staff performing software development and systems support; overseeing corporate computer operations in utilizing System Development Life Cycle processes to ensure validated computer systems are implemented and that a state of validation is maintained
With Lancaster Laboratories since 2008
Principal Chemist, Environmental Sciences (2008)
Responsibilities included performing sample analyses utilizing high resolution gas chromatography/high resolution mass spectrometry (HRGC/HRMS)
Principal Chemist, Specialty Services Group, Environmental Sciences (2010)
Responsibilities include acting as technical resource within the environmental division; developing and validating analytical protocols; troubleshooting and solving analytical chemistry problems; optimizing instrument configuration and performance; evaluating and interpreting analytical results; writing SOPs; assisting in responding to and eliminating ICARs, assisting in optimizing procedures in prep lab; communicating effectively within department; performing routine work as required

Awards, Citations, Honorary Societies & Publications:

7 scientific papers on chemical analysis of carcinogens, solvent recovery, workforce scheduling

Robin C. Runkle, B.S., Senior Specialist, GC/MS Volatiles

Education:

B.S. Chemistry, State University of New York at Oneonta (1988)

Continuing Education:

Introduction to Mass Spectral Interpretation, Finnigan Mat (1991)
Gas Chromatography: Practical Theory and Applications for LL (1993)
HP5890 GC Troubleshooting and Maintenance, Hewlett-Packard (1993)
Technical Training, OI Analytical (1995)

Uncontrolled Copy

Professional Experience:

With Lancaster Laboratories since 1989
Senior Chemist (1993)
Responsibilities included: sample preparation; perform GC/MS volatile testing; operate GC/MS instruments; data interpretation; review and approve data; developing and evaluating new methods; calibrating and repairing instruments; prepare standards; reagent preparation; revise and update SOPs and analytical methods; order supplies; train other analysts; and prepare and test trip blank water.
Senior Specialist, GC/MS Volatiles (2005)
Responsibilities include: data review and verification, review and sign reports, respond to and work on client inquiries and ATF requests.

Stephanie A. Selis, B.S.E., Senior Chemist, GC/MS Volatiles

Education:

B.S.E. Biology, Chemistry Minor, Millersville University (1996)

Professional Experience:

Access I, Access II, PC Focus (1997)
Emergency Evacuation Coordinator (1998)
Gas Chromatography Principles and Practices, Lancaster Laboratories University (1998)
GC/MS Theories and Applications, MDL Systems (1999)
Statistics, Lancaster Laboratories University (2000)

Professional Experience:

With Lancaster Laboratories since 1996
Chemist (1996)
Senior Chemist, Volatiles by GC (2000)
Responsibilities included: Sample analysis, troubleshooting and maintenance, system calibration, establish QC windows for soil analysis, write SOPs, data entry, prepare standards, sample verification, analyst training.
Senior Chemist, GC/MS Volatiles (2005)
Responsibilities include: Sample analysis, troubleshooting and maintenance, system calibration, establish QC windows for soil analysis, write SOPs, data entry, prepare standards, sample verification, analyst training.

Richard A. Shober, B.S., Principal Chemist, Pesticide Residue Analysis

Education:

B.S. Chemistry, Muhlenberg College (1984)

Continuing Education:

Inductively Coupled Plasma Spectroscopy, Allied Analytical (1985)
ACS Short Course, Analytical Chemistry of Contaminants in Surface and Groundwater (1986)
Gas Chromatography: Practical Theory & Application, Lancaster Laboratories (1994)
Mass Spectral Interpretation, Hewlett-Packard (1995)
Comprehensive HPLC, RESTEK (2010)

Professional Experience:

With Lancaster Laboratories since 1984
Principal Chemist, Pesticide Residue Analysis (1999)
Responsibilities include performing pesticide residue testing; operating gas chromatography instruments; interpreting data; repairing instruments; developing new methods for and operating LC/MS/MS; developing and maintaining computer systems/programs for lab use

Awards, Citations, Honorary Societies & Publications:

Poster paper on computer applications for analytical chemistry
Poster paper on tobacco specific nitrosamine analysis

Biographical Listings:

Who's Who in Environmental Science

Uncontrolled Copy

Michele J. Smith, B.S., Senior Specialist, Specialty Services Group

Education:

B.S. Chemistry, St. Mary's College, Notre Dame, Indiana (1998)
22 credits master's study with Penn State University (2000-2002)

Continuing Education:

Gas Chromatography Principles and Practices, Lancaster Laboratories University (1999)
Statistics, Lancaster Laboratories University (2000)

Professional Experience:

St. Mary's College, Laboratory Teaching Assistant (1996-1998)
Responsibilities included: assisted professor in the laboratory—responsible for experiment demonstrations, answered student's questions, and graded lab reports.
With Lancaster Laboratories since 1998
Chemist (1998)
Responsibilities included: maintain GC/MS instrumentation, tune and calibrate GC/MS, analyze samples by GC/MS, review and assemble all supporting GC/MS data, review daily QC outliers.
Senior Chemist (2001)
Responsibilities included: maintain GC/MS instrumentation, tune and calibrate GC/MS, analyze samples by GC/MS, review and assemble all supporting GC/MS data, perform technical audit of GC/MS and HPLC, sign analysis reports, track samples to meet turn around time.
Senior Chemist Coordinator (2004)
Responsibilities included: maintain GC/MS instrumentation, tune and calibrate GC/MS, analyze samples by GC/MS, review and assemble all supporting GC/MS data, perform technical audit of GC/MS and HPLC, sign analysis reports, track samples to meet turn around time.
Senior Specialist Group Leader, GC/MS Semivolatiles (2005)
Responsibilities included: review and assemble GC/MS data, perform technical audit of GC/MS and HPLC, sign analysis reports, schedule and track samples to meet turn around time.
Senior Specialist, Environmental Client Services (2008)
Responsibilities included auditing sample paperwork; setting up standard forms; generating bottle orders; preparing quotes
Senior Specialist, Specialty Services Group (2011)
Responsibilities include maintaining instrumentation; tuning and calibrating instrument daily; analyzing quality control and client samples; reviewing and assembling data in an efficient manner with a high degree of quality; evaluating current organizational and analytical systems; diagnosing complex problems and offering solutions with a high degree of independence; suggesting and implementing improvements to maximize quality and productivity; acting as technical resource for internal problems and projects; assisting in "brainstorming" client problems and projects; training new employees in all aspects of instrumentation; researching new and emerging technologies

Memberships and Appointments:

American Chemical Society (1998-2002)

Max E. Snavely, B.S., Senior Specialist, Metals

Education:

B.S. Chemistry, Lebanon Valley College (1977)

Continuing Education:

Inductively Coupled Plasma Spectroscopy, Thermo Jarrell Ash (1991)

Professional Experience:

Sterling Drug, Inc., Quality Control Chemist (1977-1980)
Andrew S. McCreath & Sons, Inc., Analytical Chemist (1980-1987)
With Lancaster Laboratories since 1987
Senior Chemist (1990)
Responsibilities included: operate ICP instruments; data interpretation; review and approve data; train other analysts; and coordinate performance evaluation samples.
Senior Specialist, Metals (2005)
Responsibilities include: operate ICP instruments; data interpretation; review and approve data; train other analysts; and coordinate performance evaluation samples.

Uncontrolled Copy

Sarah M. Snyder, B.S., Senior Specialist, Pesticide Residue Analysis

Education:

B.S. Chemistry, Alvernia College (2004)
B.S. Forensic Science, Alvernia College (2004)

Professional Experience:

With Lancaster Laboratories since 2003
- Laboratory Technician, Organic Extraction (2003)
  - Responsibilities included prepping organic soil extractions of PCBs and tobaccos; washing glassware; running the Automated Solvent Extractor and nitrite instrument; prepping micro-extractions
- Chemist, EPH/Misc. GC (2005)
  - Responsibilities included maintaining and operating 5890 and 6890 FID-GC instrumentation; prepping standards; reading Diesel Range Organics and state specific samples; performing computer work
- Chemist, Pesticide Residue Analysis (2007)
  - Responsibilities included maintaining and operating 5890 and 6890 ECD-GC instrumentation; prepping standards; reading Herbicide and Organophosphate samples; performing computer work
- Specialist, Pesticide Residue Analysis (2007)
  - Responsibilities included reviewing data from all analyses; keeping track of department samples; signing reports; working with data package
- Senior Specialist, Pesticide Residue Analysis (2010)
  - Responsibilities include mentoring newer analysts; reviewing data from all analyses; keeping track of department samples; signing/reviewing reports; helping data packages with questions; helping with projects

Tara M. Spaide, Senior Specialist, Environmental Client Services

Continuing Education:

Algebra and Analytical Geometry, Pennsylvania State University (1993)
Chemistry, Pennsylvania State University (1993)

Professional Experience:

With Lancaster Laboratories since 1986
- Senior Specialist Coordinator, Organic Extraction (1997)
  - Responsibilities included supervising personnel; scheduling lab work; managing laboratory operations; reviewing and approving data; and revising and updating analytical methods
- Senior Chemist Coordinator, Organic Extraction (2003)
  - Responsibilities included supervising personnel; scheduling lab work; managing laboratory operations; reviewing and approving data; and revising and updating analytical methods
- Senior Chemist Group Leader, Organic Extraction (2005)
  - Responsibilities included supervising personnel; scheduling lab work; managing laboratory operations; reviewing and approving data; and revising and updating analytical methods
- Senior Specialist, Environmental Client Services (2007)
  - Responsibilities include auditing sample paperwork; setting up standard forms; generating bottle orders; preparing quotes

Dale R. Stoneroad, B.S., Senior Chemist, GC/MS Semivolatiles

Education:

B.S. Science, Chowan University (1998)

Professional Experience:

Analytical Laboratory Services, Inc., Chemical Specialist (1998-2010)
- Responsibilities included analyzing 525, 527 529 8270, 625 EPA methods; training fellow employees how to use new instrumentation; operating HP 5971, HP5972, HP5973, and HP5975 instruments; being responsible for standard prep and inventory; assisting in sample collection and sample preparation; serving as a data reviewer for the GC/MS volatile group; organizing workloads by due dates and reporting data into a company LIMS to be released to clients; performing minor and major maintenance of all GC/MS equipment

With Lancaster Laboratories since 2010
- Senior Chemist, GC/MS Semivolatiles (2010)
  - Responsibilities include operating, maintaining, and troubleshooting GC/MS instrumentation; operating HP5890/6890 GCs, 5971, 5972, 5973, 5975 Mass Spec. Thermo DSQII MS/Trace GCs; reviewing and interpreting data of various analyses including but not limited to 8270C, Appendix IX, 625, CLP 3/90, and 2/88; preparing standards for various methods; interpreting data and assembling data packages of batch data; evaluating and reviewing system procedures; performing GC/MS analysis

Uncontrolled Copy

Awards, Citations, Honorary Societies, and Publications:

Resident Assistant of the Year (1996)
Employee of the Quarter (2002)
Employee of the Year (2007)

Andrew J. Strebel, Principal Chemist, GC/MS Semivolatiles

Continuing Education:

Advanced Aquarius Programmers Course, Hewlett-Packard (1989)
Environmental Applications of GC/MS, Indiana University (1989)
Environmental GC-MS (DOS) Operation, Hewlett-Packard (1995)
Unix Module 1, Albright College (1995)
Unix Module 2, Albright College (1995)
Unix Shell Scripts, Albright College (1995)
Unix AWK Programming, Albright College (1995)
Target Training, Thru-Put Systems, Inc. (1995)
Report Writer Training, Thru-Put Systems, Inc. (1998)
HP-UX System Administration for HP 9000s, Hewlett Packard (1998)
HP-UX Troubleshooting for HP 9000s, Hewlett Packard (1998)
GC/MS Training Course, MDL Systems (1999)
LC/MS/MS 101 Training Course, Basic Mass Spec Solutions, Inc. (2001)

Professional Experience:

With Lancaster Laboratories since 1986
- Technical Specialist (1991)
- Chemist (1994)
- Senior Chemist (1997)
- Principal Chemist, GC/MS Semivolatiles (2001)
  - Responsibilities include: perform routine semivolatile testing; operate GC/MS semivolatile instruments; data interpretation; review and approve data; developing and evaluating new methods; calibrating and repairing instruments; prepare standards; revise and update SOPs and analytical methods; train other analysts; develop and maintain computer systems/programs for lab use; and computer validation testing.

Robert Strocko, Jr., B.S., Manager, Metals

Education:

B.S. Biology, York College of Pennsylvania (1988)

Continuing Education:

Thermo Jarrel l ASA ICP Course, Thermo Jarrell ASA (1993)

Professional Experience:

Springettsbury Waste Water Treatment Facility, Chemistry Technician (1986-1988)
- Responsibilities included running NPDES tests on wastewater, % solids, NH4, pH, BOD, suspended solids, coliform, dissolved solids, temperature, and Hexa-Chrome testing

Penn Dairies, Laboratory Technician (1988-1989)
- Responsibilities included testing raw milk for coliform bacteria for acceptance; performing milk-fat percent solids on milk products; calculating sugar content in sweetened milk

Pennsylvania Department of Environmental Resources, Chemistry Technician (1989-1992)
- Responsibilities included receiving samples; logging data for analysis to computer; handling field sampling questions; operating flame AA; shipping cooler to field samples

With Lancaster Laboratories since 1992
- Chemist, Metals (1992)
  - Responsibilities included setting up, pouring, and running samples on ICP; reviewing and verifying ICP data; performing instrument maintenance; calculating IDLs, MDLs, and linear ranges; writing SOPs
- Chemist/Coordinator, Metals (1996)
  - Responsibilities included overseeing prep room personnel and work flow; scheduling work flow through prep room; writing job plans and job reviews; ordering standards and reagents; overchecking notebooks
- Manager, Metals (1998)
  - Responsibilities include overseeing technical areas in ICP, low-level mercury, ICP-MS, and mercury; writing SOPs, ICARs, etc.; writing job plans and job reviews; handling technical questions for clients/client services; verifying ICP data; signing reports

Uncontrolled Copy

Christiane S. Sweigart, B.S., Senior Specialist, Electronic Data Deliverables

Education:

B.S. Science, Elizabethtown College (1985)
Medical/Technology Degree, St. Joseph School of Medical Technology (1985)

Continuing Education:

The Principals of Gas Chromatography (1993)
Statistics Course (1993)
Creative Training Techniques Conference (1997)

Professional Experience:

With Lancaster Laboratories since 1985
- Chemist, GC/MS (1985)
  - Responsibilities included GC/MS operation targeting both VOA and BNA compounds, instrument maintenance, sample handling, and data handling (interpretation and documentation)
- Chemist, GC/VOA (1986)
  - Responsibilities included GC operation targeting both aromatic and halogenated compounds, FID operation, instrument maintenance, sample handling, and data handling (interpretation and documentation). Training of others on FID methods, development of training/reference manual for FID, development of internal Operating Manual, standard documentation, definition and maintenance of Statistically defined windows, and temporary coordinator in Department 25.
- Chemist Coordinator, GC/VOA (1993)
  - Responsibilities included coordination of sample analysis and data management; job plans and feedback for several personnel; communication both internal and external, and data handling (interpretation and documentation; and combination of existing department with another (personnel, instrumentation, sample volume).
- Senior Specialist, Human Resources (1997)
  - Responsibilities included recruiting, training, and professional development.
- Senior Specialist, Electronic Data Deliverables (2001)
  - Responsibilities include EDD generation, EDD content review, and communication (internal and external).

Awards, Citations, Honorary Societies & Publications:

Recognition for the implementation of a revamped New Hire Orientation (1999)
Recognition for the development and presentation of the Ethic's Refresher (2001)

Memberships & Appointments:

LCAHRM (1997-2001)

Lawrence M. Taylor, B.S., Senior Specialist, GC/MS Volatiles

Education:

B.S. Chemistry, Shippensburg University (1989)

Continuing Education:

QA Report Operator Training Course, Finnigan Mat Institute (1990)
Technical Training, OI Analytical (1995)
Mass Spectral Interpretation Course, Hewlett-Packard (1995)
Archon Training Course, PTS (1997)

Professional Experience:

With Lancaster Laboratories since 1989
- Senior Chemist (1992)
  - Responsibilities included GC/MS volatile data interpretation; review and approve data; verify sample results, and sign reports.
- Senior Specialist, GC/MS Volatiles (2005)
  - Responsibilities include GC/MS volatile data interpretation; review and approve data; verify sample results, and sign reports.

Lauren C. Temple, B.S., Senior Chemist, GC/MS Volatiles

Education:

B.S. Chemistry, Shippensburg University (2003)

Continuing Education:

Intro to Interpretation of Mass Spectra, Lancaster Laboratories University (2005)

Uncontrolled Copy

Professional Experience:

With Lancaster Laboratories since 2003
Chemist, GC/MS Volatiles (2003)
Responsibilities included analyzing water and soil samples using purge and trap GC/MS; prepping samples and performing data review; performing maintenance as needed on purge and traps, GC/MS, and autosamplers
Senior Chemist, GC/MS Volatiles (2006)
Responsibilities include analyzing water and soil samples using purge and trap GC/MS; prepping samples and performing data review; performing maintenance as needed on purge and traps, GC/MS, and autosamplers; performing basic data review and audit; assisting in training new hires as needed

Valerie L. Tomayko, B.S., Senior Specialist Group Leader, Volatiles by GC

Education:

A.S. Chemical Engineering Technology, Pennsylvania State University (1977)
B.S. Human Resource Management, Geneva College (1993)

Professional Experience:

Hercules Inc., Laboratory Technician (1977-1983)
Antech Ltd., Associate Chemist, (1985-1989)
Quanterra (formerly Wadsworth/Alert), Chemist, (1989-1997)
UEC (United States Steel Engineering Consultants), Chemist (1997)
With Lancaster Laboratories since 1997
Senior Chemist, Pesticide Residue Analysis (1997)
Responsibilities included: data interpretation; review and approve data; review data packages; and generate statistical QC limits for Pesticide Residue Analysis and Extractable Petroleum Hydrocarbons/MBC GC and Nitrosamines departments.
Senior Chemist Coordinator, Pesticide Residue Analysis (2001)
Responsibilities included: Monitor turnaround time and status of samples and packages; coordinate work flow; track employees' progress; assist in implementing procedures/protocols for meeting QA requirements, data package requirements, and special client or project-specific requests. In addition to data interpretation; review and approve data; review data packages; and generate statistical QC limits for Pesticide Residue Analysis and Extractable Petroleum Hydrocarbons/MBC GC and Nitrosamines departments.
Senior Specialist Group Leader, Pesticide Residue Analysis (2005)
Responsibilities included: Monitor turnaround time and status of samples and packages; coordinate work flow; track employees' progress; assist in implementing procedures/protocols for meeting QA requirements, data package requirements, and special client or project-specific requests. In addition to data interpretation; review and approve data; review data packages; and generate statistical QC limits for Pesticide Residue Analysis and Extractable Petroleum Hydrocarbons/MBC GC and Nitrosamines departments.
Senior Specialist Group Leader, Volatiles by GC (2006)
Responsibilities include: Monitor turnaround time and status of samples; coordinate work flow; track employees' progress; assist in implementing procedures/protocols for meeting QA requirements, data package requirements, and special client or project-specific requests. In addition to data interpretation; review and approve data; review data packages; and generate statistical QC limits for GC Volatile analysis.

Luz C. Torres, B.S., Senior Specialist Group Leader, Data Deliverables

Education:

B.S. Secretarial Sciences, Catholic University of Puerto Rico (1982)

Continuing Education:

English as a Second Language, Spanish American Civic Association (1988)
Computer Literacy, Spanish American Civic Association (1989)

Professional Experience:

Dr. Jose Moro, Pediatrician, Administrative Secretary (1976-1986)
Responsibilities included customer service, answering phone, collecting payment, billing medical insurance, dictation, transcription, writing letters, filing, archiving, account receivables, ordering supplies.
With Lancaster Laboratories since 1988
Laboratory Assistant, Water Quality (1988)
Responsibilities included washing glassware, assisting technical staff by performing Odor and TDS analyses.
Clerk II, Data Deliverables (1991)
Responsibilities included data package assembly, tracking/preparing/sending QC summary reports, processing and sending data packages, generating and sending Lotus Text file disks, and DP content review.

Uncontrolled Copy

Administrator I, II, III, Data Deliverables (1992)
Responsibilities included DP assembly, DP content review, review of analytical data, DP processing and sending, training new hires and current staff learning new tasks, DP corrections follow up.
Specialist Coordinator, Data Deliverables (1996)
Responsibilities included technical data review, package correction and problems investigation, Package TAT monitoring, oversee data package assembly, content review, and data package processing, documentation of departmental procedures, maintenance of database, interviewing, supervision of personnel
Senior Specialist Coordinator, Data Deliverables (2003)
Responsibilities included QA review, interviewing, supervision of personnel including writing job plan and performance evaluation, package correction and problems investigation, package TAT monitoring, documentation of departmental procedures, training new hires and cross-training employee from other areas, maintenance of method summary database, oversee data package assembly, content review, and data package processing.
Senior Specialist Group Leader, Data Deliverables (2005)
Responsibilities include QA review, interviewing, supervision of personnel including writing job plan and performance evaluation, package correction and problems investigation, package TAT monitoring, documentation of departmental procedures, training new hires and cross-training employee from other areas, maintenance of method summary database, oversee data package review and data package processing.

Timothy J. Trees, A.A.S., Principal Chemist, Specialty Services Group

Education:

Certificate, N.Y.S. Water/Wastewater Treatment Operations, Columbia Greene Community College (1985)
A.A.S. Environmental Control of Hazardous Waste/Water Quality, Ulster County Community College (1986)

Continuing Education:

Water Treatment Operations, NYS License Board (1984)
Wastewater Treatment Operations, NYS License Board (1986)
Varian AA Course (1992)
Service Operations Process Optimization, Pennsylvania State University (1992)
24-hour HAZWOPER (spill response) (1995)
Atomic Spectroscopy Workshop, Perkin-Elmer (1997)
Hitachi GFAA Workshop, Hitachi, CT (1994)

Professional Experience:

York Wastewater Management (1985-1986)
Rider Engineering (1986-1988)
With Lancaster Laboratories since 1988
Senior Technician, Metals (1988)
Responsibilities included: operation, maintenance, and sample preparation of mercury cold vapor and hydride generation instrumentation for the determination of mercury, arsenic, and selenium; data entry; troubleshooting instruments; repair of instrumentations' electronic system.
Chemist I, Metals (1990)
Responsibilities included: operation and maintenance of graphite furnace instrumentation; verification of mercury cold vapor and hydride generation data; coaching and training of personnel in the operation of mercury and hydride instrumentation; troubleshooting and repair of instrumentations' mechanical and electronic system.
Chemist I/Coordinator, Metals (1992)
Responsibilities included: operation and maintenance of graphite furnace instrumentation; ICP operation; verification of mercury cold vapor and hydride generation data; coaching and training of personnel in the operation of mercury, hydride, and graphite furnace instrumentation; troubleshooting and repair of instrumentations' mechanical and electronic system; systems operation optimization to increase production; scheduling of personnel for department operation; job plan and review with employees.
Chemist II/Coordinator, Metals (1993)
Responsibilities included: coaching and training of personnel in the operation of mercury, hydride, and graphite furnace instrumentation; assist clients with data interpretation and process improvement; ICP operation; verification of graphite furnace, mercury cold vapor, and hydride generation data; data package review; troubleshooting and repair of instrumentations' mechanical and electronic systems; system operations optimization to increase production; scheduling of personnel for department operation; job plan and review with employees.
Senior Chemist/Coordinator, Metals (1994)
Responsibilities included: operation, maintenance, repair, and troubleshooting of department graphite furnaces; flame atomic absorption, mercury cold vapor, hydride generation, and Inductively Coupled Plasma Instrumentation as well as computer systems used in the operation with these instruments; data qualification, interpretation, and verification of department workload; assist clients with interpretation of data, cause and effect; coaching and training of department personnel in areas of sample preparation, instrument setup, maintenance, and analysis using these instruments; job plan, review, and evaluation with employees; ordering of supplies; maintained operation of Metals Atomic Absorption for the department; method development for both environmental and pharmaceutical divisions for graphite furnace and ICP work; Set up and maintain, all SOPs and documentation for computer systems and instrumentation to comply with GMP regulations; data package review for metals analysis; review and verification of ICP data as needed.

Uncontrolled Copy

Principal Chemist/Coordinator, Metals (1996)
Responsibilities included: operation, maintenance, repair, and troubleshooting of department graphite furnaces; flame atomic absorption, mercury cold vapor, hydride generation, and Inductively Coupled Plasma Instrumentation as well as computer systems used in the operation with these instruments; data qualification, interpretation, and verification of department workload; assist clients with interpretation of data, cause and effect; coaching and training of department personnel in areas of sample preparation, instrument setup, maintenance, and analysis using these instruments; job plan, review, and evaluation with employees; ordering of supplies; maintained operation of Metals Atomic Absorption for the department; method development for both environmental and pharmaceutical divisions for graphite furnace and ICP work; Set up and maintain, all SOPs and documentation for computer systems and instrumentation to comply with GMP regulations; data package review for metals analysis; review and verification of ICP data as needed.

Senior Chemist, GC/MS Semivolatiles (1998)
Responsibilities included: operation, maintenance, and troubleshooting of GC/MS instrumentation; HP5890, 6890 GC, 5971, 5972, 5973 Mass Spec; review and data interpretation of various analyses including but not limited to, 8270C, Appendix IX, 625, CLP 3/90, and 2/88; standards preparation for various methods; data interpretation and data package assembly of batch data; evaluation and review of system procedures.

Principal Chemist, GC/MS Semivolatiles (2001)
Responsibilities included: operation, maintenance, and troubleshooting of GC/MS instrumentation; HP5890, 6890 GC, 5971,5972, 5973 Mass Spec; method development, research, and development of GC/MS procedures; review and data interpretation of various analyses including but not limited to 8270C, Appendix IX, 625, CLP 3/90 and 2/88; standards preparation for various methods; data interpretation and data package assembly of batch data; evaluation and review of system procedures; analysis and troubleshooting of HPLC and analysis of PAHs; coaching and training of analysts to assist with troubleshooting; working in Pharmaceutical Method Development and Validation, operating LC/MS, LC/MS/MS, and GC/MS instrumentation, and performing instrument qualifications since June 2003.

Principal Chemist, Flexible Staffing (2006)
Responsibilities included working in GC/MS Volatiles in Air department; operation, maintenance, and troubleshooting GC/MS instrumentation; HP5890, 6890 GC, 5971, 5972, 5973 Mass Spec; method development, research, and development of GC/MS procedures; review and data interpretation of various analyses including but not limited to TO-15 and TO-14; standards preparation for various methods; data interpretation and data package assembly of batch data; evaluation and review of system procedures; ability to operate a variety of instrumentation and data systems.

Principal Chemist, GC/MS Semivolatiles (2007)
Responsibilities included operating, performing maintenance on, and troubleshooting GC/MS instrumentation; HP5890, 6890 GC, 5971,5972, 5973, 5975 Mass Spec; setting up and performing method development of Thermo Fisher TRACE GC and DSQ II MS; performing method development using both EI and CI mode of analysis; method development, research, and development of GC/MS procedures; review and data interpretation of various analyses including, but not limited to, 8270C, Appendix IX, 625, CLP 3/90 and 2/88; standards preparation for various methods; data interpretation and data package assembly of batch data; evaluation and review of system procedures; analysis and troubleshooting of HPLC and analysis of PAHs; coaching and training of analysts to assist with troubleshooting; Including working in GC/MS Volatiles in Air department; operation, maintenance, and troubleshooting GC/MS instrumentation; HP5890, 6890 GC, 5971, 5972, 5973 Mass Spec; method development, research, and development of GC/MS procedures; review and data interpretation of various analyses including but not limited to TO-15 and TO-14; standards preparation for various methods; data interpretation and data package assembly of batch data; evaluation and review of system procedures; ability to operate a variety of instrumentation and data systems.

Principal Chemist, Specialty Services Group (2011)
Responsibilities include acting as technical resource within the environmental division; developing and validating analytical protocols; troubleshooting and solving analytical chemistry problems; optimizing instrument configuration and performance; evaluating and interpreting analytical results; writing SOPs; assisting in responding to and eliminating ICARs, assisting in optimizing procedures in prep lab; communicating effectively within department; performing routine work as required

Abraham H. Uysal, M.S., Senior Data Review Specialist, GC/MS Volatiles

Education:

B.S. Chemistry, M.E. Tech. University-Turkey (1979)
M.S. Chemistry, M.E. Tech. University-Turkey (1982)

Professional Experience:

Aerotek, Senior Chemist (1997-1998)
Responsibilities included analysis of semivolatiles by GC/MS and analysis of volatile organics by GC/PID/ELCD.

Wastex Inc., Lead Supervisor (1998-1999)
Responsibilities included analysis of semivolatiles by GC/MS and analysis of pesticides/PCBs by GC/ECD.

M.J. Reider Assoc. Inc., Senior Chemist (1999-005)
Responsibilities included analysis of pesticides and PCBs by GC/ECD: Preparation, analysis, and data review.

With Lancaster Laboratories since 2005

Senior Data Review Specialist, GC/MS Volatiles (2005)
Responsibilities include auditing GC/MS volatiles data for accuracy and integrity.

Uncontrolled Copy

Robert Todd Vincent, B.S., Principal Chemist, Organic Extraction

Education:

B.S. Chemistry, West Virginia Wesleyan College (2001)

Professional Experience:

With Lancaster Laboratories since 2001
- Chemist, EPH/Misc. GC (2001)
  - Responsibilities included analyzing samples; performing equipment repair; GC method development
- Chemist, Organic Extraction (2005)
  - Responsibilities included performing method development; equipment repair
- Senior Chemist, Organic Extraction (2007)
  - Responsibilities included performing method development; equipment repair; vendor relations; technology evaluation
- Principal Chemist, Organic Extraction (2011)
  - Responsibilities include performing high level, difficult preps (with minimal supervision or guidance) following standard operating procedures (SOPs); self train in new techniques; entering information into computer; training new or existing employees in extraction techniques or use of equipment; using knowledge to actively improve current processes; developing, enhancing, and validating new extraction methods; keeping work area clean and organized; preparing spikes; repairing equipment; updating departmental SOPs and training manual; disposing of wastes in approved manner; assisting in incident prevention and remediation when necessary

Heather E. Williams, B.S., Senior Chemist, EPH/Misc. GC

Education:

B.S. Forensic and Investigative Science, West Virginia University (2004)

Continuing Education:

Principles of Gas Chromatography, LLU (2007)

Professional Experience:

With Lancaster Laboratories since 2006
- Chemist, EPH/Misc. GC (2006)
  - Responsibilities included analyzing routine samples and their associated QC by gas chromatography for extractable petroleum products such as DRO, TPH, and other related materials; reviewing, calculating, and reporting the corresponding data and results; maintaining, optimizing, and calibrating Gas Chromatographs in an efficient and accurate manner; assisting in organization of department work, track samples, and prepare samples and standards to consistently meet turn around time requirements
- Senior Chemist, EPH/Misc. GC (2008)
  - Responsibilities include analyzing routine samples and their associated QC by gas chromatography for extractable petroleum products such as DRO, TPH and other related materials; reviewing, interpreting, calculating, and reporting the corresponding data and results; maintaining, optimizing, and calibrating Gas Chromatographs in an efficient and accurate manner; assisting in organization of department work, track samples, prepare samples and standards to consistently meet turn around time requirements; verify sample data

Donald E. Wyand, B.S., Director, Environmental Business Development/Sales

Education:

B.S. Chemistry, Lebanon Valley College (1989)

Continuing Education:

Graduate Chemistry, Villanova University

Professional Experience:

With Lancaster Laboratories since 1989
- Client Services Specialist (1990)
- Business Development Specialist (1993)
- Principal Specialist/Account Manager (1995)

Uncontrolled Copy

Principal Specialist/Sales (1998) Principal Specialist/Coordinator/Sales, Environmental Sciences (2001)

Responsibilities included: National Account Manager; project management; evaluating new methods; consult with clients regarding testing needs; develop long-term, mutually beneficial relationships with new and existing clients by maximizing our clients' efficiency and effectiveness in managing analytical projects; present relevant market information to senior management and technical operations staff to develop new services for our clients; organize and manage National Account teams; prepare, organize, and manage project planning for target accounts; present Lancaster Labs' capabilities through formal presentations, personal account visits, and marketing campaigns; develop and maintain marketing programs within assigned geographic territory; maintain and communicate knowledge of regulatory issues, analytical methodology, and industry requirements to new and existing clients; prepare proposals and quotations; advise clients on testing; communicate client requirements to lab areas; perform technical presentation to inform our clients of new environmental regulations; and lead client teams to offer analytical solutions to client problems.

Principal Specialist/Group Leader/Sales (2005)

Responsibilities included: National Account Manager; project management; evaluating new methods; consult with clients regarding testing needs; develop long-term, mutually beneficial relationships with new and existing clients by maximizing our clients' efficiency and effectiveness in managing analytical projects; present relevant market information to senior management and technical operations staff to develop new services for our clients; organize and manage National Account teams; prepare, organize, and manage project planning for target accounts; present Lancaster Labs' capabilities through formal presentations, personal account visits, and marketing campaigns; develop and maintain marketing programs within assigned geographic territory; maintain and communicate knowledge of regulatory issues, analytical methodology, and industry requirements to new and existing clients; prepare proposals and quotations; advise clients on testing; communicate client requirements to lab areas; perform technical presentation to inform our clients of new environmental regulations; and lead client teams to offer analytical solutions to client problems.

Director, Environmental Business Development/Sales (2006)

Responsibilities include: National Account Manager; project management; evaluating new methods; consult with clients regarding testing needs; develop long-term, mutually beneficial relationships with new and existing clients by maximizing our clients' efficiency and effectiveness in managing analytical projects; present relevant market information to senior management and technical operations staff to develop new services for our clients; organize and manage National Account teams; prepare, organize, and manage project planning for target accounts; present Lancaster Labs' capabilities through formal presentations, personal account visits, and marketing campaigns; develop and maintain marketing programs within assigned geographic territory; maintain and communicate knowledge of regulatory issues, analytical methodology, and industry requirements to new and existing clients; prepare proposals and quotations; advise clients on testing; communicate client requirements to lab areas; perform technical presentation to inform our clients of new environmental regulations; and lead client teams to offer analytical solutions to client problems.

Memberships & Appointments:

American Chemical Society
Society of American Military Engineers
Society of Environmental Toxicology and Chemistry

Meng Yu, M.S., Principal Chemist, Specialty Services Group

Education:

B.E. Analytical Chemistry, Zhejiang University of Technology (1986)
Post Graduate, Biogeography and Environmental Assessment, University of Saarland (1996)
M.S. Chemistry, Catholic University of Leuven (1998)

Professional Experience:

Setsco Service Ltd, Executive Chemist (1999-2002)

Responsibilities included setting up new analyses for pharmaceutical and food testing using USP, BP, and AOAC methods; performing pesticide residue analysis using all kinds of GC

Cantest Ltd, Research Chemist (2002-2008)

Responsibilities included performing pesticide and drug residue method validation as per USDA, EPA, CFIA methods; performing bioanalytical method development and validation; UPLCMSMS, LCMSMS, LCMS and GCMS operation and maintenance

Pharmanet Inc. HSP Laboratory, Research Scientist (2008-2010)

Responsibilities included performing bioanalytical method development and validation, LCMSMS operation, tuning, and maintenance

With Lancaster Laboratories since 2010

Principal Chemist, Specialty Services Group (2010)

Responsibilities include developing and validating new testing methods; operating and maintaining LCMSMS instruments; performing sample analyses

Uncontrolled Copy

eurofins | Lancaster Laboratories

Environmental Quality Policy Manual

Appendix E
SOPs and Analytical Methods

Current as of October 05, 2011
23 Total Pages (including this coversheet)

NOTE: Current indices available from Document Control.

Uncontrolled Copy

Lancaster Laboratories, Inc. • 2425 New Holland Pike, PO Box 12425, Lancaster, PA 17605-2425 • 717-656-2300 Fax: 717-656-2681

Index of Corporate Procedures

Procedure No.	Title
Environmental Quality Policy Manual	Environmental Quality Policy Manual
Environmental Quality Policy Manual Appendix A	Procedure Cross Reference List
Environmental Quality Policy Manual Appendix B	Certifications, Accreditation, Registrations, and Contracts
Environmental Quality Policy Manual Appendix C	Organizational Charts Personnel to Sign Reports
Environmental Quality Policy Manual Appendix D	Personnel Qualifications and Responsibilities
Environmental Quality Policy Manual Appendix E	SOPs and Analytical Methods
Environmental Quality Policy Manual Appendix F	Instrument and Equipment List
Environmental Quality Policy Manual Appendix G	Preventative Maintenance Schedules
Environmental Quality Policy Manual Appendix H	Calibration Schedules
Environmental Quality Policy Manual Appendix I	NELAP Scope of Testing
Environmental Quality Policy Manual Appendix J	Quality Control Types, Frequency, and Corrective Action
Environmental Quality Policy Manual Appendix K	Microbiological Testing
LOM-SOP-ES-201	Forensic Laboratory Services
LOM-SOP-ES-202	Guidelines for Writing Technical Reports
LOM-SOP-ES-203	Determining Method Detection Limits and Limits of Quantitation
LOM-SOP-ES-204	Subcontracting Analytical Testing
LOM-SOP-ES-205	Monitoring of the Volatile Organics Analysis (VOA) Storage Areas for Contamination
LOM-SOP-ES-206	Sample Requisition
LOM-SOP-ES-207	Establishing Control Limits
LOM-SOP-ES-208	Thermometer Calibration
LOM-SOP-ES-209	Investigation and Corrective Action of Noncompliant Data
LOM-SOP-ES-210	Monitoring Temperatures in Refrigerators, Freezers, Incubators, and Ovens Using the Andover System
LOM-SOP-ES-211	Quarantine Soils Procedures
LOM-SOP-ES-212	Laboratory Sample Analysis Record (LSAR) Documentation
LOM-SOP-ES-213	Quality Control Records
LOM-SOP-ES-214	Composing and Maintaining Comments in Parallax
LOM-SOP-ES-215	Subcontracting to Other Laboratories
LOM-SOP-ES-216	Proficiency Test Samples
LOM-SOP-ES-218	Final Review of Analytical Reports
LOM-SOP-ES-219	Documentation for the Parallax Analysis Definition Function
LOM-SOP-ES-221	Analytical Methods for Nonstandard Analyses
LOM-SOP-ES-222	Instrument and Equipment Maintenance and Calibration
LOM-SOP-ES-223	Missed Holding Time Reports
LOM-SOP-ES-224	Data Rounding, Parallax Entry, Verification, and Reporting
LOM-SOP-ES-225	Reagents and Standards
LOM-SOP-ES-226	Validation and Authorization of Analytical Methods
LOM-SOP-ES-227	Communicating Maximum Contaminant Level (MCL) Exceedances

Uncontrolled Copy

Index of Corporate Procedures

Procedure No.	Title
LOM-SOP-ES-230	Investigation and Corrective Action Reporting for Laboratory Problems
LOM-SOP-ES-231	Handling of Client Technical Complaints (Investigations and Response)
LOM-SOP-ES-232	Chromatography Integration and Documentation
LOM-SOP-ES-233	Obtaining a Representative Environmental Solid Sample Aliquot
LOM-SOP-ES-234	Legal Chain-of-Custody Documentation
LOM-SOP-ES-235	Certification of Syringes
LOM-SOP-ES-236	HP-UX Target 3.5 Data System Accounts and Electronic Signature Security
LOM-SOP-ES-237	Bay Area Service Center Dangerous Goods Shipping Procedure
LOM-SOP-HS-202	Safety Glasses
LOM-SOP-HS-203	Reporting Work Related Incidents
LOM-SOP-HS-204	Respiratory Protection Program
LOM-SOP-HS-207	Lockout/Tagout
LOM-SOP-HS-208	Emergency Evacuation Plan
LOM-SOP-HS-209	Environmental, Health, and Safety (EHS) Assessments
LOM-SOP-HS-210	Hot Work Permit Program
LOM-SOP-HS-211	Environmental Hazardous Sample Communication Procedure
LOM-SOP-HS-212	Incident Response Plan
LOM-SOP-HS-213	Radiation Safety Program
LOM-SOP-HS-214	Disposal of Regulated Medical Waste
LOM-SOP-HS-215	Automated External Defibrillator (AED) Program
LOM-SOP-HS-218	Pharmaceutical Sample Handling
LOM-SOP-HS-219	Management of Hazardous Wastes in the Laboratory
LOM-SOP-LAB-201	Writing and Reviewing Lancaster Laboratories Policies and Operating Procedures
LOM-SOP-LAB-202	Document Control
LOM-SOP-LAB-203	Data and Record Storage, Security, Retention, Archival, and Disposal
LOM-SOP-LAB-204	Regulatory Training
LOM-SOP-LAB-205	E-Mail System
LOM-SOP-LAB-206	Windows Network and Computer Accounts
LOM-SOP-LAB-207	Utilizing the Services and Support of the Computer Systems Group
LOM-SOP-LAB-208	Laboratory Balances
LOM-SOP-LAB-209	Facility Change Control Procedure
LOM-SOP-LAB-211	Client Credit Procedure
LOM-SOP-LAB-212	Building Security
LOM-SOP-LAB-213	Insect and Rodent Control
LOM-SOP-LAB-214	Use and Maintenance of Reagent Water Supply
LOM-SOP-LAB-216	Use of the Dixon Test to Evaluate Outlying Observations
LOM-SOP-LAB-218	Procurement of Laboratory Supplies
LOM-SOP-LAB-219	Review of Legal Matters
LOM-SOP-LAB-220	Laboratory Notebooks, Logbooks, and Documentation
LOM-SOP-LAB-221	Laboratory Housekeeping and Cleaning
LOM-SOP-LAB-223	Facilities Operation Manual
LOM-SOP-LAB-224	Compliance with Good Laboratory Practice Regulations

Uncontrolled Copy

Index of Corporate Procedures

Procedure No.	Title
LOM-SOP-LAB-225	Position Qualification Descriptions (PQDs) and Essential Job Functions (EJFs)
LOM-SOP-LAB-226	Guidelines for Analytical Decision Making
LOM-SOP-LAB-228	Use of PreCovery for Disaster Recovery Planning
LOM-SOP-LAB-229	Site Computer Control Guide
LOM-SOP-LAB-230	Environmental Health and Safety Training
LOM-SOP-LAB-231	Employee Training Program
Policy 0001	Manual Integration
Policy 0006	Computer Services Validation Master Plan (CSVMP) Policy
Policy 0007	Laboratory Ethics and Data Integrity Policy
Policy 0010	Preparedness, Prevention, and Contingency Plan
Policy 0011	Exposure Control Plan for Bloodborne Pathogens
Policy 0012	Corporate Change Control Policy for Lancaster Laboratories
Policy 0016	Prevention of Cross-Contamination in the Biopharmaceutical Laboratories
Policy 0017	Operation of the Viral Clearance Suites

Uncontrolled Copy

Index of Environmental and Supporting Departmental Procedures

Procedure No.	Title
Client Services	
SOP-CL-005	Tracking and Communicating Rush Results
SOP-CL-006	Phone Log and Email Documentation
SOP-CL-007	Auditing Client Paperwork
SOP-CL-008	Preparing Quotations
SOP-CL-010	Scheduling and Pricing of Rush Samples
SOP-CL-012	Daily or Weekly DEP Reporting
SOP-CL-013	Monthly DEP Reporting
SOP-CL-014	Sample Set-Up Form Creation Guide
SOP-CL-015	Client Concern and ISPD Code Entry
SOP-CL-016	Creating Bottle Orders
SOP-MK-104	Client/Prospects Visits
SOP-MK-105	Proposal Preparation
Computer Applications Development	
SOP-CS-018	Configuration Management
SOP-CS-049	Implementation of the Computer Services Division Validation Master Plan
SOP-CS-062	Validation of Spreadsheets for Pharmaceutical Sciences Division using the Software Development Lifecycle
Computer Systems	
SOP-CS-026	Oracle Database Installation Manual
SOP-CS-030	System Administration for Oracle
SOP-CS-031	Server Backup/Recovery Manual
SOP-CS-034	Computer Services Procedures for Incident and Defect Tracking
SOP-CS-041	Network Management
SOP-CS-048	Service Request
SOP-CS-052	Personal Computer Management and Disposal
SOP-CS-055	Server Management
SOP-CS-057	Processing of Cross Charges
SOP-CS-058	Software Management
SOP-CS-061	Standby Databases
SOP-CS-064	Firewall Management
SOP-CS-065	Configuration and Maintenance of EmailXtender
SOP-CS-066	System Administration for IBM Servers
SOP-CS-070	Account Administration
SOP-CS-071	Computer Operating System and Software Patching
SOP-CS-072	Information Systems Disaster Recovery Plan
TRN-CS-001	Introduction to Software Quality
Data Deliverables	
SOP-DP-002	Flow of Data Through the Data Deliverables Department
SOP-DP-007	Processing and Sending Data Packages
SOP-DP-009	Overchecking the Electronic Data Deliverable
SOP-DP-010	Assembly/Content Review of Environmental Data Package
SOP-DP-011	QA/QC Compliance Review of Environmental Data Packages

Uncontrolled Copy

Index of Environmental and Supporting Departmental Procedures

Procedure No.	Title
SOP-DP-013	Maintenance of Bell+Howell Copiscan 8000 Spectrum Scanner
SOP-DP-014	Preparation of Data Packages on CD ROM
SOP-DP-017	GC/MS Volatiles Data Package Assembly
SOP-DP-021	Dept 4038 Assembly of Instrumental Water Quality Data Packages
SOP-DP-022	Archiving Department 4025 Raw Sample Data and Other Miscellaneous Data
SOP-DP-024	Assembly of Inorganic Metals Data Packages
SOP-DP-027	Assembly of Data Packages for Department 4025
SOP-DP-028	Tune File Folders Contents
SOP-DP-029	Assembly of Department 4024 Data Packages
SOP-DP-030	Assembly of GC/MS Semivolatile Data Packages
SOP-DP-031	Assembly of Semivolatile Archive Batch Department 4026
SOP-DP-032	Raw Data Labeling for CLP Protocol
SOP-DP-033	Assembly of Department 4032 Data Packages
SOP-DP-034	Generation and Content Review of GLP Compliant Data Packages
SOP-DP-035	Department 4029 Assembly
SOP-DP-036	Assembly of Department 4030 Data Packages
Environmental Microbiology	
0199, 11028	Modification Fecal Coliform by Membrane Filtration
0307, 4196	Heterotrophic Plate Count Testing for Environmental Solid and Liquid Samples Pour Plate Method
0308	Free Chlorine Residual Data Records (Optional Total Chlorine Reading)
0416	Modification DPD Free Chlorine Residual In Water (Presence/Absence)
6157, 6158	Hydrocarbon Degrading Plate Count Study Waters and Solids
6477, 6479, 8161	Total Coliform and E. coli Analysis Potable Water (Presence/Absence), 6477 Swimming Pool Samples, 6479 Potable Water (Quantitative), 8161
OMC-PM-078	Quanti-Tray X Sealer
SOP-PM-041	Quality Control/Quality Assurance Procedure for Environmental Microbiology
EPH/Misc. GC	
0380	Extraction of Solids/Soils for Analysis of Alcohols
0497	Silica Gel Fractionation for Hydrocarbons by GC in Soil and Water Matrices
0969	CCWE Water Miscible Solvents
10318, 10319	Determination of Terphenyls in Water and Soils Using Gas Chromatography with Flame Ionization Detection (GC-FID)
10441	Hydrocarbon Oil Index
10442	Hydrocarbon Oil Index Waters Procedure
10581, 10584	Amines by Gas Chromatography with Direct Injections
10600, 10601	TPH-DRO by GC-FID using 8015C in Water and Soil (Diesel Range Organics)
10942, 11509	Microwave Extraction for the Determination of Diesel Range Organics (DRO) and Saturated Hydrocarbons in a Solid Matrix
11029WI	Extraction Procedure for Wisconsin DRO Soils and Solid Waste
11507, 11554	Total Saturated Hydrocarbons in Waters and Solids by Gas Chromatography using Flame Ionization Detection (GC/FID)
11551	Extraction of Soils/Solids for Glycol Analysis
11599, 11600	Alumina Column Cleanup of Solids
11657	Waste Dilution for the Determination of Saturated Hydrocarbons in an Oil Matrix
11681	10g Silica Gel Cleanup for Hydrocarbons by GC in Soil and Water Matrices

Uncontrolled Copy

Index of Environmental and Supporting Departmental Procedures

Procedure No.	Title
1464, 1469, 10007	Analytical Method for the Determination of Total Extractable Hydrocarbons (TEH) by GC-FID
2012, 2535	Qualitative/Quantitative GC Fingerprint
2099, 2100, 0347, 0359	Analytical Method for the Determination of Petroleum Range Organics in Waters and Soils using FL-PRO
2110, 2112	Method for the Determination of Extractable Petroleum Hydrocarbons by GC/FID using OA-2 Iowa/Missouri Protocol for Waters and Soils
2168MT	Extraction Procedure for the Determination of Extractable Petroleum Hydrocarbons in a Solid Matrix by Montana Protocol
2366, 2380	PMI Volatile Organic Compounds by Direct Injection GC/FID
2768, 2769	TPH by CT ETPH
4833	Extraction Procedure for the Determination of GC Fingerprint on Petroleum Products in Soil or Solid Matrix by Sonic Disruption
5256, 5260, 8734, 8735	TPH by GC-FID and TPH by Custom 8015B
5665, 5666	WADOE - Method for the Determination of Volatile Petroleum Hydrocarbons (VPH) Fractions
6624, 10501, 10603, 10604	Water Miscible Solvents by GC-FID
7001	Determination of the Volatile Organic Concentration of Waste Samples by FID and ELCD
7003, 11164, 11167, 11171, 11172, 11176, 11177, 11181, 11182, 11183, 11189, 11190, 11191, 11195, 11196, 11201	Separatory Funnel Extraction Procedure for the Determination of Diesel Range Organics in a Water or Wastewater Matrix
7004, 11204, 11205, 11209, 11210, 11215, 11218, 11219, 11220, 11221, 11224, 11225, 11228, 11229, 11232, 11233, 11236, 11237	Extraction Procedure for the Determination of Diesel Range Organics in Soil or Solid Matrix
7004ME	Extraction Procedure for the Determination of Total Petroleum Hydrocarbon Organics in Soil or Solid Matrix Maine Methodology
7105, 10602	Determination of Volatile Hydrocarbons in Water Using Headspace Sampling Techniques and Gas Chromatography with Flame Ionization Detection (GC-FID)
7553, 7554	Analysis for TPH-DRO (Diesel Range Organics) in Soils or Waters by Wisconsin DRO Methodology
7645	Silica Gel Cleanup for Hydrocarbons by GC in Soil and Water Matrices
8093, 8107, 2500, 2516, 2729, 2740, 0071, 0072, 0965, 1020, 6631, 6635, 10199, 10365	Analysis of Total Petroleum Hydrocarbons with Ranges by GC-FID
8097	Determination of Carbon Dioxide in Water Using Headspace Sampling Techniques and Gas Chromatography with Thermal Conductivity Detection (GC-TCD)
8269, 8270, 1070, 1104, 1736, 1737, 2216, 2222, 2251, 2252, 8345, 8349, 6609, 6610, 5867, 5868, 6884, 6885, 6901, 6902, 6912, 6913, 10941	TPH-DRO by 8015B (Diesel Range Organics)
8271, 8272, 2211, 2214	TPH by NWTPH-Dx (modified) in Waters and Soils using GC-FID
8278, 11099	Analysis of Glycols in Waters using GC-FID

Uncontrolled Copy

Index of Environmental and Supporting Departmental Procedures

Procedure No.	Title
8283	Analysis of Glycols in Soils by GC-FID
8323, 8324, 6976, 7062	Method for the Determination of Fractionated Extractable Petroleum Hydrocarbons using LA RECAP Ranges
SOP-EP-006	Maintenance and Troubleshooting Procedures for GC-FID Instrumentation
SOP-EP-008	Common Equations Used During Chromatographic Analyses
SOP-EP-009	QC Data Acceptability and Corrective Action
SOP-EP-010	Monitoring QC Data Acceptance Limits
SOP-EP-011	Interpretation and Integration of Chromatographic Data
Field Sampling	
MC-FS-002	Maintenance and Calibration of pH Probes and Meters
SOP-FS-002	Wastewater Field Sampling Procedures
SOP-FS-003	Soil Sampling Procedures
SOP-FS-004	Collecting Potable Water Samples
SOP-FS-006	Groundwater Monitoring Sampling Procedure
SOP-FS-008	Direct Field Readings Using Orion Model 1230 Multi-Parameter Meter
SOP-FS-009	Symphony Multi-Parameter Meter
SOP-FS-010	Low Level Mercury Sampling
GC/MS Semivolatiles	
0381, 10478, 10480, 10483, 10487L	Low-Level Sonic Probe Extraction Procedure for the Determination of Semivolatiles in a Solid Matrix
0381DIL	Waste Dilution Procedure for the Determination of Acid Extractables and Base-Neutrals in a Non-Water Soluble Matrix
0382, 1196	Dioxin Screening of Water and Soils (Screening Procedure for 2,3,7,8-Tetrachlorodibenzo-p-Dioxin by Selective Ion Monitoring Gas Chromatography/Mass Spectrometry)
0813, 11010, 11015, 10464, 10467, 10476	Separatory Funnel Extraction Procedure for the Determination of Base-Neutrals and Acid Extractables in a Wastewater Matrix by SW-846 Method 3510C
0813THPA	Solid Phase Extraction Procedure for the Determination of THPA, THPI and PA in a Water Matrix
0885, 0886, 0887, 0893, 7125	Semivolatile Organics Tentatively Identified Compound Method
0941, 0774, 0627	Polynuclear Aromatic Hydrocarbons in Soils, Sludges, Water, and Wastewater
0949, 1309, 1476, 1536, 1946, 1947, 1953, 2035, 2395, 4615, 4678, 4688, 6387, 6397, 7804, 7805, 10032, 10723, 10724, 10727, 10728, 11013	Determination of Semivolatile Organic Compounds by Method 8270C
10215	The Determination of d-Limonene in Plastic by Gas Chromatography/Mass Spectrometry (GC/MS)
10333	Analysis of Semivolatile Compounds in Drinking Water by Method 525.2
10334, 2783	Determination of Priority Pollutants by Method 625
10458	Liquid/Liquid Extraction Procedure for the Determination of Base-Neutrals and Acid Extractables in a Wastewater Matrix by Method 8270
10461, 10462, 10726	Determination of Semivolatile Organic Compounds by Method 8270D
10472	Extraction Procedure for the Determination of Tetraethyl Lead in a Water or Wastewater Matrix
10475	Extraction Procedure for the Determination of 2-Chlrorbenzalmalonotrile (CS) and 3-Quinuclidinyl Benzilate (BZ) in Water and Wastewater

Uncontrolled Copy

Index of Environmental and Supporting Departmental Procedures

Procedure No.	Title
10479, 10484, 10489	Sonic Probe Extraction Procedure for the Determination of Semivolatiles in a Solid Matrix by SIM
10498, 10809, 10810, 10811, 10812, 10813, 10814, 11630	Microwave Extraction Procedure for the Determination of Semivolatiles in a Solid Matrix
10962, 11622	Determination of N-Nitrosodimethylamine (NDMA) in Water and Soil by EPA 1625C
11012, 10470, 10471SIM	Separatory Funnel Extraction Procedure for the Determination of Base-Neutrals and Acid Extractables by SIM in a Wastewater Matrix
11629	Liquid/Liquid Extraction Procedure for the Determination of Neutral Extractables in a Wastewater Matrix
1542, 2345	Determination of cis-1,2,3,6-Tetrahydrophthalic anhydride (THPA), cis-1,2,3,6-tetrahydrophthalimide (THPI), Phthalic anhydride (PA) in Water/Wastewater by SPE and Soil by Sonic Probe Extraction with analysis by GC/MS
2026	Analysis of Chlorinated Herbicides in Water by Selective Ion Monitoring Gas Chromatography/Mass Spectroscopy (SIM/GC/MS)
3337, 11150	Separatory Funnel Extraction Procedure for the Determination of Polynuclear Aromatic Hydrocarbons (PAH) in Water and Wastewater
3338	Sonication Extraction Procedure for the Determination of Polynuclear Aromatic Hydrocarbons (PAH) in a Solid Matrix
4220, 4221	Determination of Tetraethyl Lead (TEL) and Tetramethyl Lead (TML) by GC/MS Analysis
4372, 4438, 4722, 4723	CLP Semivolatile Analysis of Waters and Soils by the OLM03.2 and/or the OLM04.3 Statement of Work
4606	Liquid-Liquid Extraction Procedure for the Determination of Target Compound List Analytes in a Water Matrix
4607L	Low-Level Sonic Probe Extraction Procedure for the Determination of Target Compound List Analytes in a Solid Matrix
4731	Separatory Funnel Extraction Procedure for the Determination of Base Neutrals and Acid Extractables in a Toxicity Characteristic Leachate by SW-846 Method 3510C
4731DIL	Waste Dilution Procedure for the Determination of Acid Extractables and Base-Neutrals in a Non-Water Soluble Leachate Matrix
4894	Extraction of Organic Compounds in Drinking Water By Method 525.2
6007	Paraquat in Wastewater by HPLC
6570	The Determination of Semivolatiles by Large Volume Injection (LVI) Gas Chromatography/Mass Spectrometry (GC/MS)
7325, 0089	Determination of Benz(a)pyrene in Smokeless Tobacco by Selective Ion Monitoring Gas Chromatography/Mass Spectrometry (SIM/GC/MS)
7806	Low-Level Sonication Extraction Procedure for the Determination of Polynuclear Aromatic Hydrocarbons (PAHs) in a Solid Matrix by GC/MS
7806AIR	Extraction Procedure for the Determination of Polycyclic Aromatic Hydrocarbons (PAHs) in an XAD Air Tube Sample
7807	Extraction Procedure for the Determination of Polynuclear Aromatic Hydrocarbons (PAH) in Water and Wastewater by GC/MS
8108	Separatory Funnel Extraction Procedure for the Determination of Base-Neutrals and Acid Extractables in a Wastewater Matrix by Method 625
8108TJ	Sonic Probe Extraction Procedure for the Determination of Semivolatiles in a Complex Matrix
8357, 2858, 0038, 0039, 10010, 10137, 10138, 10722, 10725	The Determination of Semivolatiles by Selected Ion Monitoring (SIM) Gas Chromatography/Mass Spectrometry (GC/MS)
MC-EX-001	GC/MS Preventative and Corrective Maintenance
MC-EX-003	Preventative and Corrective HPLC Maintenance
MC-OE-003	Semivolatile Extract Cleanup Using Gel Permeation Chromatography
SOP-EX-001	Semivolatile Spiking and Calibration Standards
SOP-EX-006	GC/MS Electronic Data Management and Handling
SOP-EX-008	Quality Control Spike Mix Verification
SOP-EX-009	GC/MS Audit Process
SOP-EX-019	Semivolatile Run/Injection Log Generation
SOP-EX-020	Monitoring QC Data Acceptance Limits

Uncontrolled Copy

Index of Environmental and Supporting Departmental Procedures

Procedure No.	Title
GC/MS Volatiles	
0373	Preparation of Oil Samples
0527, 10326	The Determination of 1,4-Dioxane by Gas Chromatography/Mass Spectrometry (GC/MS) using Isotope Dilution and Selective Ion Monitoring (SIM)
0527, 10903, 10904, 10949, 10950 OH VAP	Volatile Compounds in Aqueous and Solid Samples by SW-846 8260B and 1,4-Dioxane in Aqueous Samples by SW-846 8260B Selective Ion Monitoring (SIM)
0882, 0884	Volatile Organics Tentatively Identified Compound Method (interpretive)
0890, 0880	Volatile Organics Tentatively Identified Compound Method
10237, 10607, 10949, 10950, 10951	Determination of Volatile Target Compounds and Gasoline Range Organics (GRO) by Capillary Column Gas Chromatography/Mass Spectrometry (GC/MS) in Soils and Solids by Method 8260B
10371	Waters for Volatile Organic Compounds by Purge and Trap Gas Chromatography/Mass Spectrometry using EPA Method 624
10460	Determination of Volatile Target Compounds by Capillary Column Gas Chromatography/Mass Spectrometry (GC/MS) in Waters and Wastewaters by Method 6200B
10903, 10904, 10949, 10950WI	Soils, Solids, and Waters from Wisconsin for Volatile Target Compounds by Gas Chromatography/Mass Spectrometry (GC/MS): Capillary Column Technique
11017	The Determination of 1,2,3- Trichloropropane by Gas Chromatography/Mass Spectrometry (GC/MS) using Isotope Dilution and Selective Ion Monitoring (SIM)
11660	Targeted Library Search by GC/MS
2394, 2417	The Determination of Volatile Organic Compounds in Wastewater by Isotope Dilution and Gas Chromatography/Mass Spectrometry (GC/MS)
2601, 3540	Waters for Volatile OLM4.3 Target Compound List Compounds
2657, 3596	Soils for Volatile OLM04.3 Target Compound List Compounds
2898, 10335, 10903, 10904, 10905, 10943, 10945	Determination of Volatile Target Compounds and Gasoline Range Organics (GRO) by Capillary Column Gas Chromatography/Mass Spectrometry (GC/MS) in Waters and Wastewaters by Method 8260B
3636	Toxicity Characteristic Leachate Procedure (TCLP); Analysis of Zero Headspace Extractions (ZHE) of Solid Waste, Soils, and other Matrices for Volatile Target Compounds by Gas Chromatography/Mass Spectrometry (GC/MS): Capillary Column Technique
3648	Waters for Purgeable Organic Compounds by Capillary Column Gas Chromatography Mass Spectrometry
4914	Low Concentration Waters for Volatile Organic Analysis
6008	The Determination of Vinyl Chloride and Carbon Disulfide by Gas Chromatography/Mass Spectrometry (GC/MS) using Selective Ion Monitoring (SIM)
6372, 6377	The Determination of Ethylene Oxide and Crotonaldehyde by Gas Chromatography/Mass Spectrometry (GC/MS) in Water and Soil by SW-846 Method 8260B
7126	Volatile Organics Library Search Method for CLP
7156	Waters for Volatile OLM03.2 Target Compound List Compounds
7157	Soils and Solids for Volatile OLM03.2 Target Compound List Compounds
SOP-MS-001	Glassware Cleaning
SOP-MS-002	Preparation and Testing of Trip Blanks for GC/MS Volatile Analyses
SOP-MS-004	GC/MS Instrumentation Maintenance
SOP-MS-005	Preservation and Residual Chloride Checks of Samples for GC/MS Volatile Water Analysis
SOP-MS-006	GC/MS Volatile Standards Traceability
SOP-MS-007	Preparation and Analysis of Cleaning Blanks for GC and GC/MS Volatiles
SOP-MS-012	GC/MS Volatiles Audit Process
SOP-MS-014	Volatile Run/Injection Log Generation
SOP-MS-015	Preparation and Testing of Storage Blanks for GC/MS Volatile Analysis
SOP-MS-016	Use of 40-mL Vials for Volatile Organic Analyses

Uncontrolled Copy

Index of Environmental and Supporting Departmental Procedures

Procedure No.	Title
SOP-MS-017	Level II Review of GS/MS Volatiles
Instrumental Water Quality	
0217, 1511, 0223, 4235, 6165	Automated Determination of Total Kjeldahl Nitrogen in Water, Wastewater, and Solids
0219, 5991	Nitrite Nitrogen in Water and Wastewater (Colorimetric, Automated)
0220, 7882, 5992	Nitrate Nitrogen in Water and Wastewater (Colorimetric, Automated Cadmium Reduction)
0224, 0228, 0332, 0368, 1504, 1505, 1506, 7322, 7332, 7333, 7334, 7335, 7336, 7337, 7338	Determination of Inorganic Anions by Ion Chromatography
0227, 0345, 1546, 5893, 5894	Determination of Total and Soluble Phosphorus in Water, Wastewater, and Soils (Colorimetric, Ascorbic Acid, Automated)
0237, 1123, 1549, 5895, 5898, 8255, 0241, 4814, 0961, 0957, 0959	Determination of Total and Amenable Cyanide in Water, Wastewater, and Soils, Free Cyanide in Water and Wastewater, Reactive Cyanide of Solids, and Weak and Dissociable Cyanide in Waters and Soils
0273, 6090, 7547	Determination of Total Organic Carbon, Dissolved Organic Carbon, and Inorganic Carbon in Water and Wastewater
0354	Determination of Total Organic Carbon in Water and Wastewater (Quadruplicate Studies)
0370, 0371, 1105, 1106	Determination of Nitrocellulose in Water and Soil
0434, 2393, 5912	Automated Determination of Phenols in Water, Wastewater, and Soils By Automated Flow Analyzer
0491, 5911, 8123	Phenol Distillation (as Preparation for Analysis on the Flow Analyzer)
0492, 1548, 5896, 5897, 8256, 0956, 0958	Total and Amenable Cyanide Distillation (As Preparation for Analysis on the Automatic Flow Analyzer)
10704, 10705	Determination of Total Cyanide in Water, Wastewater, and Soils (Department of Defense)
11151	Total Cyanide Analysis by Massachusetts Contingency Plan (MCP)
1352, 10129	Deionized Water Extraction (as Preparation for Analysis on the Ion Chromatograph or Autoanalyzer)
1460	Total Kjeldahl Nitrogen Digestion of Water and Wastewater (A Preparation for Analysis #0217)
1465	Total Kjeldahl Nitrogen Digestion of Solids and Soils (a preparation for Analysis #1511)
1550	Determination of Total Carbon in Water and Wastewater
2079, 0383, 6623, 10065, 11356, 11763	Determination of TOC and TC in Solids and Sludges by Combustion
2111, 2118, 2121, 2553	Moisture by Sartorius Moisture Analyzer/Moisture by Mettler Toledo HB43
3343, 5910, 5861, 5863	Automated Determination of Total Cyanide in Water, Wastewater, and Soils by CLP Protocol
3344, 5909, 5860, 5862	Total Cyanide Distillation (As Preparation for Analysis on the Automated Analyzer) by CLP Protocol
5892, 6467	Determination of Hexavalent Chromium by Ion Chromatography in Solids and Waters
6019, 10130, 10147	Determination of Perchlorate by Ion Chromatography
7528, 0960	Weak and Dissociable Cyanide Distillation (as Preparation for Analysis on the Flow Analyzer)
8261, 8262, 8263, 8264, 8895	Digestion of Total and Soluble Phosphorus in Water, Wastewater, and Soils
MC-IC-001	Adjustable Volume Handheld Pipettes
MC-IC-003	pH Electrodes and Meters
MC-IC-005	Maintenance and Calibration of A.I. Scientific AIM600 Digestor
MC-IC-006	Maintenance of the OI Analytical Model 1030 Total Organic Carbon Analyzer
MC-IC-007	Maintenance of Continuous Flow Analyzers

Uncontrolled Copy

Index of Environmental and Supporting Departmental Procedures

Procedure No.	Title
MC-IC-008	Accusterilizer - Steam Sterilizer
MC-IC-009	Automatic Pipette Dispensers
MC-IC-010	DX-500, DX-320, ICS-1000, ICS 1100, and ICS-3000 Ion Chromatography Systems
SOP-IC-004	Quality Control for Auto-Analyzer Analyses Performed in Instrumental Water Quality
SOP-IC-010	Use of Cardy Compact Ion Meter to Prescreen Nitrate-Nitrogen Samples
SOP-IC-016	Department 4027 Chemical Inventory and Review Procedures
SOP-IC-017	Maintenance of the OI Analytical Total Organic Carbon Solids Analyzer
Leachate Preparation	
0447	Shake Extraction of Solid Waste with Water ASTM Method #D3987-85
0946, 2573, 0075	Toxicity Characteristic Leaching Procedure TCLP Zero Headspace Leachates
0947, 1339	Toxicity Characteristic Leaching Procedure TCLP Nonvolatile Leachates
1435, 1436	Waste Extraction Test Leaching Procedure for Volatile and Non-volatile Analytes
1567	Synthetic Precipitation Leaching Procedure (SPLP) for Nonvolatile Leachates
2487	Food and Tissue Preparation
2595	Cation Exchange Capacity of Soils (Sodium Acetate)
8792, 1339	Synthetic Precipitation Leaching Procedure (SPLP) Zero Headspace Leachates
MC-TL-001	pH Meters and Probes
MC-TL-002	Calibration of the Leachate Tumblers
SOP-TL-001	Glassware Cleaning for Leachate Extractions
SOP-TL-002	Leachate Blank Evaluations
SOP-TL-003	Subsampling and Preservation of Leachates
SOP-TL-004	Manually Pressurized Zero Headspace Extractor (ZHE)
SOP-TL-005	Procedure for Calculating and Reporting Weighted Average Results for TCLP Extracts
Metals	
0259, 0159	Mercury in Aqueous, Solid, and Tissue Samples by Cold Vapor AA
0259, 0159 OH VAP	Mercury in Aqueous and Solid Samples by SW-846 Method 7470A (Aqueous) and 7471A (Solid)
0494	Sample Preparation of Soil, Sediment, and Sludge for Total Mercury Analysis by Atomic Absorption Cold Vapor Technique
0576	Langelier Index in Water
0821, 5713, 5714	Digestion of Aqueous Samples by SW-846 Method 7470A, EPA 254.1, CLP2.10, CLP4.0 and CLP 5.2.
0821, 5713, 5714WB	Sample Preparation of Potable Water and Wastewater for Total Mercury Analysis by Cold Vapor Technique
1015, 11355	Sample Preparation of Oils for Analysis of Metals by Inductively Coupled Plasma Spectroscopy
1573, 1574	Mercury in Aqueous and Solid Samples by SW-846 Method 7470A (aqueous) and 7471A (solid)
1848, 5720, 10635	Sample Preparation of Waters for Analysis of Total Recoverable Metals by Inductively Coupled Plasma Atomic Emission Spectrometry
1849	Preparation of Soil, Sediment, and Sludge for Analysis of Metals by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES)
2812, 10651	3030 C. Treatment for Acid-Extractable Metals for North Carolina Groundwater Samples
4792	Dilute/Run and AVS/SEM Sample Handling for Metals
5281	Undigested Sample Preparation of Potable Water for Analysis of Total Recoverable Metals by Inductively Coupled Plasma Atomic Emission Spectrometry
5705, 10636	Sample Preparation of Wastewater and Leachates for Analysis of Total Metals by Inductively Coupled Plasma Atomic Emission Spectrometry
5708, 10637, 11026, 11027	Sample Preparation of Sediments, Sludges, Soils, and Fish Tissue for Analysis of Metals by Inductively Coupled Plasma Atomic Emission Spectrometry and Inductively Coupled Plasma Mass Spectrometry

Uncontrolled Copy

Index of Environmental and Supporting Departmental Procedures

Procedure No.	Title
5708, 10637, 11026, 11027OH VAP	Preparation of Solid Samples for Analysis of Metals by Inductively Coupled Plasma Atomic Emission Spectrometry
5708II	Sample Preparation of Sediments, Sludges, and Soils for Analysis of Metals by Inductively Coupled Plasma Atomic Emission Spectrometry (5708)
5711 OH VAP	Digestion of Solid Samples by SW-846 Method 7471A
5711, 10638	Sample Preparation of Soil, Sediment, Sludge, Oils, and Fish Tissue for Total Mercury Analysis by Atomic Absorption Cold Vapor Technique
5713 OH VAP	Digestion of Aqueous Samples by SW-846 Method 7470A
5716	Sample Preparation of Potable Water, Groundwater, Surface Water, and Wastewater for Analysis of Total Recoverable Metals by Inductively Coupled Plasma Atomic Emission (5716)
6050, 10639	Sample Preparation of Leachates and Other Wastewater for Analysis of Total Metals by Inductively Coupled Plasma-Mass Spectrometer (ICP-MS)
6051	Undigested Sample Preparation of Potable Water for Analysis of Total Recoverable Metals by Inductively Coupled Plasma Mass Spectrometry [ICP-MS]
6052	Sample Preparation of Wastewater for Analysis of Total Recoverable Metals by Inductively Coupled Mass Spectrometer (ICP-MS)
6966, 1643, 6935, 7914, 6946, 6947, 1650, 6949, 6952, 6951, 6953, 1654, 1662, 1656, 1657, 6958, 6960, 1667, 6961,10145, 6955, 6944, 6936, 6969, 7968, 6970, 6925, 6971, 6972, 10146, 7066, 1743, 7035, 8014, 7046, 7047, 1750, 7049, 7052, 7051, 7053,...	Metals by Inductively Coupled Plasma Atomic Emission Spectroscopy for SW-846 Methods 6010A/B (aqueous, solid, tissue), CLP 2.1(water/solid/tissue), CLP 4.0(water/solid/tissue), CLP 5.2 (water/solid/tissue) and EPA 200.7(aqueous)
7050	Sample Preparation of Potable Water, Groundwater, Surface Water, and Wastewater for Analysis of Total Recoverable Metals by Inductively Coupled Plasma-Mass Spectrometry (7050)
MC-IO-003	Fixed-Volume Hand-Held and Electronic Pipettes
MC-IO-017	Maintenance and Calibration of HACH Model 2100N Laboratory Turbidimeter
MC-IO-019	Bottletop Dispensers
SOP-IO-001	Preservation, Storage Conditions, and Holding Times for Inorganic Samples
SOP-IO-005	Quality Control Procedures for Mercury
SOP-IO-007	Preparation of Standards and Solutions
SOP-IO-007, Section A	Reagents
SOP-IO-007, Section D	ICPMS Solutions
SOP-IO-007, Section E	Mercury Solutions
SOP-IO-007, Section G	Prep Room Solutions (Waters)
SOP-IO-007, Section H	Prep Room Solutions (Solids)
SOP-IO-011	Inorganic Analysis Safety and Waste Handling Procedures
SOP-IO-012	Calculations Used by the Inorganics Group
SOP-IO-013	Glassware Cleaning
SOP-IO-033	Maintenance for the Perkin Elmer Elan 9000 ICP-MS
SOP-IO-034	Operation of and Analysis with the Perkin-Elmer Elan 9000 ICP-MS
SOP-IO-035	Quality Control Procedures for ICP-MS

Uncontrolled Copy

Index of Environmental and Supporting Departmental Procedures

Procedure No.	Title
SOP-IO-036	Metals Use of the LLENS System
SOP-IO-037	Quality Control Procedures for Mercury by Cold Vapor Atomic Fluorescence Spectrometry
SOP-IO-038	Maintenance for the Agilent 7500 ICP-MS and ESI SC-8 FAST Autosampler
SOP-IO-039	Operation of the Agilent 7500 Series ICP-MS
Organic Extraction	
0085	Total Particulates in Air Not Otherwise Regulated
10068	Sampling Equipment Cleaning and Validation for Metals Analysis
10500	Pore Water Generation Procedure
1948, 1949, 1950, 1951, 1952	Soxhlet Extraction Procedure for Extractable Matter in Textiles
4193ASE	Determination of Percentage Fat Using Accelerated Solvent Extraction (ASE)
MC-OE-002	Ultrasonic Processor Maintenance and Tuning
MC-OE-007	Steam Bath and N-Evap Usage. Calibration and Maintenance
MC-OE-008	Refrigerated Recirculators
MC-OE-009	Electrothermal Heating Mantles
MC-OE-010	N-Evap
MC-OE-013	Maintenance and Calibration of the Microwave Accelerated Reaction System
SOP-OE-002	Solvent and Reagent Lot Testing for Organic Extractions
SOP-OE-004	Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs)
SOP-OE-005	pH Meters and Electrodes
SOP-OE-006	Procedure for Containment and Clean Up of Hazardous Materials Spills in Organic Prep Lab
SOP-OE-007	Determining QC Sample Volume for Organic Extractions
SOP-OE-008	Scheduling Extraction Batches
SOP-OE-009	Spike Solution Testing and Approval
SOP-OE-010	Ultrasonic Probe Horn Cleaning
SOP-OE-011	Routine Maintenance of Miele Glass Washers
SOP-OE-012	Pesticide Extract Concentration Using a Zymark TurboVap II Concentration Workstation
SOP-OE-013	Maintenance of Accelerated Solvent Extractor (ASE) and the Pressurized Solvent Extractor (PSE)
SOP-OE-014	Glassware Cleaning using Automatic Washers for non-Organic Extraction Glassware
SOP-OE-015	Semivolatile Extract Concentration Using a Zymark TurboVap II Concentration Workstation
SOP-OE-016	Concentration Using a TurboVap LV Concentration Workstation
SOP-OE-017	Organic Extraction Standards Storage and Handling
Pesticide Residue Analysis	
0144, 0119	Analysis of Polychlorinated Terphenyls in Solid and Aqueous Samples using Gas Chromatography with Electron Capture Detector
0173, 6030, 7394, 2034, 10227	Analysis of Polychlorinated Biphenyls (PCBs) in Aqueous Samples using Gas Chromatography with Electron Capture Detection (GC-ECD)
0174	Determination of PCBs in Oil
0177, 0950, 0180, 1954	Analysis of Pesticides in Aqueous Samples using GC-ECD
0298	Determination of Nitroglycerin in Water using Method 8332
0815	Waste Dilution Procedure for the Determination of PCBs in Oil
0816, 11110, 11111	Extraction of Chlorinated Herbicides in a Water Matrix by SW-846 8151A

Uncontrolled Copy

Index of Environmental and Supporting Departmental Procedures

Procedure No.	Title
0817, 6654, 10241, 11112, 11113, 11114, 11116, 11117, 11118, 11119, 11120, 11121, 11123, 11126	Separatory Funnel Extraction Procedure for the Determination of Pesticides and PCBs in a Wastewater Matrix
0817DIL	Waste Dilution Procedure for the Determination of Pesticides and PCBs in a Non-Water Soluble Leachate Matrix
0817L, 6654	Liquid/Liquid Extraction Procedure for the Determination of Organophosphorous Pesticides in a Wastewater Matrix
0819, 11128, 11132, 11135	Sonic Probe Extraction Procedure for the Determination of Polychlorinated Biphenyls (PCBs) in a Solid Matrix
0819M	Medium Level Sonic Probe Extraction Procedure for the Determination of Pesticides and PCBs in a Solid Matrix
0952, 5593, 5300, 10407	Analysis of Chlorinated Herbicides in Water by Gas Chromatography (GC) with Electron Capture Detection (ECD)
1013	Extraction Procedure for the Determination of Formaldehyde and Aldehydes in a Water Matrix
1034, 7934, 7879, 10187	Analysis of Waters for EDB/DBCP and TCP Using Microextraction and Gas Chromatography with Electron Capture Detector
10496	Microwave Extraction Procedure for the Determination of Pesticides in a Solid Matrix
10497	Microwave Extraction Procedure for the Determination of PCBs in a Solid Matrix
10589	Analysis of Pesticides in Aqueous Samples using Gas Chromatography with Electron Capture Detection (GC-ECD)
10590	Analysis of Pesticides in Solid Samples using Gas Chromatography with Electron Capture Detection (GC-ECD)
10591	Analysis of Polychlorinated Biphenyls (PCBs) in Aqueous Samples by GC-ECD
10592	Analysis of Polychlorinated Biphenyls (PCBs) in Solid Samples by GC-ECD
10709	Determination of Picric Acid in Soil Samples by HPLC with UV
11696	Soxhlet Extraction Procedure for the Determination of Polychlorinated Biphenyls (PCBs) in a Solid Matrix
1216, 7512, 8899, 0042, 5108, 6011, 1030, 2033, 10736, 10885	Analysis of Polychlorinated Biphenyls (PCBs) by Gas Chromatography (GC) with Electron Capture Detector (ECD) in Solid Samples and Wipes
1340	N-Methylcarbamates in Groundwater and Drinking Water by High Performance Liquid Chromatography (HPLC)
1363, 1420, 4225, 10738	Analysis of Pesticides in Solid Samples using Gas Chromatography with Electron Capture Detection (GC-ECD)
1509, 10597	Analysis of Soil and Sediment for N-Methylcarbamate Pesticides
1510, 11143	Extraction Procedure for the Determination of Carbamate and Urea Pesticides in a Soil or Solid Waste Matrix
1782, 1785	Analysis of Acephate and Methamidophos using Gas Chromatography with Nitrogen Phosphorous Detection in Aqueous and Solid Samples
1864	Analysis of Chlorinated Acids in Water Using Capillary Gas Chromatography with an Electron Capture Detector
1869	Analysis of Aqueous Samples for Chlorinated Pesticides and PCBs by Gas Chromatography with an Electron Capture Detector
1870	Analysis of Aqueous Samples for Nitrogen- and Phosphorus-Containing Pesticides by Gas Chromatography with a Nitrogen-Phosphorus Detector
2082, 2001	Determination of m-Benzene disulfonic acid, p-Phenol sulfonic acid, Benzene sulfonic acid, and Resorcinol in Groundwater and Surface Water and Soil
2127, 2144, 6271, 6272	Determination of Didodecylbenzenesulfonic Acid (KSS) and Calcium Petronate (CP) in Groundwater and Surface Water and Soil
2146	Preparation of Soils for the Determination of Benzenesulfonic Acid (BSA)
2147	Preparation of Soils for the Determination of Didodecylbenzenesulfonic Acid (KSS) and Calcium Petronate
2149	Preparation of Soils for the Determination of Didodecylsulfonic Acid (KSS)
2257, 2253	Analysis of Captan and Captafol by Gas Chromatography with Electron Capture Detection of Waters and Solids
2265	Determination of Picric Acid in Water by High Performance Liquid Chromatography (HPLC) with Ultra-Violet (UV) Detection

Uncontrolled Copy

Index of Environmental and Supporting Departmental Procedures

Procedure No.	Title
2726	Determination of Dinitrosopentamethylenetetramine in Water by HPLC
2727	Determination of Azodicarbonamide in Water
3342	Separatory Funnel Extraction Procedure for the Determination of Pesticides/Aroclors (PCBs) in a Wastewater Matrix by the Contract Laboratory Protocol
4144, 4173, 8044, 8045	Analysis of Formaldehyde and other Aldehydes in Aqueous and Solid Samples by High Performance Liquid Chromatography (HPLC)
4181	Extraction of Chlorinated Herbicides in a Soil Matrix
4185	Sonic Probe Extraction Procedure for the Determination of Pesticides/Aroclors (PCBs) in a Solid Matrix by the Contract Laboratory Protocol
4533, 4562	Analysis of Water and Soil Samples for Pesticides/Aroclors (PCBs) by the Contract Laboratory Protocol
5366, 10410, 10593	Analysis of Organophosphorous Pesticides in Aqueous Samples by Gas Chromatography with a Nitrogen-Phosphorous Detector
5367, 10408, 10594	Analysis of Organophosphorous Pesticides in Solid Samples by Gas Chromatography with a Nitrogen-Phosphorous Detector
5592, 10401	Analysis of Chlorinated Herbicides in Soil by Gas Chromatography (GC) with Electron Capture Detection (ECD)
5876, 11139	Extraction Procedure for the Determination of Formaldehyde and Aldehydes in a Solid Matrix
6006, 11129, 11131, 11134	Sonic Probe Extraction Procedure for the Determination of Pesticides and Polychlorinated Biphenyls (PCBs) in a Solid Matrix
6006SOX	Soxhlet Extraction Procedure for the Determination of Pesticides in a Solid Matrix
6273	Preparation of Waters for the Determination of Calcium Petronate (CP)
6368	Separatory Funnel Extraction Procedure for the Determination of Chlorinated Pesticides; Nitrogen and Phosphorus Containing Pesticides; and PCBs in a Drinking Water Matrix
6369	Extraction of Chlorinated Acids and Herbicides in Drinking Water
6386, 6557	Determination of Perchlorate in Aqueous Samples and Soil Samples by LC/MS/MS
6550	Extraction Procedure for the Determination of Carbamate and Urea Pesticides in a Water Matrix by EPA 632
6568	Extraction Procedure for Perchlorate in Soil Samples by LC/MS/MS
6677, 11130, 11133, 11142	Soxhlet Extraction Procedure for the Determination of Triazine Herbicides and Organophosphorous Pesticides in a Solid Matrix
6915, 11122, 11125	Extraction of Nitroaromatics and Nitroamines in Water
6916, 6918, 10595, 10596, 10412, 10131, 10132	Determination of Nitroaromatics and Nitroamines in Water and Soil Samples by High Performance Liquid Chromatography (HPLC) with Ultra-Violet (UV) Detection
6917	Extraction of Nitroaromatics and Nitroamines in Soil
6917DoD	Sonication Extraction of Nitroaromatics and Nitroamines in Soil (DoD)
7153, 7154	Analysis of Aldehydes and Ketones in Ambient Air by High Performance Liquid Chromatography (HPLC)
7572	Analysis of Pesticides and Polychlorinated Biphenyls (PCBs) in Aqueous Samples by Method 608
7786	Microextraction of 1,2-Dibromoethane (EDB), 1,2-Dibromo-3-chloropropane (DBCP), and 1,2,3-Trichloropropane (TCP), in Water
7799	Extraction Procedure for the Determination of Ethylene Thiourea in Water by EPA 509
7800	Ethylene Thiourea, EPA Method 509
8145, 8152	Determination of Methyl Carbamates in Wastewater and Soil
8843	Organic Acids in Water by HPLC/UV
MC-OE-004	Pesticide Extract Cleanup Using Gel Permeation Chromatography
SOP-PP-002	QC Data Acceptability and Corrective Action
SOP-PP-003	Standards Traceability and Monitoring
SOP-PP-011	Interpretation of Chromatographic Data
SOP-PP-012	Obtaining Acceptable Standards for OLM3.2 and OLM4.2 CLP Pesticide/PCB Analyses
SOP-PP-013	Preventative and Corrective GC Maintenance

Uncontrolled Copy

Index of Environmental and Supporting Departmental Procedures

Procedure No.	Title
SOP-PP-021	Standards Preparation, Coding, and Storage
SOP-PP-022	Hard Disk Drive Maintenance Procedure
SOP-PP-023	Data Audit Procedure for Department 4024
SOP-PP-025	Monitoring QC Data Acceptance Limits
SOP-PP-027	Uploading Data to the LIMS
SOP-PP-029	Preventative and Corrective HPLC Maintenance for the Pesticide Residue Analysis Department
SOP-PP-031	Setting Up Single Component Initial Calibrations
SOP-PP-032	Using "Datalog" Software for Data Acquisition of Multicomponent Pesticides/PCBs
SOP-PP-033	Using "Datalog" Software for Single-component Data Acquisition
SOP-PP-035	Setting Retention Time Windows
SOP-PP-036	Creating Calibration Timed Events in Chrom Perfect
SOP-PP-037	Setting Up Analysis Numbers in the Departmental Database
SOP-PP-040	Common Equations Used During Chromatographic Analyses
SOP-PP-041	Prescreening Water and Soil Samples for Pesticides and PCBs
SOP-PP-042	Micromass Quattro Micro Tandem Mass Spectrometer with a Waters 2795 HPLC System (LC/MS/MS)
Physical Services	
SOP-MN-002	Reagent Water System Maintenance
SOP-MN-003	Testing of the Automatic Sprinkler System in Building B
SOP-MN-004	Emergency Notification
SOP-MN-005	CO2 Delivery System
Quality Control	
MC-WQ-003	Andover System Probe Calibration
SOP-QC-003	Blind Sample Guidelines
SOP-QC-006	Performing Quality Assurance Audits
SOP-QC-007	The Submittal and Reporting of Proficiency Test Samples (PTs)
SOP-QC-008	Hosting Agency Audits
SOP-QC-009	Quality Assurance Approval of Standard Operating Procedures and Analytical Methods
SOP-QC-010	Hosting of Client Audits by Quality Assurance
SOP-QC-011	Tracking and Filing of Procedures within the Quality Assurance Department
SOP-QC-013	Maintaining the Environmental and Pharmaceutical Quality Policy Manuals
SOP-QC-014	Training of QA Personnel
SOP-QC-021	Monitoring Quality Assurance Audits
SOP-QC-022	Quality Assurance Reviews
SOP-QC-023	Environmental Quality Assurance Approval of Subcontractor Laboratories
SOP-QC-024	Responsibilities of the Quality Assurance Department
SOP-QC-025	Preparing Quality Assurance Reports for Management
SOP-QC-026	Development and Use of Training Procedures in the QA Department
SOP-QC-027	Quality Assurance Review of Pharmaceutical Exception Investigation Reports
SOP-QC-028	Quality Assurance Review of End-of-Month QC Reports
SOP-QC-030	Quality Assurance Review of Client Project and Bid Documents
SOP-QC-031	Quality Assurance Review of Validation Documentation
SOP-QC-032	Quality Assurance Functions for GLP Compliance

Uncontrolled Copy

Index of Environmental and Supporting Departmental Procedures

Procedure No.	Title
SOP-QC-034	Final Review of Analytical Reports in Nautilus LIMS
SOP-QC-035	Emergency Notification of Quality Assurance Personnel
SOP-QC-036	Performing Electronic Data Audits using Mint Miner Software
SOP-QC-038	Pharmaceutical Quality Assurance Evaluation of Subcontract Test Laboratories
SOP-QC-039	Maintenance of Environmental Certifications and Accreditations
TRN-PS-006	Nautilus - Exceptions System Overview
TRN-PS-012	Writing Investigations in Nautilus
TRN-QC-002	Procedure Review
TRN-QC-003	Internal Audits
TRN-QC-004	Training of the Quality Assurance Department to Perform GLP Support Functions
TRN-QC-005	Training of Quality Assurance Staff for Review of Pharmaceutical Exception Reports
TRN-QC-006	Training of the Quality Assurance and Environmental Data Package Departments to Perform QA Review of Environmental Data Packages
TRN-QC-007	Training of the Quality Assurance Department to Review Environmental Division End-of-Month QC Reports
TRN-QC-009	Training of the Quality Assurance Department to Review Project and Bid Documents
TRN-QC-010	Training of the Quality Assurance Department to Review Validation Documentation
TRN-QC-011	Reviewing and Releasing/Rejecting Pharmaceutical Nautilus Reports
TRN-QC-012	External Audit Training
TRN-QC-013	Training of Quality Assurance Personnel to Perform Laboratory Data Review
TRN-QC-014	Training Quality Assurance Staff for Review of Stability Protocols
Sample Administration	
SOP-SA-101	Environmental Sample Entry
SOP-SA-102	Sample Receipt at Sample Receipt Desk
SOP-SA-103	Environmental Sample Receipt and Unpacking
SOP-SA-107	Filing of Sample Information
SOP-SA-119	Assigning Sample Delivery Group Numbers and Five-Digit Sample Codes to Sample Groups
SOP-SA-129	Entry of Environmental Samples Requiring Subcontracting
SOP-SA-138	Taking the Temperature of Environmental Samples Upon Arrival at the Lab
Sample Bottles	
SOP-SB-003	Bottle Preparation
SOP-SB-008	Packing Bottle Orders
SOP-SB-012	Preparation of Trip Blanks
SOP-SB-016	Processing Bottle Orders
SOP-SB-017	Preparation of Acid Dilutions
SOP-SB-019	Pipette Dispenser Calibration Procedure
Sample Support	
0111, 6111, 7611, 11624	Moisture (Gravimetric)
0374, 6646, 10445	GC/MS - Bulk Solid Matrix Sample Preparation
0388, 6119, 6169, 6647, 0405, 1169, 6171, 6172, 6173, 6645, 2392, 6176, 7579, 0069, 11014, 11764	Preparation of Vials for Field Preservation of Soils for Volatile Analysis

Uncontrolled Copy

Index of Environmental and Supporting Departmental Procedures

Procedure No.	Title
10445 OH VAP	Ohio Voluntary Action Program Bulk Solid Sample Preparation by SW-846 5035
1132	GC - Bulk Methanolic Preparation of Soils and Solid Waste
1150, 6170	Preparation of Soil and Solid Samples for GC Volatile Analyses
1353	Moisture (non-EPA/CLP Protocol)
6611	Tobacco Moisture
7116, 7119	Water Content (Moisture) by ASTM D 2216
7400	Total Residue
8389, 8390, 6130, 6117, 6174, 7578, 7320	Preparation of Soils for Volatile Analysis by EPA SW-846 Method 5035
MC-SS-001	Sample Support Ovens
MC-SS-002	Maintenance of Desiccators
SOP-SS-002	Liquid Sample Preservation
SOP-SS-006	Automated Storage, Retrieval, and Discarding of Samples
SOP-SS-009	Homogenization and Subsampling of Solid Waste Samples from Environmental Sources
SOP-SS-010	Subsampling for Subcontracted Analyses
SOP-SS-015	Hardware Procedures for ASRS
SOP-SS-017	Preservation and Bottles Room Preservative Traceability
SOP-SS-018	Pipette Dispenser Calibration Procedure
SOP-SS-019	Automated Storage and Retrieval System (ASRS) Lockout/Tagout Procedure
SOP-SS-020	Outlier Quality Control Data
SOP-SS-021	Instructions for Collecting Data on the LLENS System
SOP-SS-022	Non-Automated Storage, Retrieval, and Discarding of Samples
SOP-SS-023	Prescreening Water and Soil Samples for Volatile Organic Compounds
SOP-SS-024	ASRS Emergency Failure Procedure
SOP-SS-025	Incremental Sampling of Soil/Solid Samples
SOP-SS-026	Glassware Cleaning
Specialty Services	
10342	Determination of Hydrazine, Monomethylhydrazine and 1,1-Dimethylhydrazine in Aqueous Samples by LC/MS/MS
10346	Determination of Hydrazine, Monomethylhydrazine and 1,1-Dimethylhydrazine in Soil Samples by LC/MS/MS
10914	Separatory Funnel Extraction Procedure for the Determination of Dioxins/Furans (CDD/CDF) in a Water Matrix
10915, 11031	Determination of Tetra- Through Octa-Chlorinated Dioxins and Furans by HRGC/HRMS
10954	Determination of Selected Perfluorinated Alkyl Acids (PFAAs) in Aqueous Samples by LC/MS/MS
11016	Determination of Perfluorooctanoic Acid (PFOA) in Aqueous Samples by LC/MS/MS
11030	Dean Stark Soxhlet Extraction Procedure for the Determination of Dioxins/Furans (CDD/CDF) in a Solid Matrix
11639	Determination of Diuron, Fenuron and Monuron in Water Samples by SPE Extraction and LC/MS/MS
11663	Determination of Diuron, Fenuron and Monuron in Soil Samples by LC/MS/MS
11688	Determination of Endothall in Soil Samples by LCMSMS
MC-SP-001	DFS HRGC/HRMS Preventative and Corrective Maintenance
SOP-SP-001	Maintenance and Tuning for Thermo Scientific TSQ Quantum Access Tandem Mass Spectrometer with a Thermo Electron Accela HPLC System (LC/MS/MS)
SOP-SP-002	Fix or Adjustable Volume Handheld Pipettes
SOP-SP-003	Column Cleanup Procedure for Dioxins/Furans (CDD/CDF) Sample Extracts

Uncontrolled Copy

Index of Environmental and Supporting Departmental Procedures

Procedure No.	Title
SOP-SP-004	Processing EPA 1613B PCDD/PCDF High Resolution Mass Spectrometry Data using TargetQuan 2.0
Tobacco Analysis	
0088	Extraction of Nicotine from Tobacco Products Using the Centers for Disease Control Protocol
0091	CDC Tobacco Moisture
0097	Analysis of Nicotine in Tobacco by GC/FID for Smokeless Tobacco Products Using the CDC Method
11067	Drying and Grinding for Cyclopamine
2145	Extraction of Nicotine and Minor Alkaloid from Tobacco
2264	Nitrite in Tobacco Prep
2266	Nitrite Nitrogen Analysis in Tobacco
2326LC	Extraction of Tobacco Specific N-Nitrosamines in Tobacco Filler
2610	Nitrate in Tobacco Prep
2808	Nitrate Nitrogen in Tobacco (Colorimetric, Automated Cadmium Reduction)
4998	Tobacco Drying and Grinding
5102	Analysis of Tobacco Specific Nitrosamines (TSNA) in Tobacco Leaf by LC/MS/MS
6870	Extraction of Nicotine from Tobacco and Tobacco Products
6878	Analysis of Nicotine in Tobacco by GC/FID Following Coresta 62
6883	Extraction of Tobacco for Benzo[a]Pyrene
6962	Column Cleanup of Tobacco for TSNAs
Transportation	
SOP-TR-001	Collecting Water Samples for Regulatory Purposes
SOP-TR-003	Sampling Swimming Pool Water
SOP-TR-010	What to Do in Case of Vehicular Accident or Breakdown
SOP-TR-018	Sample Pick-Up, Transportation, and Delivery
SOP-TR-019	Performing Free Chlorine Residual Readings
Volatiles by GC	
10902, 8419, 8432, 8416, 8418	Purgeable Halocarbons/Aromatics/Miscellaneous Organics in Water and Solid Samples
1635, 1636, 1728, 1729, 2762, 2763, 8229, 8268, 10598	Gasoline Range Organics (GRO) in Water Samples Using Purge and Trap Gas Chromatography
1637, 1638, 1700, 1725, 1726, 2765, 2766, 5550, 5551, 10599	Gasoline Range Organics (GRO) in Soils using Purge and Trap Gas Chromatography
2005, 2006, 8273, 8274	Determination of Volatile Gasoline Range Organics in Soil and Water - Northwest GX Method
2102, 6464, 8806	Purgeable Aromatics in Water Samples
8179	Purgeable Aromatics in High-Level Soils
8230	Tertiary Butylamine in Water Samples
8241	Purgeable Aromatics in Water Samples by Method 602
8465, 8466, 8467, 8470, 8476, 8478, 8482, 8464, 8893	Purgeable Halocarbons/Aromatics in Water Samples by EPA 601 and EPA 602
SOP-OR-020	Statistical Calculations Used in the Analysis of Samples by EPA Methodology
SOP-OR-065	Checking and Documenting of pH for Volatile Organic Samples
SOP-OR-070	Glassware Cleaning

Uncontrolled Copy

Index of Environmental and Supporting Departmental Procedures

Procedure No.	Title
SOP-OR-075	Calibrating the 1-uL Standard Delivery Groove on the Archon Model 5100A and O.I. 4660 Autosampler Systems
SOP-OR-077	GC Routine and Nonroutine Maintenance
SOP-OR-080	Use of 40-mL Vials for Volatile Organic Analyses
SOP-OR-081 (Client-Specific)	Client-Specific PE Sample Preparation
SOP-OR-082	Using "Range Compound Analysis" Software for Range Data Acquisition
Volatiles in Air	
0034	Oxygen and Carbon Dioxide in Air
10341	Helium as a Tracer Gas
10734	The Automated Determination of Volatile Organic Compounds in Air Collected in Specially Treated Canisters Using Cryogenic Preconcentration and Gas Chromatography with Mass Selective Detection Using NJDEP Modified Low Level Method TO-15
5265, 5298, 0015, 0037, 7199, 7869	The Automated Determination of Volatile Organic Compounds in Air Collected in Specially Treated Canisters or Tedlar Bags Using Cryogenic Preconcentration and Gas Chromatography with Mass Selective Detection Using EPA Method TO-14 or TO-15
6820	Analysis of Air for Selected Volatile Organic Compounds by Gas Chromatography with Flame Ionization Detector and Photoionization Detector for Louisiana RECAP Vapor Evaluation
7090	Analysis of Air for Selected Volatile Organic Compounds by Gas Chromatography with Flame Ionization Detector and Photoionization Detector
7345	SIM Analysis of Low-Level Volatile Organic Compounds in Air Collected in Specially Treated Canisters or Tedlar Bags Using Cryogenic Preconcentration and Gas Chromatography with SIM Mass Selective Detection Using EPA Method TO-15
MC-AL-002	Calibration of Pressure Gauges
MC-AL-003	Routine Instrument Maintenance for Volatiles in Air by GC and GC/MS
SOP-AL-001	Cleaning and Handling of Summa Canisters
SOP-AL-002	Cleaning and Handling of Flow Controllers
SOP-AL-003	Volatiles in Air Audit Process
SOP-AL-004	Procedure for Compositing Samples from a Tedlar Bag
SOP-AL-005	Preparing Summa Can Order
Water Quality	
0200, 10331	pH (WW) (electrometric)
0201, 0202	Analysis #0201 Alkalinity to pH 8.3 (titrimetric) Analysis #0202 Alkalinity to pH 4.5 (titrimetric)
0203	Total Solids in Waters (Gravimetric)
0204, 0205	Total Fixed Solids (Gravimetric) (#0204) Total Volatile Solids (Gravimetric) (#205)
0206	Total Suspended Solids in Waters (Gravimetric)
0207, 0208	Fixed Suspended Solids (Gravimetric) (#207) Volatile Suspended Solids (Gravimetric) (#208)
0209	Total Dissolved Solids (Calculation)
0210	Fixed Dissolved Solids (Calculation)
0211	Volatile Dissolved Solids (Calculation)
0212	Total Dissolved Solids in Waters (Gravimetric)
0215	Settleable Solids
0216	Total Hardness (Titrimetric Determination)
0221	Ammonia-Nitrogen for Waters (Titrimetric Distillation Procedure)
0225	Methylene-Blue-Active Substances (MBAS)
0226	Orthophosphate
0229	Sulfite
0230, 10293, 10499	Colorimetric Sulfide in Waters (#0230) Sulfide as H2S (#10293 calculation) Dissolved Sulfide in Waters (#10499)

Uncontrolled Copy

Index of Environmental and Supporting Departmental Procedures

Procedure No.	Title
0234	Chemical Oxygen Demand (COD) (Dichromate Reflux Method) (Titrimetric, Mid-Level)
0235	Biochemical Oxygen Demand Determination in Waters by Incubation
0238	Free Carbon Dioxide (Calculation)
0240	Chlorine Residual
0263, 2200	(#0263) Fluoride by Ion Selective Electrode (ISE) (#2200) Distilled Fluoride by Ion Selective Electrode (ISE)
0276, 10330	Hexavalent Chromium (colorimetric)
0277	Color
0279	Turbidity (Nephelometric)
0280	Specific Conductance
0394, 0496	pH (SW) (Electrometric)
0425, 7825, 2432	Hexavalent Chromium in Solids (Alkaline Digestion and Analysis Methods)
0428	Dissolved Oxygen (Membrane Electrode)
0430	Determination of Flash Point for Liquids and Solids
0475, 0476	Acidity to pH 3.7 and pH 8.3 (titrimetric)
0521	Total Residue
0522, 1029	Volatile Residue (#0522) Total Fixed Residue/Ash (#1029)
0541	Soluble Biochemical Oxygen Demand Determination in Waters by Incubation
0542	Ignitability of Solids
0559	Dissolved Silica (Colorimetric)
0573	Ammonia-Nitrogen for Soils (Tritrimetric distillation procedure)
10222, 10696	Ammonia Nitrogen by Ion-selective Electrode Method (ISE) in Solids
10695	Ammonia - Nitrogen in Water by Ion-Selective Electrode Method (ISE)
11145	Hexavalent Chromium (Colorimetric) in Waters by MCP
11146	Hexavalent Chromium in Solids by MCP (Alkaline Digestion and Analysis Methods)
1121	Reactivity
1122	Reactive Sulfide
1124	Chloride (Titrimetric Determination)
1125	Sulfate (turbidimetric) in Waters
1215	Specific Conductance (Solids)
1333	Sulfide Titration for Water
1364	Carbonaceous Biochemical Oxygen Demand Determination in Waters by Incubation
1441	pH (CLP) (Electrometric)
1443, 6569	#1443 Specific Gravity #6569 Bulk Density
1446	Low-Level Hexavalent Chromium (colorimetric)
1448	Bellack Distillation for Fluoride in Waters and Solids
1454, 1455, 1456	Bicarbonate (#1454), Carbonate (#1455), Hydroxide (#1456) Alkalinity (Calculation)
1553	Chemical Oxygen Demand (COD) in Waters (Dichromate Reflux Method) (Titrimetric, Low-Level)
1630	Acid Volatile Sulfide in Solids
1820	Paint Filter Liquids Test (Free Liquids Test)
1821	Oxidation-Reduction Potential
1962, 7825	Hexavalent Chromium in Solids by CTRCP (Alkaline Digestion and Analysis Methods)
1968	Hexavalent Chromium (Colorimetric) in Waters by CTRCP

Uncontrolled Copy

Index of Environmental and Supporting Departmental Procedures

Procedure No.	Title
2365	Percent Solids for GC/MS
2562, 6598	n-Hexane Extractable Material (HEM) in Solids and Silica Gel Treated n-Hexane Extractable Material (SGT-HEM)
4001	Chemical Oxygen Demand (COD) (Dichromatic Reflux Method) (Colorimetric)
4530	Total Acidity for Wastewater
6649	Total Dissolved Solids (Gravimetric) in Waters
6866	Moisture (Gravimetric)
6914, 4219, 2593	(#6914) Ammonia – Nitrogen by Ion-Selective Electrode Method (ISE) (#4219) Ammonia Distillation (#2593) Un-ionized Ammonia
7103, 11601, 11604	Particle Size Distribution of Soils and Solids/Grain Size Classification
7120	UV254
8079, 8078, 0612	Hexane Extractable Material (HEM) and Silica Gel Treated Hexane Extractable Materials (SGT-HEM) in Waters by EPA Method 1664A
8344, 10328	Ferrous Iron
MC-WQ-002	Spectronic Genesys 2 Spectrophotometer
MC-WQ-004	Accumet Model AB30 pH/Ion/Conductivity Meter
MC-WQ-006	Equipment Incubators and Refrigerators
MC-WQ-007	pH Probes and Meters
MC-WQ-009	Equipment Muffle Furnaces and Ovens
MC-WQ-010	Calibration of Hach 2100AN Turbidimeter
MC-WQ-012	Maintenance of Desiccators
MC-WQ-013	Fixed Volume Hand-Held Pipettes
MC-WQ-014	Adjustable Volume Handheld Pipettes
MC-WQ-017	Hach DR 2800 Spectrophotometer
MC-WQ-022	Orion 960 Autotitration System
MC-WQ-023	YSI Model 5100 Dissolved Oxygen Meter
MC-WQ-024	Maintenance of Hot Plates
SOP-WQ-002	Standardization of 0.02 and 0.1 Normal Sulfuric Acid
SOP-WQ-005	Standardization of 0.02 Normal Sodium Hydroxide
SOP-WQ-006	Water Quality Washroom Procedures
SOP-WQ-014	Instructions for Collecting Data on the LLENS System
SOP-WQ-016	Chemical Review
SOP-WQ-017	Quality Control Data for Wet Chemistry

Uncontrolled Copy

eurofins | Lancaster Laboratories

Environmental Quality Policy Manual

Appendix F
Instrument and Equipment List

Current as of October 05, 2011
4 Total Pages (including this coversheet)

NOTE: Current lists available from technical departments.

Uncontrolled Copy

Instrument	# of Units	Manufacturer/Model #
Liquid Chromatography/Gas Chromatography/Mass Spectrometry (LC/GC/MS)		
LC/MS/MS	3	Waters 2795 LC with Micromass Quattro micro MS/MS and Waters 2996 Photodiode Array UV-Vis Detector
LC/MS/MS	1	Thermo Scientific TSQ Quantum Access with Acella LC
LC/MS/MS	1	Agilent 1200 LC with Agilent 6410 MS/MS
GC/MS	1	Agilent 5971
GC/MS	6	Thermo Scientific DSQII
GC/MS	1	Agilent 5972
GC/MS	6	Agilent 5973
GC/MS	3	Agilent 5975
GC/MS	1	Thermo Scientific ISQ
GC/MS/MS	1	Thermo Scientific TSQ with Ultra Trace GC
HRGC/HRMS	3	Thermo Scientific DFS
Gas Chromatograph	23	Agilent 5890
Gas Chromatograph	19	Agilent 6890
Gas Chromatograph	5	Agilent 7890
Gas Chromatograph	4	Thermo Scientific
Gas Chromatograph	1	Varian 3400
Auxiliary Equipment for Gas Chromatographs		
Most of the GC/MS and GC systems include autosamplers and approximately half are fitted with purge and trap concentrators for analysis of volatiles.		
Purge/Trap Concentrators	13	OI 4560/4660
Autosamplers	2	Archon 5100/5100A
Autosamplers	44	Agilent 7683
Autosamplers	14	Agilent 7693
Autosamplers	6	OI 4551/4552
Autosamplers	11	EST Centruion
Autosamplers	7	Thermo Scientific AS TriPlus
Autosamplers	2	CTC Combipal Headspace
Automated Sampling System (Tedlar Bags)	1	Tekmar 2016/2032/LSC2000
Automated Sampling System (Summa Canisters)	3	Entech 7016CR Autosamplers
Automated Sampling System (Tedlar Bags/Summa Canisters)	1	Entech 7032A
Automated Concentrator	3	Entech 7100
Detectors available for GC: Electron Capture, Flame Ionization, Pthooionization, Hall Electrolytic Conductivity, Nitrogen/Phosphorus, and Thermal Conductivity. All of the chromatographs are connected to electronic integration systems.		
High Performance Liquid Chromatography		
High Performance Liquid Chromatograph	1	Agilent 1100 LC
High Performance Liquid Chromatograph	1	Agilent 1200 HPLC
High Performance Liquid Chromatograph	1	Hitachi L7000
High Performance Liquid Chromatograph	1	Shimadzu LC-10
High Performance Liquid Chromatograph	1	Shimadzu LC-6A or 6B
Gel Permeation Chromatography		
Gel Permeation Chromatograph	3	J2Scientific AccuPrep
Ion Chromatography		
Ion Chromatograph	1	Dionex DX320
Ion Chromatograph	1	Dionex ICS1000
Ion Chromatograph	1	Dionex ICS3000

Uncontrolled Copy

Instrument	# of Units	Manufacturer/Model #
Ion Chromatograph	1	Dionex ICS2000
Ion Chromatograph	2	Dionex ICS1100
Atomic Absorption/Emission Spectrophotometry		
ICAP™ 6000 Duo ICP Analyzer	4	Thermo
ICP/MS	1	P/E Sciex Elan 9000
ICP/MS	1	Agilent 7500CC
Mercury Analyzer	1	Leeman Labs PS 200II
Mercury Analyzer	1	Leeman Labs Hydra II
Mercury Analyzer	1	Leeman Labs HYDRA AF_{GOLD+}
Mercury Prep Station	1	Thomas Cain DEENA 60
UV Vis/IR Spectrophotometry:		
UV-Vis Spectrophotometer	2	Spectronic Genesys
UV-Vis Spectrophotomenter	1	Hach DR2800
Miscellaneous Chemistry Instrumentation		
Block Digestion Systems	8	Environmental Express SC150
Block Digestion Systems	6	Environmental Express SC154
Centrifuge	6	Various
Chilled water recirculators	14	Various
Closed Cup Flashpoint Apparatus, Pensky-Martin	1	Fisher Scientific TA6
Cyanide Midi Distillation Kits	4	Various
Discrete Analyzer	1	Seal AQ2
Dissolved Oxygen Meter	1	YSI Model 59
Flow Solution Autoanalyzer	2	Alpkem
Glassware washer - automated	4	Miele – (2) PG8257 (1) G7827 (1) G7704
Kjehldal Distillation Apparatus	1	Fisher
Microwave Extractors	3	CEM MarsXpress
pH meters	8	Various
Phenol Midi Distillation	2	Andrews Glass
Pressurized Solvent Extractor	2	Dionex ASE200
Sonicators	9	Various
Total Organic Carbon Analyzer	2	O.I. Corp. 1030
Total Organic Carbon Combustion Analyzer	2	O.I. Corp. 1010
Turbidimeter	1	Hach 2100AN
Zero Headspace Extractor	74	Various Models
Microbiology Equipment		
Autoclave	2	Steris – Amsco,
Balance	5	Mettler, PB 3002
Balance	1	Mettler-Toledo, AT200
Balance	2	Mettler-Toledo, PR2002
Balance	1	Sartorius BP4100
Biological Safety Cabinet	4	NuAire NU-425-600 Type A/B 3
Biological Safety Cabinet	1	NuAire NU-435-600 Type B2 Fume Hood
Colony Counter	3	Quebec Dark Field
Incubator	1	PGC 9311-1127
Incubator	1	PS WFY20SAWI
Microscope	1	Stereoscope with Zoom, AO Model 570
Microscope	1	Zeiss
pH Meter	2	Orion Model 410A
Quanti-Tray Sealer	1	IDEXX Model 2X
Water Bath	1	Boekel Grant with Removal Heater Circulator

Uncontrolled Copy

Instrument	# of Units	Manufacturer/Model #
Water Bath	1	Thermo Electron Corp.
Water Bath	1	Precision Coliform Incubator Bath
Water Bath	1	VWR 1275PC
UV Light	2	Spectronics
UV Sterilizer	1	Millipore

Computer Equipment

Our laboratories make extensive use of computers for business applications, technical operations (e.g., our sample management system), and QA Program (see section on Quality Assurance). The following is a list of the major components of our computer systems.

Numerous physical and virtual servers used to support the systems

Oracle systems run on IBM UNIX servers:

Five IBM P5-510 Servers running AIX UNIX 5.3L with 2-way 1.90GHz CPUs

One IBM P5-520 Server running AIX UNIX 5.3L with 4-way 1.90GHz CPUs

- 16-24 GB RAM in IBM servers
- 6.7+ Terra Bytes of disk storage and several SAN devices including DS4300, DS4100, and Clariion CX3-40
- Various tape backup systems
- On-line fail over databases are available for all corporate production Oracle databases.

Networks/Telecommunication:

- TCP/IP based network
- Ten Gigabit switch to accommodate company server farm
- Dual Cisco 6506E network cores

Personal Computers/Servers:

- 3 T1s for Internet access through Cisco ASDM firewall
- ArcServe backup server
- Microsoft Exchange server
- Dell PowerEdge file and print servers
- More than 30 Network File Servers
- More than 1000 Personal Computers

Power Systems:

- 3 Phase Uninterrupted Power System

Uncontrolled Copy

eurofins | Lancaster Laboratories

Environmental Quality Policy Manual

Appendix G
Preventative Maintenance Schedules

Current as of October 05, 2011
3 Total Pages (including this coversheet)

NOTE: Current schedules available in technical departments.

Uncontrolled Copy

Preventive Maintenance Schedule

Instrument	Preventive Maintenance	Frequency
GC/MS	Change septum	AN* : Min. weekly
	Clean/replace injection port seal & liner	AN
	Check fans	Monthly
	Check cool flow	Monthly
	Clean source	Bimonthly or AN
	Change oil in diffusion pump	Annually
	Change oil in rough pump	Annually
GC Volatiles	Check propanol level in ELCD reservoir	AN: Min. semiweekly
	Check all liquid and gas flows	Prior to calib. or AN
	Clean ELCD cell, change reaction tube	AN
	Change ELCD Teflon line, resin tube	AN
	Replace adsorbent trap in concentrators	AN
	Change PID lamp	AN
	Precalibration instrument settings check	Prior to each calibration
GC	Septum change	Each run
	Column/injection port maintenance	AN
	Clean detector	AN
	Leak check ECDs	Semiannually
GC/HRMS	System bakeout	AN
	Replacing the Secondary Electron Multiplier (SEM)	AN
	Adjusting potentials on ion source	Daily
	Check sensitivity and resolution on ion source	Weekly
	Cleaning ion source	AN
	Replace filament on ion source	AN
	Cleaning reference inlet	AN
	Check oil level on forepumps	monthly
	Change oil on forepumps	Yearly or if oil is cloudy or discolored
	Exchange lubricant reservoir on turbopumps	Yearly or after 5000 hours of operation
	Replace injection port liner	AN
	Clip injection port end of column	AN
	Replace septum	AN
LC/MS/MS	Change rough pump (vacuum) oil	Semiannually
	Clean cones and spray chamber	As needed, before each calibration
	Clean source and ion lenses	Annually
	Check electrospray capillary	AN
	Empty waste liquid reservoir	AN
	Tune and calibrate MS	AN

Uncontrolled Copy

Instrument	Preventive Maintenance	Frequency
HPLC	Pump lubrication	Annually
	Check pump seals	Annually
	Check-valves cleaned or rebuilt	AN
	Replace and/or adjust detector bulb	AN
	Clean detector flow cell	AN
	Replace Teflon lines	AN
	Autosampler septa replacement	AN
	In-line filter sonication/cleaning	AN
	System passivation	AN
	PCRS pump lubrication	AN
	Empty waste liquid reservoir	Daily
Cold Vapor AA and Cold Vapor AF	Replace pump tubing	AN
	Lubricate pump head & autosampler	AN
	Clean optical cells and windows	AN
ICP	Replace pump winding	AN
	Lubricate autosampler	AN
	Vacuum instrument airfilters and air intakes	AN
	Clean optics and lenses	AN
	Clean Torch and injector tip	AN
	Clean nebulizer and spray chamber	AN
ICP/MS	Change interface rough pump oil	Quarterly
	Change MS rough pump oil	Semiannually
	Clean cones and ion lenses	AN
	Clean Torch, injector tip, nebulizer and spray chamber	AN
	Change peristaltic tubing	AN
	Vacuum instrument airfilters and air intakes	AN
	Empty waste liquid reservoir	AN
Total Organic Carbon Analyzer	Check for leaks	AN
	Inspect rotary valve	AN
	Clean gas permeation tube	AN
	Check halide scrubber	AN
	Check dessicant tube	AN
	Dust back and clean circuit boards	AN
Autoanalyzer spectrophotometer	Clean sample probe	AN
	Clean proportioning pump	AN
	Inspect pump tubing, replace if worn	AN
	Clean wash receptacles	AN

*AN = as needed. These actions may be performed more frequently as required by the instrument's operational response.

Uncontrolled Copy

eurofins | Lancaster Laboratories

Environmental Quality Policy Manual

Appendix H
Calibration Schedules

Current as of October 05, 2011
14 Total Pages (including this coversheet)

NOTE: Current schedules available in technical departments.

Uncontrolled Copy

Calibration Summary for SW-846 Methods						
	Initial Calibration			Continuing Calibration Verification		
Instrument	Frequency	# Std Conc	Acceptance Criteria	Frequency	# Std Conc	Acceptance Criteria
GC/MS Volatiles*	After C-cal fails	6	RF for SPCCs >0.300 for chlorobenzene and 1,1,2,2-tetrachloroethane, and >0.100 for 1,1-dichloroethene, bromoform and chloromethane %RSD CCCs <30%	Every 12 hours	1	RF for SPCCs >0.300 for chlorobenzene and 1,1,2,2-tetrachloro-ethane, and >0.100 for 1,1-dichloroethene, bromoform and chloromethane %Drift for CCCs <20
GC/MS Semivolatiles (8270C)*	After C-cal fails	6	RF for SPCCs >0.050 Max %RSD for CCCs <30%	Every 12 hours	1	RF for SPCCs 0.050 %Drift for CCCs <20
GC/MS Semivolatiles (8270D)*	After C-cal fails	6	% RSD ≤ 20% for each compound, (no more than 10% of the compounds can exceed 20% RSD); alternate fit must be used for any analyte with RSD >20% (use linear fit if correlation coefficient is 0.990 or greater; if correlation coefficient is < 0.990 then quadratic fit can be used, but the coefficient of determination must be 0.990 or greater). If linear fit is used, it must pass a linear regression check (the low standard must be within 30% of its true concentration)	Every 12 hours	1	%Drift ± 20%; (no more than 20% of the compounds can exceed 20% drift, and all compounds that exceed 20% drift must be ≤ 50% drift)
GC/MS Semi-volatiles SIM	After C-cal Fails	6	% RSD for all compounds ≤20%	Every 12 hours	1	%Drift ± 20%
GC VOA	After C-cal fails	At least 5	% RSD ≤20% for individual compounds. Alternatively, if the average of the %RSDs of all compounds in the calibration standard is ≤20% then the average RF can be used for all compounds.	Every 10 samples	1	%Drift ± 15% for individual compounds or average % drift for all compounds in the standard ± 15%

Uncontrolled Copy

Calibration Summary for SW-846 Methods						
	Initial Calibration			Continuing Calibration Verification		
Instrument	Frequency	# Std Conc	Acceptance Criteria	Frequency	# Std Conc	Acceptance Criteria
GC Pesticides	After C-cal fails	5	20% RSD of RFs of initial calibration to use avg. RF, otherwise use curve fit. Degradation for DDT, endrin 15% Alternatively, if the average of the %RSDs of all compounds in the calibration standard is ≤20%, then the AVG RF can be used for all compounds.	Every 10 samples Every 20 samples or 12 hours for Method 8081A, 8082	1	≤15% drift from initial response for quantitation C-cal - A CCV is also compliant if the average % difference is ≤15% for all compounds in the CCV standard. DDT/Endrin breakdown check 15% every 12 hours or 20 injections (8081A)
Dioxins by HRGC/HRMS	After C-cal fails	6	If %RSD for native compounds <20% and for labeled compounds <35%, otherwise a calibration curve is used	Every 12 hours	1	<15% valley peak resolution for 2378-TCDD All native and labeled compounds meet method defined recovery limits RTs within ±15 secs of RT in ICAL
HPLC	Each new run or after C-cal fails	5	20% RSD of RFs of initial calibration to use average RF, otherwise use curve fit Alternatively, if the average of the %RSDs of all compounds in the calibration standard is ≤20%, then the AVG RF can be used for all compounds.	Every 10 samples	1	≤15% drift from initial response for quantitation C-cal - A CCV is also compliant if the average % difference is ≤15% for all compounds in the CCV standard.
GC TPH-GRO	After C-cal fails	At least 5	% RSD of <20% to use the average CF, otherwise use calibration curve	Every 12 hours	1	%Drift ±15%
GC TPH-DRO	After C-cal fails	5	20% RSD of RFs of initial calibration to use average RF, otherwise use curve fit.	Every 12 hours	1	% Drift ±15%
ICP/MS	Each new run	1	Independent calibration verification (ICV) within ±10%	Every 10 samples	1	±10% of true value
ICP	Each new run	1	Independent calibration verification within ±10%, standards <5%RSD	Every 10 samples	1	Same as initial

Uncontrolled Copy

Calibration Summary for SW-846 Methods						
	Initial Calibration			Continuing Calibration Verification		
Instrument	Frequency	# Std Conc	Acceptance Criteria	Frequency	# Std Conc	Acceptance Criteria
CVAA	Each new run	5	Independent calibration verification within ±10% Correlation coefficient >0.995	Every 10 samples	1	±20% of true value
Autoanalyzer	Daily	6	Correlation coefficient >0.995	Every 10 samples	1	±10% of true value
TOC Analyzer	Monthly	Water – 6 Soil -4	Corr. Coeff. > 0.995	Every 10 samples	1	±10% of true value
Balance	Daily	4	Top-loading ±.5%, Analytical ± .1% for weights >.1 g 50 mg ± .5%, 20 mg ± 1.0% 10 mg and 5 mg ± 2.0%	N/A	N/A	N/A

*All compounds with %RSD >15 must use first or second order regression fit of the six calibration points. Alternatively, if average of the %RSD of all compounds in calibration standard is ≤15%, the AVG RF can be used for all compounds.

Abbreviations
Std Conc - The number of standard concentrations used
%RSD - Percent Relative Standard Deviation CF – Calibration Factor
SPCCs - System Performance Check Compounds
CCCs - Calibration Check Compounds C-cal - Continuing Calibration
RF - Response factor
CVAA - Cold Vapor Atomic Absorption
ICP/MS - Inductively Coupled Plasma – Mass Spectrometry
ICP - Inductively Coupled Plasma spectrophotometer; ICP run also includes inter-element correction check standard (at beginning and end of run)

Uncontrolled Copy

Calibration Summary for CLP Methods						
	Initial Calibration			Continuing Calibration Verification		
Instrument	Frequency	# Std Conc	Acceptance Criteria	Frequency	# Std Conc	Acceptance Criteria
GC/MS Volatiles	After C-cal fails	5	Specified compounds must meet contract minimum RRF criteria and max %RSD of ≤20.5%	Every 12 hours	1	Specified compounds must meet contract minimum RRF criteria and max %D of ≤25%
GC/MS Semivolatiles	After C-cal fails	5	Specified compounds must meet contract minimum RRF criteria and max %RSD of ≤25%. Up to 4 compounds may fail, but must be <40%.	Every 12 hours	1	Specified compounds must meet contract minimum RRF criteria max %D of ≤ 25%. Up to four compounds may fail, but must be <40%.
GC Pesticides	After C-cal fails	3	%RSD for compounds ≤20% (alpha-BHC and delta-BHC ≤25%) %RSD for surrogates ≤30%	Every 12 hours	1	IND A & B/PEM alternate every 12 hours with %D ≤25. Degradation for DDT, endrin ≤20%, combined ≤30% IBLK every 12 hours with CCV
Cold Vapor AA	Each new run	5	Independent calibration verification within ±20%	Every 10 samples	1	Same as initial
ICP	Each new run	1	Independent calibration verification within ±10%	Every 10 samples	1	Same as initial
ICP-MS	Each new run	1	Independent calibration verification within ±10%	Every 10 samples	1	Same as initial
Autoanalyzer (cyanide)	Daily	5	Correlation coefficient >0.995	Every 10 samples	1	±10% of original response
Balance	Daily	4	±0.5%	N/A	N/A	N/A

Abbreviations

RRF – Relative Response Factor
%RSD – Percent Relative Standard Deviation
%D – Percent difference IND – Individual standard mix
RPD – Relative Percent Difference PEM – Performance Evaluation Mix
C-cal – Continuing Calibration
ICP – Inductively Coupled Plasma spectrophotometer
ICP/MS - Inductively Coupled Plasma – Mass Spectrometry
IBLK – Instrument Blank
For volatiles, up to two compounds may be outside criteria providing the RRF is ≥0.010 and %RSD ≤40%.
For semivolatiles, up to four compounds may be outside criteria providing the RRF is ≥0.010 and %RSD ≤40%.
For both volatile and semivolatile compounds with no established RRF criteria, the minimum RRF is ≥0.010.
For pesticides, up to two target compounds may have %RSD >20% but ≤ 30%.

Uncontrolled Copy

GC/MS Tuning Criteria			
BFB Key Ions and Ion Abundance Criteria:			
Mass	**CLP Methods**	**Method 8260B**	**Method 524.2**
50	8% to 40% of mass 95	15% to 40% of mass 95	15% to 40% of mass 95
75	30% to 66% of mass 95	30% to 60% of mass 95	30% to 80% of mass 95
95	Base peak = 100%	Base peak = 100%	Base peak = 100%
96	5% to 9% of mass 95	5% to 9% of mass 95	5% to 9% of mass 95
173	<2% of mass 174	<2% of mass 174	<2% of mass 174
174	50% to 120% of mass 95	>50% of mass 95	>50% of mass 95
175	4% to 9% of mass 174	5% to 9% of mass 174	5% to 9% of mass 174
176	93% to 101% of mass 174	>95% but <101% of mass 174	>95% but <101% of mass 174
177	5% to 9% of mass 176	5% to 9% of mass 176	5% to 9% of mass 176
DFTPP Key Ions and Ion Abundance Critieria:			
Mass	**Methods** 8270D & CLP	**Method 8270C**	**Method 525.2**
51	30 % to 80 % of mass 198	30 % to 60 % of mass 198	10 % to 80 % of base peak
68	<2% of mass 69	<2% of mass 69	<2% of mass 69
69	mass 69 relative abundance	mass 69 relative abundance	mass 69 relative abundance
70	<2% of mass 69	<2% of mass 69	<2% of mass 69
127	25 % to 75 % of mass 198	40% to 60 % of mass 198	10% to 80 % of base peak
197	<1% of mass 198	<1% of mass 198	<2% of mass 198
198	Base Peak = 100%	Base Peak = 100%	Base peak or >50 % of mass 442
199	5% to 9% of mass 198	5% to 9% of mass 198	5% to 9% of mass 198
275	10% to 30% of mass 198	10% to 30% of mass 198	10% to 60% of base peak
365	>0.75% of mass 198	>1% of mass 198	>1% of base peak
441	8270D: Present but < 24% mass 442 CLP: Present but < mass 443	Present but < mass 443	Present but < mass 443
442	8270D: >50% of mass 198 CLP: 40% to 110% of mass 198	>40% of mass 198	Base peak or >50% of mass 198
443	15% to 24% of mass 442	17% to 23% of mass 442	15% to 24% of mass 442

Uncontrolled Copy

Calibration Summary for Drinking Water Methods						
	Initial Calibration			Continuing Calibration Verification		
Instrument	Frequency	# Std Conc	Acceptance Criteria	Frequency	# Std Conc	Acceptance Criteria
GC/MS 525.2	After C-cal fails	6	The RSD for each analyte mean RF must be ≤30%. Or a linear regression calibration curve may be used.	Every 12 hours	1	%D for RF must be ≤30%. If curve used, the point must fall on curve from I-cal.
GC 504.1	Every new run	5	% RSD <20% to use Average RF, otherwise use calibration curve.	Every 10 samples or each batch if <10 samples	1	70% to 130% of expected value
GC/MS 524.2	After C-cal fails	4	% RSD <20% otherwise use calibration curve	Every 12 hours	1	%D for RF must be ≤30%. If curved used, the % recovery based on the concentration spiked must be 70% to 130% of expected value.
GC 507 508 515.1	Each new run, or after C-cal fails	3	≤20% RSD of RFs of Initial Calibration to use avg. RF, otherwise use curve fit. (Degradation for DDT, Endrin ≤20% initially - Method 508.)	Every 10 samples	1	≤20% drift from initial response for both quantitation and confirmation.
HPLC 531.1	Each new run, or after C-cal fails	3	≤20% RSD of RFs of initial calibration to use avg. RF, otherwise use curve fit	Every 10 samples and/or blanks	1	≤20% drift from initial response.
Mercury auto-analyzer	Each new run	5	Initial calibration verification with ±5%	Every 10 samples	1	±10% of true value
Auto-analyzer	Daily	6	Correlation coefficient >0.995	Every 10 samples	1	±10% of true value
Balance	Daily	4	See SOP	N/A	N/A	N/A
ICP	Each new run	1	Initial calibration verification ±5%	Every 10 samples	1	±10% of true value
ICP-MS	Each new run	1	Independent calibration verification within ±10%	Every 10 samples	1	±15% of true value

Uncontrolled Copy

Calibration Summary for Drinking Water Methods						
	Initial Calibration			Continuing Calibration Verification		
Instrument	Frequency	# Std Conc	Acceptance Criteria	Frequency	# Std Conc	Acceptance Criteria
pH meter	Daily	3	See SOP	Every 10 samples	1	Statistical limits
IC	Monthly	5	Correlation coefficient >0.995	Every 10 samples	1	±10% of true value
ISE	Every 3 months	5	Correlation coefficient >0.995	Every 10 samples	1	±10% of true value

Abbreviations

Std Conc - The number of standard concentrations used
SPCCs - System Performance Check Compounds
CCCs - Calibration Check Compounds
RF - Response Factor
%RSD - Percent Relative Standard Deviation
%D - Percent Difference
C-cal - Continuing Calibration
CVAF – Cold Vapor Atomic Fluorescence
HPLC - High Performance Liquid Chromatography
GC - Gas Chromatograph
GC/MS - Gas Chromatography/Mass Spectrometry
ICP - Inductively Coupled Plasma spectrophotometer
ICP/MS - Inductively Coupled Plasma – Mass Spectrometry
IC - Ion Chromatograph
ISE - Ion Specific Electrode

Uncontrolled Copy

Method 507 Laboratory Performance Check Solution (analyzed prior to system calibration)			
Test	Analyte	Conc. µg/mL	Requirements
Sensitivity	Vernolate	0.05	Detection of analyte; S/N > 3
Chromatographic performance	Bromacil	5.0	0.80 < PGF[a] <1.20
Column performance	Prometon Atrazine	0.30 0.15	Resolution[b] > 0.7

[a]PGF - Peak Gaussian factor. Calculated using the equation:

$$PGF = \frac{1.83 \times W(1/2)}{W(1/10)}$$

Where W(1/2) is the peak width at half height and W(1/10) is the peak width at 10% peak height.

[b]Resolution between the two peaks as defined by the equation:

$$R = \frac{t}{W}$$

Where t is the difference in elution times between the two peaks and W is the average peak width, at the baseline, of the two peaks.

Uncontrolled Copy

Method 508 Laboratory Performance Check Solution (analyzed prior to system calibration)			
Test	Analyte	Conc. µg/mL	Requirements
Sensitivity	Chlorpyrifos	0.0020	Detection of analyte; S/N > 3
Chromatographic performance	DCPA	0.0500	0.80 < PGF[a] < 1.15
Column performance	Chlorothalonil HCH-delta	0.0500 0.0400	Resolution[b] > 0.50

[a]PGF - Peak Gaussian factor. Calculated using the equation:

$$PGF = \frac{1.83 \times W(1/2)}{W(1/10)}$$

Where W(1/2) is the peak width at half height and W(1/10) is the peak width at 10% peak height.

[b]Resolution between the two peaks as defined by the equation:

$$R = \frac{t}{W}$$

Where t is the difference in elution times between the two peaks and W is the average peak width, at the baseline, of the two peaks.

Uncontrolled Copy

Method 515 Laboratory Performance Check Solution (analyzed prior to system calibration)			
Test	Analyte	Conc. µg/mL	Requirements
Sensitivity	Dinoseb	0.004	Detection of analyte; S/N >3
Chromatographic performance	4-Nitrophenol	1.6	0.70 < PGF[a] < 1.05
Column performance	3,5-Dichlorobenzoic acid 4-Nitrophenol	0.6 1.6	Resolution[b] >0.40

[a]PGF - Peak Gaussian factor. Calculated using the equation:

$$PGF = \frac{1.83 \times W(1/2)}{W(1/10)}$$

Where W(1/2) is the peak width at half height and W(1/10) is the peak width at tenth height.

[b]Resolution between the two peaks as defined by the equation:

$$R = \frac{t}{W}$$

Where t is the difference in elution times between the two peaks and W is the average peak width, at the baseline, of the two peaks.

Uncontrolled Copy

Calibration Summary for EPA 100, 200, 300, 600 & 1600 Series Methods						
	Initial Calibration			Continuing Calibration Verification		
Instrument	Frequency	# Std Conc	Acceptance Criteria	Frequency	# Std Conc	Acceptance Criteria
GC/MS Volatiles*	After C-cal fails	5	RSD ≤35% for all compounds*, or a linear regression may be used	Every 24 hours	1	All compounds must meet the QC acceptance criteria as stated in the method. Compounds not stated must meet a 65% -135% recovery criteria.
GC/MS Semivolatiles**	After C-cal fails	5	RSD ≤35% for all compounds**, or a linear regression may be used Tailing factors: Benzidine < 3 Pentachlorophenol < 5	Every 24 hours	1	All compounds calibrating for <20
GC Pesticides & PCBs (Method 608)	After C-cal fails	5	10% RSD of RFs of initial calibration to use avg. RF, otherwise use curve fit. Degradation for DDT, Endrin 15%	Every 10 samples	1	≤15% drift from initial response for quantitation
GC VOA Halocarbons and/or Aromatics	After C-cal fails	At least 5	%RSD of ≤10% for individual compounds to use average RFs. If %RSD >10%, a quadratic fit type is used if correlation coefficient is >0.995.	Every 12 hours, or every 10 samples	1	Method defined limits
HPLC	Each new run or after C-cal fails	5	10% RSD of RFs of initial calibration to use average RF, otherwise use curve fit	Every 10 samples	1	≤15% difference from initial response for quantitation
ICP/MS	Each new run	1	Independent calibration verification (ICV) within ±10%	Every 10 samples	1	±15% of true value
ICP	Each new run	1	Independent calibration verification within ±5%, standards <5%RSD	Every 10 samples	1	±10% of true value

Uncontrolled Copy

Calibration Summary for EPA 100, 200, 300, 600 & 1600 Series Methods						
	Initial Calibration			Continuing Calibration Verification		
Instrument	Frequency	# Std Conc	Acceptance Criteria	Frequency	# Std Conc	Acceptance Criteria
CVAA	Each new run	5	Independent calibration verification within ±5% Correlation coefficient >0.995	Every 10 samples	1	±10% of true value
CVAF	Each new run	5	The RSD ≤ 15%, and the low standard recovers 75-125% of the true value	After the calibration and at the end of the analytical batch	1	±23% of the true value
Auto-analyzer	Daily	6	Correlation coefficient >0.995	Every 10 samples	1	±10% of true value
TOC	Monthly	6 5	Corr. Coeff. > 0.995 Corr. Coeff. > 0.995	Every 10 samples	1	±10% of true value
Balance	Daily	4	Top-loading ±0.5%, Analytical ± 0.1% for weights >0.1 g 50 mg ± 0.5%, 20 mg ± 1.0% 10 mg and 5 mg ± 2.0%	N/A	N/A	N/A

*All compounds with %RSD >35 must use first or second order regression fit of the five calibration points. The first order regression may only be used if the correlation coefficient r ≥0.990. The second order regression may only be used if the coefficient of determination r^2 ≥0.990.

* * All compounds with % RSD >35 must use first order regression fit of the five calibration points. The first order regression may only be used if the correlation coefficient r ≥0.990.

Abbreviations
Std Conc - The number of standard concentrations used
SPCCs - System Performance Check Compounds
CCCs - Calibration Check Compounds
RF - Response Factor
%RSD - Percent Relative Standard Deviation
C-cal - Continuing Calibration
CVAA - Cold Vapor Atomic Absorption spectrophotometer
HPLC - High Performance Liquid Chromatography
ICP - Inductively Coupled Plasma spectrophotometer; ICP run also includes inter-element correction check standard (beginning and end of run)
ICP/MS - Inductively Coupled Plasma – Mass Spectrometry

Uncontrolled Copy

Calibration Summary for EPA TO Series Methods						
	Initial Calibration			Continuing Calibration Verification		
Instrument	Frequency	# Std Conc	Acceptance Criteria	Frequency	# Std Conc	Acceptance Criteria
GC/MS Volatiles TO-15	After C-cal fails	5	RSD ≤30% for all compounds, 2 allowed to be >30% as long as <40%.	Every 24 hours	1	All compounds ≤30 difference, 2 compounds allowed to be >30% as long as ≤40%.
GC/MS Volatiles TO-14A	After C-cal fails	3	RSD ≤30% for all compounds, 2 allowed to be >30% as long as <40%.	Every 24 hours	1	All compounds ≤30 difference, 2 compounds allowed to be >30% as long as ≤40%.

Uncontrolled Copy

eurofins | Lancaster Laboratories

Environmental Quality Policy Manual

Appendix I
NELAP Scope of Testing

Current as of October 05, 2011
61 Total Pages (including this coversheet)

NOTE: Current certificates maintained by QA Department.

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Drinking Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 110.2	Color	NELAP	PA	4/4/2005
EPA 150.1	pH	NELAP	PA	2/28/2002
EPA 1613	Dioxin	NELAP	PA	10/5/2010
EPA 1664 Rev A	Oil and grease	NELAP	PA	5/24/2011
EPA 180.1	Turbidity	NELAP	PA	4/4/2005
EPA 200.7	Aluminum	NELAP	PA	4/4/2005
EPA 200.7	Barium	NELAP	PA	1/22/2001
EPA 200.7	Beryllium	NELAP	PA	6/2/2004
EPA 200.7	Cadmium	NELAP	PA	1/22/2001
EPA 200.7	Calcium	NELAP	PA	11/28/2001
EPA 200.7	Chromium	NELAP	PA	1/22/2001
EPA 200.7	Cobalt	NELAP	PA	10/16/2008
EPA 200.7	Copper	NELAP	PA	1/22/2001
EPA 200.7	Iron	NELAP	PA	4/4/2005
EPA 200.7	Magnesium	NELAP	PA	12/4/2007
EPA 200.7	Manganese	NELAP	PA	4/4/2005
EPA 200.7	Nickel	NELAP	PA	1/22/2001
EPA 200.7	Potassium	NELAP	PA	5/24/2011
EPA 200.7	Silver	NELAP	PA	1/26/2001
EPA 200.7	Sodium	NELAP	PA	1/22/2001
EPA 200.7	Strontium	NELAP	PA	5/24/2011
EPA 200.7	Tin	NELAP	PA	11/3/2008
EPA 200.7	Vanadium	NELAP	PA	10/16/2008
EPA 200.7	Zinc	NELAP	PA	4/4/2005
EPA 200.8	Antimony	NELAP	PA	2/10/2005
EPA 200.8	Arsenic	NELAP	PA	2/10/2005
EPA 200.8	Beryllium	NELAP	PA	2/10/2005
EPA 200.8	Cadmium	NELAP	PA	2/10/2005
EPA 200.8	Chromium	NELAP	PA	2/10/2005
EPA 200.8	Copper	NELAP	PA	3/9/2007
EPA 200.8	Lead	NELAP	PA	2/10/2005
EPA 200.8	Nickel	NELAP	PA	2/10/2005
EPA 200.8	Selenium	NELAP	PA	2/10/2005
EPA 200.8	Thallium	NELAP	PA	2/10/2005
EPA 245.1	Mercury	NELAP	PA	8/29/2001
EPA 300.0	Chloride	NELAP	PA	5/17/2005

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized accrediting authority. Customers are urged to verify the laboratory's current accreditation standing.

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Drinking Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 300.0	Fluoride	NELAP	PA	1/22/2004
EPA 300.0	Nitrate	NELAP	PA	10/31/2002
EPA 300.0	Nitrite	NELAP	PA	10/31/2002
EPA 300.0	Sulfate	NELAP	PA	7/7/2003
EPA 314.0	Perchlorate	NELAP	PA	5/24/2007
EPA 335.4	Cyanide	NELAP	PA	7/11/2006
EPA 353.2	Nitrate as N	NELAP	PA	2/28/2002
EPA 353.2	Nitrite	NELAP	PA	2/28/2002
EPA 353.2	Total nitrate-nitrite	NELAP	PA	5/24/2011
EPA 504.1	1,2,3-Trichloropropane (1,2,3-TCP)	NELAP	PA	5/17/2005
EPA 504.1	1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane)	NELAP	PA	2/28/2002
EPA 504.1	1,2-Dibromoethane (EDB, Ethylene dibromide)	NELAP	PA	1/26/2001
EPA 507	Alachlor (Lasso)	NELAP	PA	2/28/2002
EPA 507	Atrazine	NELAP	PA	2/28/2002
EPA 507	Simazine	NELAP	PA	2/28/2002
EPA 508	Aldrin (HHDN)	NELAP	PA	5/18/2005
EPA 508	Aroclor-1016 (PCB-1016)	NELAP	PA	4/24/2007
EPA 508	Aroclor-1221 (PCB-1221)	NELAP	PA	4/24/2007
EPA 508	Aroclor-1232 (PCB-1232)	NELAP	PA	4/24/2007
EPA 508	Aroclor-1242 (PCB-1242)	NELAP	PA	4/24/2007
EPA 508	Aroclor-1248 (PCB-1248)	NELAP	PA	4/24/2007
EPA 508	Aroclor-1254 (PCB-1254)	NELAP	PA	4/24/2007
EPA 508	Aroclor-1260 (PCB-1260)	NELAP	PA	4/24/2007
EPA 508	Chlordane (tech.)	NELAP	PA	2/28/2002
EPA 508	Dieldrin	NELAP	PA	1/3/2002
EPA 508	Endrin	NELAP	PA	2/28/2002
EPA 508	Heptachlor	NELAP	PA	2/28/2002
EPA 508	Heptachlor epoxide	NELAP	PA	2/28/2002
EPA 508	Hexachlorobenzene	NELAP	PA	2/28/2002
EPA 508	Hexachlorocyclopentadiene	NELAP	PA	2/28/2002
EPA 508	Methoxychlor	NELAP	PA	2/28/2002
EPA 508	Toxaphene (Chlorinated camphene)	NELAP	PA	5/25/2007
EPA 508	gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	NELAP	PA	2/28/2002
EPA 515.1	2,4,5-TP (Silvex)	NELAP	PA	1/24/2001
EPA 515.1	2,4-D	NELAP	PA	1/24/2001

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized accrediting authority. Customers are urged to verify the laboratory's current accreditation standing.
www.dep.state.pa.us **Issue Date: 05/25/2011**

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Drinking Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 515.1	Dalapon (2,2-Dichloropropionic acid)	NELAP	PA	1/24/2001
EPA 515.1	Dicamba	NELAP	PA	1/24/2001
EPA 515.1	Dinoseb (2-sec-Butyl-4,6-dinitrophenol, DNBP)	NELAP	PA	1/24/2001
EPA 515.1	Pentachlorophenol (PCP)	NELAP	PA	1/24/2001
EPA 515.1	Picloram (4-Amino-3,5,6-trichloro-2-pyridinecarboxylic acid)	NELAP	PA	1/24/2001
EPA 524.2	1,1,1,2-Tetrachloroethane	NELAP	PA	10/31/2002
EPA 524.2	1,1,1-Trichloroethane	NELAP	PA	10/31/2002
EPA 524.2	1,1,2,2-Tetrachloroethane	NELAP	PA	10/31/2002
EPA 524.2	1,1,2-Trichloroethane	NELAP	PA	10/31/2002
EPA 524.2	1,1-Dichloro-2-propanone (1,1-Dichloropropanone)	NELAP	PA	5/17/2005
EPA 524.2	1,1-Dichloroethane	NELAP	PA	10/31/2002
EPA 524.2	1,1-Dichloroethene (1,1-Dichloroethylene)	NELAP	PA	10/31/2002
EPA 524.2	1,1-Dichloropropene	NELAP	PA	10/31/2002
EPA 524.2	1,2,3-Trichlorobenzene	NELAP	PA	4/4/2005
EPA 524.2	1,2,3-Trichloropropane (1,2,3-TCP)	NELAP	PA	10/31/2002
EPA 524.2	1,2,4-Trichlorobenzene	NELAP	PA	10/31/2002
EPA 524.2	1,2,4-Trimethylbenzene	NELAP	PA	4/4/2005
EPA 524.2	1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane)	NELAP	PA	5/24/2007
EPA 524.2	1,2-Dibromoethane (EDB, Ethylene dibromide)	NELAP	PA	5/24/2007
EPA 524.2	1,2-Dichlorobenzene (o-Dichlorobenzene)	NELAP	PA	10/31/2002
EPA 524.2	1,2-Dichloroethane	NELAP	PA	10/31/2002
EPA 524.2	1,2-Dichloropropane	NELAP	PA	10/31/2002
EPA 524.2	1,3,5-Trimethylbenzene	NELAP	PA	5/17/2005
EPA 524.2	1,3-Dichlorobenzene (m-Dichlorobenzene)	NELAP	PA	10/31/2002
EPA 524.2	1,3-Dichloropropane	NELAP	PA	10/31/2002
EPA 524.2	1,4-Dichlorobenzene (p-Dichlorobenzene)	NELAP	PA	10/31/2002
EPA 524.2	1-Chlorobutane	NELAP	PA	5/24/2007
EPA 524.2	2,2-Dichloropropane	NELAP	PA	10/31/2002
EPA 524.2	2-Butanone (Methyl ethyl ketone, MEK)	NELAP	PA	5/24/2007
EPA 524.2	2-Chlorotoluene	NELAP	PA	10/31/2002
EPA 524.2	2-Hexanone	NELAP	PA	5/24/2007
EPA 524.2	2-Nitropropane	NELAP	PA	5/24/2007
EPA 524.2	4-Chlorotoluene	NELAP	PA	10/31/2002
EPA 524.2	4-Isopropyltoluene (p-Isopropyltoluene)	NELAP	PA	5/17/2005
EPA 524.2	4-Methyl-2-pentanone (MIBK)	NELAP	PA	5/24/2007

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Drinking Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 524.2	Acetone	NELAP	PA	5/24/2007
EPA 524.2	Acrylonitrile	NELAP	PA	5/24/2007
EPA 524.2	Allyl chloride (3-Chloropropene)	NELAP	PA	5/24/2007
EPA 524.2	Benzene	NELAP	PA	10/31/2002
EPA 524.2	Bromobenzene	NELAP	PA	10/31/2002
EPA 524.2	Bromochloromethane	NELAP	PA	4/4/2005
EPA 524.2	Bromodichloromethane	NELAP	PA	10/31/2002
EPA 524.2	Bromoform	NELAP	PA	10/31/2002
EPA 524.2	Carbon disulfide	NELAP	PA	5/24/2007
EPA 524.2	Carbon tetrachloride	NELAP	PA	10/31/2002
EPA 524.2	Chloroacetonitrile	NELAP	PA	5/24/2007
EPA 524.2	Chlorobenzene	NELAP	PA	10/31/2002
EPA 524.2	Chloroethane	NELAP	PA	10/31/2002
EPA 524.2	Chloroform	NELAP	PA	10/31/2002
EPA 524.2	Dibromochloromethane	NELAP	PA	10/31/2002
EPA 524.2	Dibromomethane	NELAP	PA	10/31/2002
EPA 524.2	Dichlorodifluoromethane (Freon 12)	NELAP	PA	4/4/2005
EPA 524.2	Dichloromethane (DCM, Methylene chloride)	NELAP	PA	10/31/2002
EPA 524.2	Diethyl ether (Ethyl ether)	NELAP	PA	5/24/2007
EPA 524.2	Ethyl methacrylate	NELAP	PA	5/24/2007
EPA 524.2	Ethylbenzene	NELAP	PA	10/31/2002
EPA 524.2	Hexachlorobutadiene (1,3-Hexachlorobutadiene)	NELAP	PA	4/4/2005
EPA 524.2	Hexachloroethane	NELAP	PA	5/24/2007
EPA 524.2	Isopropylbenzene (Cumene)	NELAP	PA	4/4/2005
EPA 524.2	Methacrylonitrile	NELAP	PA	5/24/2007
EPA 524.2	Methyl bromide (Bromomethane)	NELAP	PA	10/31/2002
EPA 524.2	Methyl chloride (Chloromethane)	NELAP	PA	10/31/2002
EPA 524.2	Methyl iodide (Iodomethane)	NELAP	PA	5/24/2007
EPA 524.2	Methyl tert-butyl ether (MTBE)	NELAP	PA	4/4/2005
EPA 524.2	Methylacrylate	NELAP	PA	5/24/2007
EPA 524.2	Methylmethacrylate	NELAP	PA	5/24/2007
EPA 524.2	Naphthalene	NELAP	PA	5/17/2005
EPA 524.2	Nitrobenzene	NELAP	PA	5/17/2005
EPA 524.2	Pentachloroethane	NELAP	PA	5/24/2007
EPA 524.2	Propionitrile (Ethyl cyanide)	NELAP	PA	5/24/2007
EPA 524.2	Styrene	NELAP	PA	10/31/2002

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized accrediting authority. Customers are urged to verify the laboratory's current accreditation standing.
www.dep.state.pa.us **Issue Date: 05/25/2011**

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Drinking Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 524.2	Tetrachloroethene (PCE, Perchloroethylene)	NELAP	PA	10/31/2002
EPA 524.2	Tetrahydrofuran (THF)	NELAP	PA	5/24/2007
EPA 524.2	Toluene	NELAP	PA	10/31/2002
EPA 524.2	Total trihalomethanes (TTHMs)	NELAP	PA	10/31/2002
EPA 524.2	Trichloroethene (TCE, Trichloroethylene)	NELAP	PA	10/31/2002
EPA 524.2	Trichlorofluoromethane (Freon 11)	NELAP	PA	4/4/2005
EPA 524.2	Vinyl chloride (Chloroethene)	NELAP	PA	10/31/2002
EPA 524.2	Xylenes, total	NELAP	PA	10/31/2002
EPA 524.2	cis-1,2-Dichloroethene	NELAP	PA	10/31/2002
EPA 524.2	cis-1,3-Dichloropropene	NELAP	PA	10/31/2002
EPA 524.2	n-Butylbenzene	NELAP	PA	4/4/2005
EPA 524.2	n-Propylbenzene	NELAP	PA	5/17/2005
EPA 524.2	sec-Butylbenzene	NELAP	PA	4/4/2005
EPA 524.2	tert-Butylbenzene	NELAP	PA	4/4/2005
EPA 524.2	trans-1,2-Dichloroethene	NELAP	PA	10/31/2002
EPA 524.2	trans-1,3-Dichloropropene	NELAP	PA	10/31/2002
EPA 524.2	trans-1,4-Dichloro-2-butene	NELAP	PA	5/24/2007
EPA 524.2-Extended	Allyl chloride (3-Chloropropene)	NELAP	PA	7/3/2007
EPA 524.2-Extended	Diisopropyl ether (DIPE)	NELAP	PA	1/7/2010
EPA 524.2-Extended	Ethyl tert-butyl ether (ETBE)	NELAP	PA	1/24/2007
EPA 524.2-Extended	tert-Amyl methyl ether (TAME)	NELAP	PA	1/24/2007
EPA 524.2-Extended	tert-Butyl alcohol (2-Methyl-2-propanol)	NELAP	PA	5/24/2007
EPA 525.2	2,3-Dichlorobiphenyl (BZ 5)	NELAP	PA	5/17/2005
EPA 525.2	Acenaphthylene	NELAP	PA	4/28/2010
EPA 525.2	Alachlor (Lasso)	NELAP	PA	2/28/2002
EPA 525.2	Anthracene	NELAP	PA	5/25/2007
EPA 525.2	Atrazine	NELAP	PA	1/3/2002
EPA 525.2	Benzo[a]anthracene	NELAP	PA	5/25/2007
EPA 525.2	Benzo[a]pyrene	NELAP	PA	1/24/2001
EPA 525.2	Benzo[b]fluoranthene	NELAP	PA	6/4/2007
EPA 525.2	Benzo[ghi]perylene	NELAP	PA	7/3/2007
EPA 525.2	Benzo[k]fluoranthene	NELAP	PA	6/4/2007
EPA 525.2	Benzyl butyl phthalate (Butyl benzyl phthalate)	NELAP	PA	5/25/2007
EPA 525.2	Butachlor	NELAP	PA	12/19/2002
EPA 525.2	Chrysene (Benzo[a]phenanthrene)	NELAP	PA	5/25/2007
EPA 525.2	Di-n-butyl phthalate	NELAP	PA	5/25/2007

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Drinking Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 525.2	Dibenzo[a,h]anthracene	NELAP	PA	5/25/2007
EPA 525.2	Dieldrin	NELAP	PA	5/17/2005
EPA 525.2	Diethyl phthalate	NELAP	PA	5/25/2007
EPA 525.2	Dimethyl phthalate	NELAP	PA	5/25/2007
EPA 525.2	Endrin	NELAP	PA	5/17/2005
EPA 525.2	Heptachlor	NELAP	PA	5/17/2005
EPA 525.2	Heptachlor epoxide	NELAP	PA	5/17/2005
EPA 525.2	Hexachlorobenzene	NELAP	PA	2/11/2005
EPA 525.2	Hexachlorocyclopentadiene	NELAP	PA	1/24/2001
EPA 525.2	Methoxychlor	NELAP	PA	1/24/2001
EPA 525.2	Metolachlor	NELAP	PA	12/19/2002
EPA 525.2	Metribuzin	NELAP	PA	12/19/2002
EPA 525.2	Phenanthrene	NELAP	PA	5/25/2007
EPA 525.2	Propachlor (Ramrod)	NELAP	PA	1/24/2001
EPA 525.2	Pyrene	NELAP	PA	5/25/2007
EPA 525.2	Simazine	NELAP	PA	1/3/2002
EPA 525.2	bis(2-Ethylhexyl) adipate (di(2-Ethylhexyl) adipate)	NELAP	PA	1/24/2001
EPA 525.2	bis(2-Ethylhexyl) phthalate (DEHP)	NELAP	PA	1/24/2001
EPA 525.2	gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	NELAP	PA	1/24/2001
EPA 525.2-Extended	Acenaphthene	NELAP	PA	5/25/2007
EPA 531.1	3-Hydroxycarbofuran	NELAP	PA	11/7/2006
EPA 531.1	Aldicarb (Temik)	NELAP	PA	1/24/2001
EPA 531.1	Aldicarb sulfone	NELAP	PA	1/24/2001
EPA 531.1	Aldicarb sulfoxide	NELAP	PA	1/24/2001
EPA 531.1	Carbaryl (Sevin)	NELAP	PA	10/9/2002
EPA 531.1	Carbofuran (Furadan)	NELAP	PA	1/24/2001
EPA 531.1	Methomyl (Lannate)	NELAP	PA	1/24/2001
EPA 531.1	Oxamyl (Vydate)	NELAP	PA	1/24/2001
EPA 8015-Extended	Ethane	NELAP	PA	5/24/2011
EPA 8015-Extended	Methane	NELAP	PA	5/24/2011
SM 2120 B	Color	NELAP	PA	5/25/2005
SM 2130 B	Turbidity	NELAP	PA	5/17/2005
SM 2320 B	Alkalinity as CaCO3	NELAP	PA	1/24/2001
SM 2340 B	Total hardness as CaCO3	NELAP	PA	4/4/2005
SM 2340 C	Total hardness as CaCO3	NELAP	PA	5/24/2011
SM 2510 B	Conductivity	NELAP	PA	5/17/2005

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized accrediting authority. Customers are urged to verify the laboratory's current accreditation standing.

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code:** PA00009 **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Drinking Water

Method	Analyte	Accreditation Type	Primary	Effective Date
SM 2540 C	Total dissolved solids (TDS)	NELAP	PA	6/2/2004
SM 2540 D	Residue, nonfilterable (TSS)	NELAP	PA	5/24/2011
SM 2550 B	Temperature, deg. C	NELAP	PA	4/4/2005
SM 4500-CN- E	Free cyanide	NELAP	PA	5/24/2011
SM 4500-Cl F	Total residual chlorine	NELAP	PA	5/24/2011
SM 4500-Cl G	Residual free chlorine	NELAP	PA	1/7/2010
SM 4500-F- C	Fluoride	NELAP	PA	10/15/2003
SM 4500-H+ B	pH	NELAP	PA	5/16/2007
SM 4500-P E	Orthophosphate as P	NELAP	PA	6/12/2007
SM 4500-SiO2 C (20th ed.)	Silica, dissolved	NELAP	PA	5/24/2007
SM 5540 C	Surfactants as MBAS	NELAP	PA	5/24/2007
SM 9215 B	Heterotrophic bacteria (Enumeration)	NELAP	PA	2/5/2003
SM 9223 B	Total coliform & E. coli	NELAP	PA	1/26/2001

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
AK-101	Gasoline-range organics (GRO)	NELAP	PA	12/12/2005
AK-102	Diesel-range organics (DRO)	NELAP	PA	12/12/2005
EPA 1010	Ignitability	NELAP	PA	12/12/2005
EPA 130.2	Hardness	NELAP	PA	1/19/2005
EPA 1311	Toxicity characteristic leaching procedure (TCLP)	NELAP	PA	12/12/2005
EPA 1312	Synthetic precipitation leaching procedure (SPLP)	NELAP	PA	12/12/2005
EPA 160.1	Residue, filterable (TDS)	NELAP	PA	1/19/2005
EPA 160.4	Residue, volatile	NELAP	PA	1/19/2005
EPA 1613	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	NELAP	PA	6/30/2010
EPA 1613	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	NELAP	PA	6/30/2010
EPA 1613	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)	NELAP	PA	6/30/2010
EPA 1613	1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	NELAP	PA	6/30/2010
EPA 1613	1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)	NELAP	PA	6/30/2010
EPA 1613	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	NELAP	PA	6/30/2010
EPA 1613	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	NELAP	PA	6/30/2010
EPA 1613	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	NELAP	PA	6/30/2010
EPA 1613	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	NELAP	PA	6/30/2010
EPA 1613	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	NELAP	PA	6/30/2010
EPA 1613	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	NELAP	PA	6/30/2010
EPA 1613	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	NELAP	PA	6/30/2010
EPA 1613	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	NELAP	PA	6/30/2010
EPA 1613	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	NELAP	PA	6/30/2010
EPA 1613	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	NELAP	PA	6/30/2010
EPA 1613	2,3,7,8-TCDD (Dioxin)	NELAP	PA	6/30/2010
EPA 1613	2,3,7,8-Tetrachlorodibenzofuran (TCDF)	NELAP	PA	6/30/2010
EPA 1613	Total heptachlorodibenzo-p-dioxin (HpCDD)	NELAP	PA	8/6/2010
EPA 1613	Total heptachlorodibenzofuran (HpCDF)	NELAP	PA	8/6/2010
EPA 1613	Total hexachlorodibenzo-p-dioxin (HxCDD)	NELAP	PA	8/6/2010
EPA 1613	Total hexachlorodibenzofuran (HxCDF)	NELAP	PA	8/6/2010
EPA 1613	Total pentachlorodibenzo-p-dioxin (PeCDD)	NELAP	PA	8/6/2010
EPA 1613	Total pentachlorodibenzofuran (PeCDF)	NELAP	PA	8/6/2010
EPA 1613	Total tetrachlorodibenzo-p-dioxin (TCDD)	NELAP	PA	8/6/2010
EPA 1613	Total tetrachlorodibenzofuran (TCDF)	NELAP	PA	8/6/2010
EPA 1625 Rev C	N-Nitrosodimethylamine	NELAP	PA	11/23/2010
EPA 1631	Mercury	NELAP	PA	6/11/2007

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized accrediting authority. Customers are urged to verify the laboratory's current accreditation standing.

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code:** PA00009 (717) 656-2300

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 1664 Rev A	Non-polar material	NELAP	PA	11/17/2006
EPA 1664 Rev A	Oil and grease	NELAP	PA	1/19/2005
EPA 1666 Rev A	2-Propanol (Isopropyl alcohol)	NELAP	PA	12/2/2009
EPA 1666 Rev A	4-Methyl-2-pentanone (MIBK)	NELAP	PA	12/12/2005
EPA 1666 Rev A	Ethyl acetate	NELAP	PA	1/19/2005
EPA 1666 Rev A	Isobutyraldehyde	NELAP	PA	1/19/2005
EPA 1666 Rev A	Isopropyl acetate	NELAP	PA	1/19/2005
EPA 1666 Rev A	Isopropyl ether	NELAP	PA	1/19/2005
EPA 1666 Rev A	Methyl formate	NELAP	PA	1/19/2005
EPA 1666 Rev A	Tetrahydrofuran (THF)	NELAP	PA	1/19/2005
EPA 1666 Rev A	Xylenes, total	NELAP	PA	1/19/2005
EPA 1666 Rev A	n-Amyl acetate (n-Pentyl acetate)	NELAP	PA	4/4/2005
EPA 1666 Rev A	n-Amyl alcohol (1-Pentanol)	NELAP	PA	4/4/2005
EPA 1666 Rev A	n-Butyl acetate	NELAP	PA	4/4/2005
EPA 1666 Rev A	n-Heptane	NELAP	PA	1/19/2005
EPA 1666 Rev A	n-Hexane	NELAP	PA	1/19/2005
EPA 1666 Rev A	tert-Butyl alcohol (2-Methyl-2-propanol)	NELAP	PA	4/4/2005
EPA 1671 Rev A	Acetonitrile	NELAP	PA	1/19/2005
EPA 1671 Rev A	Diethylamine	NELAP	PA	1/19/2005
EPA 1671 Rev A	Dimethyl sulfoxide	NELAP	PA	1/19/2005
EPA 1671 Rev A	Ethanol	NELAP	PA	1/19/2005
EPA 1671 Rev A	Methanol	NELAP	PA	1/19/2005
EPA 1671 Rev A	Methyl cellosolve (2-Methoxyethanol)	NELAP	PA	1/19/2005
EPA 1671 Rev A	Triethylamine	NELAP	PA	1/19/2005
EPA 1671 Rev A	n-Propanol (1-Propanol)	NELAP	PA	1/19/2005
EPA 170.1	Temperature, deg. C	NELAP	PA	4/4/2005
EPA 180.1	Turbidity	NELAP	PA	1/19/2005
EPA 200.2	Metals sample preparation	NELAP	PA	1/24/2007
EPA 200.7	Aluminum	NELAP	PA	1/19/2005
EPA 200.7	Antimony	NELAP	PA	1/19/2005
EPA 200.7	Arsenic	NELAP	PA	1/19/2005
EPA 200.7	Barium	NELAP	PA	1/19/2005
EPA 200.7	Beryllium	NELAP	PA	1/19/2005
EPA 200.7	Boron	NELAP	PA	1/19/2005
EPA 200.7	Cadmium	NELAP	PA	1/19/2005
EPA 200.7	Calcium	NELAP	PA	1/19/2005

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code:** PA00009 (717) 656-2300

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 200.7	Chromium	NELAP	PA	1/19/2005
EPA 200.7	Cobalt	NELAP	PA	1/19/2005
EPA 200.7	Copper	NELAP	PA	1/19/2005
EPA 200.7	Iron	NELAP	PA	1/19/2005
EPA 200.7	Lead	NELAP	PA	1/19/2005
EPA 200.7	Magnesium	NELAP	PA	1/19/2005
EPA 200.7	Manganese	NELAP	PA	1/19/2005
EPA 200.7	Molybdenum	NELAP	PA	1/19/2005
EPA 200.7	Nickel	NELAP	PA	1/19/2005
EPA 200.7	Potassium	NELAP	PA	1/19/2005
EPA 200.7	Selenium	NELAP	PA	1/19/2005
EPA 200.7	Silver	NELAP	PA	4/4/2005
EPA 200.7	Sodium	NELAP	PA	1/19/2005
EPA 200.7	Strontium	NELAP	PA	5/24/2011
EPA 200.7	Thallium	NELAP	PA	1/19/2005
EPA 200.7	Tin	NELAP	PA	1/19/2005
EPA 200.7	Titanium	NELAP	PA	1/19/2005
EPA 200.7	Vanadium	NELAP	PA	1/19/2005
EPA 200.7	Zinc	NELAP	PA	1/19/2005
EPA 200.8	Aluminum	NELAP	PA	1/7/2010
EPA 200.8	Antimony	NELAP	PA	4/4/2005
EPA 200.8	Arsenic	NELAP	PA	4/4/2005
EPA 200.8	Barium	NELAP	PA	4/4/2005
EPA 200.8	Beryllium	NELAP	PA	4/4/2005
EPA 200.8	Cadmium	NELAP	PA	4/4/2005
EPA 200.8	Chromium	NELAP	PA	4/4/2005
EPA 200.8	Cobalt	NELAP	PA	11/23/2010
EPA 200.8	Copper	NELAP	PA	4/4/2005
EPA 200.8	Lead	NELAP	PA	4/4/2005
EPA 200.8	Manganese	NELAP	PA	11/23/2010
EPA 200.8	Molybdenum	NELAP	PA	1/7/2010
EPA 200.8	Nickel	NELAP	PA	4/4/2005
EPA 200.8	Selenium	NELAP	PA	12/12/2005
EPA 200.8	Silver	NELAP	PA	1/2/2007
EPA 200.8	Thallium	NELAP	PA	5/31/2006
EPA 200.8	Vanadium	NELAP	PA	1/7/2010

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 200.8	Zinc	NELAP	PA	1/18/2011
EPA 200.8-Extended	Boron	NELAP	PA	1/7/2010
EPA 200.8-Extended	Calcium	NELAP	PA	1/7/2010
EPA 200.8-Extended	Iron	NELAP	PA	11/23/2010
EPA 200.8-Extended	Magnesium	NELAP	PA	1/7/2010
EPA 200.8-Extended	Potassium	NELAP	PA	1/7/2010
EPA 200.8-Extended	Sodium	NELAP	PA	1/7/2010
EPA 200.8-Extended	Strontium	NELAP	PA	1/7/2010
EPA 200.8-Extended	Tin	NELAP	PA	1/7/2010
EPA 200.8-Extended	Titanium	NELAP	PA	1/7/2010
EPA 218.6	Chromium VI	NELAP	PA	4/4/2005
EPA 245.1	Mercury	NELAP	PA	1/19/2005
EPA 300.0	Bromide	NELAP	PA	4/4/2005
EPA 300.0	Chloride	NELAP	PA	1/19/2005
EPA 300.0	Fluoride	NELAP	PA	5/25/2005
EPA 300.0	Nitrate as N	NELAP	PA	1/19/2005
EPA 300.0	Nitrite as N	NELAP	PA	1/19/2005
EPA 300.0	Orthophosphate as P	NELAP	PA	11/23/2010
EPA 300.0	Sulfate	NELAP	PA	1/19/2005
EPA 3005A	Preconcentration under acid	NELAP	PA	12/12/2005
EPA 3010A	Hot plate acid digestion (HNO3 + HCl)	NELAP	PA	12/12/2005
EPA 3020A	Hot plate acid digestion (HNO3 only)	NELAP	PA	12/12/2005
EPA 305.2	Acidity as CaCO3	NELAP	PA	1/24/2007
EPA 3060A	Alkaline digestion of Cr(VI)	NELAP	PA	1/24/2007
EPA 314.0	Perchlorate	NELAP	PA	11/23/2009
EPA 335.4	Total cyanide	NELAP	PA	1/19/2005
EPA 351.2	Kjeldahl nitrogen, total (TKN)	NELAP	PA	1/19/2005
EPA 3510C	Separatory funnel liquid-liquid extraction	NELAP	PA	12/12/2005
EPA 3520C	Continuous liquid-liquid extraction	NELAP	PA	12/12/2005
EPA 353.2	Nitrate as N	NELAP	PA	1/19/2005
EPA 353.2	Nitrite as N	NELAP	PA	1/19/2005
EPA 353.2	Total nitrate-nitrite	NELAP	PA	4/4/2005
EPA 3620B	Florisil cleanup	NELAP	PA	12/12/2005
EPA 3630C	Silica gel cleanup	NELAP	PA	12/12/2005
EPA 3640A	Gel permeation cleanup (GPC)	NELAP	PA	12/12/2005
EPA 365.1	Phosphorus, total	NELAP	PA	4/4/2005

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized accrediting authority. Customers are urged to verify the laboratory's current accreditation standing.
www.dep.state.pa.us **Issue Date: 05/25/2011**

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 365.3	Orthophosphate as P	NELAP	PA	1/19/2005
EPA 3660B	Sulfur cleanup	NELAP	PA	12/12/2005
EPA 375.4	Sulfate	NELAP	PA	4/4/2005
EPA 410.1	Chemical oxygen demand (COD)	NELAP	PA	12/11/2006
EPA 410.4	Chemical oxygen demand (COD)	NELAP	PA	4/1/2005
EPA 415.1	Total organic carbon (TOC)	NELAP	PA	1/19/2005
EPA 420.4	Total phenolics	NELAP	PA	4/17/2007
EPA 425.1	Surfactants as MBAS	NELAP	PA	1/19/2005
EPA 5030B	Aqueous-phase purge-and-trap	NELAP	PA	12/12/2005
EPA 524.2	1,2-Dichlorobenzene (o-Dichlorobenzene)	NELAP	PA	1/18/2011
EPA 524.2	1,2-Dichloroethane	NELAP	PA	1/18/2011
EPA 524.2	4-Methyl-2-pentanone (MIBK)	NELAP	PA	5/24/2011
EPA 524.2	Acetone	NELAP	PA	1/18/2011
EPA 524.2	Benzene	NELAP	PA	1/18/2011
EPA 524.2	Chlorobenzene	NELAP	PA	1/18/2011
EPA 524.2	Chloroform	NELAP	PA	1/18/2011
EPA 524.2	Dichloromethane (DCM, Methylene chloride)	NELAP	PA	5/24/2011
EPA 524.2	Tetrahydrofuran (THF)	NELAP	PA	5/24/2011
EPA 524.2	Toluene	NELAP	PA	1/18/2011
EPA 524.2	o-Xylene	NELAP	PA	5/24/2011
EPA 6010	Aluminum	NELAP	PA	12/12/2005
EPA 6010	Antimony	NELAP	PA	12/12/2005
EPA 6010	Arsenic	NELAP	PA	12/12/2005
EPA 6010	Barium	NELAP	PA	12/12/2005
EPA 6010	Beryllium	NELAP	PA	12/12/2005
EPA 6010	Boron	NELAP	PA	12/12/2005
EPA 6010	Cadmium	NELAP	PA	12/12/2005
EPA 6010	Calcium	NELAP	PA	12/12/2005
EPA 6010	Chromium	NELAP	PA	12/12/2005
EPA 6010	Cobalt	NELAP	PA	12/12/2005
EPA 6010	Copper	NELAP	PA	12/12/2005
EPA 6010	Iron	NELAP	PA	12/12/2005
EPA 6010	Lead	NELAP	PA	12/12/2005
EPA 6010	Lithium	NELAP	PA	1/18/2011
EPA 6010	Magnesium	NELAP	PA	12/12/2005
EPA 6010	Manganese	NELAP	PA	12/12/2005

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 6010	Molybdenum	NELAP	PA	12/12/2005
EPA 6010	Nickel	NELAP	PA	12/12/2005
EPA 6010	Potassium	NELAP	PA	12/12/2005
EPA 6010	Selenium	NELAP	PA	12/12/2005
EPA 6010	Silver	NELAP	PA	12/12/2005
EPA 6010	Sodium	NELAP	PA	12/12/2005
EPA 6010	Strontium	NELAP	PA	12/12/2005
EPA 6010	Thallium	NELAP	PA	12/12/2005
EPA 6010	Tin	NELAP	PA	12/12/2005
EPA 6010	Titanium	NELAP	PA	12/12/2005
EPA 6010	Vanadium	NELAP	PA	12/12/2005
EPA 6010	Zinc	NELAP	PA	12/12/2005
EPA 602	Benzene	NELAP	PA	1/19/2005
EPA 602	Ethylbenzene	NELAP	PA	1/19/2005
EPA 602	Methyl tert-butyl ether (MTBE)	NELAP	PA	1/19/2005
EPA 602	Toluene	NELAP	PA	1/19/2005
EPA 602	Xylenes, total	NELAP	PA	1/19/2005
EPA 602-Extended	Naphthalene	NELAP	PA	1/18/2011
EPA 602-Extended	Styrene	NELAP	PA	6/24/2008
EPA 602-Extended	m+p-Xylene	NELAP	PA	1/18/2011
EPA 602-Extended	o-Xylene	NELAP	PA	1/18/2011
EPA 6020	Aluminum	NELAP	PA	1/7/2010
EPA 6020	Antimony	NELAP	PA	12/12/2005
EPA 6020	Arsenic	NELAP	PA	12/12/2005
EPA 6020	Barium	NELAP	PA	12/12/2005
EPA 6020	Beryllium	NELAP	PA	12/12/2005
EPA 6020	Cadmium	NELAP	PA	12/12/2005
EPA 6020	Calcium	NELAP	PA	1/7/2010
EPA 6020	Chromium	NELAP	PA	12/12/2005
EPA 6020	Cobalt	NELAP	PA	11/23/2010
EPA 6020	Copper	NELAP	PA	12/12/2005
EPA 6020	Iron	NELAP	PA	11/23/2010
EPA 6020	Lead	NELAP	PA	12/12/2005
EPA 6020	Magnesium	NELAP	PA	1/7/2010
EPA 6020	Manganese	NELAP	PA	11/23/2010
EPA 6020	Molybdenum	NELAP	PA	1/7/2010

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 6020	Nickel	NELAP	PA	7/23/2008
EPA 6020	Potassium	NELAP	PA	1/7/2010
EPA 6020	Selenium	NELAP	PA	12/12/2005
EPA 6020	Silver	NELAP	PA	1/12/2007
EPA 6020	Sodium	NELAP	PA	1/7/2010
EPA 6020	Thallium	NELAP	PA	12/12/2005
EPA 6020	Vanadium	NELAP	PA	1/7/2010
EPA 6020	Zinc	NELAP	PA	1/18/2011
EPA 6020-Extended	Boron	NELAP	PA	1/7/2010
EPA 6020-Extended	Strontium	NELAP	PA	1/7/2010
EPA 6020-Extended	Tin	NELAP	PA	1/7/2010
EPA 6020-Extended	Titanium	NELAP	PA	1/7/2010
EPA 608	4,4'-DDD	NELAP	PA	1/19/2005
EPA 608	4,4'-DDE	NELAP	PA	1/19/2005
EPA 608	4,4'-DDT	NELAP	PA	1/19/2005
EPA 608	Aldrin (HHDN)	NELAP	PA	1/19/2005
EPA 608	Aroclor-1016 (PCB-1016)	NELAP	PA	12/11/2006
EPA 608	Aroclor-1221 (PCB-1221)	NELAP	PA	12/11/2006
EPA 608	Aroclor-1232 (PCB-1232)	NELAP	PA	12/11/2006
EPA 608	Aroclor-1242 (PCB-1242)	NELAP	PA	12/11/2006
EPA 608	Aroclor-1248 (PCB-1248)	NELAP	PA	12/11/2006
EPA 608	Aroclor-1254 (PCB-1254)	NELAP	PA	12/11/2006
EPA 608	Aroclor-1260 (PCB-1260)	NELAP	PA	12/11/2006
EPA 608	Chlordane (tech.)	NELAP	PA	1/19/2005
EPA 608	Dieldrin	NELAP	PA	1/19/2005
EPA 608	Endosulfan I	NELAP	PA	1/19/2005
EPA 608	Endosulfan II	NELAP	PA	1/19/2005
EPA 608	Endosulfan sulfate	NELAP	PA	1/19/2005
EPA 608	Endrin	NELAP	PA	1/19/2005
EPA 608	Endrin aldehyde	NELAP	PA	1/19/2005
EPA 608	Heptachlor	NELAP	PA	1/19/2005
EPA 608	Heptachlor epoxide	NELAP	PA	1/19/2005
EPA 608	Methoxychlor	NELAP	PA	5/2/2006
EPA 608	Toxaphene (Chlorinated camphene)	NELAP	PA	1/19/2005
EPA 608	alpha-BHC (alpha-Hexachlorocyclohexane)	NELAP	PA	1/19/2005
EPA 608	beta-BHC (beta-Hexachlorocyclohexane)	NELAP	PA	1/19/2005

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized accrediting authority. Customers are urged to verify the laboratory's current accreditation standing.
www.dep.state.pa.us **Issue Date: 05/25/2011**

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 608	delta-BHC (delta-Hexachlorocyclohexane)	NELAP	PA	1/19/2005
EPA 608	gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	NELAP	PA	1/19/2005
EPA 610	Acenaphthene	NELAP	PA	1/2/2007
EPA 610	Acenaphthylene	NELAP	PA	1/2/2007
EPA 610	Anthracene	NELAP	PA	1/2/2007
EPA 610	Benzo[a]anthracene	NELAP	PA	1/2/2007
EPA 610	Benzo[a]pyrene	NELAP	PA	1/2/2007
EPA 610	Benzo[b]fluoranthene	NELAP	PA	1/2/2007
EPA 610	Benzo[ghi]perylene	NELAP	PA	1/2/2007
EPA 610	Benzo[k]fluoranthene	NELAP	PA	1/2/2007
EPA 610	Chrysene (Benzo[a]phenanthrene)	NELAP	PA	1/2/2007
EPA 610	Dibenzo[a,h]anthracene	NELAP	PA	1/2/2007
EPA 610	Fluoranthene	NELAP	PA	1/2/2007
EPA 610	Fluorene	NELAP	PA	1/2/2007
EPA 610	Indeno(1,2,3-cd)pyrene	NELAP	PA	1/2/2007
EPA 610	Naphthalene	NELAP	PA	1/2/2007
EPA 610	Phenanthrene	NELAP	PA	1/2/2007
EPA 610	Pyrene	NELAP	PA	1/2/2007
EPA 622	Azinphos-methyl (Guthion)	NELAP	PA	6/15/2009
EPA 622	Bolstar (Sulprofos)	NELAP	PA	6/15/2009
EPA 622	Chlorpyrifos	NELAP	PA	6/15/2009
EPA 622	Coumaphos	NELAP	PA	6/15/2009
EPA 622	Demeton-O	NELAP	PA	6/15/2009
EPA 622	Demeton-S	NELAP	PA	6/15/2009
EPA 622	Diazinon (Spectracide)	NELAP	PA	6/15/2009
EPA 622	Dichlorovos (DDVP, Dichlorvos)	NELAP	PA	6/15/2009
EPA 622	Disulfoton	NELAP	PA	6/15/2009
EPA 622	Ethoprop (Prophos)	NELAP	PA	6/15/2009
EPA 622	Fensulfothion	NELAP	PA	6/15/2009
EPA 622	Fenthion	NELAP	PA	6/15/2009
EPA 622	Merphos	NELAP	PA	6/15/2009
EPA 622	Methyl parathion (Parathion, methyl)	NELAP	PA	6/15/2009
EPA 622	Mevinphos	NELAP	PA	6/15/2009
EPA 622	Naled	NELAP	PA	6/15/2009
EPA 622	Phorate (Thimet)	NELAP	PA	6/15/2009
EPA 622	Ronnel	NELAP	PA	6/15/2009

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 622	Stirophos (Tetrachlorovinphos)	NELAP	PA	6/15/2009
EPA 622	Tokuthion (Prothiophos)	NELAP	PA	6/15/2009
EPA 622	Trichloronate	NELAP	PA	6/15/2009
EPA 622-Extended	Carbophenothion (Trithion)	NELAP	PA	4/28/2010
EPA 622-Extended	EPN (Santox)	NELAP	PA	6/15/2009
EPA 622-Extended	Ethion	NELAP	PA	6/15/2009
EPA 622-Extended	Famphur	NELAP	PA	6/15/2009
EPA 622-Extended	Malathion	NELAP	PA	6/15/2009
EPA 622-Extended	Parathion (Ethyl parathion)	NELAP	PA	6/15/2009
EPA 624	1,1,1,2-Tetrachloroethane	NELAP	PA	1/19/2005
EPA 624	1,1,1-Trichloroethane	NELAP	PA	1/19/2005
EPA 624	1,1,2,2-Tetrachloroethane	NELAP	PA	1/19/2005
EPA 624	1,1,2-Trichloroethane	NELAP	PA	1/19/2005
EPA 624	1,1-Dichloroethane	NELAP	PA	1/19/2005
EPA 624	1,1-Dichloroethene (1,1-Dichloroethylene)	NELAP	PA	1/19/2005
EPA 624	1,2-Dichlorobenzene (o-Dichlorobenzene)	NELAP	PA	1/19/2005
EPA 624	1,2-Dichloroethane	NELAP	PA	1/19/2005
EPA 624	1,2-Dichloropropane	NELAP	PA	1/19/2005
EPA 624	1,3-Dichlorobenzene (m-Dichlorobenzene)	NELAP	PA	1/19/2005
EPA 624	1,4-Dichlorobenzene (p-Dichlorobenzene)	NELAP	PA	1/19/2005
EPA 624	2-Chloroethyl vinyl ether	NELAP	PA	1/19/2005
EPA 624	Acrolein (Propenal)	NELAP	PA	1/19/2005
EPA 624	Acrylonitrile	NELAP	PA	1/19/2005
EPA 624	Benzene	NELAP	PA	1/19/2005
EPA 624	Bromodichloromethane	NELAP	PA	1/19/2005
EPA 624	Bromoform	NELAP	PA	1/19/2005
EPA 624	Carbon tetrachloride	NELAP	PA	1/19/2005
EPA 624	Chlorobenzene	NELAP	PA	1/19/2005
EPA 624	Chloroethane	NELAP	PA	1/19/2005
EPA 624	Chloroform	NELAP	PA	1/19/2005
EPA 624	Dibromochloromethane	NELAP	PA	4/4/2005
EPA 624	Ethylbenzene	NELAP	PA	1/19/2005
EPA 624	Methyl bromide (Bromomethane)	NELAP	PA	1/19/2005
EPA 624	Methyl chloride (Chloromethane)	NELAP	PA	1/19/2005
EPA 624	Methylene chloride (Dichloromethane)	NELAP	PA	1/19/2005
EPA 624	Tetrachloroethene (PCE, Perchloroethylene)	NELAP	PA	1/19/2005

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized accrediting authority. Customers are urged to verify the laboratory's current accreditation standing.

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 624	Toluene	NELAP	PA	1/19/2005
EPA 624	Trichloroethene (TCE, Trichloroethylene)	NELAP	PA	1/19/2005
EPA 624	Trichlorofluoromethane (Freon 11)	NELAP	PA	1/19/2005
EPA 624	Vinyl chloride (Chloroethene)	NELAP	PA	1/19/2005
EPA 624	Xylenes, total	NELAP	PA	1/19/2005
EPA 624	cis-1,3-Dichloropropene	NELAP	PA	1/19/2005
EPA 624	trans-1,2-Dichloroethene	NELAP	PA	1/19/2005
EPA 624	trans-1,3-Dichloropropene	NELAP	PA	1/19/2005
EPA 624-Extended	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	NELAP	PA	7/3/2007
EPA 624-Extended	1,1-Dichloropropene	NELAP	PA	7/3/2007
EPA 624-Extended	1,2,3-Trichlorobenzene	NELAP	PA	7/3/2007
EPA 624-Extended	1,2,3-Trichloropropane (1,2,3-TCP)	NELAP	PA	7/3/2007
EPA 624-Extended	1,2,3-Trimethylbenzene	NELAP	PA	7/3/2007
EPA 624-Extended	1,2,4-Trichlorobenzene	NELAP	PA	7/3/2007
EPA 624-Extended	1,2,4-Trimethylbenzene	NELAP	PA	7/3/2007
EPA 624-Extended	1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane)	NELAP	PA	7/3/2007
EPA 624-Extended	1,2-Dibromoethane (EDB, Ethylene dibromide)	NELAP	PA	7/3/2007
EPA 624-Extended	1,3,5-Trimethylbenzene	NELAP	PA	7/3/2007
EPA 624-Extended	1,3-Dichloropropane	NELAP	PA	7/3/2007
EPA 624-Extended	1,4-Dioxane (1,4-Diethyleneoxide)	NELAP	PA	7/3/2007
EPA 624-Extended	2,2-Dichloropropane	NELAP	PA	7/3/2007
EPA 624-Extended	2-Butanone (Methyl ethyl ketone, MEK)	NELAP	PA	7/3/2007
EPA 624-Extended	2-Chlorotoluene	NELAP	PA	7/3/2007
EPA 624-Extended	2-Hexanone	NELAP	PA	7/3/2007
EPA 624-Extended	4-Chloro-2-nitrophenol	NELAP	PA	7/3/2007
EPA 624-Extended	4-Chlorotoluene	NELAP	PA	7/3/2007
EPA 624-Extended	4-Isopropyltoluene (p-Isopropyltoluene)	NELAP	PA	7/3/2007
EPA 624-Extended	Acetone	NELAP	PA	7/3/2007
EPA 624-Extended	Acetonitrile	NELAP	PA	7/3/2007
EPA 624-Extended	Allyl chloride (3-Chloropropene)	NELAP	PA	7/3/2007
EPA 624-Extended	Bromobenzene	NELAP	PA	7/3/2007
EPA 624-Extended	Bromochloromethane	NELAP	PA	5/2/2006
EPA 624-Extended	Carbon disulfide	NELAP	PA	7/3/2007
EPA 624-Extended	Chloroprene (2-Chloro-1,3-butadiene)	NELAP	PA	6/12/2009
EPA 624-Extended	Cyclohexane	NELAP	PA	7/3/2007
EPA 624-Extended	Dibromomethane	NELAP	PA	7/3/2007

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 624-Extended	Dichlorodifluoromethane (Freon 12)	NELAP	PA	7/3/2007
EPA 624-Extended	Diisopropyl ether (DIPE)	NELAP	PA	5/2/2006
EPA 624-Extended	Ethyl methacrylate	NELAP	PA	7/3/2007
EPA 624-Extended	Freon 113 (1,1,2-Trichloro-1,2,2-trifluoroethane)	NELAP	PA	2/1/2011
EPA 624-Extended	Freon-123A	NELAP	PA	2/1/2011
EPA 624-Extended	Isobutyl alcohol (2-Methyl-1-propanol)	NELAP	PA	7/3/2007
EPA 624-Extended	Isopropylbenzene (Cumene)	NELAP	PA	5/2/2006
EPA 624-Extended	Methacrylonitrile	NELAP	PA	7/3/2007
EPA 624-Extended	Methyl iodide (Iodomethane)	NELAP	PA	7/3/2007
EPA 624-Extended	Methyl isobutyl ketone (MIBK, 4-Methyl-2-pentanone)	NELAP	PA	5/2/2006
EPA 624-Extended	Methyl tert-butyl ether (MTBE)	NELAP	PA	12/12/2005
EPA 624-Extended	Methylmethacrylate	NELAP	PA	7/3/2007
EPA 624-Extended	Naphthalene	NELAP	PA	7/3/2007
EPA 624-Extended	Pentachloroethane	NELAP	PA	7/3/2007
EPA 624-Extended	Propionitrile (Ethyl cyanide)	NELAP	PA	7/3/2007
EPA 624-Extended	Styrene	NELAP	PA	5/2/2006
EPA 624-Extended	Tetrahydrofuran (THF)	NELAP	PA	7/3/2007
EPA 624-Extended	Vinyl acetate	NELAP	PA	7/3/2007
EPA 624-Extended	cis-1,2-Dichloroethene	NELAP	PA	6/12/2009
EPA 624-Extended	n-Butylbenzene	NELAP	PA	7/3/2007
EPA 624-Extended	n-Heptane	NELAP	PA	7/3/2007
EPA 624-Extended	n-Hexane	NELAP	PA	7/3/2007
EPA 624-Extended	n-Propylbenzene	NELAP	PA	7/3/2007
EPA 624-Extended	sec-Butylbenzene	NELAP	PA	7/3/2007
EPA 624-Extended	tert-Amyl methyl ether (TAME)	NELAP	PA	5/2/2006
EPA 624-Extended	tert-Butyl alcohol (2-Methyl-2-propanol)	NELAP	PA	5/2/2006
EPA 624-Extended	tert-Butyl ethyl ether	NELAP	PA	5/2/2006
EPA 624-Extended	tert-Butylbenzene	NELAP	PA	7/3/2007
EPA 625	1,2,4-Trichlorobenzene	NELAP	PA	1/19/2005
EPA 625	1,2-Dichlorobenzene (o-Dichlorobenzene)	NELAP	PA	1/19/2005
EPA 625	1,3-Dichlorobenzene (m-Dichlorobenzene)	NELAP	PA	1/19/2005
EPA 625	1,4-Dichlorobenzene (p-Dichlorobenzene)	NELAP	PA	1/19/2005
EPA 625	2,4,5-Trichlorophenol	NELAP	PA	7/3/2007
EPA 625	2,4,6-Trichlorophenol	NELAP	PA	1/19/2005
EPA 625	2,4-Dichlorophenol	NELAP	PA	1/19/2005
EPA 625	2,4-Dimethylphenol	NELAP	PA	1/19/2005

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 625	2,4-Dinitrophenol	NELAP	PA	1/19/2005
EPA 625	2,4-Dinitrotoluene (2,4-DNT)	NELAP	PA	1/19/2005
EPA 625	2,6-Dinitrotoluene (2,6-DNT)	NELAP	PA	1/19/2005
EPA 625	2-Chloronaphthalene	NELAP	PA	1/19/2005
EPA 625	2-Chlorophenol	NELAP	PA	1/19/2005
EPA 625	2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	NELAP	PA	1/19/2005
EPA 625	2-Methylphenol (o-Cresol)	NELAP	PA	7/3/2007
EPA 625	2-Nitrophenol	NELAP	PA	1/19/2005
EPA 625	3,3'-Dichlorobenzidine	NELAP	PA	1/19/2005
EPA 625	4-Bromophenyl phenyl ether	NELAP	PA	1/19/2005
EPA 625	4-Chloro-3-methylphenol	NELAP	PA	1/19/2005
EPA 625	4-Chlorophenyl phenyl ether	NELAP	PA	1/19/2005
EPA 625	4-Nitrophenol	NELAP	PA	1/19/2005
EPA 625	Acenaphthene	NELAP	PA	1/19/2005
EPA 625	Acenaphthylene	NELAP	PA	1/19/2005
EPA 625	Acetophenone	NELAP	PA	5/2/2006
EPA 625	Aniline	NELAP	PA	5/2/2006
EPA 625	Anthracene	NELAP	PA	4/4/2005
EPA 625	Benzidine	NELAP	PA	1/19/2005
EPA 625	Benzo[a]anthracene	NELAP	PA	1/19/2005
EPA 625	Benzo[a]pyrene	NELAP	PA	1/19/2005
EPA 625	Benzo[b]fluoranthene	NELAP	PA	1/19/2005
EPA 625	Benzo[ghi]perylene	NELAP	PA	1/19/2005
EPA 625	Benzo[k]fluoranthene	NELAP	PA	1/19/2005
EPA 625	Butyl benzyl phthalate (Benzyl butyl phthalate)	NELAP	PA	1/19/2005
EPA 625	Carbazole	NELAP	PA	5/2/2006
EPA 625	Chrysene (Benzo[a]phenanthrene)	NELAP	PA	1/19/2005
EPA 625	Di-n-butyl phthalate	NELAP	PA	1/19/2005
EPA 625	Di-n-octyl phthalate	NELAP	PA	1/19/2005
EPA 625	Dibenzo[a,h]anthracene	NELAP	PA	1/19/2005
EPA 625	Diethyl phthalate	NELAP	PA	1/19/2005
EPA 625	Dimethyl phthalate	NELAP	PA	1/19/2005
EPA 625	Fluoranthene	NELAP	PA	1/19/2005
EPA 625	Fluorene	NELAP	PA	1/19/2005
EPA 625	Hexachlorobenzene	NELAP	PA	1/19/2005
EPA 625	Hexachlorobutadiene (1,3-Hexachlorobutadiene)	NELAP	PA	1/19/2005

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 625	Hexachlorocyclopentadiene	NELAP	PA	1/19/2005
EPA 625	Hexachloroethane	NELAP	PA	1/19/2005
EPA 625	Indeno(1,2,3-cd)pyrene	NELAP	PA	1/19/2005
EPA 625	Isophorone	NELAP	PA	1/19/2005
EPA 625	N-Nitrosodi-n-propylamine	NELAP	PA	1/19/2005
EPA 625	N-Nitrosodimethylamine	NELAP	PA	1/19/2005
EPA 625	N-Nitrosodiphenylamine	NELAP	PA	1/19/2005
EPA 625	Naphthalene	NELAP	PA	1/19/2005
EPA 625	Nitrobenzene	NELAP	PA	1/19/2005
EPA 625	Pentachlorophenol (PCP)	NELAP	PA	1/19/2005
EPA 625	Phenanthrene	NELAP	PA	1/19/2005
EPA 625	Phenol	NELAP	PA	1/19/2005
EPA 625	Pyrene	NELAP	PA	1/19/2005
EPA 625	Pyridine	NELAP	PA	5/2/2006
EPA 625	bis(2-Chloroethoxy)methane	NELAP	PA	1/19/2005
EPA 625	bis(2-Chloroethyl) ether	NELAP	PA	1/19/2005
EPA 625	bis(2-Chloroisopropyl) ether	NELAP	PA	1/19/2005
EPA 625	bis(2-Ethylhexyl) phthalate (DEHP)	NELAP	PA	1/19/2005
EPA 625-Extended	1,1'-Biphenyl (Biphenyl, Lemonene)	NELAP	PA	7/3/2007
EPA 625-Extended	1,2,4,5-Tetrachlorobenzene	NELAP	PA	5/2/2006
EPA 625-Extended	1,2-Diphenylhydrazine	NELAP	PA	5/2/2006
EPA 625-Extended	1,4-Dioxane (1,4-Diethyleneoxide)	NELAP	PA	7/3/2007
EPA 625-Extended	1-Methylphenanthrene	NELAP	PA	5/2/2006
EPA 625-Extended	2,3,4,6-Tetrachlorophenol	NELAP	PA	7/3/2007
EPA 625-Extended	2,3-Dichloroaniline	NELAP	PA	5/2/2006
EPA 625-Extended	2,3-Dinitrotoluene	NELAP	PA	7/3/2007
EPA 625-Extended	2,4,5-Trichlorophenol	NELAP	PA	7/3/2007
EPA 625-Extended	2,6-Dichlorophenol	NELAP	PA	7/3/2007
EPA 625-Extended	2-Methylnaphthalene	NELAP	PA	7/3/2007
EPA 625-Extended	2-Methylphenol (o-Cresol)	NELAP	PA	7/3/2007
EPA 625-Extended	2-Nitroaniline	NELAP	PA	7/3/2007
EPA 625-Extended	3-Methylphenol (m-Cresol)	NELAP	PA	7/3/2007
EPA 625-Extended	3-Nitroaniline	NELAP	PA	7/3/2007
EPA 625-Extended	4-Chloroaniline	NELAP	PA	7/3/2007
EPA 625-Extended	4-Methylphenol (p-Cresol)	NELAP	PA	7/3/2007
EPA 625-Extended	4-Nitroaniline	NELAP	PA	7/3/2007

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 625-Extended	Benzoic acid	NELAP	PA	5/2/2006
EPA 625-Extended	Benzyl alcohol	NELAP	PA	7/3/2007
EPA 625-Extended	Dibenzofuran	NELAP	PA	7/3/2007
EPA 625-Extended	Diphenyl ether	NELAP	PA	7/3/2007
EPA 625-Extended	N-Nitrosodi-n-butylamine	NELAP	PA	5/2/2006
EPA 625-Extended	N-Nitrosodiethylamine	NELAP	PA	5/2/2006
EPA 625-Extended	N-Nitrosopyrrolidine	NELAP	PA	5/2/2006
EPA 625-Extended	Pentachlorobenzene	NELAP	PA	7/3/2007
EPA 625-Extended	alpha-Terpineol	NELAP	PA	5/2/2006
EPA 625-Extended	n-Decane	NELAP	PA	5/2/2006
EPA 625-Extended	n-Docosane	NELAP	PA	5/2/2006
EPA 625-Extended	n-Dodecane	NELAP	PA	5/2/2006
EPA 625-Extended	n-Eicosane	NELAP	PA	5/2/2006
EPA 625-Extended	n-Hexadecane	NELAP	PA	5/2/2006
EPA 625-Extended	n-Octadecane	NELAP	PA	5/2/2006
EPA 625-Extended	n-Tetradecane	NELAP	PA	5/2/2006
EPA 625-Extended	o-Toluidine (2-Toluidine, 2-Methylaniline)	NELAP	PA	7/3/2007
EPA 6850	Perchlorate	NELAP	PA	1/19/2011
EPA 7196A	Chromium VI	NELAP	PA	4/6/2006
EPA 7199	Chromium VI	NELAP	PA	1/4/2006
EPA 7470	Mercury	NELAP	PA	11/21/2005
EPA 8011	1,2-Dibromoethane (EDB, Ethylene dibromide)	NELAP	PA	12/12/2005
EPA 8011	Dibromochloropropane (1,2-Dibromo-3-chloropropane, DBCP)	NELAP	PA	5/2/2006
EPA 8015	Diesel-range organics (DRO)	NELAP	PA	12/12/2005
EPA 8015	Ethanol	NELAP	PA	12/4/2007
EPA 8015	Ethylene glycol	NELAP	PA	12/4/2007
EPA 8015	Gasoline-range organics (GRO)	NELAP	PA	12/12/2005
EPA 8015	Isopropyl alcohol (2-Propanol)	NELAP	PA	12/4/2007
EPA 8015	Methanol	NELAP	PA	12/4/2007
EPA 8015	Total petroleum hydrocarbons (TPH)	NELAP	PA	1/24/2007
EPA 8015B-Extended	Ethane	NELAP	PA	12/4/2007
EPA 8015B-Extended	Ethene	NELAP	PA	12/4/2007
EPA 8015B-Extended	Methane	NELAP	PA	12/4/2007
EPA 8015B-Extended	Propane	NELAP	PA	12/4/2007
EPA 8021	Benzene	NELAP	PA	12/12/2005
EPA 8021	Ethylbenzene	NELAP	PA	12/12/2005

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8021	Isopropylbenzene (Cumene)	NELAP	PA	12/12/2005
EPA 8021	Methyl tert-butyl ether (MTBE)	NELAP	PA	2/11/2011
EPA 8021	Naphthalene	NELAP	PA	6/24/2008
EPA 8021	Toluene	NELAP	PA	12/12/2005
EPA 8021	Xylenes, total	NELAP	PA	12/12/2005
EPA 8021	m-Xylene	NELAP	PA	11/23/2009
EPA 8021	o-Xylene	NELAP	PA	11/23/2009
EPA 8021	p-Xylene	NELAP	PA	11/23/2009
EPA 8081	4,4'-DDD	NELAP	PA	2/10/2006
EPA 8081	4,4'-DDE	NELAP	PA	12/12/2005
EPA 8081	4,4'-DDT	NELAP	PA	12/12/2005
EPA 8081	Aldrin (HHDN)	NELAP	PA	12/12/2005
EPA 8081	Chlordane (tech.)	NELAP	PA	12/12/2005
EPA 8081	Dieldrin	NELAP	PA	12/12/2005
EPA 8081	Endosulfan I	NELAP	PA	2/10/2006
EPA 8081	Endosulfan II	NELAP	PA	12/12/2005
EPA 8081	Endosulfan sulfate	NELAP	PA	12/12/2005
EPA 8081	Endrin	NELAP	PA	12/12/2005
EPA 8081	Endrin aldehyde	NELAP	PA	12/12/2005
EPA 8081	Endrin ketone	NELAP	PA	2/10/2006
EPA 8081	Heptachlor	NELAP	PA	12/12/2005
EPA 8081	Heptachlor epoxide	NELAP	PA	12/12/2005
EPA 8081	Kepone	NELAP	PA	5/2/2006
EPA 8081	Methoxychlor	NELAP	PA	12/12/2005
EPA 8081	Mirex	NELAP	PA	12/12/2005
EPA 8081	Toxaphene (Chlorinated camphene)	NELAP	PA	12/12/2005
EPA 8081	alpha-BHC (alpha-Hexachlorocyclohexane)	NELAP	PA	2/10/2006
EPA 8081	alpha-Chlordane	NELAP	PA	2/10/2006
EPA 8081	beta-BHC (beta-Hexachlorocyclohexane)	NELAP	PA	2/10/2006
EPA 8081	delta-BHC (delta-Hexachlorocyclohexane)	NELAP	PA	2/10/2006
EPA 8081	gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	NELAP	PA	2/10/2006
EPA 8081	gamma-Chlordane	NELAP	PA	2/10/2006
EPA 8082	Aroclor-1016 (PCB-1016)	NELAP	PA	12/11/2006
EPA 8082	Aroclor-1221 (PCB-1221)	NELAP	PA	12/11/2006
EPA 8082	Aroclor-1232 (PCB-1232)	NELAP	PA	12/11/2006
EPA 8082	Aroclor-1242 (PCB-1242)	NELAP	PA	12/11/2006

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8082	Aroclor-1248 (PCB-1248)	NELAP	PA	12/11/2006
EPA 8082	Aroclor-1254 (PCB-1254)	NELAP	PA	12/11/2006
EPA 8082	Aroclor-1260 (PCB-1260)	NELAP	PA	12/11/2006
EPA 8082-Extended	Aroclor-1262 (PCB-1262)	NELAP	PA	7/23/2008
EPA 8082-Extended	Aroclor-1268 (PCB-1268)	NELAP	PA	7/23/2008
EPA 8141	Atrazine	NELAP	PA	12/12/2005
EPA 8141	Azinphos-methyl (Guthion)	NELAP	PA	12/12/2005
EPA 8141	Bolstar (Sulprofos)	NELAP	PA	12/12/2005
EPA 8141	Chlorpyrifos	NELAP	PA	12/12/2005
EPA 8141	Coumaphos	NELAP	PA	12/12/2005
EPA 8141	Demeton-O	NELAP	PA	12/12/2005
EPA 8141	Demeton-S	NELAP	PA	12/12/2005
EPA 8141	Diazinon (Spectracide)	NELAP	PA	12/12/2005
EPA 8141	Dichlorovos (DDVP, Dichlorvos)	NELAP	PA	12/12/2005
EPA 8141	Disulfoton	NELAP	PA	12/12/2005
EPA 8141	EPN (Santox)	NELAP	PA	12/12/2005
EPA 8141	Ethion	NELAP	PA	12/12/2005
EPA 8141	Ethoprop (Prophos)	NELAP	PA	12/12/2005
EPA 8141	Famphur	NELAP	PA	12/12/2005
EPA 8141	Fensulfothion	NELAP	PA	12/12/2005
EPA 8141	Fenthion	NELAP	PA	12/12/2005
EPA 8141	Malathion	NELAP	PA	12/12/2005
EPA 8141	Merphos	NELAP	PA	12/12/2005
EPA 8141	Methyl parathion (Parathion, methyl)	NELAP	PA	12/12/2005
EPA 8141	Mevinphos	NELAP	PA	12/12/2005
EPA 8141	Naled	NELAP	PA	12/12/2005
EPA 8141	Parathion, ethyl (Ethyl parathion, Parathion)	NELAP	PA	12/12/2005
EPA 8141	Phorate (Thimet)	NELAP	PA	12/12/2005
EPA 8141	Ronnel	NELAP	PA	12/12/2005
EPA 8141	Simazine	NELAP	PA	12/12/2005
EPA 8141	Stirophos (Tetrachlorovinphos)	NELAP	PA	5/2/2006
EPA 8141	Tokuthion (Prothiophos)	NELAP	PA	12/12/2005
EPA 8141	Trichloronate	NELAP	PA	5/2/2006
EPA 8141-Extended	Alachlor (Lasso)	NELAP	PA	1/21/2009
EPA 8141-Extended	Metolachlor	NELAP	PA	1/24/2007
EPA 8151	2,4,5-T	NELAP	PA	12/12/2005

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized accrediting authority. Customers are urged to verify the laboratory's current accreditation standing.
www.dep.state.pa.us **Issue Date: 05/25/2011**

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8151	2,4,5-TP (Silvex)	NELAP	PA	12/12/2005
EPA 8151	2,4-D	NELAP	PA	12/12/2005
EPA 8151	2,4-DB (Butoxon)	NELAP	PA	12/12/2005
EPA 8151	Dalapon (2,2-Dichloropropionic acid)	NELAP	PA	12/12/2005
EPA 8151	Dicamba	NELAP	PA	12/12/2005
EPA 8151	Dichloroprop (Dichlorprop)	NELAP	PA	1/24/2007
EPA 8151	Dinoseb (2-sec-Butyl-4,6-dinitrophenol, DNBP)	NELAP	PA	12/12/2005
EPA 8151	MCPA	NELAP	PA	12/12/2005
EPA 8151	MCPP (Mecoprop)	NELAP	PA	12/12/2005
EPA 8151	Pentachlorophenol (PCP)	NELAP	PA	12/12/2005
EPA 8151	Picloram (4-Amino-3,5,6-trichloro-2-pyridinecarboxylic acid)	NELAP	PA	12/12/2005
EPA 8260	1,1,1,2-Tetrachloroethane	NELAP	PA	12/12/2005
EPA 8260	1,1,1-Trichloroethane	NELAP	PA	12/12/2005
EPA 8260	1,1,2,2-Tetrachloroethane	NELAP	PA	12/12/2005
EPA 8260	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	NELAP	PA	12/12/2005
EPA 8260	1,1,2-Trichloroethane	NELAP	PA	12/12/2005
EPA 8260	1,1-Dichloroethane	NELAP	PA	12/12/2005
EPA 8260	1,1-Dichloroethene (1,1-Dichloroethylene)	NELAP	PA	12/12/2005
EPA 8260	1,1-Dichloropropene	NELAP	PA	12/12/2005
EPA 8260	1,2,3-Trichlorobenzene	NELAP	PA	12/12/2005
EPA 8260	1,2,3-Trichloropropane (1,2,3-TCP)	NELAP	PA	12/12/2005
EPA 8260	1,2,4-Trichlorobenzene	NELAP	PA	12/12/2005
EPA 8260	1,2,4-Trimethylbenzene	NELAP	PA	12/12/2005
EPA 8260	1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane)	NELAP	PA	5/2/2006
EPA 8260	1,2-Dibromoethane (EDB, Ethylene dibromide)	NELAP	PA	12/12/2005
EPA 8260	1,2-Dichlorobenzene (o-Dichlorobenzene)	NELAP	PA	12/12/2005
EPA 8260	1,2-Dichloroethane	NELAP	PA	12/12/2005
EPA 8260	1,2-Dichloropropane	NELAP	PA	12/12/2005
EPA 8260	1,3,5-Trimethylbenzene	NELAP	PA	12/12/2005
EPA 8260	1,3-Dichlorobenzene (m-Dichlorobenzene)	NELAP	PA	12/12/2005
EPA 8260	1,3-Dichloropropane	NELAP	PA	12/12/2005
EPA 8260	1,4-Dichlorobenzene (p-Dichlorobenzene)	NELAP	PA	12/12/2005
EPA 8260	1,4-Dioxane (1,4-Diethyleneoxide)	NELAP	PA	12/12/2005
EPA 8260	2,2-Dichloropropane	NELAP	PA	5/2/2006
EPA 8260	2-Butanone (Methyl ethyl ketone, MEK)	NELAP	PA	5/2/2006

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8260	2-Chloroethyl vinyl ether	NELAP	PA	12/12/2005
EPA 8260	2-Chlorotoluene	NELAP	PA	12/12/2005
EPA 8260	2-Hexanone	NELAP	PA	12/12/2005
EPA 8260	2-Nitropropane	NELAP	PA	1/19/2011
EPA 8260	2-Propanol (Isopropyl alcohol)	NELAP	PA	1/18/2011
EPA 8260	4-Chlorotoluene	NELAP	PA	12/12/2005
EPA 8260	4-Methyl-2-pentanone (MIBK)	NELAP	PA	12/12/2005
EPA 8260	Acetone	NELAP	PA	12/12/2005
EPA 8260	Acetonitrile	NELAP	PA	12/12/2005
EPA 8260	Acrolein (Propenal)	NELAP	PA	12/12/2005
EPA 8260	Acrylonitrile	NELAP	PA	12/12/2005
EPA 8260	Allyl chloride (3-Chloropropene)	NELAP	PA	12/12/2005
EPA 8260	Benzene	NELAP	PA	12/12/2005
EPA 8260	Benzyl chloride	NELAP	PA	7/3/2007
EPA 8260	Bromobenzene	NELAP	PA	12/12/2005
EPA 8260	Bromochloromethane	NELAP	PA	12/12/2005
EPA 8260	Bromodichloromethane	NELAP	PA	12/12/2005
EPA 8260	Bromoform	NELAP	PA	12/12/2005
EPA 8260	Carbon disulfide	NELAP	PA	12/12/2005
EPA 8260	Carbon tetrachloride	NELAP	PA	12/12/2005
EPA 8260	Chlorobenzene	NELAP	PA	12/12/2005
EPA 8260	Chloroethane	NELAP	PA	12/12/2005
EPA 8260	Chloroform	NELAP	PA	12/12/2005
EPA 8260	Chloroprene (2-Chloro-1,3-butadiene)	NELAP	PA	7/3/2007
EPA 8260	Dibromochloromethane	NELAP	PA	12/12/2005
EPA 8260	Dibromochloropropane (1,2-Dibromo-3-chloropropane, DBCP)	NELAP	PA	12/12/2005
EPA 8260	Dibromomethane	NELAP	PA	5/2/2006
EPA 8260	Dichlorodifluoromethane (Freon 12)	NELAP	PA	12/12/2005
EPA 8260	Diethyl ether (Ethyl ether)	NELAP	PA	2/1/2011
EPA 8260	Epichlorohydrin (1-Chloro-2,3-epoxypropane)	NELAP	PA	4/17/2009
EPA 8260	Ethylbenzene	NELAP	PA	12/12/2005
EPA 8260	Hexachlorobutadiene (1,3-Hexachlorobutadiene)	NELAP	PA	12/12/2005
EPA 8260	Isobutyl alcohol (2-Methyl-1-propanol)	NELAP	PA	7/3/2007
EPA 8260	Isopropylbenzene (Cumene)	NELAP	PA	5/2/2006
EPA 8260	Methacrylonitrile	NELAP	PA	7/3/2007
EPA 8260	Methyl bromide (Bromomethane)	NELAP	PA	12/12/2005

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8260	Methyl chloride (Chloromethane)	NELAP	PA	12/12/2005
EPA 8260	Methyl tert-butyl ether (MTBE)	NELAP	PA	12/12/2005
EPA 8260	Methylene chloride (Dichloromethane)	NELAP	PA	12/12/2005
EPA 8260	Methylmethacrylate	NELAP	PA	5/25/2007
EPA 8260	Naphthalene	NELAP	PA	12/12/2005
EPA 8260	Propionitrile (Ethyl cyanide)	NELAP	PA	12/12/2005
EPA 8260	Styrene	NELAP	PA	12/12/2005
EPA 8260	Tetrachloroethene (PCE, Perchloroethylene)	NELAP	PA	12/12/2005
EPA 8260	Toluene	NELAP	PA	12/12/2005
EPA 8260	Trichloroethene (TCE, Trichloroethylene)	NELAP	PA	12/12/2005
EPA 8260	Trichlorofluoromethane (Freon 11)	NELAP	PA	12/12/2005
EPA 8260	Vinyl acetate	NELAP	PA	12/12/2005
EPA 8260	Vinyl chloride (Chloroethene)	NELAP	PA	12/12/2005
EPA 8260	Xylenes, total	NELAP	PA	12/12/2005
EPA 8260	cis-1,2-Dichloroethene	NELAP	PA	12/12/2005
EPA 8260	cis-1,3-Dichloropropene	NELAP	PA	12/12/2005
EPA 8260	m+p-Xylene	NELAP	PA	4/17/2009
EPA 8260	n-Butyl alcohol (n-Butanol, 1-Butanol)	NELAP	PA	4/17/2009
EPA 8260	n-Butylbenzene	NELAP	PA	12/12/2005
EPA 8260	n-Propylamine	NELAP	PA	12/12/2005
EPA 8260	o-Xylene	NELAP	PA	4/17/2009
EPA 8260	sec-Butylbenzene	NELAP	PA	12/12/2005
EPA 8260	tert-Butyl alcohol (2-Methyl-2-propanol)	NELAP	PA	12/12/2005
EPA 8260	tert-Butylbenzene	NELAP	PA	12/12/2005
EPA 8260	trans-1,2-Dichloroethene	NELAP	PA	12/12/2005
EPA 8260	trans-1,3-Dichloropropene	NELAP	PA	12/12/2005
EPA 8260	trans-1,4-Dichloro-2-butene	NELAP	PA	7/3/2007
EPA 8260 SIM	1,4-Dioxane (1,4-Diethyleneoxide)	NELAP	PA	12/4/2007
EPA 8260-Extended	3,3'-Dimethyl-1-butanol	NELAP	PA	4/17/2009
EPA 8260-Extended	Ethyl tert-butyl ether (ETBE)	NELAP	PA	1/24/2007
EPA 8260-Extended	Gasoline-range organics (GRO)	NELAP	PA	6/8/2006
EPA 8260-Extended	Methyl acetate	NELAP	PA	1/24/2007
EPA 8260-Extended	Methyl iodide (Iodomethane)	NELAP	PA	5/25/2007
EPA 8260-Extended	Methylcyclohexane	NELAP	PA	1/21/2009
EPA 8260-Extended	Tetrahydrofuran (THF)	NELAP	PA	1/18/2011
EPA 8260-Extended	tert-Amyl alcohol (2-Methyl-2-butanol)	NELAP	PA	4/17/2009

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized accrediting authority. Customers are urged to verify the laboratory's current accreditation standing.
www.dep.state.pa.us **Issue Date: 05/25/2011**

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8260-Extended	tert-Amyl methyl ether (TAME)	NELAP	PA	1/24/2007
EPA 8260-Extended	tert-Butyl formate	NELAP	PA	4/17/2009
EPA 8260B	4-Isopropyltoluene (p-Isopropyltoluene)	NELAP	PA	1/24/2007
EPA 8260B	Ethanol	NELAP	PA	1/24/2007
EPA 8260B	Ethyl acetate	NELAP	PA	1/24/2007
EPA 8260B	Ethyl methacrylate	NELAP	PA	1/24/2007
EPA 8260B	Isobutyl alcohol (2-Methyl-1-propanol)	NELAP	PA	1/24/2007
EPA 8260B	Pentachloroethane	NELAP	PA	1/24/2007
EPA 8260B	n-Propylbenzene	NELAP	PA	1/24/2007
EPA 8260B-Extended	Cyclohexane	NELAP	PA	7/3/2007
EPA 8260B-Extended	Diisopropyl ether (DIPE)	NELAP	PA	7/3/2007
EPA 8270	1,2,4,5-Tetrachlorobenzene	NELAP	PA	12/12/2005
EPA 8270	1,2,4-Trichlorobenzene	NELAP	PA	12/12/2005
EPA 8270	1,2-Dichlorobenzene (o-Dichlorobenzene)	NELAP	PA	12/12/2005
EPA 8270	1,2-Diphenylhydrazine	NELAP	PA	12/12/2005
EPA 8270	1,3,5-Trinitrobenzene (1,3,5-TNB)	NELAP	PA	12/12/2005
EPA 8270	1,3-Dichlorobenzene (m-Dichlorobenzene)	NELAP	PA	12/12/2005
EPA 8270	1,3-Dinitrobenzene (1,3-DNB)	NELAP	PA	12/12/2005
EPA 8270	1,4-Dichlorobenzene (p-Dichlorobenzene)	NELAP	PA	12/12/2005
EPA 8270	1,4-Dinitrobenzene (1,4-DNB)	NELAP	PA	4/17/2009
EPA 8270	1,4-Naphthoquinone	NELAP	PA	12/12/2005
EPA 8270	1,4-Phenylenediamine	NELAP	PA	12/12/2005
EPA 8270	1-Chloronaphthalene	NELAP	PA	12/12/2005
EPA 8270	1-Naphthylamine (alpha-Naphthylamine)	NELAP	PA	12/12/2005
EPA 8270	2,3,4,6-Tetrachlorophenol	NELAP	PA	12/12/2005
EPA 8270	2,4,5-Trichlorophenol	NELAP	PA	12/12/2005
EPA 8270	2,4,6-Trichlorophenol	NELAP	PA	12/12/2005
EPA 8270	2,4-Dichlorophenol	NELAP	PA	12/12/2005
EPA 8270	2,4-Dimethylphenol	NELAP	PA	12/12/2005
EPA 8270	2,4-Dinitrophenol	NELAP	PA	12/12/2005
EPA 8270	2,4-Dinitrotoluene (2,4-DNT)	NELAP	PA	12/12/2005
EPA 8270	2,6-Dichlorophenol	NELAP	PA	12/12/2005
EPA 8270	2,6-Dinitrotoluene (2,6-DNT)	NELAP	PA	12/12/2005
EPA 8270	2-Acetylaminofluorene	NELAP	PA	12/12/2005
EPA 8270	2-Chloronaphthalene	NELAP	PA	12/12/2005
EPA 8270	2-Chlorophenol	NELAP	PA	12/12/2005

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270	2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	NELAP	PA	12/12/2005
EPA 8270	2-Methylnaphthalene	NELAP	PA	12/12/2005
EPA 8270	2-Methylphenol (o-Cresol)	NELAP	PA	12/12/2005
EPA 8270	2-Naphthylamine (beta-Naphthylamine)	NELAP	PA	12/12/2005
EPA 8270	2-Nitroaniline	NELAP	PA	12/12/2005
EPA 8270	2-Nitrophenol	NELAP	PA	12/12/2005
EPA 8270	2-Picoline (2-Methylpyridine)	NELAP	PA	5/2/2006
EPA 8270	3,3'-Dichlorobenzidine	NELAP	PA	12/12/2005
EPA 8270	3,3'-Dimethylbenzidine	NELAP	PA	7/3/2007
EPA 8270	3-Methylcholanthrene	NELAP	PA	12/12/2005
EPA 8270	3-Methylphenol (m-Cresol)	NELAP	PA	5/2/2006
EPA 8270	3-Nitroaniline	NELAP	PA	12/12/2005
EPA 8270	4,4'-Methylenebis(2-chloroaniline)	NELAP	PA	12/12/2005
EPA 8270	4-Aminobiphenyl	NELAP	PA	12/12/2005
EPA 8270	4-Bromophenyl phenyl ether	NELAP	PA	12/12/2005
EPA 8270	4-Chloro-3-methylphenol	NELAP	PA	12/12/2005
EPA 8270	4-Chloroaniline	NELAP	PA	12/12/2005
EPA 8270	4-Chlorophenyl phenyl ether	NELAP	PA	12/12/2005
EPA 8270	4-Methylphenol (p-Cresol)	NELAP	PA	12/12/2005
EPA 8270	4-Nitroaniline	NELAP	PA	12/12/2005
EPA 8270	4-Nitrophenol	NELAP	PA	12/12/2005
EPA 8270	5-Nitro-o-toluidine	NELAP	PA	12/12/2005
EPA 8270	7,12-Dimethylbenz(a)anthracene	NELAP	PA	12/12/2005
EPA 8270	Acenaphthene	NELAP	PA	12/12/2005
EPA 8270	Acenaphthylene	NELAP	PA	12/12/2005
EPA 8270	Acetophenone	NELAP	PA	12/12/2005
EPA 8270	Aniline	NELAP	PA	12/12/2005
EPA 8270	Anthracene	NELAP	PA	12/12/2005
EPA 8270	Aramite	NELAP	PA	12/12/2005
EPA 8270	Benzidine	NELAP	PA	12/12/2005
EPA 8270	Benzo[a]anthracene	NELAP	PA	12/12/2005
EPA 8270	Benzo[a]pyrene	NELAP	PA	12/12/2005
EPA 8270	Benzo[b]fluoranthene	NELAP	PA	12/12/2005
EPA 8270	Benzo[ghi]perylene	NELAP	PA	12/12/2005
EPA 8270	Benzo[k]fluoranthene	NELAP	PA	12/12/2005
EPA 8270	*Benzoic acid*	NELAP	PA	12/12/2005

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized accrediting authority. Customers are urged to verify the laboratory's current accreditation standing.

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270	Benzyl alcohol	NELAP	PA	12/12/2005
EPA 8270	Butyl benzyl phthalate (Benzyl butyl phthalate)	NELAP	PA	12/12/2005
EPA 8270	Chlorobenzilate	NELAP	PA	12/12/2005
EPA 8270	Chrysene (Benzo[a]phenanthrene)	NELAP	PA	12/12/2005
EPA 8270	Di-n-butyl phthalate	NELAP	PA	12/12/2005
EPA 8270	Di-n-octyl phthalate	NELAP	PA	12/12/2005
EPA 8270	Diallate (cis or trans)	NELAP	PA	12/12/2005
EPA 8270	Dibenz[a,j]acridine	NELAP	PA	12/12/2005
EPA 8270	Dibenzo[a,h]anthracene	NELAP	PA	12/12/2005
EPA 8270	Dibenzofuran	NELAP	PA	12/12/2005
EPA 8270	Diethyl phthalate	NELAP	PA	12/12/2005
EPA 8270	Dimethoate	NELAP	PA	12/12/2005
EPA 8270	Dimethyl phthalate	NELAP	PA	12/12/2005
EPA 8270	Dimethylaminoazobenzene (4-Dimethylaminoazobenzene)	NELAP	PA	5/2/2006
EPA 8270	Dinoseb (2-sec-Butyl-4,6-dinitrophenol, DNBP)	NELAP	PA	12/12/2005
EPA 8270	Diphenylamine	NELAP	PA	12/12/2005
EPA 8270	Disulfoton	NELAP	PA	12/12/2005
EPA 8270	Ethyl methanesulfonate	NELAP	PA	12/12/2005
EPA 8270	Famphur	NELAP	PA	12/12/2005
EPA 8270	Fluoranthene	NELAP	PA	12/12/2005
EPA 8270	Fluorene	NELAP	PA	12/12/2005
EPA 8270	Hexachlorobenzene	NELAP	PA	12/12/2005
EPA 8270	Hexachlorobutadiene (1,3-Hexachlorobutadiene)	NELAP	PA	12/12/2005
EPA 8270	Hexachlorocyclopentadiene	NELAP	PA	12/12/2005
EPA 8270	Hexachloroethane	NELAP	PA	12/12/2005
EPA 8270	Hexachloropropene	NELAP	PA	12/12/2005
EPA 8270	Indeno(1,2,3-cd)pyrene	NELAP	PA	12/12/2005
EPA 8270	Isodrin	NELAP	PA	12/12/2005
EPA 8270	Isophorone	NELAP	PA	12/12/2005
EPA 8270	Isosafrole	NELAP	PA	12/12/2005
EPA 8270	Kepone	NELAP	PA	12/12/2005
EPA 8270	Methapyrilene	NELAP	PA	12/12/2005
EPA 8270	Methyl methanesulfonate	NELAP	PA	12/12/2005
EPA 8270	Methyl parathion (Parathion, methyl)	NELAP	PA	5/25/2007
EPA 8270	N-Nitrosodi-n-butylamine	NELAP	PA	12/12/2005
EPA 8270	N-Nitrosodi-n-propylamine	NELAP	PA	12/12/2005

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270	N-Nitrosodiethylamine	NELAP	PA	12/12/2005
EPA 8270	N-Nitrosodimethylamine	NELAP	PA	12/12/2005
EPA 8270	N-Nitrosodiphenylamine	NELAP	PA	12/12/2005
EPA 8270	N-Nitrosomethylethylamine	NELAP	PA	12/12/2005
EPA 8270	N-Nitrosomorpholine	NELAP	PA	12/12/2005
EPA 8270	N-Nitrosopiperidine	NELAP	PA	12/12/2005
EPA 8270	N-Nitrosopyrrolidine	NELAP	PA	12/12/2005
EPA 8270	Naphthalene	NELAP	PA	12/12/2005
EPA 8270	Nitrobenzene	NELAP	PA	12/12/2005
EPA 8270	Nitroquinoline-1-oxide	NELAP	PA	7/3/2007
EPA 8270	O,O,O-Triethyl phosphorothioate	NELAP	PA	12/12/2005
EPA 8270	Parathion, ethyl (Ethyl parathion, Parathion)	NELAP	PA	5/25/2007
EPA 8270	Pentachlorobenzene	NELAP	PA	12/12/2005
EPA 8270	Pentachloronitrobenzene (PCNB)	NELAP	PA	12/12/2005
EPA 8270	Pentachlorophenol (PCP)	NELAP	PA	12/12/2005
EPA 8270	Phenacetin	NELAP	PA	12/12/2005
EPA 8270	Phenanthrene	NELAP	PA	12/12/2005
EPA 8270	Phenol	NELAP	PA	12/12/2005
EPA 8270	Phorate (Thimet)	NELAP	PA	12/12/2005
EPA 8270	Phthalic anhydride	NELAP	PA	1/21/2009
EPA 8270	Pronamide (Kerb)	NELAP	PA	12/12/2005
EPA 8270	Pyrene	NELAP	PA	12/12/2005
EPA 8270	Pyridine	NELAP	PA	12/12/2005
EPA 8270	Safrole	NELAP	PA	12/12/2005
EPA 8270	Tetraethyl dithiopyrophosphate	NELAP	PA	4/17/2009
EPA 8270	Thionazine (Thionazin, Zinophos)	NELAP	PA	12/12/2005
EPA 8270	a,a-Dimethylphenethylamine (Phentermine)	NELAP	PA	12/12/2005
EPA 8270	bis(2-Chloroethoxy)methane	NELAP	PA	12/12/2005
EPA 8270	bis(2-Chloroethyl) ether	NELAP	PA	12/12/2005
EPA 8270	bis(2-Chloroisopropyl) ether	NELAP	PA	12/12/2005
EPA 8270	bis(2-Ethylhexyl) phthalate (DEHP)	NELAP	PA	12/12/2005
EPA 8270	o-Toluidine (2-Toluidine, 2-Methylaniline)	NELAP	PA	12/12/2005
EPA 8270	tris-(2,3-Dibromopropyl) phosphate (tris-BP)	NELAP	PA	4/17/2009
EPA 8270 SIM	Acenaphthene	NELAP	PA	12/4/2007
EPA 8270 SIM	Acenaphthylene	NELAP	PA	12/4/2007
EPA 8270 SIM	Anthracene	NELAP	PA	12/4/2007

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270 SIM	Benzo[a]anthracene	NELAP	PA	12/4/2007
EPA 8270 SIM	Benzo[a]pyrene	NELAP	PA	12/4/2007
EPA 8270 SIM	Benzo[b]fluoranthene	NELAP	PA	12/4/2007
EPA 8270 SIM	Benzo[ghi]perylene	NELAP	PA	12/4/2007
EPA 8270 SIM	Benzo[k]fluoranthene	NELAP	PA	12/4/2007
EPA 8270 SIM	Chrysene (Benzo[a]phenanthrene)	NELAP	PA	12/4/2007
EPA 8270 SIM	Dibenzo[a,h]anthracene	NELAP	PA	12/4/2007
EPA 8270 SIM	Fluoranthene	NELAP	PA	12/4/2007
EPA 8270 SIM	Fluorene	NELAP	PA	12/4/2007
EPA 8270 SIM	Indeno(1,2,3-cd)pyrene	NELAP	PA	12/4/2007
EPA 8270 SIM	Naphthalene	NELAP	PA	12/4/2007
EPA 8270 SIM	Phenanthrene	NELAP	PA	12/4/2007
EPA 8270 SIM	Pyrene	NELAP	PA	12/4/2007
EPA 8270-Extended	1,1'-Biphenyl (Biphenyl, Lemonene)	NELAP	PA	4/17/2009
EPA 8270-Extended	1,2,3,4-Tetrachlorobenzene	NELAP	PA	7/3/2007
EPA 8270-Extended	1,2,3,4-Tetrahydronaphthalene	NELAP	PA	4/17/2009
EPA 8270-Extended	1,2,3,5-Tetrachlorobenzene	NELAP	PA	7/3/2007
EPA 8270-Extended	1,4-Dioxane (1,4-Diethyleneoxide)	NELAP	PA	4/17/2009
EPA 8270-Extended	1-Methylnaphthalene	NELAP	PA	4/17/2009
EPA 8270-Extended	2,2'-Oxybis(1-chloropropane) (bis(2-Chloro-1-methylethyl) ether)	NELAP	PA	1/19/2011
EPA 8270-Extended	6-Methylchrysene	NELAP	PA	1/19/2011
EPA 8270-Extended	Atrazine	NELAP	PA	1/22/2007
EPA 8270-Extended	Benzaldehyde	NELAP	PA	4/17/2009
EPA 8270-Extended	Benzenethiol	NELAP	PA	4/17/2009
EPA 8270-Extended	Caprolactam	NELAP	PA	4/17/2009
EPA 8270-Extended	Carbazole	NELAP	PA	12/12/2005
EPA 8270-Extended	Dibenz[a,h]acridine	NELAP	PA	4/17/2009
EPA 8270-Extended	Indene	NELAP	PA	4/17/2009
EPA 8270-Extended	N,N-Dimethylacetamide	NELAP	PA	4/17/2009
EPA 8270-Extended	N,N-Dimethylformamide	NELAP	PA	4/17/2009
EPA 8270-Extended	Quinoline	NELAP	PA	4/17/2009
EPA 8270-Extended	a-Methylstyrene	NELAP	PA	4/17/2009
EPA 8270-Extended	bis(2-Chloromethyl) ether	NELAP	PA	1/21/2009
EPA 8270-Extended	p-(Dimethylamino)azobenzene	NELAP	PA	4/17/2009
EPA 8290	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	NELAP	PA	6/30/2010
EPA 8290	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	NELAP	PA	6/30/2010

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized accrediting authority. Customers are urged to verify the laboratory's current accreditation standing.
www.dep.state.pa.us **Issue Date: 05/25/2011**

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8290	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)	NELAP	PA	6/30/2010
EPA 8290	1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	NELAP	PA	6/30/2010
EPA 8290	1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)	NELAP	PA	6/30/2010
EPA 8290	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	NELAP	PA	6/30/2010
EPA 8290	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	NELAP	PA	8/6/2010
EPA 8290	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	NELAP	PA	6/30/2010
EPA 8290	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	NELAP	PA	6/30/2010
EPA 8290	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	NELAP	PA	6/30/2010
EPA 8290	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	NELAP	PA	6/30/2010
EPA 8290	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	NELAP	PA	6/30/2010
EPA 8290	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	NELAP	PA	6/30/2010
EPA 8290	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	NELAP	PA	6/30/2010
EPA 8290	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	NELAP	PA	8/6/2010
EPA 8290	2,3,7,8-TCDD (Dioxin)	NELAP	PA	6/30/2010
EPA 8290	2,3,7,8-Tetrachlorodibenzofuran (TCDF)	NELAP	PA	6/30/2010
EPA 8290	Total TCDD	NELAP	PA	6/30/2010
EPA 8290	Total TCDF	NELAP	PA	6/30/2010
EPA 8290	Total heptachlorodibenzo-p-dioxin (HpCDD)	NELAP	PA	6/30/2010
EPA 8290	Total heptachlorodibenzofuran (HpCDF)	NELAP	PA	6/30/2010
EPA 8290	Total hexachlorodibenzo-p-dioxin (HxCDD)	NELAP	PA	6/30/2010
EPA 8290	Total hexachlorodibenzofuran (HxCDF)	NELAP	PA	6/30/2010
EPA 8290	Total pentachlorodibenzo-p-dioxin (PeCDD)	NELAP	PA	6/30/2010
EPA 8290	Total pentachlorodibenzofuran (PeCDF)	NELAP	PA	6/30/2010
EPA 8310	Acenaphthene	NELAP	PA	1/2/2007
EPA 8310	Acenaphthylene	NELAP	PA	1/2/2007
EPA 8310	Anthracene	NELAP	PA	1/2/2007
EPA 8310	Benzo[a]anthracene	NELAP	PA	1/2/2007
EPA 8310	Benzo[a]pyrene	NELAP	PA	1/2/2007
EPA 8310	Benzo[b]fluoranthene	NELAP	PA	1/2/2007
EPA 8310	Benzo[ghi]perylene	NELAP	PA	1/2/2007
EPA 8310	Benzo[k]fluoranthene	NELAP	PA	1/2/2007
EPA 8310	Chrysene (Benzo[a]phenanthrene)	NELAP	PA	1/2/2007
EPA 8310	Dibenzo[a,h]anthracene	NELAP	PA	1/2/2007
EPA 8310	Fluoranthene	NELAP	PA	1/2/2007
EPA 8310	Fluorene	NELAP	PA	1/2/2007

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8310	Indeno(1,2,3-cd)pyrene	NELAP	PA	1/2/2007
EPA 8310	Naphthalene	NELAP	PA	1/2/2007
EPA 8310	Phenanthrene	NELAP	PA	1/2/2007
EPA 8310	Pyrene	NELAP	PA	1/2/2007
EPA 8315	1,2-Tolualdehyde (o-Tolualdehyde)	NELAP	PA	1/24/2007
EPA 8315	1,3-Tolualdehyde (m-Tolualdehyde)	NELAP	PA	5/2/2006
EPA 8315	1,4-Tolualdehyde (p-Tolualdehyde)	NELAP	PA	1/24/2007
EPA 8315	2,5-Dimethylbenzaldehyde	NELAP	PA	12/12/2005
EPA 8315	Acetaldehyde	NELAP	PA	12/12/2005
EPA 8315	Acrolein (Propenal)	NELAP	PA	12/12/2005
EPA 8315	Benzaldehyde	NELAP	PA	12/12/2005
EPA 8315	Butanal (Butyraldehyde)	NELAP	PA	5/2/2006
EPA 8315	Crotonaldehyde	NELAP	PA	12/12/2005
EPA 8315	Formaldehyde	NELAP	PA	12/12/2005
EPA 8315	Hexanal (Hexaldehyde)	NELAP	PA	1/21/2009
EPA 8315	Isovaleraldehyde	NELAP	PA	12/12/2005
EPA 8315	Pentanal (Valeraldehyde)	NELAP	PA	12/12/2005
EPA 8315	Propanal (Propionaldehyde)	NELAP	PA	1/21/2009
EPA 8330	1,3,5-Trinitrobenzene (1,3,5-TNB)	NELAP	PA	12/12/2005
EPA 8330	1,3-Dinitrobenzene (1,3-DNB)	NELAP	PA	12/12/2005
EPA 8330	2,4,6-Trinitrotoluene (2,4,6-TNT)	NELAP	PA	12/12/2005
EPA 8330	2,4-Dinitrotoluene (2,4-DNT)	NELAP	PA	6/11/2007
EPA 8330	2,6-Dinitrotoluene (2,6-DNT)	NELAP	PA	6/11/2007
EPA 8330	2-Amino-4,6-dinitrotoluene (2-Am-DNT)	NELAP	PA	12/12/2005
EPA 8330	2-Nitrotoluene	NELAP	PA	12/12/2005
EPA 8330	3-Nitrotoluene	NELAP	PA	12/12/2005
EPA 8330	4-Amino-2,6-dinitrotoluene (4-Am-DNT)	NELAP	PA	12/12/2005
EPA 8330	4-Nitrotoluene	NELAP	PA	12/12/2005
EPA 8330	Nitrobenzene	NELAP	PA	6/11/2007
EPA 8330	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	NELAP	PA	12/12/2005
EPA 8330	RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine)	NELAP	PA	12/12/2005
EPA 8330	Tetryl (2,4,6-Trinitrophenylmethylnitramine)	NELAP	PA	12/12/2005
EPA 8330-Extended	Nitroglycerin	NELAP	PA	1/24/2007
EPA 8330-Extended	Pentaerythritol tetranitrate (PETN)	NELAP	PA	5/2/2006
EPA 8332	Nitroglycerin	NELAP	PA	12/12/2005
EPA 9012	Total cyanide	NELAP	PA	12/12/2005

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized accrediting authority. Customers are urged to verify the laboratory's current accreditation standing.

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 9040	pH	NELAP	PA	12/12/2005
EPA 9045	Corrosivity (pH)	NELAP	PA	4/17/2009
EPA 9050	Conductivity	NELAP	PA	12/12/2005
EPA 9056	Bromide	NELAP	PA	12/12/2005
EPA 9056	Chloride	NELAP	PA	12/12/2005
EPA 9056	Fluoride	NELAP	PA	12/12/2005
EPA 9056	Nitrate	NELAP	PA	12/12/2005
EPA 9056	Nitrite	NELAP	PA	1/19/2005
EPA 9056	Orthophosphate as P	NELAP	PA	11/23/2010
EPA 9056	Sulfate	NELAP	PA	12/12/2005
EPA 9060	Total organic carbon (TOC)	NELAP	PA	12/12/2005
EPA 9066	Total phenolics	NELAP	PA	12/12/2005
EPA 9095A	Paint filter liquids test	NELAP	PA	1/24/2007
FL-PRO	Total petroleum hydrocarbons (TPH)	NELAP	PA	12/12/2005
MA DEP EPH	Diesel-range organics (DRO)	NELAP	PA	12/12/2005
MA DEP VPH	Gasoline-range organics (GRO)	NELAP	PA	12/12/2005
NWTPH-Dx	Diesel-range organics (DRO)	NELAP	PA	12/12/2005
NWTPH-Gx	Gasoline-range organics (GRO)	NELAP	PA	12/12/2005
NWTPH-HCID	GRO/DRO/HRO Screen	NELAP	PA	10/16/2008
OA-1	Gasoline-range organics (GRO)	NELAP	PA	12/12/2005
OA-2	Diesel-range organics (DRO)	NELAP	PA	12/12/2005
RSK-175	Ethane	NELAP	PA	6/29/2010
RSK-175	Ethene	NELAP	PA	6/29/2010
RSK-175	Methane	NELAP	PA	6/29/2010
RSK-175	Propane	NELAP	PA	6/29/2010
SM 2120 B	Color	NELAP	PA	4/17/2007
SM 2310 B	Acidity as CaCO3	NELAP	PA	4/17/2007
SM 2320 B	Alkalinity as CaCO3	NELAP	PA	1/19/2005
SM 2340 B	Total hardness as CaCO3	NELAP	PA	1/24/2007
SM 2340 C	Total hardness as CaCO3	NELAP	PA	4/17/2007
SM 2510 B	Conductivity	NELAP	PA	12/12/2005
SM 2540 B	Residue, total	NELAP	PA	4/17/2007
SM 2540 C	Residue, filterable (TDS)	NELAP	PA	4/17/2007
SM 2540 D	Residue, nonfilterable (TSS)	NELAP	PA	4/17/2007
SM 2540 F	Residue, settleable	NELAP	PA	4/17/2007
SM 3500-Cr B (20th ed.)	Chromium VI	NELAP	PA	5/24/2007

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized accrediting authority. Customers are urged to verify the laboratory's current accreditation standing.

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
SM 3500-Fe B (20th ed.)	Ferrous iron	NELAP	PA	6/15/2009
SM 4500-CN- C	Cyanide	NELAP	PA	12/12/2005
SM 4500-CN- E	Cyanide	NELAP	PA	12/12/2005
SM 4500-CN- G	Amenable cyanide	NELAP	PA	5/24/2007
SM 4500-CO2 D	Free carbon dioxide	NELAP	PA	6/29/2010
SM 4500-Cl F	Total residual chlorine	NELAP	PA	4/17/2007
SM 4500-Cl- C	Chloride	NELAP	PA	4/17/2007
SM 4500-F- B	Preliminary distillation of fluoride	NELAP	PA	4/28/2010
SM 4500-F- C	Fluoride	NELAP	PA	1/19/2005
SM 4500-H+ B	pH	NELAP	PA	4/17/2007
SM 4500-NH3 B	Ammonia distillation	NELAP	PA	4/17/2007
SM 4500-NH3 C	Ammonia as N	NELAP	PA	4/17/2007
SM 4500-NH3 D	Ammonia as N	NELAP	PA	4/17/2007
SM 4500-O G	Oxygen (dissolved)	NELAP	PA	4/17/2007
SM 4500-P B	Phosphorus, total	NELAP	PA	4/28/2010
SM 4500-P E	Orthophosphate as P	NELAP	PA	12/12/2005
SM 4500-P F	Phosphorus, total	NELAP	PA	4/28/2010
SM 4500-S D	Sulfide	NELAP	PA	4/17/2007
SM 4500-S F	Sulfide	NELAP	PA	4/17/2007
SM 4500-SO3 B	Sulfite, SO3	NELAP	PA	4/17/2007
SM 4500-SiO2 C (20th ed.)	Silica, as SiO2	NELAP	PA	5/25/2007
SM 4500-SiO2 C (20th ed.)	Silica, dissolved	NELAP	PA	5/24/2007
SM 5210 B	Biochemical oxygen demand (BOD)	NELAP	PA	4/4/2005
SM 5210 B	Carbonaceous BOD (CBOD)	NELAP	PA	1/19/2005
SM 5310 B	Total organic carbon (TOC)	NELAP	PA	4/17/2007
SM 5310 C	Total organic carbon (TOC)	NELAP	PA	5/24/2007
SM 5540 C	Surfactants as MBAS	NELAP	PA	4/17/2007
SM 9222 D	Fecal coliforms	NELAP	PA	7/6/2007
TX1005 (TNRCC)	Total petroleum hydrocarbons (TPH)	NELAP	PA	12/12/2005
TX1006 (TNRCC)	Total petroleum hydrocarbons (TPH)	NELAP	PA	12/12/2005
WA-EPH	Diesel-range organics (DRO)	NELAP	PA	12/12/2005
WA-VPH	Gasoline-range organics (GRO)	NELAP	PA	12/12/2005
WI-DRO	Diesel-range organics (DRO)	NELAP	PA	12/12/2005
WI-GRO	Gasoline-range organics (GRO)	NELAP	PA	12/12/2005

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized accrediting authority. Customers are urged to verify the laboratory's current accreditation standing.
www.dep.state.pa.us **Issue Date: 05/25/2011**

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
AK-101	Gasoline-range organics (GRO)	NELAP	PA	12/12/2005
AK-102	Diesel-range organics (DRO)	NELAP	PA	12/12/2005
AK-103	Diesel-range organics (DRO)	NELAP	PA	12/12/2005
EPA 1010	Ignitability	NELAP	PA	1/19/2005
EPA 1311	Toxicity characteristic leaching procedure (TCLP)	NELAP	PA	12/12/2005
EPA 1312	Synthetic precipitation leaching procedure (SPLP)	NELAP	PA	12/12/2005
EPA 3005A	Preconcentration under acid	NELAP	PA	4/4/2005
EPA 3010A	Hot plate acid digestion (HNO3 + HCl)	NELAP	PA	4/4/2005
EPA 3020A	Hot plate acid digestion (HNO3 only)	NELAP	PA	4/4/2005
EPA 3050B	Acid digestion of solids	NELAP	PA	4/4/2005
EPA 3060A	Alkaline digestion of Cr(VI)	NELAP	PA	4/4/2005
EPA 3510C	Separatory funnel liquid-liquid extraction	NELAP	PA	4/4/2005
EPA 3540C	Soxhlet extraction	NELAP	PA	4/4/2005
EPA 3546	Microwave extraction	NELAP	PA	9/25/2009
EPA 3550B	Ultrasonic extraction	NELAP	PA	4/4/2005
EPA 3620B	Florisil cleanup	NELAP	PA	4/4/2005
EPA 3630C	Silica gel cleanup	NELAP	PA	4/4/2005
EPA 3640A	Gel permeation cleanup (GPC)	NELAP	PA	4/4/2005
EPA 3660B	Sulfur cleanup	NELAP	PA	4/4/2005
EPA 3665A	Sulfuric acid/permanganate clean-up	NELAP	PA	4/4/2005
EPA 5030	Bulk purge-and-trap (methanol)	NELAP	PA	12/4/2007
EPA 5035	Closed-system purge-and-trap (bisulfate option)	NELAP	PA	12/12/2005
EPA 5035	Closed-system purge-and-trap (methanol option)	NELAP	PA	4/4/2005
EPA 5035	Closed-system purge-and-trap (unpreserved)	NELAP	PA	4/4/2005
EPA 6010	Aluminum	NELAP	PA	1/19/2005
EPA 6010	Antimony	NELAP	PA	1/19/2005
EPA 6010	Arsenic	NELAP	PA	1/19/2005
EPA 6010	Barium	NELAP	PA	1/19/2005
EPA 6010	Beryllium	NELAP	PA	1/19/2005
EPA 6010	Boron	NELAP	PA	1/19/2005
EPA 6010	Cadmium	NELAP	PA	1/19/2005
EPA 6010	Calcium	NELAP	PA	1/19/2005
EPA 6010	Chromium	NELAP	PA	1/19/2005
EPA 6010	Cobalt	NELAP	PA	1/19/2005
EPA 6010	Copper	NELAP	PA	1/19/2005
EPA 6010	Iron	NELAP	PA	1/19/2005

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 6010	Lead	NELAP	PA	1/19/2005
EPA 6010	Magnesium	NELAP	PA	1/19/2005
EPA 6010	Manganese	NELAP	PA	1/19/2005
EPA 6010	Molybdenum	NELAP	PA	1/19/2005
EPA 6010	Nickel	NELAP	PA	1/19/2005
EPA 6010	Potassium	NELAP	PA	1/19/2005
EPA 6010	Selenium	NELAP	PA	1/19/2005
EPA 6010	Silver	NELAP	PA	1/19/2005
EPA 6010	Sodium	NELAP	PA	1/19/2005
EPA 6010	Strontium	NELAP	PA	1/19/2005
EPA 6010	Thallium	NELAP	PA	1/19/2005
EPA 6010	Tin	NELAP	PA	1/19/2005
EPA 6010	Titanium	NELAP	PA	1/19/2005
EPA 6010	Vanadium	NELAP	PA	1/19/2005
EPA 6010	Zinc	NELAP	PA	1/19/2005
EPA 6020	Aluminum	NELAP	PA	4/29/2010
EPA 6020	Antimony	NELAP	PA	1/19/2005
EPA 6020	Arsenic	NELAP	PA	1/19/2005
EPA 6020	Beryllium	NELAP	PA	1/19/2005
EPA 6020	Cadmium	NELAP	PA	1/19/2005
EPA 6020	Calcium	NELAP	PA	4/29/2010
EPA 6020	Chromium	NELAP	PA	1/19/2005
EPA 6020	Cobalt	NELAP	PA	4/29/2010
EPA 6020	Copper	NELAP	PA	1/19/2005
EPA 6020	Iron	NELAP	PA	4/29/2010
EPA 6020	Lead	NELAP	PA	1/19/2005
EPA 6020	Magnesium	NELAP	PA	4/29/2010
EPA 6020	Manganese	NELAP	PA	4/29/2010
EPA 6020	Nickel	NELAP	PA	4/4/2005
EPA 6020	Potassium	NELAP	PA	4/29/2010
EPA 6020	Selenium	NELAP	PA	4/4/2005
EPA 6020	Silver	NELAP	PA	2/23/2010
EPA 6020	Sodium	NELAP	PA	4/29/2010
EPA 6020	Strontium	NELAP	PA	4/29/2010
EPA 6020	Thallium	NELAP	PA	1/19/2005
EPA 6020	Tin	NELAP	PA	4/29/2010

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized accrediting authority. Customers are urged to verify the laboratory's current accreditation standing.
www.dep.state.pa.us **Issue Date: 05/25/2011**

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 6020	Vanadium	NELAP	PA	1/7/2010
EPA 6020	Zinc	NELAP	PA	2/1/2011
EPA 6020-Extended	Boron	NELAP	PA	4/29/2010
EPA 6020-Extended	Titanium	NELAP	PA	4/29/2010
EPA 6850	Perchlorate	NELAP	PA	1/19/2011
EPA 7.3.3.2	Reactive cyanide	NELAP	PA	12/12/2005
EPA 7.3.4.2	Reactive sulfide	NELAP	PA	12/12/2005
EPA 7196	Chromium VI	NELAP	PA	1/19/2005
EPA 7199	Chromium VI	NELAP	PA	5/2/2006
EPA 7471	Mercury	NELAP	PA	10/17/2007
EPA 8015	Ethanol	NELAP	PA	1/19/2005
EPA 8015	Ethylene glycol	NELAP	PA	12/4/2007
EPA 8015	Isopropyl alcohol (2-Propanol)	NELAP	PA	12/4/2007
EPA 8015	Methanol	NELAP	PA	1/19/2005
EPA 8015	tert-Butyl alcohol (2-Methyl-2-propanol)	NELAP	PA	1/12/2007
EPA 8015B	Diesel-range organics (DRO)	NELAP	PA	4/4/2005
EPA 8015B	Gasoline-range organics (GRO)	NELAP	PA	4/4/2005
EPA 8021	Benzene	NELAP	PA	1/19/2005
EPA 8021	Ethylbenzene	NELAP	PA	1/19/2005
EPA 8021	Isopropylbenzene (Cumene)	NELAP	PA	1/24/2007
EPA 8021	Methyl tert-butyl ether (MTBE)	NELAP	PA	5/2/2006
EPA 8021	Naphthalene	NELAP	PA	12/4/2007
EPA 8021	Toluene	NELAP	PA	1/19/2005
EPA 8021	Xylenes, total	NELAP	PA	1/19/2005
EPA 8021	m-Xylene	NELAP	PA	1/24/2007
EPA 8021	o-Xylene	NELAP	PA	1/24/2007
EPA 8021	p-Xylene	NELAP	PA	1/24/2007
EPA 8081	4,4'-DDD	NELAP	PA	1/19/2005
EPA 8081	4,4'-DDE	NELAP	PA	1/19/2005
EPA 8081	4,4'-DDT	NELAP	PA	1/19/2005
EPA 8081	Aldrin (HHDN)	NELAP	PA	1/19/2005
EPA 8081	Chlordane (tech.)	NELAP	PA	1/19/2005
EPA 8081	Dieldrin	NELAP	PA	1/19/2005
EPA 8081	Endosulfan I	NELAP	PA	1/19/2005
EPA 8081	Endosulfan II	NELAP	PA	1/19/2005
EPA 8081	Endosulfan sulfate	NELAP	PA	1/19/2005

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8081	Endrin	NELAP	PA	1/19/2005
EPA 8081	Endrin aldehyde	NELAP	PA	1/19/2005
EPA 8081	Endrin ketone	NELAP	PA	1/19/2005
EPA 8081	Heptachlor	NELAP	PA	1/19/2005
EPA 8081	Heptachlor epoxide	NELAP	PA	1/19/2005
EPA 8081	Kepone	NELAP	PA	1/19/2005
EPA 8081	Methoxychlor	NELAP	PA	1/19/2005
EPA 8081	Mirex	NELAP	PA	1/19/2005
EPA 8081	Toxaphene (Chlorinated camphene)	NELAP	PA	1/19/2005
EPA 8081	alpha-BHC (alpha-Hexachlorocyclohexane)	NELAP	PA	1/19/2005
EPA 8081	alpha-Chlordane	NELAP	PA	4/4/2005
EPA 8081	beta-BHC (beta-Hexachlorocyclohexane)	NELAP	PA	1/19/2005
EPA 8081	delta-BHC (delta-Hexachlorocyclohexane)	NELAP	PA	1/19/2005
EPA 8081	gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	NELAP	PA	1/19/2005
EPA 8081	gamma-Chlordane	NELAP	PA	4/4/2005
EPA 8082	Aroclor-1016 (PCB-1016)	NELAP	PA	1/2/2007
EPA 8082	Aroclor-1016 (in oil)	NELAP	PA	5/24/2011
EPA 8082	Aroclor-1221 (PCB-1221)	NELAP	PA	1/2/2007
EPA 8082	Aroclor-1221 (in oil)	NELAP	PA	5/24/2011
EPA 8082	Aroclor-1232 (PCB-1232)	NELAP	PA	1/2/2007
EPA 8082	Aroclor-1232 (in oil)	NELAP	PA	5/24/2011
EPA 8082	Aroclor-1242 (PCB-1242)	NELAP	PA	1/2/2007
EPA 8082	Aroclor-1242 (in oil)	NELAP	PA	5/24/2011
EPA 8082	Aroclor-1248 (PCB-1248)	NELAP	PA	1/2/2007
EPA 8082	Aroclor-1248 (in oil)	NELAP	PA	5/24/2011
EPA 8082	Aroclor-1254 (PCB-1254)	NELAP	PA	1/2/2007
EPA 8082	Aroclor-1254 (in oil)	NELAP	PA	5/24/2011
EPA 8082	Aroclor-1260 (PCB-1260)	NELAP	PA	1/2/2007
EPA 8082	Aroclor-1260 (in oil)	NELAP	PA	5/24/2011
EPA 8082-Extended	Aroclor-1262 (PCB-1262)	NELAP	PA	7/23/2008
EPA 8082-Extended	Aroclor-1268 (PCB-1268)	NELAP	PA	7/23/2008
EPA 8141	Atrazine	NELAP	PA	1/19/2005
EPA 8141	Bolstar (Sulprofos)	NELAP	PA	1/19/2005
EPA 8141	Coumaphos	NELAP	PA	1/19/2005
EPA 8141	Demeton-O	NELAP	PA	1/19/2005
EPA 8141	Demeton-S	NELAP	PA	1/19/2005

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized accrediting authority. Customers are urged to verify the laboratory's current accreditation standing.

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 069, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8141	Diazinon (Spectracide)	NELAP	PA	1/19/2005
EPA 8141	Dichloroyos (DDVP, Dichlorvos)	NELAP	PA	1/19/2005
EPA 8141	Disulfoton	NELAP	PA	1/19/2005
EPA 8141	EPN (Santox)	NELAP	PA	1/19/2005
EPA 8141	Ethion	NELAP	PA	1/19/2005
EPA 8141	Ethoprop (Prophos)	NELAP	PA	1/19/2005
EPA 8141	Famphur	NELAP	PA	1/19/2005
EPA 8141	Fensulfothion	NELAP	PA	1/19/2005
EPA 8141	Fenthion	NELAP	PA	4/4/2005
EPA 8141	Malathion	NELAP	PA	1/19/2005
EPA 8141	Merphos	NELAP	PA	1/19/2005
EPA 8141	Methyl parathion (Parathion, methyl)	NELAP	PA	5/25/2005
EPA 8141	Mevinphos	NELAP	PA	1/19/2005
EPA 8141	Naled	NELAP	PA	1/19/2005
EPA 8141	Parathion, ethyl (Ethyl parathion, Parathion)	NELAP	PA	1/19/2005
EPA 8141	Phorate (Thimet)	NELAP	PA	1/19/2005
EPA 8141	Ronnel	NELAP	PA	1/19/2005
EPA 8141	Simazine	NELAP	PA	1/4/2006
EPA 8141	Stirophos (Tetrachlorovinphos)	NELAP	PA	1/19/2005
EPA 8141	Tokuthion (Prothiophos)	NELAP	PA	1/19/2005
EPA 8141	Trichloronate	NELAP	PA	1/19/2005
EPA 8141-Extended	Alachlor (Lasso)	NELAP	PA	1/21/2009
EPA 8141A	Azinphos-methyl (Guthion)	NELAP	PA	4/4/2005
EPA 8141A	Chlorpyrifos	NELAP	PA	4/4/2005
EPA 8151	2,4,5-T	NELAP	PA	1/19/2005
EPA 8151	2,4,5-TP (Silvex)	NELAP	PA	1/19/2005
EPA 8151	2,4-D	NELAP	PA	1/19/2005
EPA 8151	2,4-DB (Butoxon)	NELAP	PA	4/4/2005
EPA 8151	Dalapon (2,2-Dichloropropionic acid)	NELAP	PA	1/19/2005
EPA 8151	Dicamba	NELAP	PA	1/19/2005
EPA 8151	Dichloroprop (Dichlorprop)	NELAP	PA	1/19/2005
EPA 8151	Dinoseb (2-sec-Butyl-4,6-dinitrophenol, DNBP)	NELAP	PA	1/19/2005
EPA 8151	MCPA	NELAP	PA	1/19/2005
EPA 8151	MCPP (Mecoprop)	NELAP	PA	5/2/2006
EPA 8151	Pentachlorophenol (PCP)	NELAP	PA	1/19/2005
EPA 8151	Picloram (4-Amino-3,5,6-trichloro-2-pyridinecarboxylic acid)	NELAP	PA	1/19/2005

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized accrediting authority. Customers are urged to verify the laboratory's current accreditation standing.

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8260	1,1,1,2-Tetrachloroethane	NELAP	PA	1/19/2005
EPA 8260	1,1,1-Trichloroethane	NELAP	PA	1/19/2005
EPA 8260	1,1,2,2-Tetrachloroethane	NELAP	PA	1/19/2005
EPA 8260	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	NELAP	PA	5/2/2006
EPA 8260	1,1,2-Trichloroethane	NELAP	PA	1/19/2005
EPA 8260	1,1-Dichloroethane	NELAP	PA	1/19/2005
EPA 8260	1,1-Dichloroethene (1,1-Dichloroethylene)	NELAP	PA	1/19/2005
EPA 8260	1,1-Dichloropropene	NELAP	PA	1/19/2005
EPA 8260	1,2,3-Trichlorobenzene	NELAP	PA	1/19/2005
EPA 8260	1,2,3-Trichloropropane (1,2,3-TCP)	NELAP	PA	1/19/2005
EPA 8260	1,2,4-Trichlorobenzene	NELAP	PA	1/19/2005
EPA 8260	1,2,4-Trimethylbenzene	NELAP	PA	1/19/2005
EPA 8260	1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane)	NELAP	PA	5/25/2005
EPA 8260	1,2-Dibromoethane (EDB, Ethylene dibromide)	NELAP	PA	1/19/2005
EPA 8260	1,2-Dichlorobenzene (o-Dichlorobenzene)	NELAP	PA	1/19/2005
EPA 8260	1,2-Dichloroethane	NELAP	PA	1/19/2005
EPA 8260	1,2-Dichloropropane	NELAP	PA	1/19/2005
EPA 8260	1,3,5-Trimethylbenzene	NELAP	PA	1/19/2005
EPA 8260	1,3-Dichlorobenzene (m-Dichlorobenzene)	NELAP	PA	1/19/2005
EPA 8260	1,3-Dichloropropane	NELAP	PA	1/19/2005
EPA 8260	1,4-Dichlorobenzene (p-Dichlorobenzene)	NELAP	PA	1/19/2005
EPA 8260	1,4-Dioxane (1,4-Diethyleneoxide)	NELAP	PA	1/19/2005
EPA 8260	2,2-Dichloropropane	NELAP	PA	1/19/2005
EPA 8260	2-Butanone (Methyl ethyl ketone, MEK)	NELAP	PA	1/19/2005
EPA 8260	2-Chloroethyl vinyl ether	NELAP	PA	1/19/2005
EPA 8260	2-Chlorotoluene	NELAP	PA	5/2/2006
EPA 8260	2-Hexanone	NELAP	PA	1/19/2005
EPA 8260	4-Chlorotoluene	NELAP	PA	1/19/2005
EPA 8260	4-Isopropyltoluene (p-Isopropyltoluene)	NELAP	PA	1/24/2007
EPA 8260	4-Methyl-2-pentanone (MIBK)	NELAP	PA	1/19/2005
EPA 8260	Acetone	NELAP	PA	1/19/2005
EPA 8260	Acetonitrile	NELAP	PA	1/4/2006
EPA 8260	Acrolein (Propenal)	NELAP	PA	1/19/2005
EPA 8260	Acrylonitrile	NELAP	PA	1/19/2005
EPA 8260	Allyl chloride (3-Chloropropene)	NELAP	PA	1/19/2005
EPA 8260	Benzene	NELAP	PA	1/19/2005

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8260	Benzyl chloride	NELAP	PA	1/4/2006
EPA 8260	Bromobenzene	NELAP	PA	1/19/2005
EPA 8260	Bromochloromethane	NELAP	PA	1/19/2005
EPA 8260	Bromodichloromethane	NELAP	PA	1/19/2005
EPA 8260	Bromoform	NELAP	PA	1/19/2005
EPA 8260	Carbon disulfide	NELAP	PA	1/19/2005
EPA 8260	Carbon tetrachloride	NELAP	PA	1/19/2005
EPA 8260	Chlorobenzene	NELAP	PA	1/19/2005
EPA 8260	Chloroethane	NELAP	PA	1/19/2005
EPA 8260	Chloroform	NELAP	PA	1/19/2005
EPA 8260	Chloroprene (2-Chloro-1,3-butadiene)	NELAP	PA	4/17/2009
EPA 8260	Cyclohexane	NELAP	PA	6/29/2010
EPA 8260	Dibromochloromethane	NELAP	PA	1/19/2005
EPA 8260	Dibromochloropropane (1,2-Dibromo-3-chloropropane, DBCP)	NELAP	PA	1/19/2005
EPA 8260	Dibromomethane	NELAP	PA	1/19/2005
EPA 8260	Dichlorodifluoromethane (Freon 12)	NELAP	PA	1/19/2005
EPA 8260	Epichlorohydrin (1-Chloro-2,3-epoxypropane)	NELAP	PA	1/4/2006
EPA 8260	Ethanol	NELAP	PA	1/4/2006
EPA 8260	Ethyl acetate	NELAP	PA	1/4/2006
EPA 8260	Ethyl methacrylate	NELAP	PA	1/4/2006
EPA 8260	Ethylbenzene	NELAP	PA	1/19/2005
EPA 8260	Hexachlorobutadiene (1,3-Hexachlorobutadiene)	NELAP	PA	1/19/2005
EPA 8260	Isobutyl alcohol (2-Methyl-1-propanol)	NELAP	PA	1/24/2007
EPA 8260	Isopropyl alcohol (2-Propanol)	NELAP	PA	1/19/2005
EPA 8260	Isopropylbenzene (Cumene)	NELAP	PA	8/7/2005
EPA 8260	Methacrylonitrile	NELAP	PA	1/24/2007
EPA 8260	Methyl bromide (Bromomethane)	NELAP	PA	1/19/2005
EPA 8260	Methyl chloride (Chloromethane)	NELAP	PA	1/19/2005
EPA 8260	Methyl tert-butyl ether (MTBE)	NELAP	PA	1/19/2005
EPA 8260	Methylene chloride (Dichloromethane)	NELAP	PA	1/19/2005
EPA 8260	Methylmethacrylate	NELAP	PA	5/2/2006
EPA 8260	Naphthalene	NELAP	PA	1/19/2005
EPA 8260	Pentachloroethane	NELAP	PA	1/24/2007
EPA 8260	Propionitrile (Ethyl cyanide)	NELAP	PA	1/24/2007
EPA 8260	Styrene	NELAP	PA	1/19/2005
EPA 8260	Tetrachloroethene (PCE, Perchloroethylene)	NELAP	PA	1/19/2005

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized accrediting authority. Customers are urged to verify the laboratory's current accreditation standing.

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8260	Toluene	NELAP	PA	1/19/2005
EPA 8260	Trichloroethene (TCE, Trichloroethylene)	NELAP	PA	1/19/2005
EPA 8260	Trichlorofluoromethane (Freon 11)	NELAP	PA	1/19/2005
EPA 8260	Vinyl acetate	NELAP	PA	1/19/2005
EPA 8260	Vinyl chloride (Chloroethene)	NELAP	PA	1/19/2005
EPA 8260	Xylenes, total	NELAP	PA	1/19/2005
EPA 8260	cis-1,2-Dichloroethene	NELAP	PA	1/19/2005
EPA 8260	cis-1,3-Dichloropropene	NELAP	PA	1/19/2005
EPA 8260	m+p-Xylene	NELAP	PA	1/24/2007
EPA 8260	n-Butyl alcohol (n-Butanol, 1-Butanol)	NELAP	PA	1/19/2005
EPA 8260	n-Butylbenzene	NELAP	PA	1/19/2005
EPA 8260	n-Propylbenzene	NELAP	PA	1/4/2006
EPA 8260	o-Xylene	NELAP	PA	1/24/2007
EPA 8260	sec-Butylbenzene	NELAP	PA	1/19/2005
EPA 8260	tert-Butyl alcohol (2-Methyl-2-propanol)	NELAP	PA	1/19/2005
EPA 8260	tert-Butyl ethyl ether	NELAP	PA	5/25/2007
EPA 8260	tert-Butylbenzene	NELAP	PA	1/19/2005
EPA 8260	trans-1,2-Dichloroethene	NELAP	PA	1/19/2005
EPA 8260	trans-1,3-Dichloropropene	NELAP	PA	1/19/2005
EPA 8260	trans-1,4-Dichloro-2-butene	NELAP	PA	1/24/2007
EPA 8260 SIM	1,4-Dioxane (1,4-Diethyleneoxide)	NELAP	PA	4/17/2009
EPA 8260-Extended	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	NELAP	PA	5/2/2006
EPA 8260-Extended	3,3'-Dimethyl-1-butanol	NELAP	PA	4/17/2009
EPA 8260-Extended	4-Chloro-2-nitrophenol	NELAP	PA	5/2/2006
EPA 8260-Extended	Cyclohexanone	NELAP	PA	7/3/2007
EPA 8260-Extended	Diisopropyl ether (DIPE)	NELAP	PA	7/3/2007
EPA 8260-Extended	Ethyl tert-butyl ether (ETBE)	NELAP	PA	7/3/2007
EPA 8260-Extended	Gasoline-range organics (GRO)	NELAP	PA	6/8/2006
EPA 8260-Extended	Isobutyl alcohol (2-Methyl-1-propanol)	NELAP	PA	7/3/2007
EPA 8260-Extended	Methyl acetate	NELAP	PA	6/29/2010
EPA 8260-Extended	Methyl iodide (Iodomethane)	NELAP	PA	5/2/2006
EPA 8260-Extended	Methylcyclohexane	NELAP	PA	1/21/2009
EPA 8260-Extended	tert-Amyl alcohol (2-Methyl-2-butanol)	NELAP	PA	4/17/2009
EPA 8260-Extended	tert-Amyl methyl ether (TAME)	NELAP	PA	7/3/2007
EPA 8260-Extended	tert-Butyl formate	NELAP	PA	4/17/2009
EPA 8260-Extended	trans-1,4-Dichloro-2-butene	NELAP	PA	7/3/2007

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized accrediting authority. Customers are urged to verify the laboratory's current accreditation standing.
www.dep.state.pa.us **Issue Date: 05/25/2011**

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270	1,2,4,5-Tetrachlorobenzene	NELAP	PA	4/4/2005
EPA 8270	1,2,4-Trichlorobenzene	NELAP	PA	1/19/2005
EPA 8270	1,2-Dichlorobenzene (o-Dichlorobenzene)	NELAP	PA	1/19/2005
EPA 8270	1,2-Dinitrobenzene (1,2-DNB)	NELAP	PA	1/19/2005
EPA 8270	1,2-Diphenylhydrazine	NELAP	PA	5/2/2006
EPA 8270	1,3,5-Trichlorobenzene	NELAP	PA	1/19/2005
EPA 8270	1,3,5-Trinitrobenzene (1,3,5-TNB)	NELAP	PA	1/4/2006
EPA 8270	1,3-Dichlorobenzene (m-Dichlorobenzene)	NELAP	PA	1/19/2005
EPA 8270	1,3-Dinitrobenzene (1,3-DNB)	NELAP	PA	1/19/2005
EPA 8270	1,4-Dichlorobenzene (p-Dichlorobenzene)	NELAP	PA	1/19/2005
EPA 8270	1,4-Dinitrobenzene (1,4-DNB)	NELAP	PA	5/2/2006
EPA 8270	1,4-Naphthoquinone	NELAP	PA	1/19/2005
EPA 8270	1,4-Phenylenediamine	NELAP	PA	1/19/2005
EPA 8270	1-Chloronaphthalene	NELAP	PA	1/4/2006
EPA 8270	1-Naphthylamine (alpha-Naphthylamine)	NELAP	PA	4/4/2005
EPA 8270	2,3,4,6-Tetrachlorophenol	NELAP	PA	1/19/2005
EPA 8270	2,4,5-Trichlorophenol	NELAP	PA	1/19/2005
EPA 8270	2,4,6-Trichlorophenol	NELAP	PA	1/19/2005
EPA 8270	2,4-Dichlorophenol	NELAP	PA	1/19/2005
EPA 8270	2,4-Dimethylphenol	NELAP	PA	1/19/2005
EPA 8270	2,4-Dinitrophenol	NELAP	PA	1/19/2005
EPA 8270	2,4-Dinitrotoluene (2,4-DNT)	NELAP	PA	1/19/2005
EPA 8270	2,6-Dichlorophenol	NELAP	PA	1/19/2005
EPA 8270	2,6-Dinitrotoluene (2,6-DNT)	NELAP	PA	1/19/2005
EPA 8270	2-Acetylaminofluorene	NELAP	PA	1/19/2005
EPA 8270	2-Chloronaphthalene	NELAP	PA	1/19/2005
EPA 8270	2-Chlorophenol	NELAP	PA	1/19/2005
EPA 8270	2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	NELAP	PA	1/19/2005
EPA 8270	2-Methylnaphthalene	NELAP	PA	1/19/2005
EPA 8270	2-Methylphenol (o-Cresol)	NELAP	PA	1/19/2005
EPA 8270	2-Naphthylamine (beta-Naphthylamine)	NELAP	PA	5/17/2005
EPA 8270	2-Nitroaniline	NELAP	PA	4/4/2005
EPA 8270	2-Nitrophenol	NELAP	PA	1/19/2005
EPA 8270	2-Picoline (2-Methylpyridine)	NELAP	PA	1/19/2005
EPA 8270	3,3'-Dichlorobenzidine	NELAP	PA	1/19/2005
EPA 8270	3,3'-Dimethoxybenzidine	NELAP	PA	4/17/2009

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270	3,3'-Dimethylbenzidine	NELAP	PA	1/19/2005
EPA 8270	3-Methylcholanthrene	NELAP	PA	1/19/2005
EPA 8270	3-Methylphenol (m-Cresol)	NELAP	PA	1/4/2006
EPA 8270	3-Nitroaniline	NELAP	PA	1/19/2005
EPA 8270	4,4'-Methylenebis(2-chloroaniline)	NELAP	PA	1/19/2005
EPA 8270	4-Aminobiphenyl	NELAP	PA	1/19/2005
EPA 8270	4-Bromophenyl phenyl ether	NELAP	PA	1/19/2005
EPA 8270	4-Chloro-3-methylphenol	NELAP	PA	1/19/2005
EPA 8270	4-Chloroaniline	NELAP	PA	1/19/2005
EPA 8270	4-Chlorophenyl phenyl ether	NELAP	PA	1/19/2005
EPA 8270	4-Methylphenol (p-Cresol)	NELAP	PA	1/19/2005
EPA 8270	4-Nitroaniline	NELAP	PA	4/4/2005
EPA 8270	4-Nitrophenol	NELAP	PA	1/19/2005
EPA 8270	5-Nitro-o-toluidine	NELAP	PA	4/4/2005
EPA 8270	7,12-Dimethylbenz(a)anthracene	NELAP	PA	1/19/2005
EPA 8270	Acenaphthene	NELAP	PA	1/19/2005
EPA 8270	Acenaphthylene	NELAP	PA	1/19/2005
EPA 8270	Acetophenone	NELAP	PA	1/19/2005
EPA 8270	Aniline	NELAP	PA	1/19/2005
EPA 8270	Anthracene	NELAP	PA	1/19/2005
EPA 8270	Aramite	NELAP	PA	5/17/2005
EPA 8270	Benzidine	NELAP	PA	1/19/2005
EPA 8270	Benzo[a]anthracene	NELAP	PA	1/19/2005
EPA 8270	Benzo[a]pyrene	NELAP	PA	1/19/2005
EPA 8270	Benzo[b]fluoranthene	NELAP	PA	1/19/2005
EPA 8270	Benzo[ghi]perylene	NELAP	PA	1/19/2005
EPA 8270	Benzo[k]fluoranthene	NELAP	PA	1/19/2005
EPA 8270	Benzoic acid	NELAP	PA	1/19/2005
EPA 8270	Benzyl alcohol	NELAP	PA	1/19/2005
EPA 8270	Butyl benzyl phthalate (Benzyl butyl phthalate)	NELAP	PA	5/17/2005
EPA 8270	Chlorobenzilate	NELAP	PA	5/2/2006
EPA 8270	Chrysene (Benzo[a]phenanthrene)	NELAP	PA	1/19/2005
EPA 8270	Di-n-butyl phthalate	NELAP	PA	1/19/2005
EPA 8270	Di-n-octyl phthalate	NELAP	PA	1/19/2005
EPA 8270	Dialfate (cis or trans)	NELAP	PA	5/2/2006
EPA 8270	Dibenz[a,j]acridine	NELAP	PA	5/17/2005

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270	Dibenzo[a,h]anthracene	NELAP	PA	1/19/2005
EPA 8270	Dibenzofuran	NELAP	PA	1/19/2005
EPA 8270	Diethyl phthalate	NELAP	PA	1/19/2005
EPA 8270	Dimethoate	NELAP	PA	5/2/2006
EPA 8270	Dimethyl phthalate	NELAP	PA	1/19/2005
EPA 8270	Dinoseb (2-sec-Butyl-4,6-dinitrophenol, DNBP)	NELAP	PA	5/2/2006
EPA 8270	Disulfoton	NELAP	PA	7/1/2007
EPA 8270	Ethyl methanesulfonate	NELAP	PA	1/19/2005
EPA 8270	Famphur	NELAP	PA	5/2/2006
EPA 8270	Fluoranthene	NELAP	PA	1/19/2005
EPA 8270	Fluorene	NELAP	PA	1/19/2005
EPA 8270	Hexachlorobenzene	NELAP	PA	1/19/2005
EPA 8270	Hexachlorobutadiene (1,3-Hexachlorobutadiene)	NELAP	PA	1/19/2005
EPA 8270	Hexachlorocyclopentadiene	NELAP	PA	1/19/2005
EPA 8270	Hexachloroethane	NELAP	PA	1/19/2005
EPA 8270	Hexachloropropene	NELAP	PA	1/19/2005
EPA 8270	Indeno(1,2,3-cd)pyrene	NELAP	PA	1/19/2005
EPA 8270	Isodrin	NELAP	PA	5/2/2006
EPA 8270	Isophorone	NELAP	PA	1/19/2005
EPA 8270	Isosafrole	NELAP	PA	1/19/2005
EPA 8270	Kepone	NELAP	PA	5/2/2006
EPA 8270	Methapyrilene	NELAP	PA	1/19/2005
EPA 8270	Methyl methanesulfonate	NELAP	PA	1/19/2005
EPA 8270	Methyl parathion (Parathion, methyl)	NELAP	PA	5/25/2007
EPA 8270	N-Nitrosodi-n-butylamine	NELAP	PA	1/19/2005
EPA 8270	N-Nitrosodi-n-propylamine	NELAP	PA	1/19/2005
EPA 8270	N-Nitrosodiethylamine	NELAP	PA	1/19/2005
EPA 8270	N-Nitrosodimethylamine	NELAP	PA	1/19/2005
EPA 8270	N-Nitrosodiphenylamine	NELAP	PA	1/19/2005
EPA 8270	N-Nitrosomethylethylamine	NELAP	PA	1/19/2005
EPA 8270	N-Nitrosomorpholine	NELAP	PA	1/19/2005
EPA 8270	N-Nitrosopiperidine	NELAP	PA	1/19/2005
EPA 8270	N-Nitrosopyrrolidine	NELAP	PA	1/19/2005
EPA 8270	Naphthalene	NELAP	PA	1/19/2005
EPA 8270	Nitrobenzene	NELAP	PA	1/4/2006
EPA 8270	O,O,O-Triethyl phosphorothioate	NELAP	PA	5/2/2006

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized accrediting authority. Customers are urged to verify the laboratory's current accreditation standing.
www.dep.state.pa.us **Issue Date: 05/25/2011**

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code:** PA00009 (717) 656-2300

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270	Parathion, ethyl (Ethyl parathion, Parathion)	NELAP	PA	5/25/2007
EPA 8270	Pentachlorobenzene	NELAP	PA	1/19/2005
EPA 8270	Pentachloronitrobenzene (PCNB)	NELAP	PA	1/19/2005
EPA 8270	Pentachlorophenol (PCP)	NELAP	PA	1/19/2005
EPA 8270	Phenacetin	NELAP	PA	1/19/2005
EPA 8270	Phenanthrene	NELAP	PA	1/19/2005
EPA 8270	Phenol	NELAP	PA	1/19/2005
EPA 8270	Phorate (Thimet)	NELAP	PA	5/2/2006
EPA 8270	Phthalic anhydride	NELAP	PA	1/21/2009
EPA 8270	Pronamide (Kerb)	NELAP	PA	1/19/2005
EPA 8270	Pyrene	NELAP	PA	1/19/2005
EPA 8270	Pyridine	NELAP	PA	4/4/2005
EPA 8270	Safrole	NELAP	PA	1/19/2005
EPA 8270	Thionazine (Thionuzin, Zinophos)	NELAP	PA	5/2/2006
EPA 8270	a,a-Dimethylphenethylamine (Phentermine)	NELAP	PA	5/2/2006
EPA 8270	bis(2-Chloroethoxy)methane	NELAP	PA	1/19/2005
EPA 8270	bis(2-Chloroethyl) ether	NELAP	PA	1/19/2005
EPA 8270	bis(2-Chloroisopropyl) ether	NELAP	PA	1/4/2006
EPA 8270	bis(2-Ethylhexyl) phthalate (DEHP)	NELAP	PA	1/19/2005
EPA 8270	o-Toluidine (2-Toluidine, 2-Methylaniline)	NELAP	PA	1/19/2005
EPA 8270	tris-(2,3-Dibromopropyl) phosphate (tris-BP)	NELAP	PA	12/4/2007
EPA 8270 SIM	Acenaphthene	NELAP	PA	12/4/2007
EPA 8270 SIM	Acenaphthylene	NELAP	PA	12/4/2007
EPA 8270 SIM	Anthracene	NELAP	PA	12/4/2007
EPA 8270 SIM	Benzo[a]anthracene	NELAP	PA	12/4/2007
EPA 8270 SIM	Benzo[a]pyrene	NELAP	PA	12/4/2007
EPA 8270 SIM	Benzo[b]fluoranthene	NELAP	PA	12/4/2007
EPA 8270 SIM	Benzo[ghi]perylene	NELAP	PA	12/4/2007
EPA 8270 SIM	Benzo[k]fluoranthene	NELAP	PA	12/4/2007
EPA 8270 SIM	Chrysene (Benzo[a]phenanthrene)	NELAP	PA	12/4/2007
EPA 8270 SIM	Dibenzo[a,h]anthracene	NELAP	PA	12/4/2007
EPA 8270 SIM	Fluoranthene	NELAP	PA	12/4/2007
EPA 8270 SIM	Fluorene	NELAP	PA	12/4/2007
EPA 8270 SIM	Indeno(1,2,3-cd)pyrene	NELAP	PA	12/4/2007
EPA 8270 SIM	Naphthalene	NELAP	PA	12/4/2007
EPA 8270 SIM	Phenanthrene	NELAP	PA	12/4/2007

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized accrediting authority. Customers are urged to verify the laboratory's current accreditation standing.
www.dep.state.pa.us **Issue Date: 05/25/2011**

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270 SIM	Pyrene	NELAP	PA	12/4/2007
EPA 8270-Extended	1,1'-Biphenyl (Biphenyl, Lemonene)	NELAP	PA	12/4/2007
EPA 8270-Extended	1,2,3,4-Tetrachlorobenzene	NELAP	PA	7/3/2007
EPA 8270-Extended	1,2,3,4-Tetrahydronaphthalene	NELAP	PA	12/4/2007
EPA 8270-Extended	1,2,3,5-Tetrachlorobenzene	NELAP	PA	7/3/2007
EPA 8270-Extended	1,4-Dioxane (1,4-Diethyleneoxide)	NELAP	PA	12/4/2007
EPA 8270-Extended	1-Methylnaphthalene	NELAP	PA	12/4/2007
EPA 8270-Extended	6-Methylchrysene	NELAP	PA	12/4/2007
EPA 8270-Extended	Acrylamide	NELAP	PA	1/21/2009
EPA 8270-Extended	Atrazine	NELAP	PA	1/12/2007
EPA 8270-Extended	Benzaldehyde	NELAP	PA	12/4/2007
EPA 8270-Extended	Benzenethiol	NELAP	PA	12/4/2007
EPA 8270-Extended	Caprolactam	NELAP	PA	12/4/2007
EPA 8270-Extended	Carbazole	NELAP	PA	1/19/2005
EPA 8270-Extended	Dibenz[a,h]acridine	NELAP	PA	12/4/2007
EPA 8270-Extended	Indene	NELAP	PA	12/4/2007
EPA 8270-Extended	N,N-Dimethylacetamide	NELAP	PA	12/4/2007
EPA 8270-Extended	N,N-Dimethylformamide	NELAP	PA	12/4/2007
EPA 8270-Extended	Nitroquinoline-1-oxide	NELAP	PA	7/3/2007
EPA 8270-Extended	Quinoline	NELAP	PA	12/4/2007
EPA 8270-Extended	Tetraethyl dithiopyrophosphate	NELAP	PA	12/4/2007
EPA 8270-Extended	bis(2-Chloromethyl) ether	NELAP	PA	1/21/2009
EPA 8270-Extended	bis(2-Ethylhexyl) adipate (di(2-Ethylhexyl) adipate)	NELAP	PA	1/21/2009
EPA 8270-Extended	p-(Dimethylamino)azobenzene	NELAP	PA	5/2/2006
EPA 8270-Extended	p-Chloronitrobenzene	NELAP	PA	1/21/2009
EPA 8270C	Diphenylamine	NELAP	PA	5/2/2006
EPA 8290	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	NELAP	PA	6/30/2010
EPA 8290	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	NELAP	PA	6/30/2010
EPA 8290	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)	NELAP	PA	6/30/2010
EPA 8290	1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	NELAP	PA	6/30/2010
EPA 8290	1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)	NELAP	PA	6/30/2010
EPA 8290	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	NELAP	PA	6/30/2010
EPA 8290	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	NELAP	PA	8/6/2010
EPA 8290	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	NELAP	PA	6/30/2010
EPA 8290	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	NELAP	PA	6/30/2010

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code:** PA00009 **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8290	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	NELAP	PA	6/30/2010
EPA 8290	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	NELAP	PA	6/30/2010
EPA 8290	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	NELAP	PA	6/30/2010
EPA 8290	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	NELAP	PA	6/30/2010
EPA 8290	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	NELAP	PA	6/30/2010
EPA 8290	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	NELAP	PA	8/6/2010
EPA 8290	2,3,7,8-TCDD (Dioxin)	NELAP	PA	6/30/2010
EPA 8290	2,3,7,8-Tetrachlorodibenzofuran (TCDF)	NELAP	PA	6/30/2010
EPA 8290	Total TCDD	NELAP	PA	6/30/2010
EPA 8290	Total TCDF	NELAP	PA	6/30/2010
EPA 8290	Total heptachlorodibenzo-p-dioxin (HpCDD)	NELAP	PA	6/30/2010
EPA 8290	Total heptachlorodibenzofuran (HpCDF)	NELAP	PA	6/30/2010
EPA 8290	Total hexachlorodibenzo-p-dioxin (HxCDD)	NELAP	PA	6/30/2010
EPA 8290	Total hexachlorodibenzofuran (HxCDF)	NELAP	PA	6/30/2010
EPA 8290	Total pentachlorodibenzo-p-dioxin (PeCDD)	NELAP	PA	6/30/2010
EPA 8290	Total pentachlorodibenzofuran (PeCDF)	NELAP	PA	6/30/2010
EPA 8310	Acenaphthene	NELAP	PA	1/19/2005
EPA 8310	Acenaphthylene	NELAP	PA	1/23/2007
EPA 8310	Anthracene	NELAP	PA	1/19/2005
EPA 8310	Benzo[a]anthracene	NELAP	PA	1/19/2005
EPA 8310	Benzo[a]pyrene	NELAP	PA	1/19/2005
EPA 8310	Benzo[b]fluoranthene	NELAP	PA	1/19/2005
EPA 8310	Benzo[ghi]perylene	NELAP	PA	1/19/2005
EPA 8310	Benzo[k]fluoranthene	NELAP	PA	1/19/2005
EPA 8310	Chrysene (Benzo[a]phenanthrene)	NELAP	PA	1/19/2005
EPA 8310	Dibenzo[a,h]anthracene	NELAP	PA	1/19/2005
EPA 8310	Fluoranthene	NELAP	PA	1/19/2005
EPA 8310	Fluorene	NELAP	PA	5/25/2005
EPA 8310	Indeno(1,2,3-cd)pyrene	NELAP	PA	1/19/2005
EPA 8310	Naphthalene	NELAP	PA	1/19/2005
EPA 8310	Phenanthrene	NELAP	PA	1/19/2005
EPA 8310	Pyrene	NELAP	PA	1/19/2005
EPA 8315	2,5-Dimethylbenzaldehyde	NELAP	PA	1/21/2009
EPA 8315	Acetaldehyde	NELAP	PA	1/21/2009
EPA 8315	Acrolein (Propenal)	NELAP	PA	1/21/2009
EPA 8315	Benzaldehyde	NELAP	PA	1/21/2009

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8315	Butanal (Butyraldehyde)	NELAP	PA	1/21/2009
EPA 8315	Crotonaldehyde	NELAP	PA	1/21/2009
EPA 8315	Formaldehyde	NELAP	PA	1/19/2005
EPA 8315	Hexanal (Hexaldehyde)	NELAP	PA	1/21/2009
EPA 8315	Isovaleraldehyde	NELAP	PA	1/21/2009
EPA 8315	Pentanal (Valeraldehyde)	NELAP	PA	1/21/2009
EPA 8315	Propanal (Propionaldehyde)	NELAP	PA	1/21/2009
EPA 8315	m-Tolualdehyde (1,3-Tolualdehyde)	NELAP	PA	1/21/2009
EPA 8315	o-Tolualdehyde (1,2-Tolualdehyde)	NELAP	PA	1/21/2009
EPA 8315	p-Tolualdehyde (1,4-Tolualdehyde)	NELAP	PA	1/21/2009
EPA 8318	3-Hydroxycarbofuran	NELAP	PA	4/4/2005
EPA 8318	Aldicarb (Temik)	NELAP	PA	4/4/2005
EPA 8318	Aldicarb sulfone	NELAP	PA	4/4/2005
EPA 8318	Carbaryl (Sevin)	NELAP	PA	4/4/2005
EPA 8318	Carbofuran (Furadan)	NELAP	PA	4/4/2005
EPA 8318	Methiocarb (Mesurol)	NELAP	PA	4/4/2005
EPA 8318	Methomyl (Lannate)	NELAP	PA	4/4/2005
EPA 8318	Propoxur (Baygon)	NELAP	PA	4/4/2005
EPA 8318-Extended	Aldicarb sulfoxide	NELAP	PA	12/12/2005
EPA 8318-Extended	Oxamyl (Vydate)	NELAP	PA	12/12/2005
EPA 8330	1,3,5-Trinitrobenzene (1,3,5-TNB)	NELAP	PA	1/19/2005
EPA 8330	1,3-Dinitrobenzene (1,3-DNB)	NELAP	PA	1/19/2005
EPA 8330	2,4,6-Trinitrotoluene (2,4,6-TNT)	NELAP	PA	1/19/2005
EPA 8330	2,4-Dinitrotoluene (2,4-DNT)	NELAP	PA	1/19/2005
EPA 8330	2,6-Dinitrotoluene (2,6-DNT)	NELAP	PA	1/19/2005
EPA 8330	2-Amino-4,6-dinitrotoluene (2-Am-DNT)	NELAP	PA	1/19/2005
EPA 8330	2-Nitrotoluene	NELAP	PA	1/19/2005
EPA 8330	3-Nitrotoluene	NELAP	PA	1/19/2005
EPA 8330	4-Amino-2,6-dinitrotoluene (4-Am-DNT)	NELAP	PA	1/19/2005
EPA 8330	4-Nitrotoluene	NELAP	PA	1/19/2005
EPA 8330	Nitrobenzene	NELAP	PA	1/19/2005
EPA 8330	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	NELAP	PA	1/24/2006
EPA 8330	RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine)	NELAP	PA	1/19/2005
EPA 8330	Tetryl (2,4,6-Trinitrophenylmethylnitramine)	NELAP	PA	1/19/2005
EPA 8330-Extended	Pentaerythritol tetranitrate (PETN)	NELAP	PA	11/21/2005
EPA 9012	Total cyanide	NELAP	PA	1/19/2005

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized accrediting authority. Customers are urged to verify the laboratory's current accreditation standing.
www.dep.state.pa.us **Issue Date: 05/25/2011**

Uncontrolled Copy

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 9040	Corrosivity (pH)	NELAP	PA	5/17/2005
EPA 9040	pH	NELAP	PA	1/19/2005
EPA 9045	pH	NELAP	PA	11/19/2008
EPA 9050	Conductivity	NELAP	PA	5/17/2005
EPA 9060	Total organic carbon (TOC)	NELAP	PA	1/19/2005
EPA 9066	Total phenolics	NELAP	PA	4/4/2005
EPA 9071B	Oil and grease	NELAP	PA	1/19/2005
EPA 9081	Cation exchange capacity of soils (Ammonium acetate)	NELAP	PA	5/25/2005
EPA 9095A	Paint filter liquids test	NELAP	PA	1/24/2007
FL-PRO	Total petroleum hydrocarbons (TPH)	NELAP	PA	12/12/2005
MA DEP EPH	Diesel-range organics (DRO)	NELAP	PA	12/12/2005
MA DEP VPH	Gasoline-range organics (GRO)	NELAP	PA	12/12/2005
NWTPH-Dx	Diesel-range organics (DRO)	NELAP	PA	12/12/2005
NWTPH-Gx	Gasoline-range organics (GRO)	NELAP	PA	12/12/2005
NWTPH-HCID	GRO/DRO/HRO Screen	NELAP	PA	10/16/2008
OA-1	Gasoline-range organics (GRO)	NELAP	PA	12/12/2005
OA-2	Diesel-range organics (DRO)	NELAP	PA	12/12/2005
TX1005 (TNRCC)	Total petroleum hydrocarbons (TPH)	NELAP	PA	12/12/2005
TX1006 (TNRCC)	Total petroleum hydrocarbons (TPH)	NELAP	PA	12/12/2005
WA-EPH	Diesel-range organics (DRO)	NELAP	PA	12/12/2005
WA-VPH	Gasoline-range organics (GRO)	NELAP	PA	12/12/2005
WI-DRO	Diesel-range organics (DRO)	NELAP	PA	12/12/2005
WI-GRO	Gasoline-range organics (GRO)	NELAP	PA	12/12/2005

Uncontrolled Copy

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized accrediting authority. Customers are urged to verify the laboratory's current accreditation standing.
www.dep.state.pa.us **Issue Date: 05/25/2011**

New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 11/30/2010 until 06/30/2011

Laboratory Name: LANCASTER LABORATORIES, INC Laboratory Number: PA011 Activity ID: NLC100005
2425 NEW HOLLAND PK
LANCASTER, PA 17601-5994

Category: CAP03 – Atmospheric Organic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Applied	No	NJ	CAP03.00015	AE	FID	[EPA 25]	Non-Methane Organic Compounds
Applied	No	NJ	CAP03.00040	AE	GC	[EPA 18]	Volatile organics
Certified	Yes	NJ	CAP03.00184	AE	GC/MS, Canisters	[EPA TO-15]	Acetone
Certified	Yes	NJ	CAP03.00185	AE	GC/MS, Canisters	[EPA TO-15]	Acetonitrile
Certified	Yes	NJ	CAP03.00195	AE	GC/MS, Canisters	[EPA TO-15]	Acrolein
Certified	Yes	NJ	CAP03.00210	AE	GC/MS, Canisters	[EPA TO-15]	Acrylonitrile
Certified	Yes	NJ	CAP03.00215	AE	GC/MS, Canisters	[EPA TO-15]	Allyl chloride
Certified	Yes	NJ	CAP03.00225	AE	GC/MS, Canisters	[EPA TO-15]	Benzene
Certified	Yes	NJ	CAP03.00250	AE	GC/MS, Canisters	[EPA TO-15]	Bromodichloromethane
Certified	Yes	NJ	CAP03.00255	AE	GC/MS, Canisters	[EPA TO-15]	Bromoform
Certified	Yes	NJ	CAP03.00260	AE	GC/MS, Canisters	[EPA TO-15]	Bromomethane
Certified	Yes	NJ	CAP03.00265	AE	GC/MS, Canisters	[EPA TO-15]	Butadiene (1,3-)
Certified	Yes	NJ	CAP03.00270	AE	GC/MS, Canisters	[EPA TO-15]	Carbon disulfide
Certified	Yes	NJ	CAP03.00275	AE	GC/MS, Canisters	[EPA TO-15]	Carbon tetrachloride
Certified	Yes	NJ	CAP03.00300	AE	GC/MS, Canisters	[EPA TO-15]	Chlorobenzene
Certified	Yes	NJ	CAP03.00305	AE	GC/MS, Canisters	[EPA TO-15]	Chloroethane
Certified	Yes	NJ	CAP03.00310	AE	GC/MS, Canisters	[EPA TO-15]	Chloroform
Certified	Yes	NJ	CAP03.00315	AE	GC/MS, Canisters	[EPA TO-15]	Chloromethane
Certified	Yes	NJ	CAP03.00325	AE	GC/MS, Canisters	[EPA TO-15]	Chlorotoluene (2-)
Certified	Yes	NJ	CAP03.00335	AE	GC/MS, Canisters	[EPA TO-15]	Cyclohexane
Certified	Yes	NJ	CAP03.00342	AE	GC/MS, Canisters	[EPA TO-15]	Dibromochloromethane
Certified	Yes	NJ	CAP03.00350	AE	GC/MS, Canisters	[EPA TO-15]	Dibromoethane (1,2-) (EDB)
Certified	Yes	NJ	CAP03.00355	AE	GC/MS, Canisters	[EPA TO-15]	Dichlorobenzene (1,2-)
Certified	Yes	NJ	CAP03.00360	AE	GC/MS, Canisters	[EPA TO-15]	Dichlorobenzene (1,3-)
Certified	Yes	NJ	CAP03.00365	AE	GC/MS, Canisters	[EPA TO-15]	Dichlorobenzene (1,4-)
Certified	Yes	NJ	CAP03.00368	AE	GC/MS, Canisters	[EPA TO-15]	Dichlorodifluoromethane
Certified	Yes	NJ	CAP03.00370	AE	GC/MS, Canisters	[EPA TO-15]	Dichloroethane (1,1-)
Certified	Yes	NJ	CAP03.00375	AE	GC/MS, Canisters	[EPA TO-15]	Dichloroethane (1,2-)
Certified	Yes	NJ	CAP03.00380	AE	GC/MS, Canisters	[EPA TO-15]	Dichloroethene (1,1-)
Certified	Yes	NJ	CAP03.00384	AE	GC/MS, Canisters	[EPA TO-15]	Dichloroethene (cis-1,2-)
Certified	Yes	NJ	CAP03.00385	AE	GC/MS, Canisters	[EPA TO-15]	Dichloroethene (trans-1,2-)

KEY: AE = Air and Emissions, BT = Biological Tissues, DW = Drinking Water, NPW = Non-Potable Water, SCM = Solid and Chemical Materials

Uncontrolled Copy

New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 11/30/2010 until 06/30/2011

Laboratory Name: LANCASTER LABORATORIES, INC Laboratory Number: PA011 Activity ID: NLC100005
2425 NEW HOLLAND PK
LANCASTER, PA 17601-5994

Category: CAP03 – Atmospheric Organic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	CAP03.00390	AE	GC/MS, Canisters	[EPA TO-15]	Dichlorofluoromethane
Certified	Yes	NJ	CAP03.00395	AE	GC/MS, Canisters	[EPA TO-15]	Dichloropropane (1,2-)
Certified	Yes	NJ	CAP03.00400	AE	GC/MS, Canisters	[EPA TO-15]	Dichloropropene (cis-1,3-)
Certified	Yes	NJ	CAP03.00401	AE	GC/MS, Canisters	[EPA TO-15]	Dichloropropene (trans-1,3-)
Certified	Yes	NJ	CAP03.00405	AE	GC/MS, Canisters	[EPA TO-15]	Dichlorotetrafluoroethane (1,2-)
Certified	Yes	NJ	CAP03.00440	AE	GC/MS, Canisters	[EPA TO-15]	Dioxane (1,4-)
Certified	Yes	NJ	CAP03.00455	AE	GC/MS, Canisters	[EPA TO-15]	Ethyl acrylate
Certified	Yes	NJ	CAP03.00465	AE	GC/MS, Canisters	[EPA TO-15]	Ethylbenzene
Certified	Yes	NJ	CAP03.00480	AE	GC/MS, Canisters	[EPA TO-15]	Ethyltoluene (4-)
Certified	Yes	NJ	CAP03.00490	AE	GC/MS, Canisters	[EPA TO-15]	Hexachlorobutadiene (1,3-)
Certified	Yes	NJ	CAP03.00495	AE	GC/MS, Canisters	[EPA TO-15]	Hexachloroethane
Certified	Yes	NJ	CAP03.00498	AE	GC/MS, Canisters	[EPA TO-15]	Hexanone (2-)
Certified	Yes	NJ	CAP03.00500	AE	GC/MS, Canisters	[EPA TO-15]	Heptane (n-)
Certified	Yes	NJ	CAP03.00505	AE	GC/MS, Canisters	[EPA TO-15]	Hexane (n-)
Certified	Yes	NJ	CAP03.00515	AE	GC/MS, Canisters	[EPA TO-15]	Isopropylbenzene
Certified	Yes	NJ	CAP03.00525	AE	GC/MS, Canisters	[EPA TO-15]	Methyl ethyl ketone
Certified	Yes	NJ	CAP03.00530	AE	GC/MS, Canisters	[EPA TO-15]	Methyl iodide
Certified	Yes	NJ	CAP03.00535	AE	GC/MS, Canisters	[EPA TO-15]	Methyl isobutyl ketone (MIBK)
Certified	Yes	NJ	CAP03.00545	AE	GC/MS, Canisters	[EPA TO-15]	Methyl methacrylate
Certified	Yes	NJ	CAP03.00550	AE	GC/MS, Canisters	[EPA TO-15]	Methyl tert-butyl ether
Certified	Yes	NJ	CAP03.00555	AE	GC/MS, Canisters	[EPA TO-15]	Methylene chloride (Dichloromethane)
Certified	Yes	NJ	CAP03.00567	AE	GC/MS, Canisters	[EPA TO-15]	Naphthalene
Certified	Yes	NJ	CAP03.00612	AE	GC/MS, Canisters	[EPA TO-15]	Propylene
Certified	Yes	NJ	CAP03.00625	AE	GC/MS, Canisters	[EPA TO-15]	Styrene
Certified	Yes	NJ	CAP03.00635	AE	GC/MS, Canisters	[EPA TO-15]	Trichlorobenzene (1,2,4-)
Certified	Yes	NJ	CAP03.00640	AE	GC/MS, Canisters	[EPA TO-15]	Trimethylbenzene (1,3,5-)
Certified	Yes	NJ	CAP03.00645	AE	GC/MS, Canisters	[EPA TO-15]	Trimethylbenzene (1,2,4-)
Certified	Yes	NJ	CAP03.00650	AE	GC/MS, Canisters	[EPA TO-15]	Trimethylpentane (2,2,4-)
Certified	Yes	NJ	CAP03.00652	AE	GC/MS, Canisters	[EPA TO-15]	Tert-butyl alcohol
Certified	Yes	NJ	CAP03.00655	AE	GC/MS, Canisters	[EPA TO-15]	Tetrachloromethane (1,1,2,2-)
Certified	Yes	NJ	CAP03.00660	AE	GC/MS, Canisters	[EPA TO-15]	Tetrachloroethene
Certified	Yes	NJ	CAP03.00665	AE	GC/MS, Canisters	[EPA TO-15]	Toluene

KEY: AE = Air and Emissions, BT = Biological Tissues, DW = Drinking Water, NPW = Non-Potable Water, SCM = Solid and Chemical Materials

Uncontrolled Copy

New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 11/30/2010 until 06/30/2011

Laboratory Name: LANCASTER LABORATORIES, INC Laboratory Number: PA011 Activity ID: NLC100005
2425 NEW HOLLAND PK
LANCASTER, PA 17601-5994

Category: CAP03 – Atmospheric Organic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	CAP03.00670	AE	GC/MS, Canisters	[EPA TO-15]	Trichloroethane (1,1,1-)
Certified	Yes	NJ	CAP03.00675	AE	GC/MS, Canisters	[EPA TO-15]	Trichloroethane (1,1,2-)
Certified	Yes	NJ	CAP03.00680	AE	GC/MS, Canisters	[EPA TO-15]	Trichloroethene
Certified	Yes	NJ	CAP03.00684	AE	GC/MS, Canisters	[EPA TO-15]	Trichlorofluoromethane
Certified	Yes	NJ	CAP03.00685	AE	GC/MS, Canisters	[EPA TO-15]	Trichloro (1,1,2-) trifluoroethane (1,2,2-)
Certified	Yes	NJ	CAP03.00700	AE	GC/MS, Canisters	[EPA TO-15]	Vinyl acetate
Certified	Yes	NJ	CAP03.00705	AE	GC/MS, Canisters	[EPA TO-15]	Vinyl bromide
Certified	Yes	NJ	CAP03.00710	AE	GC/MS, Canisters	[EPA TO-15]	Vinyl chloride
Certified	Yes	NJ	CAP03.00715	AE	GC/MS, Canisters	[EPA TO-15]	Xylene (m-)
Certified	Yes	NJ	CAP03.00720	AE	GC/MS, Canisters	[EPA TO-15]	Xylene (o-)
Certified	Yes	NJ	CAP03.00725	AE	GC/MS, Canisters	[EPA TO-15]	Xylene (p-)
Certified	Yes	NJ	CAP03.00730	AE	GC/MS, Canisters	[EPA TO-15]	Xylenes (total)
Certified	Yes	NJ	CAP03.06430	AE	GC/MS, Canisters	[EPA TO-14A]	Benzene
Certified	Yes	NJ	CAP03.06443	AE	GC/MS, Canisters	[EPA TO-14A]	Bromodichloromethane
Certified	Yes	NJ	CAP03.06447	AE	GC/MS, Canisters	[EPA TO-14A]	Bromoform
Certified	Yes	NJ	CAP03.06450	AE	GC/MS, Canisters	[EPA TO-14A]	Bromomethane
Certified	Yes	NJ	CAP03.06457	AE	GC/MS, Canisters	[EPA TO-14A]	Carbon disulfide
Certified	Yes	NJ	CAP03.06460	AE	GC/MS, Canisters	[EPA TO-14A]	Carbon tetrachloride
Certified	Yes	NJ	CAP03.06470	AE	GC/MS, Canisters	[EPA TO-14A]	Chlorobenzene
Certified	Yes	NJ	CAP03.06480	AE	GC/MS, Canisters	[EPA TO-14A]	Chloroethane
Certified	Yes	NJ	CAP03.06490	AE	GC/MS, Canisters	[EPA TO-14A]	Chloroform
Certified	Yes	NJ	CAP03.06500	AE	GC/MS, Canisters	[EPA TO-14A]	Chloromethane
Certified	Yes	NJ	CAP03.06510	AE	GC/MS, Canisters	[EPA TO-14A]	Dibromoethane (1,2-) (EDB)
Certified	Yes	NJ	CAP03.06520	AE	GC/MS, Canisters	[EPA TO-14A]	Dichlorobenzene (1,2-)
Certified	Yes	NJ	CAP03.06530	AE	GC/MS, Canisters	[EPA TO-14A]	Dichlorobenzene (1,3-)
Certified	Yes	NJ	CAP03.06540	AE	GC/MS, Canisters	[EPA TO-14A]	Dichlorobenzene (1,4-)
Certified	Yes	NJ	CAP03.06550	AE	GC/MS, Canisters	[EPA TO-14A]	Dichlorodifluoromethane
Certified	Yes	NJ	CAP03.06560	AE	GC/MS, Canisters	[EPA TO-14A]	Dichloroethane (1,1-)
Certified	Yes	NJ	CAP03.06570	AE	GC/MS, Canisters	[EPA TO-14A]	Dichloroethane (1,2-)
Certified	Yes	NJ	CAP03.06580	AE	GC/MS, Canisters	[EPA TO-14A]	Dichloroethene (1,1-)
Certified	Yes	NJ	CAP03.06590	AE	GC/MS, Canisters	[EPA TO-14A]	Dichloroethene (cis-1,2-)
Certified	Yes	NJ	CAP03.06591	AE	GC/MS, Canisters	[EPA TO-14A]	Dichloroethene (trans-1,2-)

KEY: AE = Air and Emissions, BT = Biological Tissues, DW = Drinking Water, NPW = Non-Potable Water, SCM = Solid and Chemical Materials

Uncontrolled Copy

New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 11/30/2010 until 06/30/2011

Laboratory Name: LANCASTER LABORATORIES, INC Laboratory Number: PA011 Activity ID: NLC100005
2425 NEW HOLLAND PK
LANCASTER, PA 17601-5994

Category: CAP03 – Atmospheric Organic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	CAP03.06595	AE	GC/MS, Canisters	[EPA TO-14A]	Dichlorofluoromethane
Certified	Yes	NJ	CAP03.06600	AE	GC/MS, Canisters	[EPA TO-14A]	Methylene chloride (Dichloromethane)
Certified	Yes	NJ	CAP03.06610	AE	GC/MS, Canisters	[EPA TO-14A]	Dichloropropane (1,2-)
Certified	Yes	NJ	CAP03.06620	AE	GC/MS, Canisters	[EPA TO-14A]	Dichloropropene (cis-1,3-)
Certified	Yes	NJ	CAP03.06630	AE	GC/MS, Canisters	[EPA TO-14A]	Dichloropropene (trans-1,3-)
Certified	Yes	NJ	CAP03.06640	AE	GC/MS, Canisters	[EPA TO-14A]	Dichlorotetrafluoroethane (1,2-)
Certified	Yes	NJ	CAP03.06650	AE	GC/MS, Canisters	[EPA TO-14A]	Ethylbenzene
Certified	Yes	NJ	CAP03.06660	AE	GC/MS, Canisters	[EPA TO-14A]	Hexachlorobutadiene (1,3-)
Certified	Yes	NJ	CAP03.06670	AE	GC/MS, Canisters	[EPA TO-14A]	Styrene
Certified	Yes	NJ	CAP03.06674	AE	GC/MS, Canisters	[EPA TO-14A]	Methyl ethyl ketone
Certified	Yes	NJ	CAP03.06676	AE	GC/MS, Canisters	[EPA TO-14A]	Methyl isobutyl ketone (MIBK)
Certified	Yes	NJ	CAP03.06678	AE	GC/MS, Canisters	[EPA TO-14A]	Methyl tert-butyl ether
Certified	Yes	NJ	CAP03.06680	AE	GC/MS, Canisters	[EPA TO-14A]	Tetrachloroethane (1,1,2,2-)
Certified	Yes	NJ	CAP03.06690	AE	GC/MS, Canisters	[EPA TO-14A]	Tetrachloroethene
Certified	Yes	NJ	CAP03.06700	AE	GC/MS, Canisters	[EPA TO-14A]	Toluene
Certified	Yes	NJ	CAP03.06710	AE	GC/MS, Canisters	[EPA TO-14A]	Trichlorobenzene (1,2,4-)
Certified	Yes	NJ	CAP03.06720	AE	GC/MS, Canisters	[EPA TO-14A]	Trichloroethane (1,1,1-)
Certified	Yes	NJ	CAP03.06721	AE	GC/MS, Canisters	[EPA TO-14A]	Trichloroethane (1,1,2-)
Certified	Yes	NJ	CAP03.06730	AE	GC/MS, Canisters	[EPA TO-14A]	Trichloroethene
Certified	Yes	NJ	CAP03.06740	AE	GC/MS, Canisters	[EPA TO-14A]	Trichlorofluoromethane
Certified	Yes	NJ	CAP03.06750	AE	GC/MS, Canisters	[EPA TO-14A]	Trichloro (1,1,2-) trifluoroethane (1,2,2-)
Certified	Yes	NJ	CAP03.06760	AE	GC/MS, Canisters	[EPA TO-14A]	Trimethylbenzene (1,2,4-)
Certified	Yes	NJ	CAP03.06770	AE	GC/MS, Canisters	[EPA TO-14A]	Trimethylbenzene (1,3,5-)
Certified	Yes	NJ	CAP03.06780	AE	GC/MS, Canisters	[EPA TO-14A]	Vinyl chloride
Certified	Yes	NJ	CAP03.06785	AE	GC/MS, Canisters	[EPA TO-14A]	Xylenes (total)
Certified	Yes	NJ	CAP03.06790	AE	GC/MS, Canisters	[EPA TO-14A]	Xylene (o-)
Certified	Yes	NJ	CAP03.06800	AE	GC/MS, Canisters	[EPA TO-14A]	Xylene (m-)
Certified	Yes	NJ	CAP03.06810	AE	GC/MS, Canisters	[EPA TO-14A]	Xylene (p-)
Applied	No	NJ	CAP03.06850	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Acetone
Applied	No	NJ	CAP03.06852	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Allyl chloride
Applied	No	NJ	CAP03.06854	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Benzene
Applied	No	NJ	CAP03.06856	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Bromodichloromethane

KEY: AE = Air and Emissions, BT = Biological Tissues, DW = Drinking Water, NPW = Non-Potable Water, SCM = Solid and Chemical Materials

Uncontrolled Copy

New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 11/30/2010 until 06/30/2011

Laboratory Name: LANCASTER LABORATORIES, INC Laboratory Number: PA011 Activity ID: NLC100005
2425 NEW HOLLAND PK
LANCASTER, PA 17601-5994

Category: CAP03 – Atmospheric Organic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Applied	No	NJ	CAP03.06858	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Bromoform
Applied	No	NJ	CAP03.06860	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Bromomethane
Applied	No	NJ	CAP03.06862	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Butadiene (1,3-)
Applied	No	NJ	CAP03.06864	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Carbon disulfide
Applied	No	NJ	CAP03.06866	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Carbon tetrachloride
Applied	No	NJ	CAP03.06868	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Chlorobenzene
Applied	No	NJ	CAP03.06870	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Chloroethane
Applied	No	NJ	CAP03.06872	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Chloroform
Applied	No	NJ	CAP03.06874	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Chloromethane
Applied	No	NJ	CAP03.06876	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Chlorotoluene (2-)
Applied	No	NJ	CAP03.06878	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Cyclohexane
Applied	No	NJ	CAP03.06880	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dibromochloromethane
Applied	No	NJ	CAP03.06882	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dibromoethane (1,2-) (EDB)
Applied	No	NJ	CAP03.06884	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dichlorobenzene (1,2-)
Applied	No	NJ	CAP03.06886	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dichlorobenzene (1,3-)
Applied	No	NJ	CAP03.06888	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dichlorobenzene (1,4-)
Applied	No	NJ	CAP03.06890	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dichlorodifluoromethane
Applied	No	NJ	CAP03.06892	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dichloroethane (1,1-)
Applied	No	NJ	CAP03.06894	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dichloroethane (1,2-)
Applied	No	NJ	CAP03.06896	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dichloroethene (1,1-)
Applied	No	NJ	CAP03.06898	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dichloroethene (cis-1,2-)
Applied	No	NJ	CAP03.06900	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dichloroethene (trans-1,2-)
Applied	No	NJ	CAP03.06902	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dichloropropane (1,2-)
Applied	No	NJ	CAP03.06904	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dichloropropene (cis-1,3-)
Applied	No	NJ	CAP03.06906	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dichloropropene (trans-1,3-)
Applied	No	NJ	CAP03.06908	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dichlorotetrafluoroethane (1,2-)
Applied	No	NJ	CAP03.06910	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dioxane (1,4-)
Applied	No	NJ	CAP03.06912	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Ethanol
Applied	No	NJ	CAP03.06914	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Ethylbenzene
Applied	No	NJ	CAP03.06916	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Ethyltoluene (4-)
Applied	No	NJ	CAP03.06918	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Heptane (n-)
Applied	No	NJ	CAP03.06920	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Hexachlorobutadiene (1,3-)

KEY: AE = Air and Emissions, BT = Biological Tissues, DW = Drinking Water, NPW = Non-Potable Water, SCM = Solid and Chemical Materials

Uncontrolled Copy

New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 11/30/2010 until 06/30/2011

Laboratory Name: LANCASTER LABORATORIES, INC Laboratory Number: PA011 Activity ID: NLC100005
2425 NEW HOLLAND PK
LANCASTER, PA 17601-5994

Category: CAP03 – Atmospheric Organic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Applied	No	NJ	CAP03.06922	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Hexane (n-)
Applied	No	NJ	CAP03.06924	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Isopropanol
Applied	No	NJ	CAP03.06926	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Methylene chloride (Dichloromethane)
Applied	No	NJ	CAP03.06928	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Methyl ethyl ketone
Applied	No	NJ	CAP03.06930	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Methyl isobutyl ketone (MIBK)
Applied	No	NJ	CAP03.06932	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Methyl methacrylate
Applied	No	NJ	CAP03.06934	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Methyl tert-butyl ether
Applied	No	NJ	CAP03.06936	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Styrene
Applied	No	NJ	CAP03.06938	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Tert-butyl alcohol
Applied	No	NJ	CAP03.06940	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Tetrachloroethane (1,1,2,2-)
Applied	No	NJ	CAP03.06942	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Tetrachloroethene
Applied	No	NJ	CAP03.06944	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Tetrahydrofuran
Applied	No	NJ	CAP03.06946	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Toluene
Applied	No	NJ	CAP03.06948	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Trichlorobenzene (1,2,4-)
Applied	No	NJ	CAP03.06950	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Trichloroethane (1,1,1-)
Applied	No	NJ	CAP03.06952	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Trichloroethane (1,1,2-)
Applied	No	NJ	CAP03.06954	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Trichloroethene
Applied	No	NJ	CAP03.06956	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Trichlorofluoromethane
Applied	No	NJ	CAP03.06958	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Trichloro (1,1,2-) trifluoroethane (1,2,2-)
Applied	No	NJ	CAP03.06960	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Trimethylbenzene (1,2,4-)
Applied	No	NJ	CAP03.06962	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Trimethylbenzene (1,3,5-)
Applied	No	NJ	CAP03.06964	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Trimethylpentane (2,2,4-)
Applied	No	NJ	CAP03.06966	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Vinyl bromide
Applied	No	NJ	CAP03.06968	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Vinyl chloride
Applied	No	NJ	CAP03.06970	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Xylene (m- + p-)
Applied	No	NJ	CAP03.06972	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Xylene (o-)

KEY: AE = Air and Emissions, BT = Biological Tissues, DW = Drinking Water, NPW = Non-Potable Water, SCM = Solid and Chemical Materials

Uncontrolled Copy

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate: T104704194-10-4
Expiration Date: 8/31/2011
Issue Date: 10/15/2010

Lancaster Laboratories Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994

These fields of accreditation supercedeall previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: *Tissue*

Method EPA 6010

Analyte	AB	Analyte ID	Method ID
Aluminum	TX	1000	10155609
Antimony	TX	1005	10155609
Arsenic	TX	1010	10155609
Barium	TX	1015	10155609
Beryllium	TX	1020	10155609
Boron	TX	1025	10155609
Cadmium	TX	1030	10155609
Calcium	TX	1035	10155609
Chromium	TX	1040	10155609
Cobalt	TX	1050	10155609
Copper	TX	1055	10155609
Iron	TX	1070	10155609
Lead	TX	1075	10155609
Magnesium	TX	1085	10155609
Manganese	TX	1090	10155609
Molybdenum	TX	1100	10155609
Nickel	TX	1105	10155609
Potassium	TX	1125	10155609
Selenium	TX	1140	10155609
Silver	TX	1150	10155609
Sodium	TX	1155	10155609
Strontium	TX	1160	10155609
Thallium	TX	1165	10155609
Tin	TX	1175	10155609
Titanium	TX	1180	10155609
Vanadium	TX	1185	10155609
Zinc	TX	1190	10155609

Method EPA 6020

Analyte	AB	Analyte ID	Method ID

Uncontrolled Copy

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate: T104704194-10-4
Expiration Date: 8/31/2011
Issue Date: 10/15/2010

Lancaster Laboratories Inc.

2425 New Holland Pike
Lancaster, PA 17601-5994

These fields of accreditation supercedeall previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: *Tissue*

Antimony	TX	1005	10156204
Arsenic	TX	1010	10156204
Beryllium	TX	1020	10156204
Cadmium	TX	1030	10156204
Chromium	TX	1040	10156204
Copper	TX	1055	10156204
Lead	TX	1075	10156204
Nickel	TX	1105	10156204
Selenium	TX	1140	10156204
Thallium	TX	1165	10156204

Method EPA 7471

Analyte	AB	Analyte ID	Method ID
Mercury	TX	1095	10166208

Method EPA 8081

Analyte	AB	Analyte ID	Method ID
4,4'-DDD	TX	7355	10178606
4,4'-DDE	TX	7360	10178606
4,4'-DDT	TX	7365	10178606
Aldrin	TX	7025	10178606
alpha-BHC (alpha-Hexachlorocyclohexane)	TX	7110	10178606
beta-BHC (beta-Hexachlorocyclohexane)	TX	7115	10178606
Chlordane (tech.)	TX	7250	10178606
delta-BHC (delta-Hexachlorocyclohexane)	TX	7105	10178606
Dieldrin	TX	7470	10178606
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	TX	7120	10178606
Heptachlor	TX	7685	10178606
Heptachlor epoxide	TX	7690	10178606
Mirex	TX	7870	10178606
Toxaphene (Chlorinated camphene)	TX	8250	10178606

Method EPA 8082

Analyte	AB	Analyte ID	Method ID

Uncontrolled Copy

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate: T104704194-10-4
Expiration Date: 8/31/2011
Issue Date: 10/15/2010

Lancaster Laboratories Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994

These fields of accreditation supercedeall previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: *Tissue*

Aroclor-1016 (PCB-1016)	TX	8880	10179007
Aroclor-1221 (PCB-1221)	TX	8885	10179007
Aroclor-1232 (PCB-1232)	TX	8890	10179007
Aroclor-1242 (PCB-1242)	TX	8895	10179007
Aroclor-1248 (PCB-1248)	TX	8900	10179007
Aroclor-1254 (PCB-1254)	TX	8905	10179007
Aroclor-1260 (PCB-1260)	TX	8910	10179007

Method EPA 8270

Analyte	AB	Analyte ID	Method ID
1,2,4,5-Tetrachlorobenzene	TX	6715	10185805
2-Methylphenol (o-Cresol)	TX	6400	10185805
3-Methylphenol (m-Cresol)	TX	6405	10185805
4-Methylphenol (p-Cresol)	TX	6410	10185805
Benzidine	TX	5595	10185805
Benzo(a)anthracene	TX	5575	10185805
Benzo(a)pyrene	TX	5580	10185805
Chrysene	TX	5855	10185805
Hexachlorobenzene	TX	6275	10185805
Hexachlorobutadiene	TX	4835	10185805
Hexachlorocyclopentadiene	TX	6285	10185805
Hexachloroethane	TX	4840	10185805
Hexachlorophene	TX	6290	10185805
n-Nitrosodiethylamine	TX	6525	10185805
n-Nitroso-di-n-butylamine	TX	5025	10185805
Pentachlorobenzene	TX	6590	10185805
Pentachlorophenol	TX	6605	10185805
Pyridine	TX	5095	10185805

Uncontrolled Copy

eurofins | Lancaster Laboratories

Environmental Quality Policy Manual

Appendix J

Quality Control Types, Frequency, and Corrective Action

Current as of October 05, 2011
32 Total Pages (including this coversheet)

NOTE: Current information available in technical departments.

Uncontrolled Copy

SW - 846 Quality Control GC/MS Volatiles Method 8260B		
Type	**Frequency**	**Corrective Action**
Surrogates: Toluene-d_8 Bromofluorobenzene 1,2-Dichloroethane-d_4 Dibromofluoromethane	Each sample, MS, MSD, LCS, and blank	Reanalyze sample if outside limits; if reanalysis confirms original, document on report and/or case narrative
Matrix Spikes: Spike all compounds of interest	Each group (≤20) of samples per matrix/level	Evaluation in conjunction with acceptable LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD.
Laboratory Control Samples: Spike all compounds of interest	Each group (≤20) of samples per matrix/level	Reanalyze LCS and associated samples for compounds outside acceptance limits that are also outside MS/MSD acceptance limits. Compounds that fail high in the LCS and are ND in the samples, can be reported.
Matrix Spike Duplicates (RPD): Spike all compounds of interest	Each group (≤20) of samples per matrix/level	Evaluated by analyst in relationship to other QC results
Blanks:	Once for each 12-hour time period or ≤20 samples	Reanalyze blank and associated samples if blank outside limits
Internal Standards (ISTD): Fluorobenzene Chlorobenzene-d_5 1,4-Dichlorobenzene-d_4	Each sample, MS, MSD, LCS, and blank	Reanalyze samples; if reanalysis confirms original, document on report or case narrative

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

Uncontrolled Copy

SW - 846 Quality Control GC/MS Semivolatiles Method 8270C		
Type	**Frequency**	**Corrective Action**
Surrogate: Nitrobenzene-d_5 2-Fluorobiphenyl Terphenyl-d_{14} Phenol-d_6 2-Fluorophenol 2,4,6-Tribromophenol	Each sample, MS, MSD, LCS, and blank	Repeat extraction and analysis; if reanalysis confirms original, document on report and/or case narrative
Matrix Spikes: Spike all compounds of interest	Each group (≤20) of samples per matrix/level	Evaluation in conjunction with acceptable LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD.
Laboratory Control Sample: Spike all compounds of interest	Each group (≤20) of samples per matrix/level	Re-extract and reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds that fail high in the LCS and are ND in the samples, can be reported.
***Matrix Spike Duplicates* (RPD):** Same as for matrix spikes	Each group (≤20) of samples per matrix/level	Evaluated by analyst in relationship to other QC results
Blanks:	Once per extraction group (≤20) of samples, each matrix, level	Re-extract and reanalyze blank and associated samples
Internal Standards (ISTD): 1,4-Dichlorobenzene-d_4 Naphthalene-d_8 Acenaphthene-d_{10} Phenanthrene-d_{10} Chrysene-d_{12} Perylene-d_{12}	Each sample, MS, MSD, LCS, and blank	Reanalyze samples; if reanalysis confirms original, document on report and/or case narrative

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

Uncontrolled Copy

SW - 846 Quality Control GC/MS Semivolatiles Method 8270C SIM		
Type	**Frequency**	**Corrective Action**
Surrogate: Nitrobenzene-d_5 2-Fluorobiphenyl Terphenyl-d_{14}	Each sample, MS, MSD, LCS, and blank	Repeat extraction and analysis; if reanalysis confirms original, document on report and/or case narrative
Matrix Spikes: Spike all compounds of interest	Each group (≤20) of samples per matrix/level	Evaluation in conjunction with acceptable LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD.
Laboratory Control Sample: Spike all compounds of interest	Each group (≤20) of samples per matrix/level	Re-extract and reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds that fail high in the LCS and are ND in the samples, can be reported.
Matrix Spike Duplicates (RPD): Same as for matrix spikes	Each group (≤20) of samples per matrix/level	Evaluated by analyst in relationship to other QC results
Blanks:	Once per extraction group (≤20) of samples, each matrix, level	Re-extract and reanalyze blank and associated samples
Internal Standards (ISTD): 1,4-Dichlorobenzene-d_4 Naphthalene-d_8 Acenaphthene-d_{10} Phenanthrene-d_{10} Chrysene-d_{12} Perylene-d_{12}	Each sample, MS, MSD, LCS, and blank	Reanalyze samples; if reanalysis confirms original, document on report and/or case narrative

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

Uncontrolled Copy

SW - 846 Quality Control GC/MS Volatiles Method 8290		
Type	**Frequency**	**Corrective Action**
Surrogates: 13C Labeled Isotope of each of 17 Toxic PCDD/PCDF	Each sample, MS, MSD, LCS, and blank	Repeat extraction and analysis; if reanalysis confirms original, document on report and/or case narrative
Matrix Spikes: Spike all compounds of interest	Each group (≤20) of samples per matrix/level	Evaluation in conjunction with acceptable LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD.
Laboratory Control Samples: Spike all compounds of interest	Each group (≤20) of samples per matrix/level	Reanalyze LCS and associated samples for compounds outside acceptance limits that are also outside MS/MSD acceptance limits. Compounds that fail high in the LCS and are ND in the samples, can be reported.
Matrix Spike Duplicates (RPD): Spike all compounds of interest	Each group (≤20) of samples per matrix/level	Evaluated by analyst in relationship to other QC results
Blanks:	Once for each 12-hour time period or ≤20 samples	Reanalyze blank and associated samples if blank outside limits
Internal Standards (ISTD): 13C12-1234-TCDD 13C12-123468-HxCDD	Each sample, MS, MSD, LCS, and blank	RT ± 15 secs of retention time in initial calibration.

Uncontrolled Copy

SW-846 Quality Control Pesticides/PCBs Methods 8081; 8082; 8141; 8151		
Type	**Frequency**	**Corrective Action**
Surrogate: Organochlorine Pesticides & PCBs Decachlorobiphenyl (DCB) Tetrachloro-*m*-xylene (TCMX) Herbicides: Dichloroacetic acid (DCAA) Organophosphorous Pesticides: 2-nitro-*m*-xylene (2NMX)	Added to each sample, MS/MSD, blank, LCS/LCSD during the extraction phase	Repeat extraction and analysis. If reanalysis confirms original result, report results and comment in case narrative
Matrix Spikes: Organochlorine Pesticides: Spike all compounds of interest, except PCBs, chlordane, and toxaphene Herbicides & Organophosphorous Pesticides: all compounds of interest PCBs: Aroclor 1016 & Aroclor 1260	Each extraction group (≤20) of samples per matrix/level	Evaluation in conjunction with acceptable LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD.
Laboratory Control Sample: Organochlorine Pesticides: Spike all compounds of interest, except PCBs, chlordane, and toxaphene Herbicides & Organophosphorous Pesticides: all compounds of interest PCBs: Aroclor 1016 & Aroclor 1260	Each group (≤20) when MS/MSD falls outside established limits	Re-extract and reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds that fail high in the LCS and are ND in the samples can be reported.

Uncontrolled Copy

SW-846 Quality Control Pesticides/PCBs Methods 8081; 8082; 8141; 8151 (continued)		
Type	**Frequency**	**Corrective Action**
Matrix Spike Duplicates (RPD): Organochlorine Pesticides: Spike all compounds of interest, except PCBs, chlordane, and toxaphene Herbicides & Organophosphorous Pesticides: all compounds of interest PCBs: Aroclor 1016 & Aroclor 1260	Each extraction group (≤20) of samples per matrix/level	Evaluated in conjunction with acceptable LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD.
Blanks:	Once per extraction group (≤20) of samples, each matrix, level	Inject a hexane or solvent blank first to be sure the analytical system is clean then reinject the blank itself. If the reinjected blank is acceptable, any samples extracted with this blank should be reinjected if they, too, contain the analyte which was contaminating the blank. If the reinjected blank is unacceptable, any affected samples must be reextracted.
Internal Standards (ISTD): Herbicides: 4,4'-dibromo octafluorobiphenyl(DBOB) OP Pesticides: 1-bromo-2-nitrobenzene	Each sample, MS, MSD, LCS, and blank	Reanalyze samples; if reanalysis confirms original, document on report and/or case narrative

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

Uncontrolled Copy

SW-846 Quality Control Volatiles by GC 8021		
Type	**Frequency**	**Corrective Action**
Surrogates: Aromatics; 1-Bromo-4-chlorobenzene (PID)	Each sample, MS, MSD, LCS and blank	Reanalyze if the surrogate recovery is outside the limits unless matrix-related problems are evident.
Matrix Spikes: Spike all compounds of interest	Each group of samples (≤20) of similar matrix/level each method	Evaluation in conjunction with acceptable LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD.
Laboratory Control Sample: Spike all compounds of interest	Each group (≤20); LCSD is analyzed if sufficient volume is not available for MS/MSD	Reanalyze LCS and associated samples for compounds outside of acceptance limits. Compounds that fail high in the LCS and are ND in the samples can be reported.
Internal Standard (ISTD): Aromatics; 1-chloro-3-fluorobenzene	Each sample, LCS , MS, MSD, blank, and standard	Reanalyze samples; if reanalysis confirms original, document on report and/or case narrative. In cases where the sample matrix is elevating the ISTD recovery, a dilution and reanalysis may be performed.
Matrix Spike Duplicate (RPD): Same compounds as matrix spikes	Each group (≤20) of samples per matrix/level	Evaluated by analyst in relationship to other QC results
Blanks:	At least once per batch (≤20 samples) and once per 24 hours	Reanalyze blank and associated samples if blank is outside limits

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

Uncontrolled Copy

SW-846 Quality Control Petroleum Analysis		
Type	**Frequency**	**Corrective Action**
Surrogate: α,α,α-Trifluorotoluene (PID)	Each sample, MS, MSD, LCS, and blank	Reanalyze if the surrogate recovery is outside the limits unless matrix-related problems are evident.
Matrix Spike: Spike all compounds of interest	Each group (≤20) of samples per matrix/level	Evaluation in conjunction with acceptable LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD.
Laboratory Control Sample: Spike all compounds of interest	Each group (≤20) of samples per matrix/level. LCSD analyzed if sufficient volume is not available for MS/MSD	Reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds that fail high and are ND in the samples can be reported.
Matrix Spike Duplicates (RPD):	Each group (≤20) of samples per matrix/level	Evaluated by an analyst in relationship to other QC results
Blanks:	At least once per batch (≤20 samples) and once per 24 hours	Reanalyze blank and associated samples if blank is outside limits
Internal Standards (ISTD): 1-Chloro-3-fluorobenzene (PID)	Each sample, MS, MSD, LCS, and blank analyzed on the PID	Reanalyze samples; if reanalysis confirms original result, document on report or case narrative. In cases where the sample matrix is elevating the ISTD recovery, a dilution and reanalysis may be performed.

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

Uncontrolled Copy

SW-846 Quality Control PAHs by HPLC Method 8310		
Type	**Frequency**	**Corrective Action**
Surrogate: Nitrobenzene and Triphenylene	Added to each sample, MS/MSD, blank, LCS/LCSD prior to extraction	Re-extract and reanalyze. If re-extraction and reanalysis confirms then comment on report and/or case narrative. Re-extraction may not be needed if matrix related problems are evident. Comment in case narrative.
Matrix Spike: Spike all compounds of interest	Each group (≤20) of samples per matrix/level	Evaluation in conjunction with acceptable LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD.
Laboratory Control Sample: Spike all compounds of interest	Each group (≤20) of samples per matrix/level	Re-extract and reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds that fail high in the LCS and are ND in the samples can be reported.
Matrix Spike Duplicates (RPD): Spike all compounds of interest	Each group (≤20) of samples per matrix/level	Evaluated by analyst in relationship to other QC results
Blanks:	Once per extraction group (≤20 samples), per matrix/level	Inject a solvent blank first to be sure the analytical system is clean then reinject the blank itself. If the reinjected blank is acceptable, any samples extracted with this blank should be reinjected, if they, too, contain the analyte which was contaminating the blank. If the reinjected blank is unacceptable, any affected samples must be re-extracted.

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

Uncontrolled Copy

SW-846 Quality Control TPH-DRO 8015B		
Type	**Frequency**	**Corrective Action**
Surrogate: *o*-Terphenyl	Added to each sample, MS/MSD, blank, LCS/LCSD during the extraction phase	Repeat extraction and analysis. If reanalysis confirms original result, report results and comment in case narrative.
Matrix Spike: # 2 Fuel	Each group (≤20) of samples per matrix/level	Reinject if surrogates appear low. If still out of spec, evaluate for matrix effect. If matrix effect, accept based on LCS data. If no matrix effect, repeat batch.
Laboratory Control Sample: # 2 Fuel	Each group (≤20) of samples per matrix/level	Reinject if surrogates appear low. If still out of spec, reextract batch. LCS that fails high and DRO is ND in the samples can be reported.
Laboratory Control Duplicates (RPD): # 2 Fuel	Each group (≤20) of samples per matrix/level	Evaluated by analyst in relationship to other QC results
Blanks:	Once per extraction group (≤20) of samples, each matrix, level	Inject a solvent blank first to be sure the analytical system is clean then reinject the blank itself. If the reinjected blank is acceptable, any samples extracted with this blank should be reinjected, if they, too, contain the analyte which was contaminating the blank. If the reinjected blank is unacceptable, any affected samples must be re-extracted.

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

Uncontrolled Copy

SW-846 Quality Control TPH-GRO 8015B		
Type	**Frequency**	**Corrective Action**
Surrogate: Trifluorotoluene (FID)	Each sample, MS/MSD, LCS, and blank	Reanalyze if the surrogate recovery is outside the limits unless matrix-related problems are evident
Matrix Spike: Gasoline standard	Each group of samples of similar matrix/level (≤20) each method	Evaluation in conjunction with acceptable LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD.
Laboratory Control Sample Gasoline standard	Each group (≤20) of samples. LCSD analyzed if sufficient volume is not available for MS/MSD.	Reanalyze LCS and associated samples. LCS that fails high and GRO is ND in the samples can be reported.
Matrix Spike Duplicate (RPD): Same compounds as matrix spikes	Each group (≤20) of samples per matrix/level	Evaluated by analyst in relationship to other QC results
Blanks:	At least one per 20 samples and at least once per 24 hours.	Reanalyze blank and associated samples if blank is outside limits

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change

Uncontrolled Copy

SW-846 Quality Control* Inorganics (Metals)		
Type	**Frequency**	**Corrective Action**
Internal Standard (ICP & ICP/MS only):	Each sample, standard and QC (Unspiked, Dup., MS, MSD, LCS, dilution, post digestion spike and blank)	If the internal standard response falls outside the specified range, then the samples would be reanalyzed.
Matrix Spikes:	Each group of samples of similar matrix/level (≤20) each method	Analyze post-digestion spike sample
Matrix Spike Duplicate (RPD):	Each group of samples of similar matrix/level (20) each method	Analyze post-digestion spike sample if not already run for MS, flag the data
Duplicates (RPD):	Each group of samples of similar matrix/level (≤20) each method	Flag the data
Blanks: Initial Calibration (ICB) Continuing Calibration (CCB)	Each element immediately after calibration verification at 10% frequency or every 2 hours (beginning and end of run min.)	Correct problem, recalibrate, and rerun
Preparation Blank	Each SDG or batch (≤20 samples)	Redigest and reanalyze blank and associated samples if sample result is greater than the LOQ and <20× blank result
Serial Dilutions (ICP, ICP/MS only):	Each group of (≤20) of similar matrix/level	Flag the data
Interference Check Sample (ICP, ICP/MS only):	Each element after Initial Calibration Verification at beginning and end of the run or min. of 2× per 8 hour	Correct for interference, recalibrate the instrument
Laboratory Control Sample:	Each SDG or batch (≤20 samples), each method	Redigest and reanalyze LCS and associated samples. Elements in the LCS that fail high and are ND in the samples can be reported.
Post Digestion Spike:	When matrix spikes are outside 75 % - 125% range, or the statistical window (whichever is tighter).	Flag the data

Uncontrolled Copy

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

QC Table for SW-846 Miscellaneous Water Tests			
Test	**QC Type**	**Frequency**	**Corrective Action**
Sulfide	Blank	Each group of samples of similar matrix (≤20)	Prepare the entire batch again and re-analyze.
	Laboratory Control Sample	Each group of samples of similar matrix (≤20)	Prepare the entire batch again and re-analyze. LCSs that fail high (and associated samples are ND) can be reported.
	Duplicate	Each group of samples of similar matrix (≤20)	Ensure that LCS meets acceptance criteria.
	Matrix Spike/ Matrix Spike Duplicate	Each group of samples of similar matrix (≤20)	Ensure that LCS meets acceptance criteria.
Bromide (IC) Chloride (IC) Cyanide (total) Fluoride (IC) Nitrate/Nitrite (IC) Sulfate (IC)	Blank	Each group of samples of similar matrix (≤20)	Prepare the entire batch again and re-analyze.
	Laboratory Control Sample	Each group of samples of similar matrix (≤20)	Prepare the entire batch again and re-analyze. LCSs that fail high (and associated samples are ND) can be reported.
	Duplicate	Each group of samples of similar matrix (≤10)	Ensure that LCS meets acceptance criteria.
	Matrix Spike	Each group of samples of similar matrix (≤10)	Ensure that LCS meets acceptance criteria.
Phenols TOC Quad	Blank	Each group of samples of similar matrix (≤20)	Prepare the entire batch again and re-analyze.
	Laboratory Control Sample	Each group of samples of similar matrix (≤20)	Prepare the entire batch again and re-analyze. LCSs that fail high (and associated samples are ND) can be reported.
	Matrix Spike/ Matrix Spike Duplicate	Each group of samples of similar matrix (≤10)	Ensure that LCS meets acceptance criteria.
pH Moisture	Laboratory Control Sample	Each group of samples of similar matrix (≤20)	Re-analyze samples.
	Duplicate	Each group of samples of similar matrix (≤10)	Ensure that LCS meets acceptance criteria.
Microbiology	Organism control	Each lot of media (minimum of one per month)	Investigate cause
	Negative control	Each lot of media (minimum of one per month)	Investigate cause

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

Uncontrolled Copy

CLP Quality Control GC/MS Volatiles		
Type	**Frequency**	**Corrective Action**
Surrogates: Toluene-d_8 Bromofluorobenzene 1,2-Dichloroethane-d_4	Each sample, MS, MSD, and blank	Reanalyze sample if outside limits; if reanalysis confirms original, document on report and/or case narrative
Matrix Spikes: 1,1-Dichloroethene Trichloroethene Benzene Toluene Chlorobenzene	Each group of samples (≤20) per matrix/level	Advisory Only Evaluated by analyst in relationship to other QC results
Matrix Spike Duplicates (RPD): 1,1-Dichloroethene Trichloroethene Benzene Toluene Chlorobenzene	Each group of samples (≤20) per matrix/level	Advisory Only Evaluated by analyst in relationship to other QC results
Blanks:	Once for each 12-hour time period or ≤20 samples	Reanalyze blank and associated samples if blank outside limits
Internal Standards (ISTD): Bromochloromethane 1,4-Difluorobenzene Chlorobenzene-d_5	Each sample, MS, MSD, and blank	Reanalyze samples; if reanalysis confirms original, document on report or case narrative

Some of the CLP recovery limits are advisory limits only. If in the opinion of the analyst, a problem other than the matrix exists, the samples will be reanalyzed.

Uncontrolled Copy

CLP Quality Control GC/MS Semivolatiles		
Type	**Frequency**	**Corrective Action**
Surrogate: Nitrobenzene-d_5 2-Fluorobiphenyl Terphenyl-d_{14} Phenol-d_5 2-Fluorophenol 2,4,6-Tribromophenol 2-Chlorophenol-d_4 1,2-dichlorobenzene-d_4	Each sample, MS, MSD, and blank (Advisory) (Advisory)	Re-extract and reanalyze if more than one surrogate out per fraction (acid/base) or any recovery <10%; if re-extraction and reanalysis confirms originals, document on report and/or case narrative
Matrix Spikes & Matrix Spike Duplicates (RPD): Phenol 2-Chlorophenol 1,4-Dichlorobenzene N-Nitroso-di-n-propylamine 1,2,4-Trichlorobenzene 4-Chloro-3-methylphenol Acenaphthene 4-Nitrophenol 2,4-Dinitrotoluene Pentachlorophenol Pyrene	Each group (≤20) of samples per matrix/level	Advisory Only Evaluated by analyst in relationship to other QC results
Blanks:	Once per extraction group (≤20) of samples, each matrix, level, instrument	Reextract and reanalyze blank and associated samples, except for phthalate contamination, which is allowed to be present at levels up to 5 times the CRQL.
Internal Standards (ISTD): 1,4-Dichlorobenzene-d_4 Naphthalene-d_8 Acenaphthene-d_{10} Phenanthrene-d_{10} Chrysene-d_{12} Perylene-d_{12}	Each sample, MS, MSD, and blank	Reanalyze samples; if reanalysis confirms original, document on report and/or case narrative

Some of the CLP recovery limits are advisory limits only. If in the opinion of the analyst, a problem exists other than matrix, the sample will be reanalyzed.

Uncontrolled Copy

CLP Quality Control Pesticides/PCBs		
Type	**Frequency**	**Corrective Action**
Surrogates: Tetrachloro-*m*-xylene (TCMX) Decachlorobiphenyl (DCB)	Added to each sample, MS/MSD, and blank during the extraction phase	Advisory Only for Samples For Blank, reinject; if still out reextract and reanalyze blank and associated samples
Matrix Spikes & Matrix Spike Duplicates (RPD): gamma-BHC (Lindane) Heptachlor Aldrin Dieldrin Endrin 4,4'-DDT	Each extraction group (≤20) of samples per matrix/level	Advisory Only Evaluated by analyst in relationship to other QC results
Blanks:	Once per extraction group (≤20) of samples, each matrix, level	Inject a hexane or solvent blank first to be sure the analytical system is clean then reinject the blank itself. If the reinjected blank is acceptable, any samples extracted with this blank should be reinjected if they, too, contain the analyte which was contaminating the blank. If the reinjected blank is unacceptable, any affected samples must be reprepped.

Some of the CLP recovery limits are advisory limits only. If in the opinion of the analyst, a problem exists other than matrix, the sample will be reanalyzed.

Uncontrolled Copy

CLP Quality Control Inorganics		
Type	**Frequency**	**Corrective Action**
Internal Standard (ICP & ICP/MS only):	Each sample, standard and QC (Unspiked, Dup., MS, , LCS, dilution, post digestion spike and blank)	If the internal standard response falls outside the specified range, then the samples would be reanalyzed.
Matrix Spikes:	Each group of samples of similar matrix/level (≤20) each method	Analyze post-digestion spike sample
Duplicates (RPD):	Each group of samples of similar matrix/level (≤20) each method	Flag the data
Blanks: Initial Calibration (ICB) Continuing Calibration (CCB) Preparation Blank	Each wavelength immediately after calibration verification at 10% frequency or every 2 hours (beginning and end of run min.) Each SDG or batch (≤20 samples)	Correct problem, recalibrate, and rerun Redigest and reanalyze blank and associated samples if sample result is greater than the LOQ and <20× blank result
Serial Dilutions (ICP, ICP/MS only):	Each group of (≤20) of similar matrix/level	Flag the data
Interference Check Sample:	Each wavelength after Initial Calibration Verification at beginning and end of the run and per 20 samples	Correct for interference, recalibrate the instrument
Laboratory Control Sample:	Each SDG or batch (≤20 samples), each method	Redigest and reanalyze LCS and associated samples
Post Digestion Spike:	When matrix spikes are outside 75% to 125% range	Flag the data

Some of the CLP recovery limits are advisory limits only. If in the opinion of the analyst, a problem exists other than matrix, the sample will be reanalyzed.

Uncontrolled Copy

Drinking Water Quality Control Inorganics (Metals)		
Type	**Frequency**	**Corrective Action**
Internal Standard (ICP & ICP/MS only):	Each sample, standard and QC (Unspiked, Dup., MS, MS, LFB, Post Digestion Spike, dilution and blank)	If the internal standard response falls outside the specified range, then the samples would be reanalyzed.
Matrix Spikes:	Each group of samples of similar matrix/level (≤10) each method	Analyze post-digestion spike sample
Duplicates (RPD):	Each group of samples of similar matrix/level (≤10) each method	Flag the data
Blanks: Initial Calibration (ICB) Continuing Calibration (CCB)	Each wavelength immediately after calibration verification at 10% frequency	Correct problem, recalibrate, and rerun
Preparation Blank	Each batch (≤10 samples)	Redigest and reanalyze blank and associated samples if sample result <10 times blank result or >LOQ
Laboratory Fortified Blank (LFB):	Each batch (≤10 samples)	Redigest and reanalyze LFB and associated samples. Elements that fail high in the LFB and are ND in the samples can be reported.
Post Digestion Spike:	When matrix spikes are outside range	Flag the data

Uncontrolled Copy

Drinking Water EPA Method 525.2 Quality Control		
Type	**Frequency**	**Corrective Action**
Lab Reagent Blank (LRB):	One per extraction batch of (≤20) samples	Re-extract and reanalyze blank and associated samples
Lab Fortified Blank (LFB): Spike all compounds of interest	One per extraction batch of (≤20) samples	Re-extract and reanalyze LFB and associated samples for compounds outside acceptance limits. Compounds that fail high in the LFB and are ND in the samples can be reported.
Matrix Spike/Matrix Spike Duplicate (MS/MSD): Spike all compounds of interest	One per extraction batch of (≤20) samples	Recoveries for LFB must be within criteria. If there is insufficient sample for MSD, then a duplicate (extraction and analysis) of another sample in the batch must be performed.
Surrogates: 1,3-Dimethyl-2-nitrobenzene Perylene-d_{12} Triphenylphosphate	Each sample, LFB, MS, MSD, and blank	Re-extract and reanalyze the sample
Internal Standards (ISTD): Acenaphthene-d_{10} Phenanthrene-d_{10} Chrysene-d_{12}	Each sample, LFB, MS, MSD, and blank	Reanalyze samples

Uncontrolled Copy

QC Table for Miscellaneous Water Tests			
Test	**QC Type**	**Frequency**	**Corrective Action**
Alkalinity **Ammonia (ISE)** **Ammonia (Distill)** **Dissolved Solids** **Fluoride (ISE)** **Hardness** **Sulfate (TURB)** **Sulfide** **Total Solids** **Turbidity**	Blank	Each group of samples of similar matrix (≤20)	Prepare the entire batch again and re-analyze.
	Laboratory Fortified Blank	Each group of samples of similar matrix (≤20)	Prepare the entire batch again and re-analyze.*
	Duplicate	Each group of samples of similar matrix (≤20) Alkalinity, Dissolved Solids, Total Solids, Turbidity each group of similar matrix (≤10)	Ensure that LFB meets acceptance criteria.
	Matrix Spike/ Matrix Spike Duplicate	Each group of samples of similar matrix (≤20) (not for Turbidity)	Ensure that LFB meets acceptance criteria.
Bromide (IC) **Chloride (IC)** **Cyanide (total & free)** **Fluoride (IC)** **Nitrogen (TKN)** **Nitrate/Nitrite** **Sulfate (IC)** **Total Phosphorus** **TOC**	Blank	Each group of samples of similar matrix (≤20)	Prepare the entire batch again and re-analyze.
	Laboratory Fortified Blank	Each group of samples of similar matrix (≤20)	Prepare the entire batch again and re-analyze.*
	Duplicate	Each group of samples of similar matrix (≤10)	Ensure that LFB meets acceptance criteria.
	Matrix Spike	Each group of samples of similar matrix (≤10)	Ensure that LFB meets acceptance criteria.
Phenols	Blank	Each group of samples of similar matrix (≤20)	Prepare the entire batch again and re-analyze.
	Laboratory Fortified Blank/Laboratory Control Sample	Each group of samples of similar matrix (≤20)	Prepare the entire batch again and re-analyze.*
	Matrix Spike/ Matrix Spike Duplicate	Each group of samples of similar matrix (≤10)	Ensure that LFB meets acceptance criteria.
pH **Moisture**	Laboratory Fortified Blank	Each group of samples of similar matrix (≤20)	Re-analyze samples.
	Duplicate	Each group of samples of similar matrix (≤10)	Ensure that LFB meets acceptance criteria.
Microbiology	Organism control (+)	Each lot of media (minimum of one per month)	Investigate cause
	Negative control (-)	Each lot of media (minimum of one per month)	Investigate cause

*LFBs that fail high and associated samples are ND can be reported.

Uncontrolled Copy

QC Table for Drinking Water Methods: 507, 508, 515.1, 531.1		
Type of QC	**Frequency**	**Corrective Action**
Blank	Each batch of (≤20) samples	Inject a solvent blank to check for analytical system contamination. Re-inject the blank. If the re-injected blank is acceptable then any samples with positive results must be re-injected. If the re-injected blank is unacceptable, all associated samples must be re-extracted.
Surrogate	Added to each field and QC sample during the extraction.	Recovery must be within specifications unless matrix-related problems are evident, in which case report results and comment.
Matrix Spike/Matrix Spike Duplicate Spike all compounds of interest, except multipeak compounds	Each batch (≤20) of samples if sample volume is available.	Evaluate in conjunction with the LFB.
Laboratory Fortified Blank (LFB) Spike all compounds of interest, rotate multipeak compounds	Each batch of (≤20) samples. LCSD may be used if insufficient sample for MS/MSD is submitted.	If LFB compounds are outside of acceptance limits, re-extract and re-analyze the batch. Compounds that fail high in the LFB and are ND in the samples can be reported.

Uncontrolled Copy

QC Table for Drinking Water Method: 524.2		
Type of QC	**Frequency**	**Corrective Action**
Blank	One blank for each 12-hour period or batch of ≤20 samples	Reanalyze blank and associated samples if blank is unacceptable.
Surrogate 4-Bromofluorobenzene 1,2-Dichlorobenzene-d_4	Added to each field and QC sample prior to analysis	Reanalyze sample if outside limits. If reanalysis confirms original, document on report.
Matrix Spike/Matrix Spike Duplicate Spike all compounds of interest	At client request.	Evaluate in conjunction with the LFB.
Laboratory Fortified Blank (LFB) Spike all compounds of interest	One LFB for each 12 hour period.	If target compounds are outside of acceptance limits, re-analyze the LFB. If second LFB fails, recalibrate instrument, re-analyze LFB and any associated samples. Compounds that fail high in the LFB and are ND in the samples can be reported.
Internal standard (ISTD) Fluorobenzene	Added to each field and QC sample prior to analysis	Reanalyze sample if outside limits. If reanalysis confirms original, document on report.

Uncontrolled Copy

EPA 624 Quality Control GC/MS Volatiles		
Type	**Frequency**	**Corrective Action**
Surrogates: 4-Bromofluorobenzene 1,2-Dichloroethane-d_4 Fluorobenzene	Each sample, MS, MSD, LCS, and blank	Reanalyze sample if outside limits; if reanalysis is within limits, the reanalysis data is reported. If surrogates confirm original, document on report and/or case narrative
Matrix Spikes: Spike all compounds of interest	Each batch (≤20) of samples	Evaluated by analyst in conjunction with the LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD.
Laboratory Control Samples: Spike all compounds of interest	Each batch (≤20) of samples	Reanalyze LCS and associated samples for compounds outside acceptance limits that are also outside MS/MSD acceptance limits. Compounds that fail high in the LCS and are ND in the samples can be reported.
Matrix Spike Duplicates (RPD): Spike all compounds of interest	Each batch (≤20) of samples	Evaluated by analyst in relationship to other QC results
Blanks:	Once every 24-hour tune period and/or 20 samples, which ever comes first	Reanalyze blank and associated samples if blank outside QC limits
Internal Standards (ISTD): Bromochloromethane 2-Bromo-1-chloropropane 1,4-Difluorobenzene	Each sample, MS, MSD, LCS, and blank	Reanalyze sample if outside limits; if reanalysis is within limits, the reanalysis data is reported. If internals confirm original, document on report and/or case narrative

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

Uncontrolled Copy

EPA 625 Quality Control GC/MS Semivolatiles		
Type	**Frequency**	**Corrective Action**
Surrogate: Nitrobenzene-d_5 2-Fluorobiphenyl Terphenyl-d_{14} Phenol-d_6 2-Fluorophenol 2,4,6-Tribromophenol	Each sample, MS, MSD, LCS, and blank	Re-extract and reanalyze if more than one surrogate out per fraction (acid/base) or any recovery <10%; if re-extraction and reanalysis confirms originals, document on report and/or case narrative
Matrix Spikes: Spike all compounds of interest	Each group (≤20) of samples per matrix/level	Evaluate in conjunction with the LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD.
Laboratory Control Sample: Spike all compounds of interest	Each group (≤20) of samples per matrix/level	Re-extract and reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds that fail high in the LCS and are ND in the samples can be reported.
Matrix Spike Duplicates (RPD): Same as for matrix spikes	Each group (≤20) of samples per matrix/level	Evaluated by analyst in relationship to other QC results
Blanks:	Once per extraction group (≤20) of samples, each matrix, level, instrument	Re-extract and reanalyze blank and associated samples
Internal Standards (ISTD): 1,4-Dichlorobenzene-d_4 2-Fluoronaphthalene Acenaphthene-d_{10} Phenanthrene-d_{10} Chrysene-d_{12} Perylene-d_{12}	Each sample, MS, MSD, LCS, and blank	Reanalyze samples; if reanalysis confirms original, document on report and/or case narrative

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

Uncontrolled Copy

EPA 608 Quality Control Pesticides/PCBs		
Type	**Frequency**	**Corrective Action**
Surrogate: Organochlorine Pesticides & PCBs DCB TCMX	Each sample, MS, MSD, LCS, and blank	Repeat extraction and analysis if reanalysis confirms original report results and comment in case narrative
Matrix Spikes: Organochlorine Pesticides: Spike all compounds of interest, except PCBs, chlordane, and toxaphene PCBs: Aroclor 1016 and Aroclor 1260	Each batch (≤20) of samples	Evaluate in conjunction with LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD.
Matrix Spike Duplicates (RPD): Organochlorine Pesticides: Spike all compounds of interest, except PCBs, chlordane, and toxaphene PCBs: Aroclor 1016 and Aroclor 1260	Each batch (≤20) of samples	Evaluated by analyst in relationship to other QC results
Laboratory Control Sample: Organochlorine Pesticides: Spike all compounds of interest, except PCBs, chlordane, and toxaphene PCBs: Aroclor 1016 and Aroclor 1260	Each batch (≤20) of samples	Re-extract and reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds in the LCS that fail high and are ND in the samples can be reported.
Blanks:	Each batch (≤20) of samples	Inject a hexane or solvent blank first to be sure the analytical system is clean then reinject the blank itself. If the reinjected blank is acceptable, any samples extracted with this blank should be reinjected if they, too, contain the analyte which was contaminating the blank. If the reinjected blank is unacceptable, any affected samples must be reextracted.

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

Uncontrolled Copy

EPA Method 602 Petroleum Analysis Acceptance Criteria		
Type	**Frequency**	**Corrective Action**
Surrogate: α,α,α-Trifluorotoluene (PID)	Each sample, MS, MSD, LCS, and blank	Reanalyze if the surrogate recovery is outside the limits unless matrix-related problems are evident.
Matrix Spike: Spike all compounds of interest	Each group (≤20) of samples	Evaluate in conjunction with LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD.
Laboratory Control Sample: Spike all compounds of interest	Each group (≤20) of samples. LCSD analyzed if sufficient volume is not available for MS/MSD	Reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds in the LCS that fail high and are ND in the samples can be reported.
Matrix Spike Duplicates (RPD): Same compounds as the matrix spike	Each group (≤20) of samples	Evaluated by an analyst in relationship to other QC results
Blanks:	At least once per 24 hours	Reanalyze blank and associated samples if blank is outside limits
Internal Standards (ISTD): 1-Chloro-3-fluorobenzene (PID)	Each sample, MS, MSD, LCS, and blank	Reanalyze samples; if reanalysis confirms original result, document on report or case narrative. In cases where the sample matrix is elevating the ISTD recovery, a dilution and reanalysis may be performed.

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change

Uncontrolled Copy

EPA 610 Quality Control PAHs by HPLC		
Type	**Frequency**	**Corrective Action**
Surrogate: Nitrobenzene Triphenylene	Each sample, MS, MSD, LCS, and blank	Re-extract and reanalyze. If re-extraction and reanalysis confirms then comment on report and/or case narrative. Re-extraction may not be needed if matrix related problems are evident. Comment in case narrative.
Matrix Spike: Spike all compounds of interest	Each batch (≤20) of samples	Evaluate in conjunction with LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD.
Laboratory Control Sample: Spike all compounds of interest	Each batch (≤20) of samples	Re-extract and reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds in the LCS that fail high and are ND in the samples can be reported.
Matrix Spike Duplicates (RPD): Spike all compounds of interest	Each batch (≤20) of samples	Evaluated by analyst in relationship to other QC results
Blanks:	Each batch (≤20) of samples	Inject a solvent blank first to be sure the analytical system is clean then reinject the blank itself. If the reinjected blank is acceptable, any samples extracted with this blank should be reinjected, if they, too, contain the analyte which was contaminating the blank. If the reinjected blank is unacceptable, any affected samples must be re-extracted.

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

Uncontrolled Copy

EPA Method 600 Series (Method 200.8 for ICP/MS) Quality Control Inorganics (Metals)		
Type	**Frequency**	**Corrective Action**
Internal Standard:	Each sample, standard and QC (Unspiked, Dup., MS, LCS, dilution, Post Digestion Spike and blank)	If the internal standard response falls outside the specified range, then the samples would be reanalyzed.
Matrix Spikes:	Each group of samples of similar matrix/level (≤10) each method	Analyze post-digestion spike sample
Matrix Spike Duplicate (RPD):	Not required	N/A
Duplicates (RPD):	Each group of samples of similar matrix/level (≤10) each method	Flag the data
Blanks: Initial Calibration (ICB) Continuing Calibration (CCB) Preparation Blank	Each wavelength immediately after calibration verification at 10% frequency or every 2 hours (beginning and end of run min.) Each SDG or batch (≤10 samples)	Correct problem, recalibrate, and rerun Redigest and reanalyze blank and associated samples if sample result is greater than the LOQ and <20× blank result
Serial Dilutions:	Each group of (≤10) of similar matrix/level	Flag the data
Interference Check Sample:	Each wavelength after Initial Calibration Verification at beginning and end of the run or min. of 2 times per 8 hour	Correct for interference, recalibrate the instrument
Laboratory Control Sample:	Each SDG or batch (≤10 samples), each method	Redigest and reanalyze LCS and associated samples. Elements in the LCS that fail high and are ND in the samples can be reported.
Post Digestion Spike:	When matrix spikes are outside 70% to 130% range or within the statistical window (whichever is tighter)	Flag the data
Analytical Spike:	One per 10 field samples	ICP-MS – flag the data

Uncontrolled Copy

Quality Control for Miscellaneous 600 Series Water Tests			
Test	**QC Type**	**Frequency**	**Corrective Action**
Alkalinity **Ammonia (ISE)** **Ammonia (Distill.)** **Dissolved Solids** **Fluoride (ISE)** **Hardness** **Sulfate (turb)** **Sulfide** **Total Solids** **Turbidity**	Blank	Each batch (≤20) of samples	Prepare the entire batch again and re-analyze.
	Laboratory Control Sample	Each batch (≤20) of samples	Prepare the entire batch again and re-analyze.*
	Duplicate	Each batch (≤20) of samples	Ensure that LCS meets acceptance criteria.
	Matrix Spike/ Matrix Spike Duplicate	Each batch (≤20) of samples (not for turbidity)	Ensure that LCS meets acceptance criteria.
Bromide (IC) **Chloride (IC)** **Sulfate (IC)** **Cyanide (total & free)** **Fluoride (IC)** **Nitrogen (TKN)** **Nitrate/Nitrite** **Total Phosphorus** **TOC**	Blank	Each batch (≤20) of samples	Prepare the entire batch again and re-analyze.
	Laboratory Control Sample	Each batch (≤20) of samples	Prepare the entire batch again and re-analyze.*
	Duplicate	Each batch (≤10) of samples	Ensure that LCS meets acceptance criteria.
	Matrix Spike	Each batch (≤10) of samples	Ensure that LCS meets acceptance criteria.
Phenols	Blank	Each batch (≤20) of samples	Prepare the entire batch again and re-analyze.
	Laboratory Control Sample	Each batch (≤20) of samples	Prepare the entire batch again and re-analyze.*
	Matrix Spike/ Matrix Spike Duplicate	Each batch (≤10) of samples	Ensure that LCS meets acceptance criteria.

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

*LCSs that fail high and associated samples are ND can be reported.

Uncontrolled Copy

TO-15 Volatile Organics in Air		
Type	**Frequency**	**Corrective Action**
Laboratory Control Sample: Spike all compounds of interest	Each group (≤20) of samples	Reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds that fail high in the LCS and are ND in the samples, can be reported.
Blanks:	Once for each 24-hour time period or ≤20 samples	Reanalyze blank and associated samples if blank outside limits
Internal Standards (ISTD): Bromochloromethane 1,4-Difluorobenzene Chlorobenzene-d_5	Each sample, LCS, and blank	Reanalyze samples; if reanalysis confirms original, document on report and/or case narrative

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

Uncontrolled Copy

TO-14A Volatile Organics in Air		
Type	**Frequency**	**Corrective Action**
Laboratory Control Sample: Spike all compounds of interest	Each group (≤20) of samples	Reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds that fail high in the LCS and are ND in the samples, can be reported.
Blanks:	Once for each 24-hour time period or ≤20 samples	Reanalyze blank and associated samples if blank outside limits
Internal Standards (ISTD): Bromochloromethane 1,4-Difluorobenzene Chlorobenzene-d_5	Each sample, LCS, and blank	Reanalyze samples; if reanalysis confirms original, document on report and/or case narrative

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

Uncontrolled Copy

eurofins | Lancaster Laboratories

Environmental Quality Policy Manual

Appendix K
Microbiological Testing

Current as of October 05, 2011
5 Total Pages (including this coversheet)

Uncontrolled Copy

MICROBIOLOGICAL TESTING

1. MICROBIOLOGICAL SAMPLE HANDLING

1.1. Microbiological Sample Collection

The containers for environmental microbiology are typically sterile, screw-cap plastic bottles. A minimum of 100 mL of sample is required. The sampling containers are purchased with a sterility certification. The sterility, absence of autofluoresence, and volume of each purchased lot of containers is verified by randomly selecting a container from each purchased lot and inoculating it with approximately 100 mL of sterile tryptic soy broth and placing it in incubation for 24 hours at 35° ± 0.5°C. Each lot of bottles is also checked for absence of autofluoresence with a 366-nm UV light with a 6-Watt bulb. The 100-mL calibration line on the container is verified using a 100-mL Class A graduated cylinder to 2.5% tolerance.

Samples collected for microbiological analyses must follow a specific protocol:

- The sampling taps are to be free of aerators, strainers, hose attachments, and purification devices; they should not be mixing type faucets, and avoid leaky faucets.
- Maintain a steady water flow for 3 to 5 minutes before collecting the sample.
- Using aseptic techniques, fill the container to just above the 100-mL mark on the container. This will allow for mixing and chlorine residual analysis.
- Do not overfill the container.
- If another environmental microbial analysis is required, or if the water is discolored (to act as a color standard), a separate container will be required.

1.2. Microbiological Sample Storage

Because sample integrity can be compromised by improper storage, the environmental microbiology samples are refrigerated with the temperature monitored until requested by the microbiologist for analysis.

Holding times for samples are monitored and analysis is scheduled accordingly. For SDWA compliance purposes, no sample (for total coliform analysis) with over 30 hours elapsed time from collection will be analyzed. HPC samples from SDWA surface water systems must be tested within 8 hours of collection. Fecal coliform tests on effluents for NPDES compliance purposes must be transported to the laboratory within 6 hours of collection. Samples that arrive past 6 hours of when they were collected can not be tested. Whenever possible, the sample should be tested within 2 hours of receipt.

1.3. Microbiological Sample Return/Disposal

All solid wastes generated from the microbiological analyses are disposed of in bags designated as "BioHazard", sterilized via autoclave and disposed of by incineration. Lancaster Laboratories uses a sophisticated, computerized sample management system (CSMS), which includes programming to assist in the identification of hazardous wastes at time of discard. In most cases, a sample for coliform testing is collected in a container that will also be the test vessel. These samples are assigned a discard location. If a sample is being tested for an analysis other than microbiology, it will be assigned a storage location.

Uncontrolled Copy

2. MICROBIOLOGICAL TECHNICAL REQUIREMENTS AND TRACEABILITY OF MEASUREMENTS

2.1. Media

- Within the microbiology laboratory, procedures are in place to address preparation, labeling, storage, expiration, documentation, and quality/sterility evaluation requirements for these materials. Only commercially prepared or manufactured dehydrated media is used for SDWA water work. Media may not be formulated from basic ingredients. Each new lot of dehydrated or commercially prepared medium is checked against positive and negative culture controls. Each purchased lot of MMO-MUG media is tested for performance using *E. coli*, *K. pneumoniae*, and *Ps. aeruginosa*, or equivalent organisms following a standard operating procedure. The positive/negative organism check is performed on each new lot of purchased or prepared media for QC purposes.

- Each analytical method includes a list of media needed for the test. These are fully described, including name, purity, and description of preparation. Where applicable, shelf life and storage conditions are also listed.

- The Microbiology Department is responsible for maintaining an inventory of the media needed. New supplies of media are checked by the Purchasing Department to ensure that they match the purchase order. The laboratory is responsible for checking that new supplies meet the method requirements.

- In addition to the name and concentration, the media containers are labeled with the storage conditions, the date opened, and an expiration or re-evaluation date. Subsequent media preparations at the laboratory are fully documented in a logbook and are traceable to, or labeled to include:

    1. Name of media
    2. Concentration, as appropriate
    3. Date prepared
    4. Name of analyst preparing or reference to logbook
    5. Storage conditions
    6. Expiration/re-evaluation date
    7. Manufacturer name and lot #
    8. Sterilization time and temperature
    9. Final pH, where required
    10. Sterility check result

2.2. Microbiological Standard Sources, Calibration, and Preparation

Microbial Control Species - Where required, laboratory cultures are obtained from the American Type Culture Collection (ATCC). Cultures used in testing are no more than five transfers from ATCC freeze-dried cultures.

2.3. Microbiological Equipment Maintenance

Equipment maintenance and calibration is addressed in instrument-specific Operation, Maintenance, and Calibration Procedures (OMC) or instrument-specific instruction manuals located within the department.

Uncontrolled Copy

The general process for sterilization procedures are outlined below:

2.3.1. All autoclaving is done at 121° ± 1°C, with times as specified below (in minutes):

Carbohydrate media	25
Rinse water	60
Contaminated materials	minimum of 70

2.3.2. Sterile disposable single use membrane filter units or sterile glass filter funnels are used for methods that require filtration.

2.4. Microbiological Labware Cleaning

Sterile disposable plasticware is primarily used for microbiological analysis. However, procedures are in place to outline the washing process for each type of labware used in the laboratory. Most glassware is machine-washed. Labware that is washed by hand is either air dried or dried in specifically designed ovens and sterilized appropriately. Each new lot, or at least annually, of detergents used to wash glassware for Environmental Microbiology labware, is tested using the Inhibitory Residue Test, as outlined in SM20 9020.B.4.a.2).

MICROBIOLOGICAL INTERNAL QUALITY CONTROL CHECKS

2.5. Microbiological Laboratory Quality Control Samples and Acceptance Criteria

Quality control (QC) samples are analyzed with each batch of samples or new lot of reagents, as required by the procedures, to demonstrate that all aspects of the analysis are in control within established limits of precision and accuracy. Chromofluorogenic media QC tests are lot-specific and performed on each newly received lot.

As required in the procedure on written methods, each analytical method specifies (or cross-references another procedure) the type of QC sample, frequency of analysis, acceptance criteria for QC sample results, and corrective action to be taken if QC sample results fall outside of the acceptable range.

The handling of QC data is described in the procedure addressing, "Quality Control Records." The types of QC samples and the information each provides are discussed in the following paragraphs.

2.5.1. Negative System Control - The QC on this is method specific and can be found in the Quality Control/Quality Assurance Procedure.

2.5.2. Positive and Negative Organism Controls - Each lot/batch of media is tested using positive and negative organism controls.

2.5.3. Duplicate Counting (Test Variability/Reproducibility) - duplicate counting is performed monthly on HPC and fecal MF plates. Each analyst who counted samples for a month, counts the plates and their results are evaluated. Counts must be within 10% difference of the total average for all analysts to be acceptable.

Uncontrolled Copy

2.5.4. Duplicates - For heterotrophic plate count samples, a duplicate is a second aliquot of a sample that is treated identically to the original to determine precision of the test. The plate counts are averaged.

2.5.5. Serial Dilutions - Fecal coliform, biosolids analyses, and heterotrophic plate counts may require serial dilution of the sample.

2.6. Microbiological Quality Control Sample Frequency and Corrective Action

Each analytical method defines the frequency for the required QC samples, where appropriate. The corrective action required when a QC result fails to meet the acceptance criteria is also given, where appropriate.

The QC acceptance criteria are available to analysts in the laboratory. If the results are not within the acceptance criteria, corrective action suitable to the situation must be taken. This may include, but is not limited to, checking calculations, examining other quality control analyzed with the same batch of samples, qualifying results with a comment stating the observed deviation, and invalidating results. It should be noted that resampling may be required in the case of invalidated results for SDWA, EPA, DEP, or DOH compliance samples due to the short hold-times in microbiological analysis.

2.7. Microbiological Water Systems

Laboratory Reagent Water Suitability Testing - On an annual basis, a sample is sent to a PADEP certified laboratory for suitability analyses. These serve as confirmation of our analyses, as well as to supply additional data on the water suitability.

2.8. Microbiological Reporting Limits

For microbiological analysis, the limits are method-specified and/or project-specific. This information is programmed into the LIMS for reporting purposes.

Uncontrolled Copy

APPENDIX II

Sample Collection Field Sheet Template

SOIL SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

SITE NAME: _____ PROJECT NO. _____

SAMPLE NO. _____ BORING NO. _____

DATE/TIME COLLECTED: _____ PERSONNEL: _____

SAMPLE METHOD / DEPTH: _____ _____

SAMPLE MEDIA: SOIL SEDIMENT SLUDGE

SAMPLE QA SPLIT: YES NO SPLIT SAMPLE NO. _____

SAMPLE QC DUPLICATE: YES NO DUPLICATE SAMPLE NO. _____

MS/MSD REQUESTED: YES NO

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested

OVA MEASUREMENTS

Background _____

Breathing zone _____

Boring _____

Headspace _____

SAMPLE DESCRIPTION

DEPTH: _____ DESCRIPTION: _____

_____ _____

_____ _____

_____ _____

_____ _____

GENERAL COMMENTS

_____

_____

_____

LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Ground-Water and Environmental Engineering Services

110 Corporate Park Drive, Suite 112
White Plains, New York 10604
(914) 694-5711
Fax: (914) 694-5744

Client:

Location:

Date:

Professional:

Weather/Comments:

Well	Hour	Ref. Pt. (feet)	Meas. Pt. (feet)	D.T.W. (feet)	T.D. (feet)	Gal Evac	D.O.		Temp (EF)	pH	Cond.	ORP	Time Sampled
						Actual	mg/l	%					

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

SITE NAME _____ PROJECT NO. _____

SAMPLE NO. _____ WELL NO. _____

DATE/TIME COLLECTED _____ PERSONNEL _____
SAMPLE METHOD _____ _____

SAMPLE MEDIA:	Groundwater	Surface Water	
SAMPLE QA SPLIT:	YES	NO	SPLIT SAMPLE NO. _____
SAMPLE QC DUPLICATE:	YES	NO	DUPLICATE SAMPLE NO. _____
MS/MSD REQUESTED	YES	NO	

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested

WELL PURGING DATA

Date	_____	Well Depth (ft. BTOC)	_____
Time Started	_____	Depth to Water (ft BTOC)	_____
Time Completed	_____	Water Column Length	_____
Hnu Measurements		Volume of Water in Well (gal)	_____
Background	_____	Casing Volumes to Purge	_____
Breathing Zone	_____	Minimum to Purge (gal)	_____
Well Head	_____	Actual Purge (gal)	_____

FIELD MEASUREMENTS

Time	Amount Purged (gal)	pH	Temperature (ºC)	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	ORP (mV)	Turbidity (NTU's)

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
Water Level Probe		
Water Quality Meter		

GENERAL COMMENTS

_____

_____

_____

Leggette, Brashears & Graham, Inc.

PAGE: _____ OF _____

SAMPLE DATE:

Low-Flow Sampling Log

TOTAL # WELLS: _____

Client Name: _____ Sample Pump: _____

Project Location: _____ Tubing Type: _____

Sampler(s): Monitoring Equipment:

Well I.D. _____ Screen Setting (ft btoc): _____ to _____

Well Diameter (inches): Inches Tubing Intake (ft btoc): _____.

Total Depth (ft btoc): _____ Comments: Purged well for approx. minutes .

Depth to Water (ft btoc): _____ before recording parameters

Time		Depth to Water (ft btoc)	Evacuation Rate (ml/min)	Water-Quality Monitoring Parameters					
#	hour			pH	Conductivity (mS/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/l)	Temperature (^{0}C)	ORP (mv)
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									

Stabilazation of Parameters (**Stabilization Achieved for three consecutive measurements**)

Time #		Change in Head (ft btoc)	Evacuation Rate (ml/min)	pH	Conductivity (uS/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/l)	Temperature (^{0}C)	ORP (mv)
From	To								
1	2								
2	3								
3	4								
4	5								
5	6								
6	7								
7	8								
8	9								
9	10								
Recommended Stabilization		0.3	(100 - 500)	0.1	3%	10%	10%	3%	10
Stabilization: (Yes/No)									

Sample Time: _____ Reviewed By: _____

ft btoc feet below top of casing
ml/min millimeters per minute
mS/cm milliseimons per centimeter
NTU Nephelometric Turbidity Units
mg/l milligrams per liter
^{0}C degrees Celcius
mv millivolts

GEOLOGIC LOG LEGGETTE, BRASHEARS & GRAHAM, INC. WHITE PLAINS, NEW YORK	OWNER: WELL NO.: PAGE: OF PAGE
SITE LOCATION:	SCREEN SIZE & TYPE: SLOT NO.: SETTING:
DATE COMPLETED:	SAND PACK SIZE & TYPE: SETTING:
DRILLING COMPANY:	CASING SIZE & TYPE: SETTING:
DRILLING METHOD:	
SAMPLING METHOD:	SEAL TYPE: SETTING:
OBSERVER:	
REFERENCE POINT (RP):	BACKFILL TYPE:
ELEVATION OF RP:	STATIC WATER LEVEL:
STICK-UP:	DEVELOPMENT METHOD:
SURFACE COMPLETION:	DURATION: YIELD:
REMARKS:	
ABBREVIATIONS: SS = split spoon W = wash C = cuttings G = grab ST = shelby tube MC = Macrocore REC = Recovery PPM = parts per million	

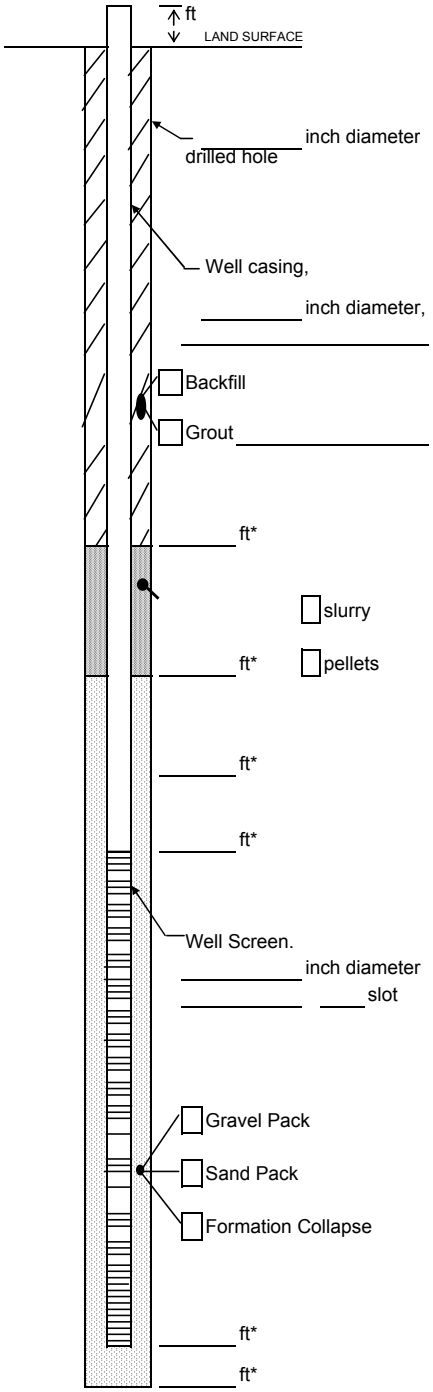
DEPTH (FEET)		SAMPLE TYPE	BLOW COUNT	REC. (FEET)	PID READING (PPM)	DESCRIPTION
FROM	TO					

OWNER:						
WELL NO.:					PAGE: OF PAGES	

DEPTH (FEET)		SAMPLE TYPE	BLOW COUNT	REC. (FEET)	PID READING (ppm)	DESCRIPTION
FROM	TO					

Well Construction Log

(Unconsolidated)



Measuring Point is
Top of Well Casing
Unless Otherwise Noted.

* Depth Below Land Surface

Project _____ Well _____

Town/City _____

County _____ State _____

Permit No. _____

Land-Surface Elevation and Datum:

_____ feet ☐ Surveyed

☐ Estimated

Installation Date(s) _____

Drilling Method _____

Drilling Contractor _____

Drilling Fluid _____

Development Technique(s) and Date(s)

Fluid Loss During Drilling _____ gallons

Water Removed During Development _____ gallons

Static Depth to Water _____ feet below M.P.

Pumping Depth to Water _____ feet below M.P.

Pumping Duration _____ hours

Yield _____ gpm Date _____

Specific Capacity _____ gpm/ft

Well Purpose _____

Remarks _____

Prepared by _____

GOWANUS VILLAGE I, LLC.
322 3rd AVENUE
BROOKLYN, KINGS COUNTY, NEW YORK
NYSDEC BCP SITE NO. C224099
INDEX NO. W2-1069-0506

Sample Collection Log

Field Sample ID	Lab Sample ID	Sample Matrix	Sample Depth	Sample Device	Stratigraphic Unit	Geo-Reference		Alpha Numeric Grid Location		QA/QC Descriptor			Sample Rationale	Analyses/Parameter											
						Latitude	Longitude	Letter	Number	Field Duplicate	Matrix Spike	Matrix Spike Duplicate		VOCs	SVOCs	PCBs	Total Metals	Pesticides	Herbicides	Reactivity	Ignitability	Corrosivity			

APPENDIX III

Sample Chain-of-Custody Form

AMRO Environmental Lab Corp.

LBG ENGINEERING SERVICES, P.C.

AMRO Environmental Laboratories Corporation
111 Herrick Street
Merrimack, NH 03054

CHAIN-OF-CUSTODY RECORD

60870

Office: (603) 424-2022
Fax: (603) 429-8496
web: www.amrolabs.com

Project No.:	Project Name:	Project State:	Project Manager:	Samplers (Signature):	AMRO Project No.:

P.O.#:	Results Needed by:
QUOTE #:	Seal Intact? Yes No N/A

Sample ID.:	Date/Time Sampled	Matrix	Total # of Cont. & Size	Comp.	Grab	REQUESTED ANALYSES	Remarks
Preservative: Cl-HCl, MeOH, N-HN03, S-H2SO4, Na-NaOH, O- Other							

Send Results To:

PRIORITY TURNAROUND TIME AUTHORIZATION
Before submitting samples for expedited TAT, you must *have a coded AUTHORIZATION NUMBER*
AUTHORIZATION No.: BY:

METALS 8 RCRA ☐ 13 PP ☐ 23 TAL ☐ 14 MCP ☐
Method: 6010 ☐ 200.7 ☐ Other Metals:
Dissolved Metals Field Filtered? YES ☐ NO ☐

PHONE #: FAX #:
E-mail:

MCP Presumptive Certainty Required? YES ☐ NO ☐

MCP Methods Needed: YES ☐ NO ☐

Required Reporting Limits: S-1 ☐ GW-1 ☐ S-2 ☐ GW-2 ☐ S-3 ☐ GW-3 ☐

Relinquished By:	Date/Time	Received By

AMRO report package level needed:

EDD required:

Other:

Please print clearly, legibly and completely. Samples can not be logged in and the turnaround time clock will not start until any ambiguities are resolved.

Samples arriving after 12:00 noon will be tracked and billed as received on the following day.

AMRO policy requires notification in writing to the laboratory in cases where the samples were collected from highly contaminated sites.

KNOWN SITE CONTAMINATION:

White: Lab Copy Yellow: Client Copy

SHEET OF

AMROCOC2004, Rev.3 08/18/04

Eurofins Lancaster Laboratories

Environmental Analysis Request/Chain of Custody

eurofins | Lancaster Laboratories Environmental

Acct. # _____ Group # _____ Sample # _____

Client:	
Project Name/#:	Site ID #:
Project Manager:	P.O. #:
Sampler:	PWSID #:
Phone #:	Quote #:
State where sample(s) were collected:	

Matrix: ☐ Sediment ☐ Soil ☐ Ground ☐ Surface ☐ Potable ☐ NPDES Water; Other:

Analyses Requested

Preservation Codes

For Lab Use Only

SF #: _____

SCR #: _____

Preservation Codes

H = HCl T = Thiosulfate

N = HNO_3 B = NaOH

S = H_2SO_4 P = H_3PO_4

O = Other

Sample Identification	Collection Date	Collection Time	Grab	Composite	Soil	Water	Other:	Total # of Containers											Remarks

Turnaround Time Requested (TAT) (please check): Standard ☐ Rush ☐

(Rush TAT is subject to laboratory approval and surcharges.)

Date results are needed:

Rush results requested by (please check): E-Mail ☐ Phone ☐

E-mail Address:

Phone:

Data Package Options (please check if required)

Type I (Validation/non-CLP) ☐ MA MCP ☐

Type III (Reduced non-CLP) ☐ CT RCP ☐

Type IV (CLP SOW) ☐ TX TRRP-13 ☐

Type VI (Raw Data Only) ☐

EDD Required? Yes ☐ No ☐ If yes, format: _____

Relinquished by:	Date	Time	Received by:	Date	Time
Relinquished by:	Date	Time	Received by:	Date	Time
Relinquished by:	Date	Time	Received by:	Date	Time
Relinquished by:	Date	Time	Received by:	Date	Time
Relinquished by:	Date	Time	Received by:	Date	Time

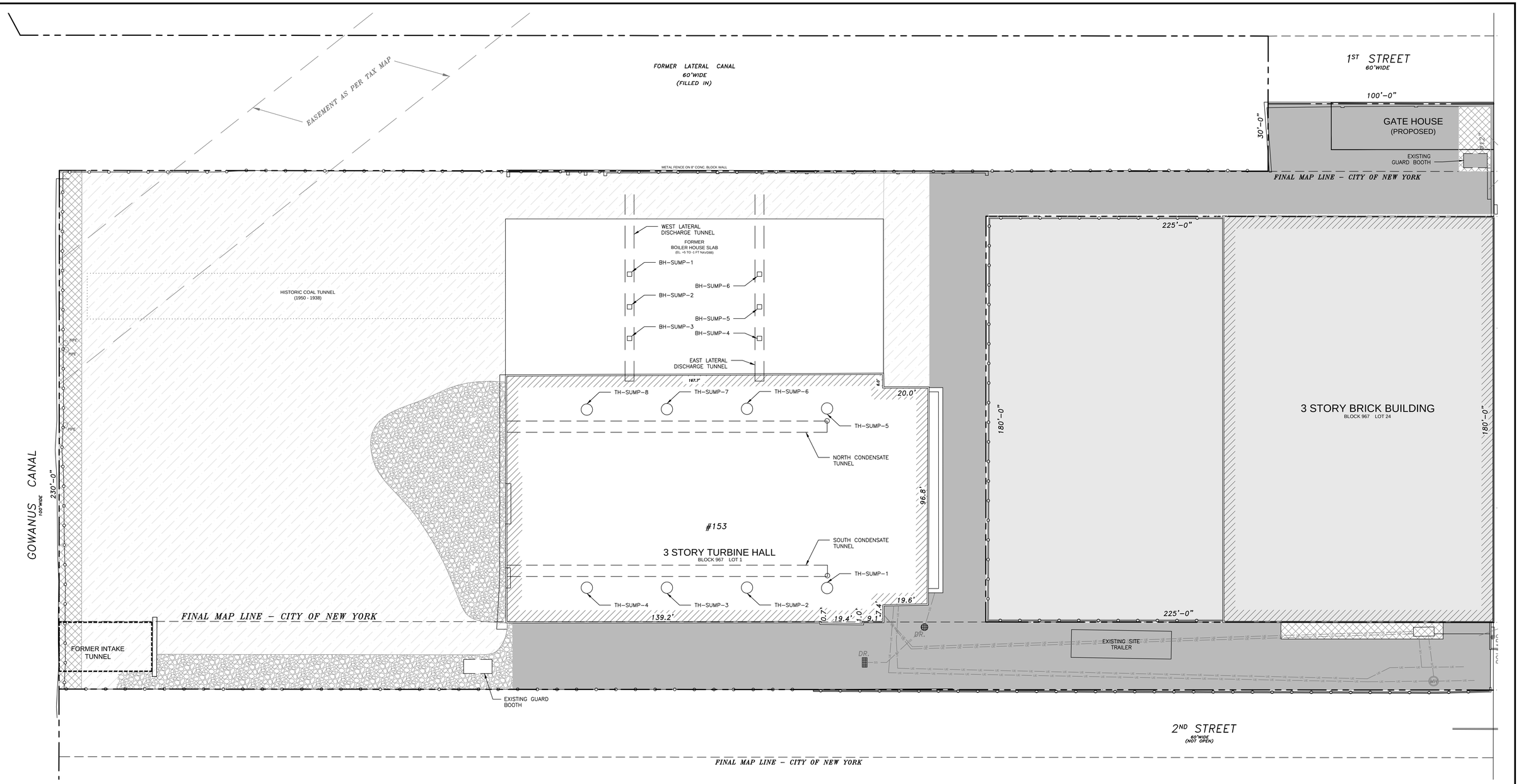
Relinquished by Commercial Carrier:

UPS _____ FedEx _____ Other _____

Temperature upon receipt _____ °C

PLATES

1. Historical Subsurface Features Site Plan
2. PCB Results in Historical Subsurface Features
3. Proposed Interior Sampling



LEGEND

- EXISTING BUILDING OR STRUCTURE
- PROPERTY LINE
- FENCE LINE
- EXISTING UNDERGROUND ELECTRIC
- EXISTING STORM WATER SEWER
- EXISTING MANHOLE
- EXISTING STORM WATER DRYWELL
- APPROXIMATE LOCATION OF FORMER LATERAL DRAINAGE TUNNELS
- APPROXIMATE LOCATION OF FORMER LATERAL CONDENSATE TUNNELS
- ASPHALT CAP
- CLEAN STONE
- EXISTING CONCRETE SLAB
- RECYCLED CONCRETE AGGREGATE

NOTES

1. BASEMAP PREPARED FROM SURVEY PERFORMED BY PERFECT POINT LAND SURVEYING, RT, JANUARY 2017.
2. HORIZONTAL LOCATIONS AND COORDINATES ARE IN U.S. FEET RELATIVE TO THE NEW YORK STATE PLANE COORDINATE SYSTEM, NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
3. APPROXIMATE LOCATIONS OF FORMER LATERAL CONDENSATE TUNNELS BASED ON HISTORICAL DRAWINGS FROM NEW YORK TRANSIT MUSEUM.

N

10' 0 10'

NO.	DATE	REVISION DESCRIPTION	INT.

UNAUTHORIZED ALTERATION OR ADDITION TO THIS DOCUMENT IS A VIOLATION OF STATE LAW.

THESE DOCUMENTS (OR COPIES OF ANY THEREOF) PREPARED BY OR BEARING THE SEAL OF THE ENGINEER, SHALL NOT BE REUSED FOR ANY EXTENSIONS OF THE PROJECT OR ANY OTHER PROJECT WITHOUT THE WRITTEN CONSENT OF THE ENGINEER.

PROJ. ENGINEER:	C.M.	DRAWN BY:	G.M.
DESIGNED BY:	J.K.	CHECKED BY:	C.P.
DRAWING SCALE:	AS SHOWN	PLOT SCALE:	1:1
DRAWING DATE:	09APR19	PRINT TYPE:	COLOR
OFFICE:	NY	PAPER SIZE:	ARCH D
PROJECT NO.:	2705.0001Y000		
DRAWING FILE:	2705.0001Y245.02.DWG		

ROUX
Roux Environmental Engineering & Geology, D.P.C.
209 SHAFTER STREET, ISLANDIA, NEW YORK 11746
(631) 232-2600

PROJECT NAME:
USEPA INTERIOR WORK PLAN
GOWANUS VILLAGE I, LLC - BROOKLYN, NEW YORK

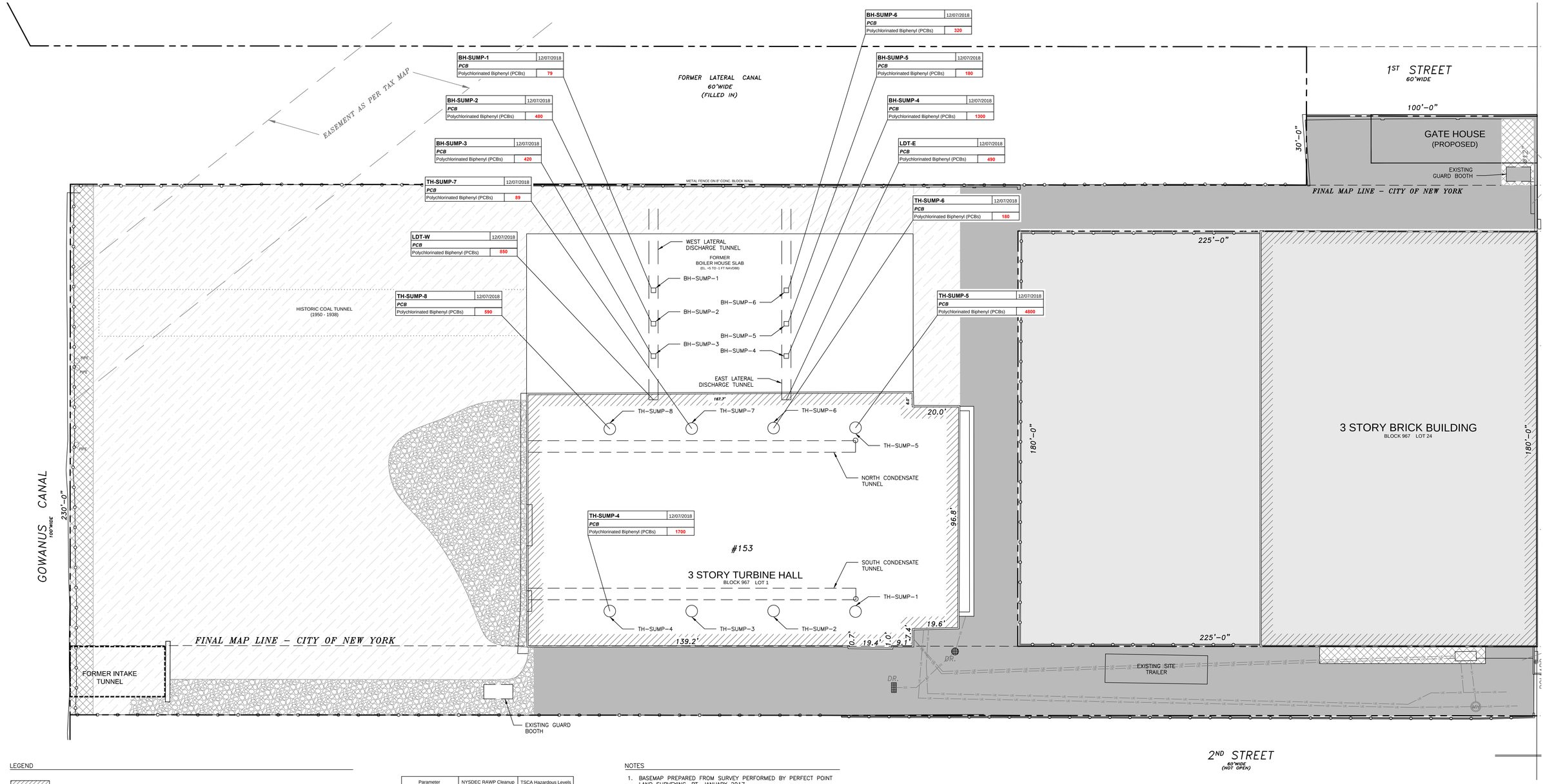
PROJECT FOR:
BRT POWERHOUSE LLC

TITLE:
HISTORICAL SUBSURFACE FEATURES SITE PLAN

FIGURE
1

FIGURE 1 OF 3

V:\CAD\PROJECTS\2705\0001\245\2705.0001Y245.02.DWG



LEGEND

- EXISTING BUILDING OR STRUCTURE
- PROPERTY LINE
- FENCE LINE
- EXISTING UNDERGROUND ELECTRIC
- EXISTING STORM WATER SEWER
- EXISTING MANHOLE
- EXISTING STORM WATER DRYWELL
- APPROXIMATE LOCATION OF FORMER LATERAL DRAINAGE TUNNELS
- APPROXIMATE LOCATION OF FORMER LATERAL CONDENSATE TUNNELS
- ASPHALT CAP
- CLEAN STONE
- EXISTING CONCRETE SLAB
- RECYCLED CONCRETE AGGREGATE

Parameter (Concentrations in mg/kg)	NYSDEC RAWP Cleanup Levels (mg/kg)	TSCA Hazardous Levels (mg/kg)
PCBs, Total	10	50

CONCENTRATIONS IN mg/kg

mg/kg – MILLIGRAMS PER KILOGRAM

* – NYSDEC RAWP CLEANUP OBJECTIVES

** – SITE SPECIFIC USEPA TSCA HAZARDOUS LEVELS

NYSDEC – NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

– – NO SOIL CLEANUP OBJECTIVES OR LEVELS AVAILABLE

PCBs – POLYCHLORINATED BIPHENYLS

NOTES

1. BASEMAP PREPARED FROM SURVEY PERFORMED BY PERFECT POINT LAND SURVEYING, RT, JANUARY 2017.
2. HORIZONTAL LOCATIONS AND COORDINATES ARE IN U.S. FEET RELATIVE TO THE NEW YORK STATE PLANE COORDINATE SYSTEM, NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
3. APPROXIMATE LOCATIONS OF FORMER LATERAL CONDENSATE TUNNELS BASED ON HISTORICAL DRAWINGS FROM NEW YORK TRANSIT MUSEUM.

NO.	DATE	REVISION DESCRIPTION	INT.

UNAUTHORIZED ALTERATION OR ADDITION TO THIS DOCUMENT IS A VIOLATION OF STATE LAW.

THESE DOCUMENTS (OR COPIES OF ANY THEREOF) PREPARED BY OR BEARING THE SEAL OF THE ENGINEER, SHALL NOT BE REUSED FOR ANY EXTENSIONS OF THE PROJECT OR ANY OTHER PROJECT WITHOUT THE WRITTEN CONSENT OF THE ENGINEER.

PROJ. ENGINEER:	C.M.	DRAWN BY:	G.M.
DESIGNED BY:	J.K.	CHECKED BY:	C.P.
DRAWING SCALE:	AS SHOWN	PLOT SCALE:	1:1
DRAWING DATE:	09APR19	PRINT TYPE:	COLOR
OFFICE:	NY	PAPER SIZE:	ARCH D
PROJECT NO.:	2705.0001Y000		
DRAWING FILE:	2705.0001Y245.02.DWG		

ROUX
Roux Environmental Engineering & Geology, D.P.C.
209 SHAFTER STREET, ISLANDIA, NEW YORK 11746
(631) 232-2600

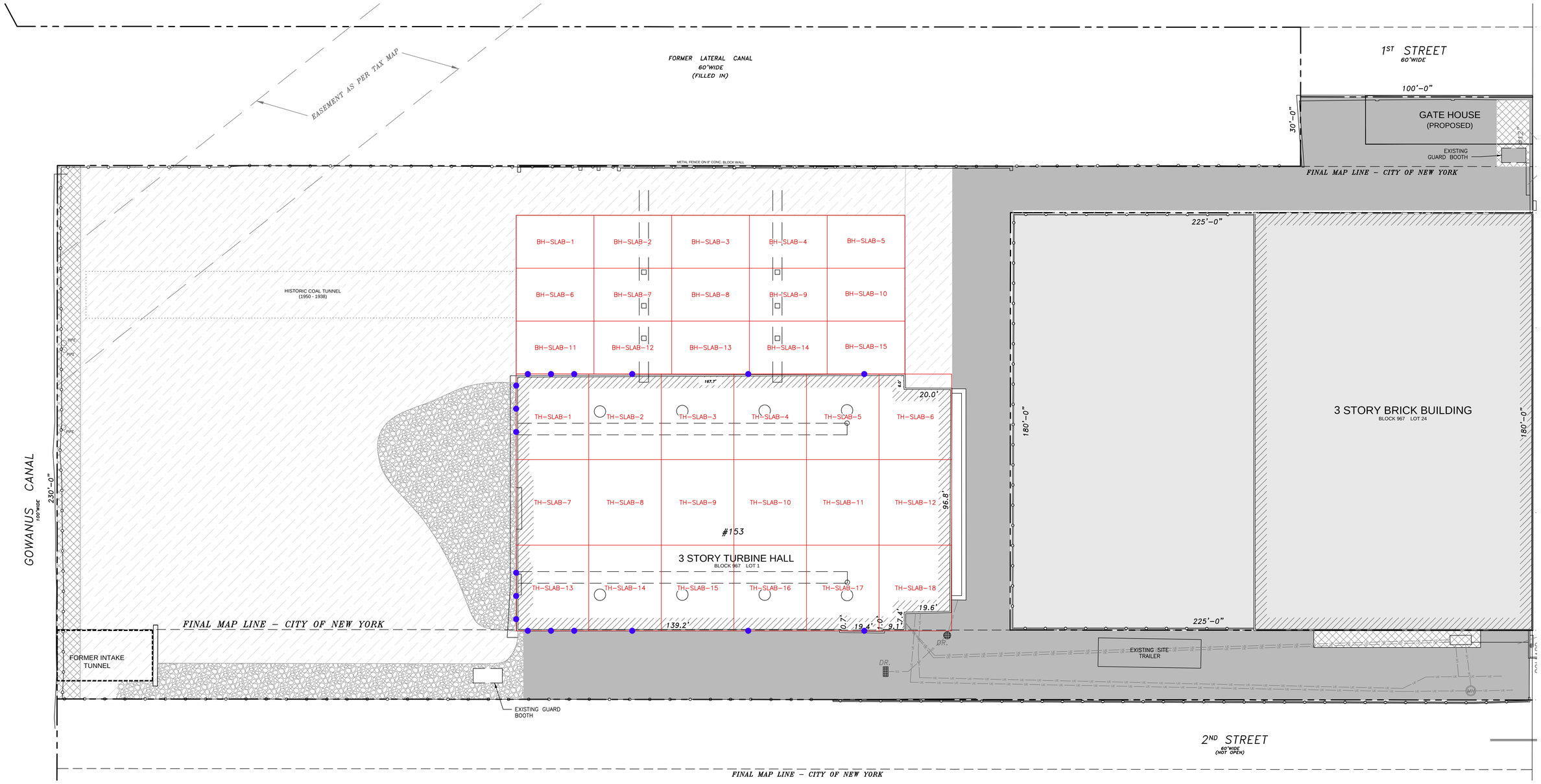
PROJECT NAME:
USEPA INTERIOR WORK PLAN
GOWANUS VILLAGE I, LLC - BROOKLYN, NEW YORK

PROJECT FOR:
BRT POWERHOUSE LLC

TITLE:
PCB RESULTS IN HISTORICAL SUBSURFACE FEATURES

FIGURE
2
FIGURE 2 OF 3

V:\CAD\PROJECTS\2705\1000\1Y\245\2705.0001Y245.02.DWG



LEGEND

- EXISTING BUILDING OR STRUCTURE
- PROPERTY LINE
- FENCE LINE
- EXISTING UNDERGROUND ELECTRIC
- EXISTING STORM WATER SEWER
- EXISTING MANHOLE
- EXISTING STORM WATER DRYWELL
- APPROXIMATE LOCATION OF FORMER LATERAL DRAINAGE TUNNELS
- APPROXIMATE LOCATION OF FORMER LATERAL CONDENSATE TUNNELS
- ASPHALT CAP
- CLEAN STONE
- EXISTING CONCRETE SLAB
- RECYCLED CONCRETE AGGREGATE
- BOILER HOUSE SUMP LOCATION
- TURBINE HALL SUMP LOCATION
- TH-SLAB-1 — APPROXIMATE LOCATION AND DESIGNATION OF PROPOSED MAT SLAB SAMPLE GRID
- APPROXIMATE LOCATION OF PROPOSED WALL SAMPLE

NOTES

1. BASEMAP PREPARED FROM SURVEY PERFORMED BY PERFECT POINT LAND SURVEYING, RT, JANUARY 2017.
2. HORIZONTAL LOCATIONS AND COORDINATES ARE IN U.S. FEET RELATIVE TO THE NEW YORK STATE PLANE COORDINATE SYSTEM, NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
3. APPROXIMATE LOCATIONS OF FORMER LATERAL CONDENSATE TUNNELS BASED ON HISTORICAL DRAWINGS FROM NEW YORK TRANSIT MUSEUM.

20' 0 20'

NO.	DATE	REVISION DESCRIPTION	INT.

UNAUTHORIZED ALTERATION OR ADDITION TO THIS DOCUMENT IS A VIOLATION OF STATE LAW.

THESE DOCUMENTS (OR COPIES OF ANY THEREOF) PREPARED BY OR BEARING THE SEAL OF THE ENGINEER, SHALL NOT BE REUSED FOR ANY EXTENSIONS OF THE PROJECT OR ANY OTHER PROJECT WITHOUT THE WRITTEN CONSENT OF THE ENGINEER.

PROJ. ENGINEER:	C.M.	DRAWN BY:	B.H.C.
DESIGNED BY:	J.K.	CHECKED BY:	C.P.
DRAWING SCALE:	AS SHOWN	PLOT SCALE:	1:1
DRAWING DATE:	10AUG18	PRINT TYPE:	COLOR
OFFICE:	NY	PAPER SIZE:	ARCH D
PROJECT NO.:	2705.0001Y000		
DRAWING FILE:	2705.0001Y245.01.DWG		

ROUX
Roux Environmental Engineering & Geology, D.P.C.
209 SHAFTER STREET, ISLANDIA, NEW YORK 11746
(631) 232-2600

PROJECT NAME:
USEPA INTERIOR WORK PLAN
GOWANUS VILLAGE I, LLC - BROOKLYN, NEW YORK

PROJECT FOR:
BRT POWERHOUSE LLC

TITLE:
PROPOSED INTERIOR SAMPLING

FIGURE
3

FIGURE 3 OF 3

V:\CAD\PROJECTS\2705Y\0001Y\245\2705.0001Y245.01.DWG

APPENDIX B

Turbine Hall Investigation and Remediation Photo Log

Photograph 1: Looking at the turbine hall mat slab, view of sumps and mat slab following removal of former leveling course.

Photograph 2: Looking east, interior of turbine hall cellar following removal of former leveling course.

Photograph 3: Looking at the turbine hall mat slab, sumps are temporarily covered with rubber gaskets and steel plating.

Photograph 4: Looking southeast, interior of turbine hall cellar as DuraSkrim® R12WB is placed on top of 1-2 feet of RCA and clean imported soil.

Photograph 5: Looking northwest in turbine hall cellar. DuraSkrim® R12WB with a 12-mil thickness is placed on top of 1-2 feet of RCA and clean imported soil.

Photograph 6: Looking north in turbine hall cellar DuraSkrim® R12WB with a 12-mil thickness is overlain by 18-inches of clean imported soil.

Photograph 7: Looking at the turbine hall mat slab, TH-SLAB-05 sample location.

Photograph 8: Looking at the turbine hall mat slab, TH-SLAB-08 sample location.

Photograph 9: Looking at the turbine hall mat slab, TH-SLAB-12 sample location.

Photograph 10: Looking southeast, excavation to complete turbine hall mat slab sample, TH-SLAB-18.

Photograph 11: Looking at the turbine west wall, location of brick wall sample TH-WALL-9, collected from behind former location of south vault.

Photograph 12: Looking at the turbine south wall, location of brick wall sample TH-WALL-5, collected from behind former location of south vault.

Photograph 13: Looking at the turbine hall south wall, location of brick wall sample TH-WALL-3, bottom 2 feet of brick wall, previously covered by leveling course and topping slab.

Photograph 14: Looking at the turbine hall west wall, location of brick wall sample TH-WALL-5, collected from behind former location of south vault.

APPENDIX C

Historical Site Drawings

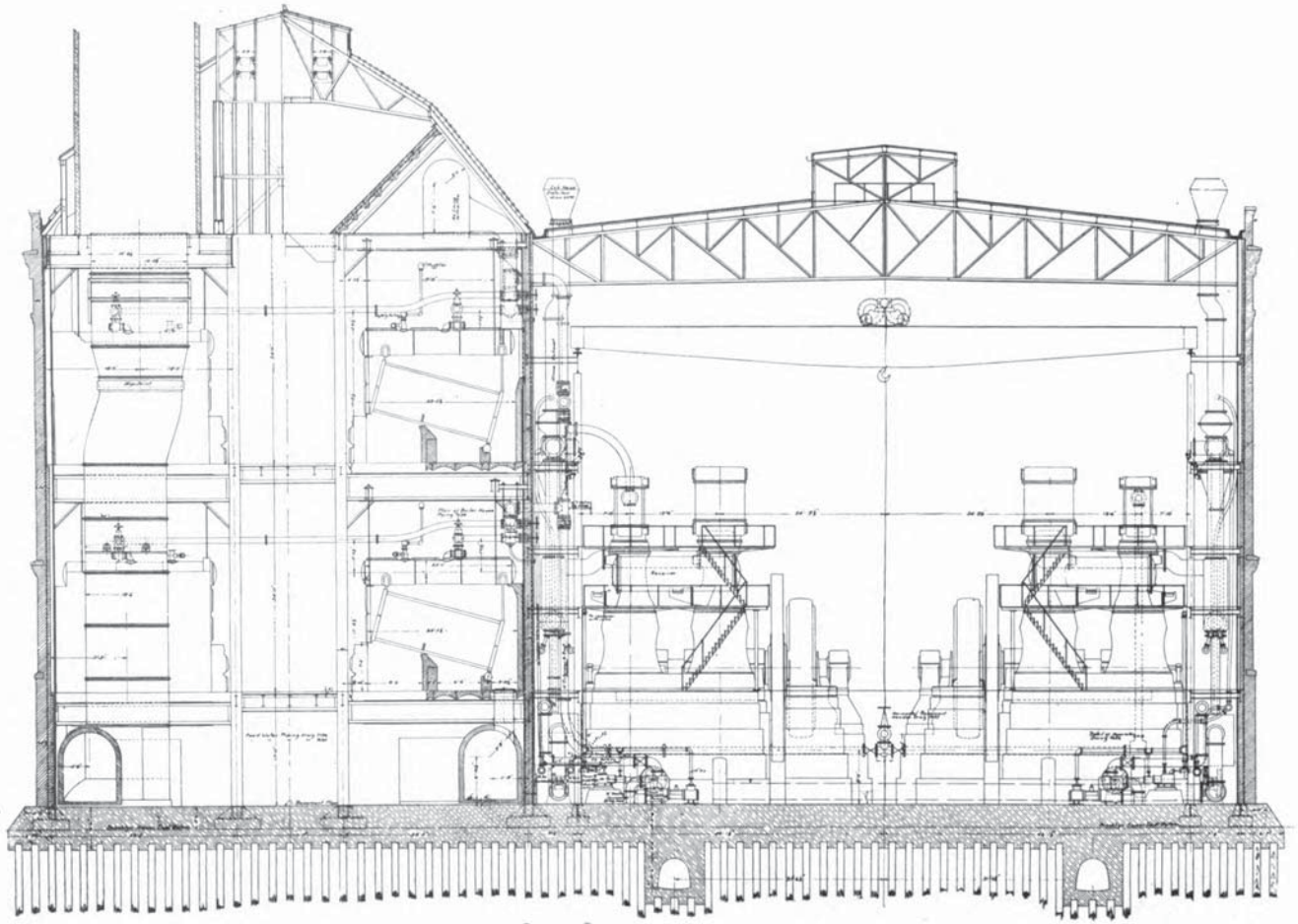
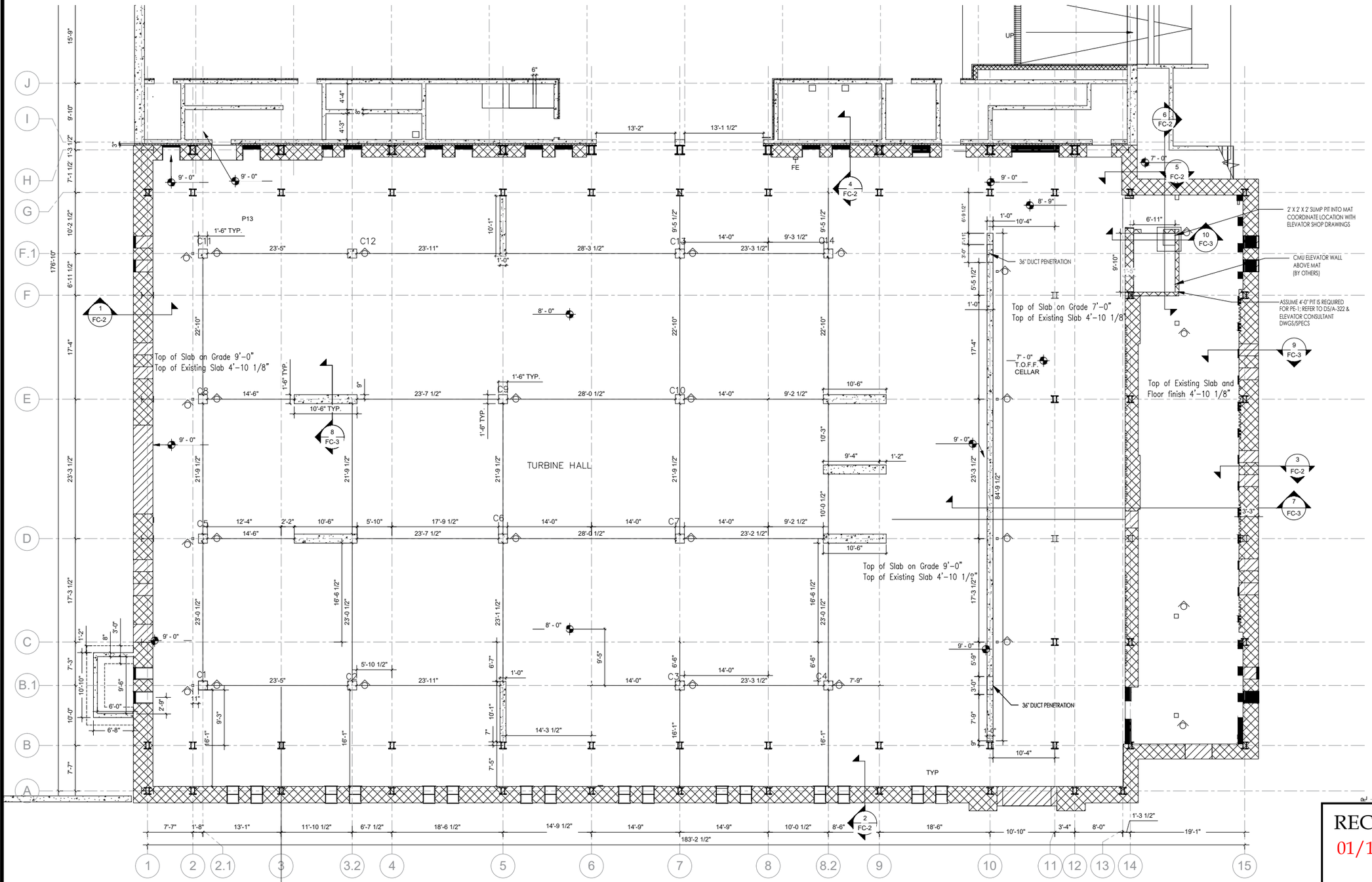


FIG. 47.—Cross Section, Central Power Station, B. R. T.

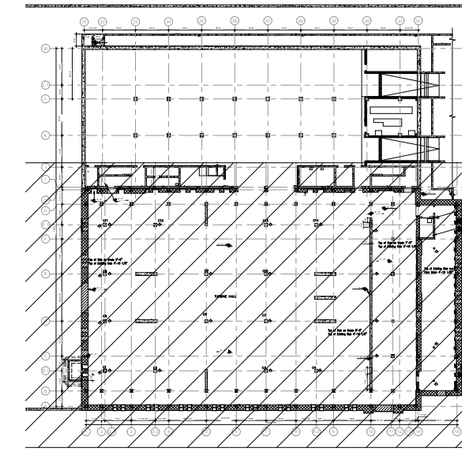
Digitized by Google

APPENDIX D

Turbine Hall Slab Construction Detail



1 FC-1 TURBINE HALL FOUNDATION PLAN
1/16" = 1'-0"



2 FC-1 KEY PLAN
1/64" = 1'-0"

TYPICAL COLUMN: 18" X 18"
TYPICAL SHEAR WALL:18" X 126"

NOTES:
THIS DRAWING IS FOR FOUNDATION CONCRETE LAYOUT ONLY. WARERPROFING DETAIL TO BE SHOWN UNDER DIFFERENT SUBMITTAL.

RECEIVED
01/13/2020
UAG

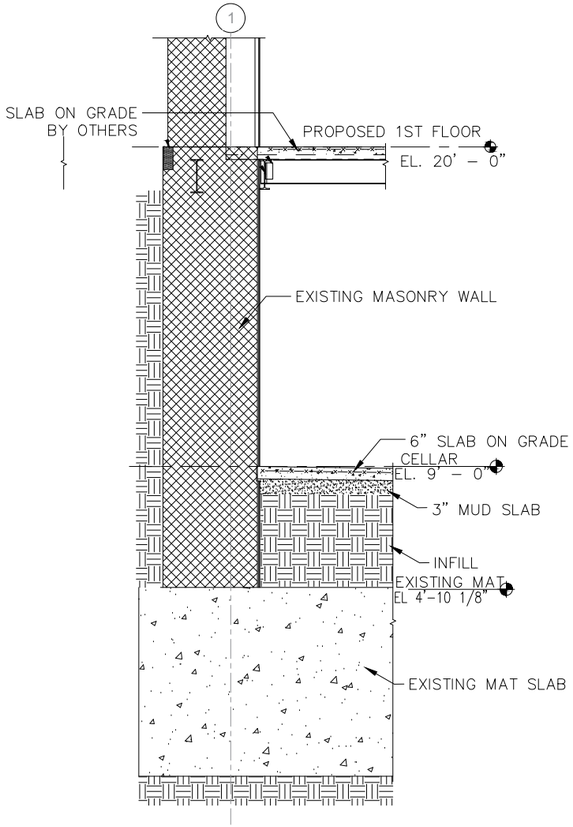
This Submittal has been reviewed for general conformance to the Contract Documents and coordination with contiguous work.
Date: 01/13/2020
Submittal #: 033000-121-01
Reviewed By: Giuseppe DiMaggio
Urban Atelier Group
This review does not relieve the Subcontractor of their responsibility to UAG to make the work conform to the requirements of the contract documents. The Subcontractor also remains responsible to UAG for all dimensions, correct fabrication and accurate fit with the work of other trades. The contents of this Submittal are subject to approval by the Architect.

R1	01.08.20	REVISION 1- TURBINE HALL COORDINATION FOR RECORD

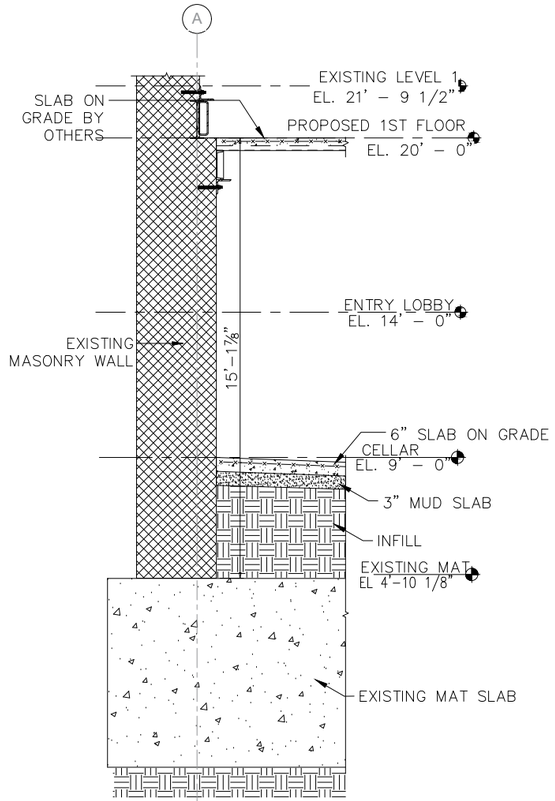
DATE: 07.16.19 BY: RV CHECKED BY: RV

STRUCTURE TECH NY
90 WEST SANDFORD BOULEVARD,
MOUNT VERNON,
NY 10550.

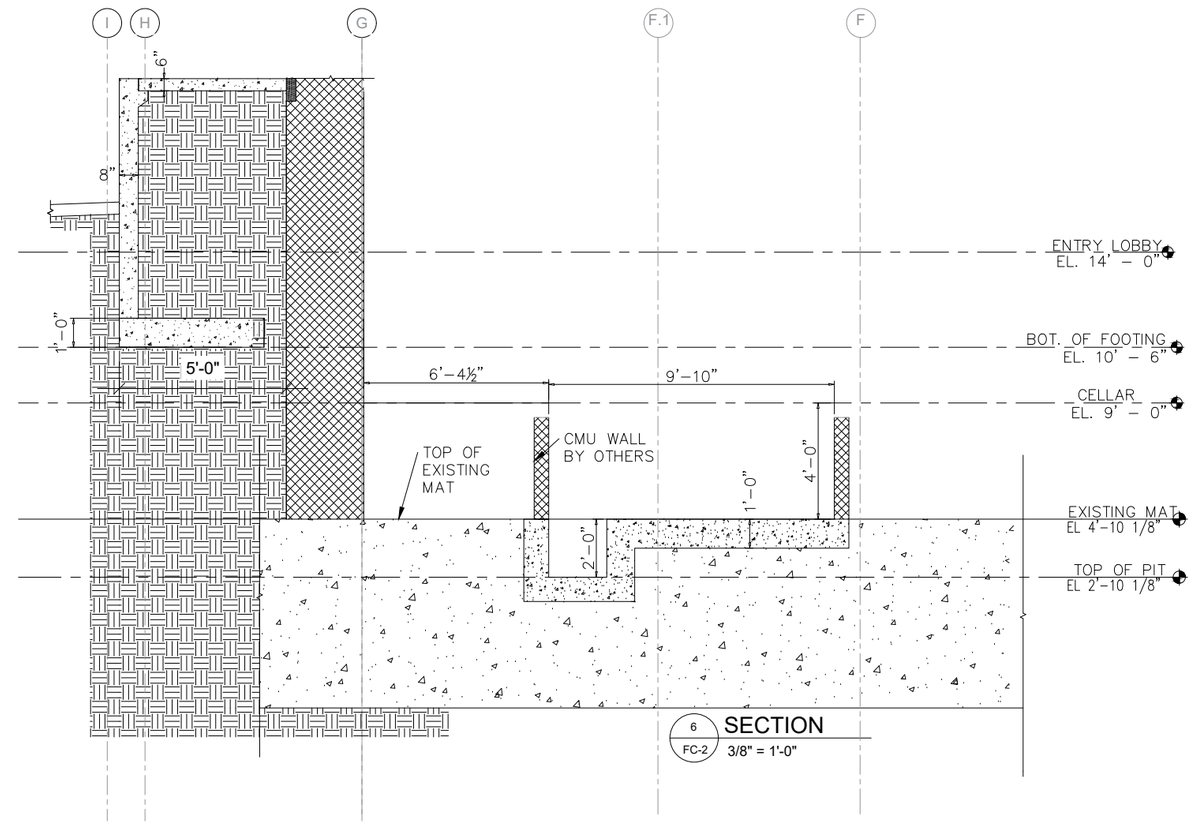
PROJECT	POWERHOUSE FOUNDATION	DRAWING NO. FC-1
LOCATION	322 3rd AVE BROOKLYN	
TITLE	FOUNDATION COORDINATION TURBINE HALL PLAN	PROJECT NO. J0429



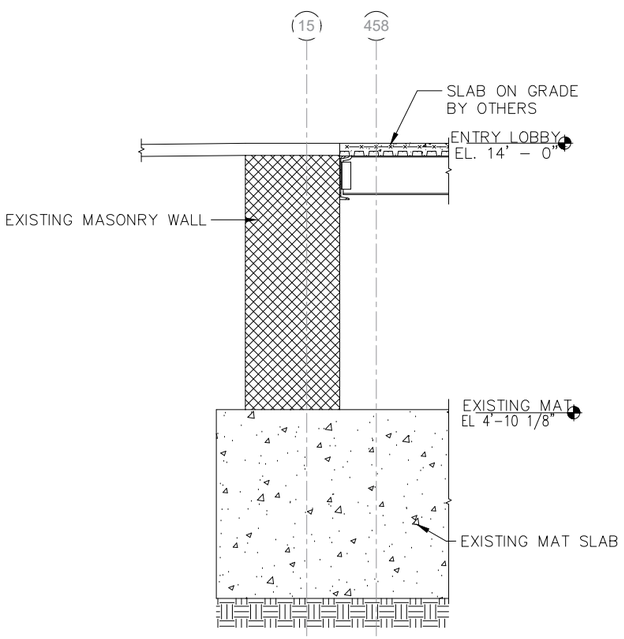
1 FC-2 SECTION
3/8" = 1'-0"



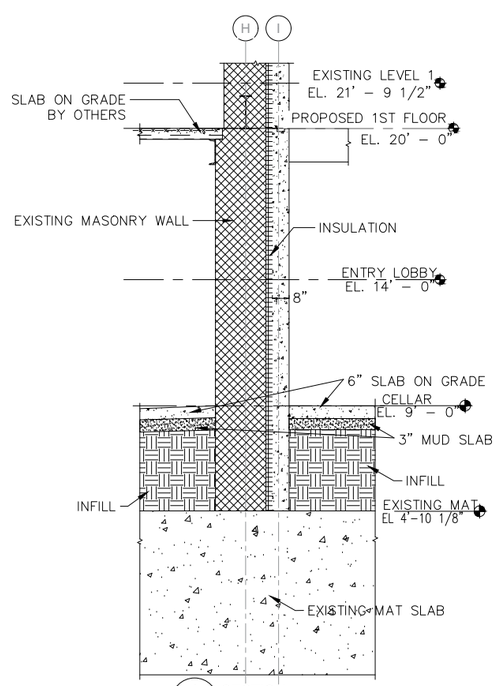
2 FC-2 SECTION
3/8" = 1'-0"



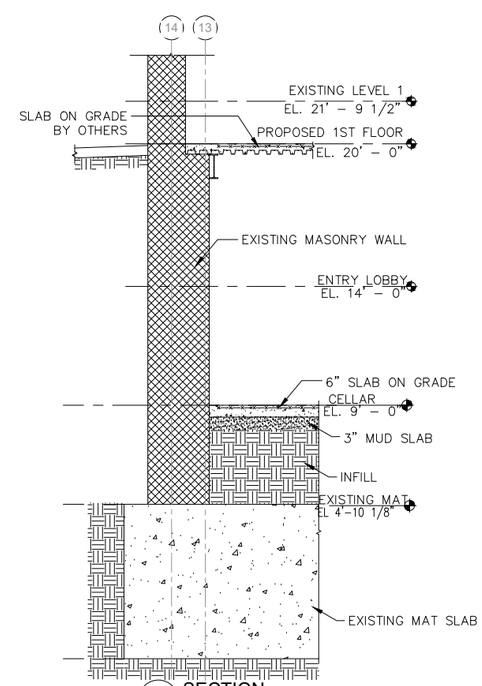
6 FC-2 SECTION
3/8" = 1'-0"



3 FC-2 SECTION
3/8" = 1'-0"



4 FC-2 SECTION
3/8" = 1'-0"



5 FC-2 SECTION
3/8" = 1'-0"

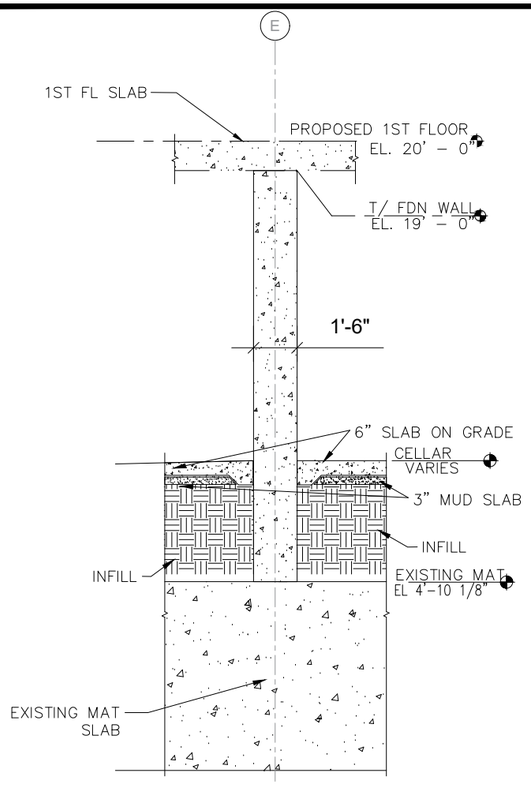
RECEIVED
01/13/2020
UAG

This Submittal has been reviewed for general conformance to the Contract Documents and coordination with contiguous work.
Date: 01/13/2020
Submittal #: 033000-121-01
Reviewed By: Giuseppe DiMaggio
Urban Atelier Group
This review does not relieve the Subcontractor of their responsibility to UAG to make the work conform to the requirements of the contract documents. The Subcontractor also remains responsible to UAG for all dimensions, correct fabrication and accurate fit with the work of other trades. The contents of this Submittal are subject to approval by the Architect.

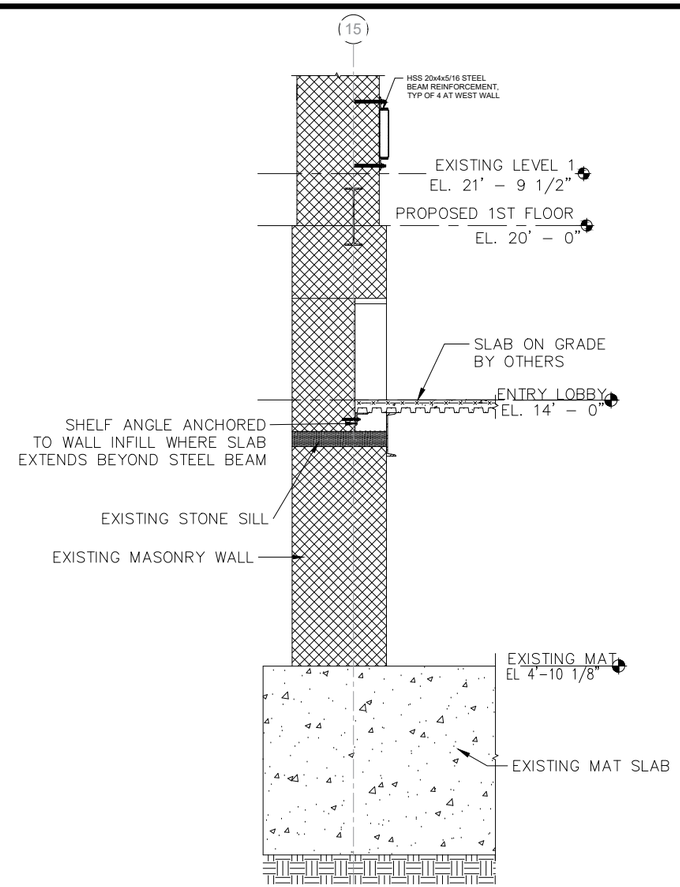
R1	01.08.20	REVISION 1– TURBINE HALL COORDINATION FOR RECORD
DATE: 01.09.20	BY: AM	CHECKED BY: RV

STRUCTURE TECH NY
90 WEST SANDFORD BOULEVARD,
MOUNT VERNON,
NY 10550.

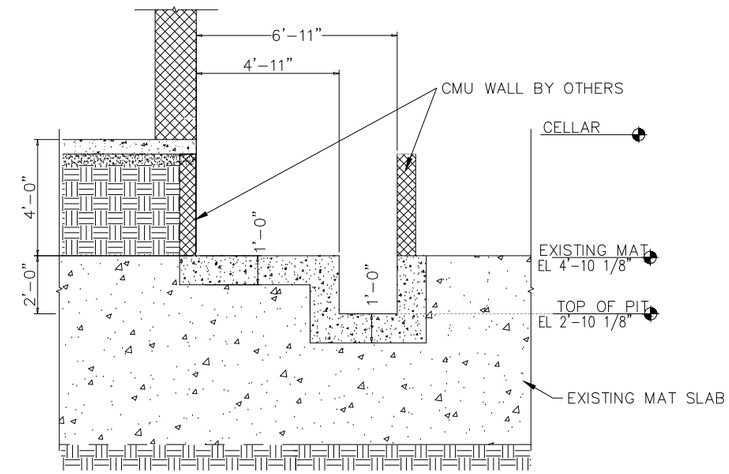
PROJECT	POWERHOUSE FOUNDATION	DRAWING NO. FC-2
LOCATION	322 3rd AVE BROOKLYN	
TITLE	FOUNDATION COORDINATION TURBINE HALL PLAN	PROJECT NO. J0429



8 FC-3 TYPICAL SW AND COLUMN SECTION
3/8" = 1'-0"

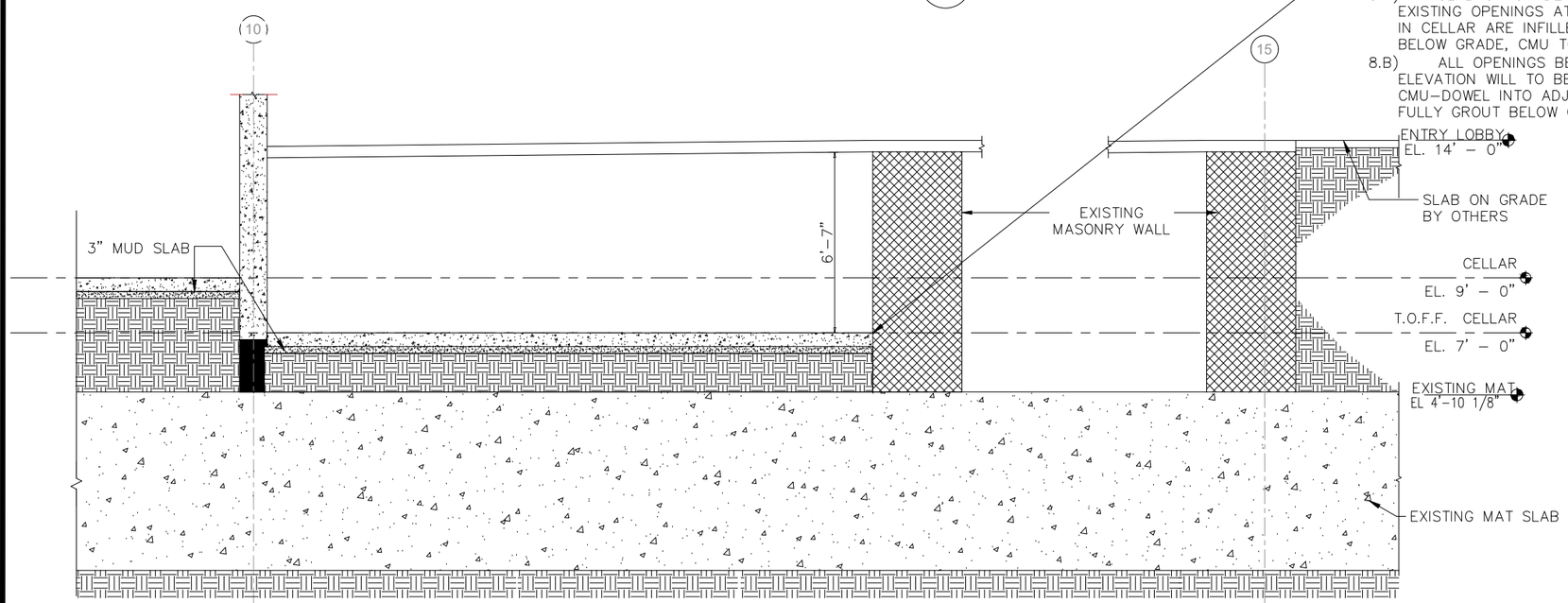


9 FC-3 SECTION
3/8" = 1'-0"



10 FC-3 SECTION
3/8" = 1'-0"

PER SILMAN RESPONSE ON RFI–143
8.A) SLAB ON GRADE ABUTS EXISTING WALL. EXISTING OPENINGS AT WALL ON GRIDLINE 14 IN CELLAR ARE INFILLED WITH CMU WHERE BELOW GRADE, CMU TO BE FULLY GROUTED.
8.B) ALL OPENINGS BELOW THE NEW S.O.G. ELEVATION WILL TO BE INFILLED WITH CMU–DOWEL INTO ADJACENT MASONRY AND FULLY GROUT BELOW GRADE.



7 FC-3 SECTION
3/16" = 1'-0"

RECEIVED
01/13/2020
UAG

This Submittal has been reviewed for general conformance to the Contract Documents and coordination with contiguous work.
Date: 01/13/2020
Submittal #: 033000-121-01
Reviewed By: Giuseppe DiMaggio
Urban Atelier Group
This review does not relieve the Subcontractor of their responsibility to UAG to make the work conform to the requirements of the contract documents. The Subcontractor also remains responsible to UAG for all dimensions, correct fabrication and accurate fit with the work of other trades. The contents of this Submittal are subject to approval by the Architect.

R1	01.08.20	REVISION 1– TURBINE HALL COORDINATION FOR RECORD

DATE: 07.16.19 BY: RV CHECKED BY: RV

STRUCTURE TECH NY
90 WEST SANDFORD BOULEVARD,
MOUNT VERNON,
NY 10550.

PROJECT	POWERHOUSE FOUNDATION	DRAWING NO. FC-3
LOCATION	322 3rd AVE BROOKLYN	
TITLE	FOUNDATION COORDINATION TURBINE HALL PLAN	PROJECT NO. J0429