TTI ENVIRONMENTAL, INC.
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TTI Project No. 19-408
August 22, 2019

SITE INVESTIGATION REPORT

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PI Number 782823
NJDEP Incident No. 19-04-16-1539-53

SITE LOCATION:
Dominick Andujar Park
Erie and Point Street
Block 12, Lots 1, 3, 17 & 18
Block 14, Lot 29
Camden, Camden County, New Jersey 08102

Reviewed by:

Kristin Heimburger, LSRP
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Attention: Mr. James Harveson

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1 INTRODUCTION

TTI Environmental, Inc. (TTI) was commissioned by Camden Redevelopment Agency (CRA) to conduct a Site Investigation (SI) for the property known as Andujar Park located at the southeast corner of Erie & Point Streets in Camden, Camden County, New Jersey (subject site). It is TTI's understanding that CRA proposes to construct a Green Infrastructure Project at the subject site. The subject site is identified by the City of Camden as Block 12, Lots 1, 3, 17 and 18 and Block 14, Lot 29 (TTI notes that for the purposes of this Site Investigation Report [SIR], the five [5] adjoining lots shall be identified as subject site). A regional site location map depicting the subject site is presented as **Figure 1.0**. An aerial photograph and site diagram map is included as **Figure 2.0**.

This report summarizes SI activities associated with 17 areas of concern (AOCs) at the site for which further investigation was recommended. An aerial view depicting the site and the AOCs is presented as **Figure 3.0**. This SI Report was prepared in accordance with New Jersey Department of Environmental Protection's (NJDEP) *Technical Guidance for the Site Investigation of Soil, Remedial Investigation of Soil, and Remedial Action Verification Sampling for Soil* dated March 2015, and with New Jersey Administrative Code (N.J.A.C.) 7:26E *Technical Requirements for Site Remediation*.

1.1 Background

1.1.1 Preliminary Assessment

TTI conducted a Preliminary Assessment (PA) in accordance with N.J.A.C. 7:26E, *Technical Requirements for Site Remediation*. The PA inspection was completed June 2018, and the PA Report was submitted to CRA and United States Environmental Protection Agency (US EPA) in July 2018. TTI identified 18 AOCs at the subject site and recommended further investigation on 17 of the AOCs.

Recommendations for each AOC provided in the PA are summarized below:

AOC 1 – Regulated Heating Oil Underground Storage Tank (UST) – A geophysical survey conducted at the subject site identified a metallic anomaly on the southeastern portion of Block 12, Lot 1. The dimensions of the UST measures approximately 30 feet in length and 11 feet in width. These dimensions are consistent with an approximately 12,000-gallon UST. This UST is associated with "Metallic Anomaly #8" in the Delta Geophysics, Inc. (Delta) geophysical report. This UST is located to the west of the former boiler house location, therefore, TTI assumes the UST contained heating oil. Based on the former use of the operation (i.e. industrial) and the size of the UST, this UST would be regulated with the NJDEP. USTs present a threat to the subsurface environment due to the potential for the tank to leak its contents or overfill from historical tank fillings. TTI recommended a subsurface soil and groundwater investigation for this AOC.

AOC 2 – Historic Automotive Waste/Scrap Piles - The 1974 aerial photographs identified waste and scrap piles to the north of a historic automotive repair facility on the southeastern corner of Block 14, Lot 19. The waste piles appear to be associated with automotive debris in the photographs. Delta identified Metallic Anomalies 5 and 6 in this area, both buried approximately two (2) and four (4) feet below grade. Potentially buried and historically stockpiled automotive waste represents a threat to the subsurface environment due to the potential for oils and solvents to leak. TTI recommended a subsurface investigation for this AOC.

AOC 3 – Historic Fill or any other Fill Material - While not in an area of mapped historic fill, the geophysical survey returned evidence of disturbed soils and several metallic anomalies. Additionally, TTI was also provided with a soil sampling map that was prepared by JMS for Trust for Public Land dated March 20, 2018. The map depicted the location where four (4) surficial soil samples were collected in the area of the baseball field located on Block 12, Lot 1.

The soil samples returned concentrations above NJDEP Residential Direct Contact Soil Remediation Standards (RDCSRS) for dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, lead, and polychlorinated biphenols (PCBs) and above NJDEP Non-Residential Direct Contact Soil Remediation Standards (NRDCSRS) for arsenic, benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene. TTI notes that each of the compounds are common contaminants associated with non-indigenous fill material with the exception of PCBs. PCBs have been detected in historic fill material in the vicinity of Andujar Park, and TTI considers PCBs to be a contaminant associated with historic fill in this geographic region of Camden City. Historic fill presents a threat to the subsurface environment as the fill may be contaminated with hazardous materials or petroleum products. TTI recommended a subsurface investigation for this AOC.

AOC 4 – Boiler Rooms - The 1885 through 1977 Sanborn maps depict a boiler room on Block 12, Lot 1 for the former tannery. Historical aerial photographs and bird's eye view photograph also depict a stack associated with this former boiler room. The boiler room was located to the east of the heating oil UST (AOC 1). This boiler room was not present during TTI's site inspection. As such, TTI was unable to observe the condition of the boiler room and determine if there were any historical releases that could impact the subsurface environment. TTI recommended a subsurface investigation for this AOC.

AOC 5 – Chemical Storage Building A (1926) - The 1926 Sanborn map depicts a chemical storage building on the northwestern corner of Block 12, Lot 1. This building was associated with the former tannery operation located on the subject site. Tanneries are known to utilize a variety of hazardous materials including chromium, resins, lacquers, and acids. This building was not present during TTI's site inspection. As such, TTI was unable to observe the floor to determine if any historic releases within this building could impact the subsurface environment. TTI recommended a subsurface investigation for this AOC.

AOC 6 – Chemical Storage Building B (1891) - The 1891 Sanborn map depicts Lauper & Doughton Chemicals on the southwestern corner of Block 12, Lot 1. This structure was associated with F. Cramer, an anchor, chain, and boat building operation. The chemicals stored within this structure are unknown. This building was not present during TTI's site inspection. As such, TTI was unable to observe the floor to determine if any historic releases within this building could impact the subsurface environment. TTI recommended a subsurface investigation for this AOC.

AOC 7 – Electrical Transformers and Capacitors - TTI observed three (3) pole-mounted transformers on the southern portion of Block 14, Lot 29. No evidence of leaks or stains were observed at the base of the transformers. TTI recommended no further action for this AOC.

AOC 8 – Historic Site Operations - The subject site has been historically utilized for industrial and commercial purposes. Specifically, Block 12, Lot 1 has been utilized as a tannery, chemical storage, and boat building operations, and the southeastern corner of Block 14, Lot 29 operated as an automotive repair facility. These operations were conducted on the subject site from the mid-1880s until the mid-1990s. A majority of these operations were conducted prior to environmental regulations (e.g. Resource Conservation and Recovery Act [RCRA]). Historic releases would not have been reported and the disposal of any hazardous materials would not have been tracked. The historic site operations associated with the subject site are known to have utilized a variety of hazardous materials and petroleum products. TTI recommended a subsurface investigation for this AOC.

AOC 9 – Former Coal Yard - The 1885 and 1891 Sanborn maps depict a coal yard on the southeastern corner of Block 12, Lot 1. This coal yard is suspected to have stored coal, on bare soil, for the former tannery on this portion of the subject site prior to utilizing heating oil. Coal is known to contain hazardous materials, including mercury, polycyclic aromatic hydrocarbons (PAHs), and heavy metals.

These compounds enter the environment due to rainwater washing over the coal, allowing the dissolved compounds to enter soil and groundwater; this runoff can be acidic. The compounds present in this runoff are toxic, persistent and can bioaccumulate in the environment (i.e. mercury). TTI recommended a subsurface investigation for this AOC.

AOC 10 – Metallic Anomaly #1 - Delta observed a metallic anomaly on the southeastern corner of Block 14, Lot 29. The anomaly measures approximately six (6) feet in length and approximately four and a half (4.5) feet in width (possible UST). The anomaly is buried approximately one (1) to two (2) feet below grade. TTI recommended the installation of test pits for this AOC.

AOC 11 – Metallic Anomaly #2 - Delta observed a metallic anomaly on the southern corner of Block 14, Lot 29. The anomaly measures approximately five and a half (5.5) feet in length and approximately four (4) feet in width. The anomaly is buried approximately two (2) to three (3) feet below grade. TTI recommended the installation of test pits for this AOC.

AOC 12 – Metallic Anomaly #3 - Delta observed a metallic anomaly on the northwestern corner of Block 14, Lot 29. The anomaly measures approximately ten (10) feet in length and approximately five (5) feet in width. The anomaly is buried approximately two (2) to four (4) feet below grade. TTI recommended the installation of test pits for this AOC.

AOC 13 – Metallic Anomaly #4 - Delta observed a metallic anomaly on the northwestern corner of Block 14, Lot 29. The anomaly measures approximately six and a half (6.5) feet in length and approximately five and a half (5.5) feet in width. The anomaly is buried approximately two (2) to four (4) feet below grade. TTI recommended the installation of test pits for this AOC.

AOC 14 – Metallic Anomaly #5 - Delta observed a metallic anomaly on the northeastern corner of Block 14, Lot 29. The anomaly measures approximately seven (7) feet in length and approximately six (6) feet in width. The anomaly is buried approximately four (4) feet below grade. This is suspected to be associated with historic automotive scrap and debris (AOC 2). TTI recommended the installation of test pits for this AOC.

AOC 15 – Metallic Anomaly #6 - Delta observed a metallic anomaly on the northeastern corner of Block 14, Lot 29. The anomaly measures approximately 12 feet in length and approximately six (6) feet in width. Delta was unable to confirm the depth of this anomaly. This is suspected to be associated with historic automotive scrap and debris (AOC 2). TTI recommended the installation of test pits for this AOC.

AOC 16 – Metallic Anomaly #7 - Delta observed a metallic anomaly on the northwestern corner of Block 12, Lot 1. The anomaly measures approximately 13 feet in length and approximately six and a half (6.5) feet in width. The anomaly was cylindrical and buried approximately two (2) to three (3) feet below grade (possible UST). TTI recommended the installation of test pits for this AOC.

AOC 17 – Metallic Anomaly #9 - Delta observed a metallic anomaly on the eastern portion of Block 12, Lot 1. The anomaly measures approximately 20.5 feet in length and approximately six and a nine (9) feet in width. The anomaly appears to be associated with reinforced concrete. TTI recommended the installation of test pits for this AOC.

AOC 18 – Metallic Anomaly #10 - Delta observed a metallic anomaly on the northeastern corner of Block 12, Lot 3. The anomaly measures approximately six (6) feet in length and six (6) feet in width. The anomaly is buried approximately four (4) feet below grade. The anomaly appears to be two (2) cylindrical features (possibly buried drums). TTI recommended the installation of test pits for this AOC.

1.2 Scope of Work

TTI prepared a Site Investigation Work Plan (SIWP) dated November 7, 2018 outlining the scope of work to investigate the 17 AOCs at the subject site. The SIWP is included as **Appendix A**.

1.3 Site Remediation Program Requirements

1.3.1 LSRP Retention

Ms. Kristin Heimburger, Director of Environmental Consulting, was retained as the Licensed Site Remediation Professional (LSRP) by CRA on February 14, 2019. Ms. Heimburger (LSRP #628897) has served as acting LSRP through this point of the investigation.

1.3.2 Annual Fee

An initial Annual Remediation Fee Form was submitted to the NJDEP on April 12, 2019. This fee included a Category 2 fee for regulated tanks, and a soil impacted by historical site operations. The fees required for the site may change as new information on the site is obtained.

1.3.3 Case Inventory Document (CID)

A CID has been prepared for submission to the NJDEP along with this milestone document. The electronic CID is submitted through the NJDEP Online Portal. The electronic version is provided to the responsible party (RP) via email.

2 SITE ACTIVITY LOG

The following significant events have occurred in relation to, or at the subject site:

May 29, 2018	TTI conducted site reconnaissance and geophysical survey of the subject site.
July 27, 2018	TTI submitted the final PA report to CRA.
November 7, 2018	TTI submitted final SIWP to CRA.
February 14, 2019	LSRP retention by Kristin Heimburger.
March 15, 2019	TTI submitted final Quality Assurance Project Plan (QAPP) to CRA and US EPA.
March 27 – 28, 2019	TTI conducted SI field investigation soil sampling.
April 16, 2019	Release case reported to NJDEP for 10,000-gallon UST (19-04-16-1539-53).

3 SITE CHARACTERISTICS

3.1 Site Description

The subject site is located in a mixed use industrial and residential portion of Camden, New Jersey. The subject site is an irregularly shaped, approximately 1.6-acre parcel identified by the City of Camden as Block 12, Lots 1, 3, 17 and 18 and Block 14, Lot 29 (TTI notes that for the purposes of this Preliminary Assessment Report (PAR), the five (5) adjoining lots shall be identified as subject site). The subject site is enclosed by four (4) streets; Point Street to the west, Erie Street to the north, York Street to the south and North Front Street to the east. Block 12 and Block 14 are separated by an alley (North Street).

The subject site has 164.92 feet of frontage along York Street and extends off York Street to the north 150 feet. The subject site maintains 339.39 feet of frontage along Erie Street and extends off Erie Street 175 feet south, at furthest point. The subject site has 71 feet of frontage along North Front Street (i.e. 57 feet of frontage for Block 12, Lot 3 and 14 feet of frontage for Block 12, Lot 17), and extends off North Front Street 339.39 feet at furthest point along the northern boundary. The subject site includes 211.75 feet of frontage along Point Street and extends off 339.39 feet east along the northern boundary at furthest point.

Block 14, Lot 29 includes an approximately 0.45-acre playground and park on the western portion. The remaining 0.05 acres is unimproved vegetated land on the southeastern corner. Block 12, Lot 1 includes an approximately 0.56-acre baseball field on the western portion, with the remaining approximately 0.25 acres being unimproved vegetated land and debris from historic site operations. Block 12, Lot 3 (approximately 0.15 acres), Lot 17 (approximately 0.06 acres), and Lot 18 (approximately 0.02 acres) are all unimproved vegetated parcels. A stormwater basin overgrown with vegetation is also located on Block 12, Lot 3.

3.1.1 Review of Sensitive Areas

Based on an inspection of the subject site, surrounding properties, and a review of available on-line and hard copy documents, no sensitive areas have been identified to be located either on, or within 200 feet of the subject site.

An Initial Receptor Evaluation form submission has been completed in conjunction with this SIR.

3.1.2 Sensitive Populations

The subject site is a park containing a baseball field, basketball court, and play area. Children utilize the park for recreational purposes. The subject site is bordered by residential properties on the eastern and western sides. TTI considers park visitors and residents living around the park to be potentially sensitive populations.

4 TECHNICAL OVERVIEW

This project was conducted under the oversight of Ms. Kristin Heimburger, LSRP (LSRP No. 628897), with the assistance of other TTI field personnel. Ms. Heimburger directly oversaw and supervised all the referenced investigations.

Personnel from Uni-Tech Drilling of Franklinville, NJ were on-site during direct push drilling activities. Test pits were installed using TTI owned and operated equipment.

4.1 Problem Definition / Project Objectives

The recent PA identified several AOCs that have the potential to have had adverse effects on the soil and groundwater at the site. Therefore, an assessment of the current state of subsurface media was recommended.

The overall objective for this SI was to determine if subsurface media at the site were impacted above criteria from those AOCs previously identified during the PA.

4.2 Identification of Applicable Remedial Standards

4.2.1 Soil Remediation Standards (SRS) / Groundwater Quality Standards (GWQS)

TTI evaluated analytical data against the current soil and groundwater standards. Soil samples were compared to the NJDEP Extractable Petroleum Hydrocarbons (EPH) remedial action levels, and/or to the NJDEP Impact to Groundwater Soil Screening Level (IGWSSL), RDCSRS, and the NRDCSRS. Groundwater samples were compared to the NJDEP GWQS.

TTI notes that several of the samples analyzed for Target Analyte List (TAL) metals returned results for aluminum, silver, and manganese above the IGWSSL. Aluminum, manganese, silver and zinc are considered secondary contaminants for aesthetic purposes. NDJEP has decided that the IGW pathway does not need to be addressed for these contaminants unless there is a cause to believe that their presence is due to a site discharge. No evidence that a discharge of aluminum, manganese, or silver occurred at the site.

4.2.2 Variances

At no point did TTI vary from *N.J.A.C. 7:26E, Technical Requirements for Site Remediation*.

4.3 Site Investigation Soil Sampling Methodology

Soil samples collected during investigative activities utilized a Geo-Probe sampling device that was advanced to the sampling depth using hydraulic direct push equipment. Each sample was collected from a dedicated plastic sleeve within the collection barrel of the device. Geoprobe macrocore sampling barrels were decontaminated inside and out using Alconox and water between each boring. Soils were also collected from test pits. Soil samples collected from test pits were collected from the bucket of a backhoe. Soil samples were not collected from the teeth of the bucket to reduce cross contamination. Backhoe teeth were cleaned to remove excess soil between test pits using a brush and rinsed with Alconox and water solution. No investigation derived wastes were generated except the disposal of acetate macrocore liners, which were disposed of as municipal waste.

Soils were field screened with a calibrated photoionization detector (PID) and observed for visual/olfactory impacts. Samples were collected from depths either exhibiting impacts, or from depths where visual contamination was observed, depending on what the purpose of the task was (i.e. to delineate known impacts, or confirm historical data). All sampling equipment was either dedicated or decontaminated in general accordance with the procedure outlined in the NJDEP Field Sampling Procedures Manual, August 2005. All soil samples were transferred directly from the sample sleeve into laboratory prepared and supplied bottles. All soil samples were transported directly to the laboratory in ice packed coolers under proper chain of custody documentation. Soil boring logs are included as **Appendix B.**

4.4 Analytical Methodology

Analytical methodologies are presented in the site-specific QAPP included as **Appendix C**.

4.5 Laboratory Quality Assurance/Quality Control

TTI reviewed the Quality Assurance/Quality Control (QA/QC) sections, and the non-conformance summary sections of the Pace Analytical Laboratory Report. Data validation was conducted by Ms. Renee Michalak of TTI who was not involved with the sample collection. Findings of the data validation and QA/QC are included in **Appendix D**.

5 SITE INVESTIGATION SUMMARY

The following sections present soil investigations performed onsite as implemented at each AOC. Sample location maps are included as **Figures 4.0, 5.0, and 6.0**. Soil boring logs are included as **Appendix B**.

5.1 AOC 1 – Regulated Heating Oil UST

TTI utilized a combination of direct push soil borings and test pits to investigate the UST. A portion of the UST was uncovered to verify the location of the UST. The UST is buried approximately two (2) feet below grade. The dimensions of the UST are approximately eight (8) feet diameter by 27 feet long, which would indicate a 10,000 to 12,000-gallon UST. Five (5) soil borings were installed, one (1) on the northern end (SB-1) and four (4) along the western long wall (SB-2 through SB-5), to investigate the UST. Shallow refusal due to the presence of debris inhibited soil boring activities, therefore, test pits were installed along the southern end and eastern long wall of the UST. Test pits unearthed debris consisting of timbers, brick, concrete, buckets, and drums buried adjacent to the eastern side of the UST. Petroleum product was observed in the bottom of the test pits at 8.5 feet below grade. Groundwater was encountered at approximately 9 feet below grade.

Six (6) soil samples were submitted for analysis for EPH Category 1. Laboratory results for EPH ranged in concentration from 5,740 milligrams per kilograms (mg/kg) to 28,700 mg/kg. EPH results are displayed in **Table 1.0**. Due to the presence of drums and other debris, a soil sample was collected from a soil boring (SB-12) on the eastern side of the UST for full TAL/Target Compound List (TCL) analysis at 9.5 – 10 feet below grade. Results greater than RDCSRS, NRDCSRS and IGWSSL from SB-12 are displayed in **Table 2.0**.

Table 1.0: AOC 1 UST EPH Cat. 1 Sample Summary & Results

Boring ID	Boring Depth (ft.)	Sample Depth (ft.)	PID Reading at Sample Depth (ppm)	EPH Result (mg/kg)
SB-1	15	9-9.5	53	5,740
SB-2	10	NS	N/A	--
SB-3	15	NS	N/A	--
SB-4	3	NS	N/A	--
SB-5	10	9-9.5	54	6,090
TP-7	8.5	8-8.5	172	18,400
TP-8	8.5	8-8.5	180	28,700
TP-9	8.5	8-8.5	186	22,500
TP-10	8.5	8-8.5	172	23,700

Notes: NS – No sample, ft. – feet, ppm – parts per million, mg/kg – milligram per kilogram, N/A – Not Applicable

Table 2.0: UST Full TAL/TCL Exceedances

Analyte	IGWSSL (mg/kg)	RDCSRS (mg/kg)	NRDCSRS (mg/kg)	SB-12 Result (mg/kg)
Benzene	0.005	2	5	0.315
Benzo(a)anthracene	0.8	5	17	3.91
Benzo(a)pyrene	0.2	0.5	2	3.43
2-Methylnaphthalene	8	230	2400	108
Aroclor 1254	0.2	0.2	0.2	0.28

Soil sampling results and observations from the investigation of AOC 1 indicate that a release of petroleum product has occurred from the UST. EPH concentrations are above the 8,000 mg/kg default product limit. Individual contaminants of concern detected in SB-12 are consistent with petroleum constituents associated with heating oil. It is unknown if the UST contained No. 2 heating oil or heavier petroleum distillates such as No. 4, 5, or 6 heating oils. TTI reported the release case to NJDEP and the case tracking number is 19-04-16-1539-53. TTI recommends registering the UST for closure, removal of the UST, delineation of petroleum impacted soils, and remediation of petroleum impacted soils.

A groundwater investigation has also been triggered due to the depth to groundwater at the site being within two (2) vertical feet of petroleum impacted soils.

5.2 AOC 2 – Historic Automotive Waste/Scrap Piles

AOC 2 was investigated through the installation of soil boring SB-13. Fill material consisting of brick and ash in a clay matrix was observed in soil samples collected from SB-13. No other evidence of a release was observed. TTI recommends no further investigation for AOC 2.

5.3 AOC 3 – Historic Fill or any other Fill Material

AOC 3 was investigated through the installation of soil borings and test pits across the site. A distinct layer of fill material was observed at several locations across the site. Fill was evaluated during the investigation of other AOCs. Discussion of fill material encountered, and contaminants of concern detected above standards shall be included in the discussion of individual AOCs. Below in **Table 3.0** is further information pertaining to historic fill encountered at the subject site. Borings where historic fill was encountered are displayed on **Figure 7.0**.

Table 3.0: AOC 3: Historic Fill or any other Fill Material Information

Location ID	Fill Encountered (Y/N)	Depth (ft.)	Fill Description
TP1	Yes	0.5 – 1.0	Layer of ash
TP2	Yes	0.5 – 2.0	Black ash
TP3	Yes	0.5 – 3.0	Black fill material with red brick. The brick appears to be from the former buildings located onsite.
TP4	Yes	1.0 – 3.0	Reinforced concrete 1 foot thick atop a stone foundation. Appears to be the former building slab.
TP5	Yes	0.5 – 6.5	Red brick consistent with material from the former building foundation.
TP6	Yes	0.5 – 1.0	Mixture of ash/brick and concrete
TP7	Yes	0.5 – 10.0	Mixture of brick, ash and concrete. A discarded drum was also present at approximately 8.0 feet; the contents of the drum were unknown. Soil was saturated with product due to the presence of the UST.
TP8	Yes	0.5 – 10.0	
TP9	Yes	0.5 – 10.0	
TP10	Yes	0.5 – 10.0	Mixture of brick, ash and concrete. Soil saturated with product
TP11	No	N/A	N/A
SB1	Yes	0.5 – 3.0	Black ash and sand
SB2	Yes	0.5 – 3.0	Black ash and sand
SB3	Yes	0.5 – 3.0	Black ash and sand
SB4	No	N/A	N/A
SB5	Yes	0.5 – 3.0	Black ash and sand
SB6	Yes	1.5 – 5.0	Brick, ash and concrete
SB7	Yes	0.5 – 5.0	Brick and ash
SB8	No	N/A	N/A
SB9	No	N/A	N/A
SB10	No	N/A	N/A
SB11	No	N/A	N/A
SB12	Yes	0.5 – 10.0	Mixture of brick, ash and petroleum stained soil due to leaking UST
SB13	Yes	0.5 – 5.0	Brick, ash, clay
SB14	Yes	0.5 – 1.0	Brick, ash, clay
SB15	Yes	0.5 – 1.0	Brick, ash, clay
SB16	No	N/A	N/A
SB17	Yes	0.5 – 5.5	Brick, ash, clay
SB18	Yes	0.5 – 5.5	Brick, ash, clay

Table 3.0: AOC 3: Historic Fill or any other Fill Material Information			
Location ID	**Fill Encountered (Y/N)**	**Depth (ft.)**	**Fill Description**
SB19	Yes	0.5 - .0	Bick, ash, clay
SB20	No	N/A	N/A
Notes AOC = Area of Concern, ft. = feet, N/A = Not Applicable			

5.4 AOC 4 – Boiler Rooms

AOC 4 was investigated through the installation of soil boring SB-20. No evidence of a release was observed and EPH results were below the 1,000 mg/kg threshold for additional analysis in the soil sample collected from SB-20. TTI recommends no further investigation for AOC 4.

5.5 AOC 5 – Chemical Storage Building A (1926)

AOC 5 was investigated through the installation of soil borings SB-8 and SB-9. Soil samples were collected from SB-8 at a depth of 7.5-8 feet below grade. No analytes exceeded standards in SB-8. Soil samples were collected from SB-9 at a depth of 3-3.5 feet below grade. Aluminum, manganese, mercury, and benzo(a)pyrene were detected above IGWSSL. Lead was detected above the IGWSSL and RDCSRS. TTI attributes the elevated levels of contaminants detected in SB-9 in the 3-3.5-foot zone to fill material. TTI recommends no further investigation for AOC 5.

5.6 AOC 6 – Chemical Storage Building B (1891)

AOC 6 was investigated through the installation of soil borings SB-7 and SB-10. SB-7 encountered a layer of fill from 0.5 feet to 5 feet below grade consisting of ash and brick. Soil samples were collected from SB-7 at the half foot interval above groundwater from 7.5 to 8 feet and exhibited aluminum and manganese above IGWSSL. No fill material was encountered in soil samples collected from SB-10. Soil samples were collected from SB-10 at a depth of 3-3.5 feet below grade and no elevated levels of contaminants were detected. TTI recommends no further investigation for AOC 6.

5.7 AOC 8 – Historic Site Operations

AOC 8 was investigated through the installation of soil boring SB-11 and test pit TP-3. SB-11 was installed in the center of the former tannery operation. No fill was encountered in SB-11. Soil samples were collected from SB-11 from a layer of undisturbed, native soil from below the suspected building slab. Chromium was detected at 2,230 mg/kg, which prompted analysis for hexavalent and trivalent chrome species. Hexavalent chromium returned a result of 28.4 mg/kg, which exceeds the NRDCSRS of 20 mg/kg. Chromium is a known contaminant of concern at tannery remediation sites and is not typically considered a contaminant in historic fill material. TTI recommends additional investigation to delineate the horizontal and vertical impacts of hexavalent chromium contamination.

TP-3 was installed to the immediate west of the former tannery operation. Fill material was encountered from 0.5 feet to 3 feet below grade. Fill material generally consisted of brick. Soil samples were collected from TP-3 at 3.5 to 4 feet below grade in the layer below the fill material. Aluminum, lead, manganese, mercury, benzo(a)anthracene, and benzo(b)fluoranthene were detected above the IGWSSL. Arsenic and benzo(a)pyrene were detected above IGWSSL, RDCSRS, and NRDCSRS. TTI attributes the elevated contaminant concentrations to the overlying fill material.

A TP-3 also yielded a PCB concentration, specifically Aroclor 1254, above IGWSSL, RDCSRS and NRDCSRS.

Hexavalent chromium was identified at a concentration of 28.4 mg/kg, which exceeds the proposed Non-Residential criterion of 20 mg/kg. Hexavalent chromium is a known compound found in tannery operations. Additionally, the other contaminants detected at TP-3 may be attributed the former tannery operation.

5.8 AOC 9 – Former Coal Yard

AOC 9 was investigated through the collection of a surficial sample from TP-6 from 0.5 to 1 foot below grade. Aluminum, cadmium, mercury, benzo(a)anthracene, and benzo(b)fluoranthene were detected above IGWSSL. Dibenz(a,h)anthracene was detected above RDCSRS. Lead was detected above IGWSSL and RDCSRS. Benzo(a)pyrene was detected above IGWSSL, RDCSRS and NRDCSRS. TTI recommends additional surficial investigation to determine if the current surficial soil can be used to cap the site or if additional clean fill will need to be imported.

5.9 AOC 10 – Metallic Anomaly #1

AOC 10 was investigated through the installation of test pit TP-11. The test pit identified two steel I-beams buried in a layer of brick. No evidence of a release was identified, and no samples were collected since AOC 10 was confirmed to not be related to a potential source of contamination or subgrade vessel containing hazardous materials or petroleum products. TTI recommends no further investigation for AOC 10.

5.10 AOC 11 – Metallic Anomaly #2

AOC 11 was investigated through the installation of soil boring SB-19. Fill material was encountered from 0.5 to 5 feet below grade. Soil samples were collected from SB-19 at the half foot interval above groundwater at 8.5 to 9 feet below grade. Manganese was detected above IGWSSL. AOC 11 was confirmed to not be related to a UST. TTI recommends no further investigation for AOC 11.

5.11 AOC 12 – Metallic Anomaly #3

AOC 12 was investigated through the installation of soil boring SB-15. Fill material was encountered from 0.5 to 1 feet below grade. No evidence of a release was identified, and no samples were collected since AOC 12 was confirmed to not be related to a UST. TTI recommends no further investigation for AOC 12.

5.12 AOC 13 – Metallic Anomaly #4

AOC 13 was investigated through the installation of soil boring SB-16. Soil samples were collected from SB-16 at the half foot interval above groundwater at 8.5 to 9 feet below grade. Manganese was detected above IGWSSL. AOC 13 was confirmed to not be related to a UST. TTI recommends no further investigation for AOC 13.

5.13 AOC 14 – Metallic Anomaly #5

AOC 14 was investigated through the installation of soil boring SB-18. Fill material was encountered from 0.5 to 5 feet below grade. No evidence of a release was identified, and no samples were collected since AOC 14 was confirmed to not be related to a UST. TTI recommends no further investigation for AOC 14.

5.14 AOC 15 – Metallic Anomaly #6

AOC 15 was investigated through the installation of soil boring SB-17. Fill material was encountered from 0.5 to 5 feet below grade. No evidence of a release was identified, and no samples were collected since AOC 15 was confirmed to not be related to a UST. TTI recommends no further investigation for AOC 15.

5.15 AOC 16 – Metallic Anomaly #7

AOC 16 was investigated through the installation of test pits TP-1 and TP-2. The metallic anomaly was identified as a metal pipe and debris in TP-2. Soil samples were collected from TP-2 at the depth where the pipe and debris were located at 2 to 2.5 feet below grade. Aluminum, lead, manganese, benzo(a)anthracene, and benzo(b)fluoranthene were detected above IGWSSL. Benzo(a)pyrene was detected above IGWSSL and RDCSRS. TTI attributes levels of contaminants detected in TP-2 in the 2 to 2.5-foot zone to fill material. TTI recommends no further investigation for AOC 16.

5.16 AOC 17 – Metallic Anomaly #9

AOC 17 was investigated through the installation of test pit TP-4. TP-4 encountered a concrete slab approximately 18 inches thick on the eastern wall of the test pit. A stone foundation was observed below the concrete slab. No evidence of a release was identified, and no samples were collected since AOC 17 was confirmed to not be related to a UST. TTI recommends no further investigation for AOC 17.

5.17 AOC 18 – Metallic Anomaly #10

AOC 18 was investigated through the installation of test pit TP-5. Soil samples were collected from TP-5 at 6.5 to 7 feet below grade and encountered brick, wires, and timbers consistent with a demolished structure. Lead, manganese, silver, mercury, dieldrin, and benzo(a)pyrene were detected above IGWSSL. TTI attributes levels of contaminants detected to fill material. TTI recommends no further investigation for AOC 18.

The full sample results are included as **Table 4.0**. Samples with exceedances of NJDEP criteria are included as **Table 5.0**.

6 CONCEPTUAL SITE MODEL

TTI constructed the Conceptual Site Model (CSM) as per the NJDEP Technical Guidance for Preparation and Submission of a Conceptual Site Model, December 16, 2011. The CSM is a written and/or illustrative representation of the physical, chemical, and biological processes that control the transport, migration, and actual/potential impacts of contamination to human and/or ecological receptors. The goal of the CSM is to provide a description of relevant site features and the surface and subsurface conditions to understand the extent of identified contaminants of concern and the risk they pose to receptors (NJDEP, 2011). The CSM is an iterative process that is refined during the investigation. This CSM has been established based on data collected thus far in the investigation. Graphical description of the CSM are included as **Figures 7.0, 8.0, and 9.0.**

6.1 Description of Source, Pathways and Receptors

Several potential sources of contamination were originally located at the site from historical site uses and facilities. The site is a park; therefore, direct contact of contaminated soil is the most likely pathway of exposure. Groundwater has not been evaluated to date. It is assumed that groundwater has been impacted by contaminants detected in historic fill material. Currently, no pathway exists for the ingestion of groundwater at the site.

6.2 Conceptual Site Model Summary

- Historic manufacturing and industrial operations began onsite prior to 1874 and continued until 1977.
- Operations included a tannery, a machine shop, boat building, chain manufacturing, and bottling works.
- The majority of the industrial operations were located on the northern portion of the site on Block 12, Lot 1.
- Fire destroyed the Allied Kid Company tannery in the 1970s and the buildings were demolished.
- The general subsurface conditions on the northern portion of the site consist of 0.5 feet of topsoil over a layer of ash, brick, timbers, and glass, which extends to a depth of approximately 5 feet below grade.
- TTI theorizes the source of the ash, brick, timber, and glass layer was from the former buildings that were onsite. The buildings were demolished, and the debris was buried under a shallow layer of topsoil.
- The ash, brick, timber, and glass material is being classified as historic fill material.
- The historic fill material is impacted with lead, mercury, arsenic, dieldrin, beryllium, benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene.
- Aroclor 1254 (PCB) exceedances were identified in samples collected in the former location of the former tannery.
- PCBs are considered a contaminant associated with historic fill in the geographic region where Andujar Park is located.
- An approximately 10,000-gallon heating oil UST is located under the right field portion of the baseball field on Block 12, Lot 1.
- Stained soils and soils impacted with EPH ranging from 5,740 mg/kg to 28,700 mg/kg were identified adjacent to the UST.
- Individual contaminants related to the UST release include benzo(a)anthracene, benzo(a)pyrene, benzene, and 2-methylnaphthalene.

- Removal of the UST and petroleum impacted soils is necessary.
- Elevated levels of hexavalent chromium were detected below the former tannery building.
- Hexavalent chromium is not typically associated with historic fill in Camden. Hexavalent chromium is a known contaminant from tannery operations.
- Additional remedial investigation for hexavalent chromium impacts is recommended.
- Surficial soils in the area of the former coal storage yard are impacted with lead, mercury, cadmium, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and dibenz(a,h)anthracene.
- Previous surficial samples returned elevated levels of dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, arsenic, and PCBs.
- Additional surficial investigation of soils is recommended.

7 ECOLOGICAL EVALUATION

An Ecological Evaluation (EE) as per requirements set forth in NJDEP Technical Requirements for Site Remediation N.J.A.C. 7:26E - 1.16 and 4.8, is required to be conducted at the site. The EE is a part of a tiered approach developed by the NJDEP SRP, to conduct an ecological evaluation and risk assessment on contaminated sites. The purpose of the EE is to evaluate ecological risks at a site early in the remedial process.

The EE is structured to identify the co-occurrence of the following at the subject site:

1.0 Contaminants of potential ecological concern (COPEC).
2.0 Environmentally sensitive areas located within the subject site boundaries and on properties immediately adjacent to the subject site.
3.0 Potential chemical migration pathways to any environmentally sensitive areas identified in Number 2; or any observations of potential impact to the identified environmentally sensitive areas that might be attributed to site contamination.

TTI searched NJDEP's GeoWeb website https://www.nj.gov/dep/gis/geowebsplash.htm to determine if any ecologically sensitive areas are within 500 feet to the site. No listings for ecologically sensitive areas were identified in TTI's search. TTI notes that the site is located in an urban section of the City of Camden.

8 CONCLUSIONS AND RECOMMENDATIONS

TTI was commissioned by CRA to investigate AOCs identified in TTI's June 2018 Preliminary Assessment. Conclusions and recommendations are summarized below for each AOC.

AOC 1 – Regulated Heating Oil UST - Soil sampling results and observations from the investigation of AOC 1 indicate that a release of petroleum product has occurred from the UST. EPH concentrations are above the 8,000 mg/kg default product limit. Individual contaminants of concern detected in SB-12 are consistent with petroleum constituents associated with heating oil. It is unknown if the UST contained No. 2 heating oil or heavier petroleum distillates such as No. 4, 5, or 6 heating oils. TTI reported the release case to NJDEP and the case tracking number is 19-04-16-1539-53. TTI recommends registering the UST for closure, removal of the UST, delineation of petroleum impacted soils, and remediation of petroleum impacted soils. A groundwater investigation has also been triggered due to the depth to groundwater at the site being within two (2) vertical feet of petroleum impacted soils.

AOC 2 – Historic Automotive Waste/Scrap Piles - Fill material consisting of brick and ash in a clay matrix was observed. No other evidence of a release was observed. TTI recommends no further investigation for AOC 2.

AOC 3 – Historic Fill or any other Fill Material - Fill material consisting of brick, ash, timbers, and glass was encountered at several locations across the site. The fill material is most likely from the demolition of the former site buildings following a fire in the 1970s. The fill material is impacted with PAHs and metals. TTI recommends sampling of surficial soils to determine if capping is necessary.

AOC 4 – Boiler Rooms - No evidence of a release was observed and EPH results were below the 1,000 mg/kg threshold for additional analysis. TTI recommends no further investigation for AOC 4.

AOC 5 – Chemical Storage Building A (1926) - Aluminum, manganese, mercury, and benzo(a)pyrene were detected above IGWSSL. Lead was detected above the IGWSSL and RDCSRS. TTI attributes the elevated levels of contaminants detected in SB-9 in the 3-3.5 foot zone to fill material. Additional investigation to be conducted in conjunction with historic fill investigation. TTI recommends no further investigation for AOC 5.

AOC 6 – Chemical Storage Building B (1891) - No contaminants of concern detected; TTI recommends no further investigation for AOC 6.

AOC 8 – Historic Site Operations - Chromium was detected at 2,230 mg/kg, which prompted analysis for hexavalent and trivalent chrome species. Hexavalent chromium returned a result of 28.4 mg/kg, which exceeds the NRDCSRS of 20 mg/kg. Chromium is a known contaminant of concern at tannery remediation sites. Chromium is also not typically considered a contaminant in historic fill material in the City of Camden. Additionally, the other contaminants detected at TP-3 may be attributed the former tannery operation. TTI recommends additional investigation to delineate the horizontal and vertical impacts of contaminants detected in the area of the former tannery operation.

AOC 9 – Former Coal Yard - Aluminum, cadmium, mercury, benzo(a)anthracene, and benzo(b)fluoranthene were detected above IGWSSL. Dibenz(a,h)anthracene was detected above RDCSRS. Lead was detected above IGWSSL and RDCSRS. Benzo(a)pyrene was detected above IGWSSL, RDCSRS, and NRDCSRS. TTI recommends additional surficial investigation to determine if the current surficial soil can be used to cap the site or if additional clean fill will need to be imported.

AOC 10 – Metallic Anomaly #1 - The test pit identified two steel I-beams buried in a layer of brick. No evidence of a release was identified, and no samples were collected since AOC 10 was confirmed to not be related to a UST. TTI recommends no further investigation for AOC 10.

AOC 11 – Metallic Anomaly #2 - AOC 11 was confirmed to not be related to a UST. TTI recommends no further investigation for AOC 11.

AOC 12 – Metallic Anomaly #3 - No evidence of a release was identified, and no samples were collected since AOC 12 was confirmed to not be related to a UST. TTI recommends no further investigation for AOC 12.

AOC 13 – Metallic Anomaly #4 - No contaminants of concern detected; AOC 13 was confirmed to not be related to a UST. TTI recommends no further investigation for AOC 13.

AOC 14 – Metallic Anomaly #5 - No evidence of a release was identified, and no samples were collected since AOC 14 was confirmed to not be related to a UST. TTI recommends no further investigation for AOC 14.

AOC 15 – Metallic Anomaly #6 - No evidence of a release was identified, and no samples were collected since AOC 15 was confirmed to not be related to a UST. TTI recommends no further investigation for AOC 15.

AOC 16 – Metallic Anomaly #7 - Aluminum, lead, manganese, benzo(a)anthracene, and benzo(b)fluoranthene were detected above IGWSSL. Benzo(a)pyrene was detected above IGWSSL and RDCSRS. TTI attributes levels of contaminants detected to fill material. Additional investigation to be conducted in conjunction with historic fill investigation. TTI recommends no further investigation for AOC 16.

AOC 17 – Metallic Anomaly #9 - No evidence of a release was identified, and no samples were collected since AOC 17 was confirmed to not be related to a UST. TTI recommends no further investigation for AOC 17.

AOC 18 – Metallic Anomaly #10 - Encountered brick, wires and timbers consistent with a demolished structure. Lead, manganese, silver, mercury, dieldrin, and benzo(a)pyrene were detected above IGWSSL. TTI attributes levels of contaminants detected to fill material. TTI recommends no further investigation for AOC 18.

9 REFERENCES

1. Preliminary Assessment Report, dated June 2018. Prepared by TTI Environmental, Inc.
2. NJDEP DataMiner. http://datamine2.state.nj.us/dep/DEP_OPRA/.
3. NJDEP GeoWeb. http://www.state.nj.us/dep/gis/geowebsplash.htm
4. Site Investigation Work Plan, dated November 7, 2018. Prepared by TTI Environmental, Inc.

Figures:

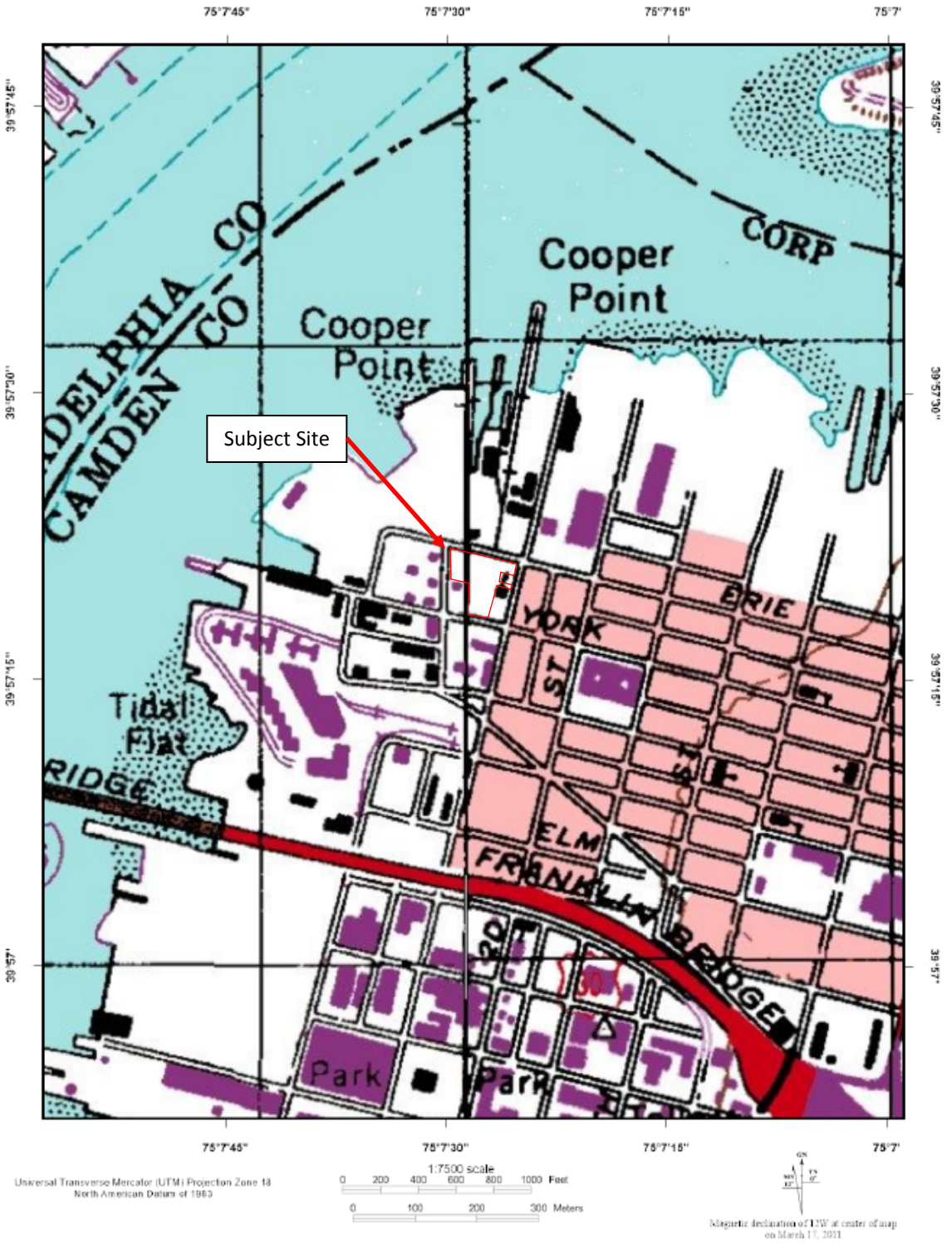

Figure 1.0:

Regional Site Location Map

Andujar Park
Erie and Point Street
Block 12, Lots 1, 3, 17 & 18
Block 14, Lot 29
Camden, Camden County, New Jersey 08102

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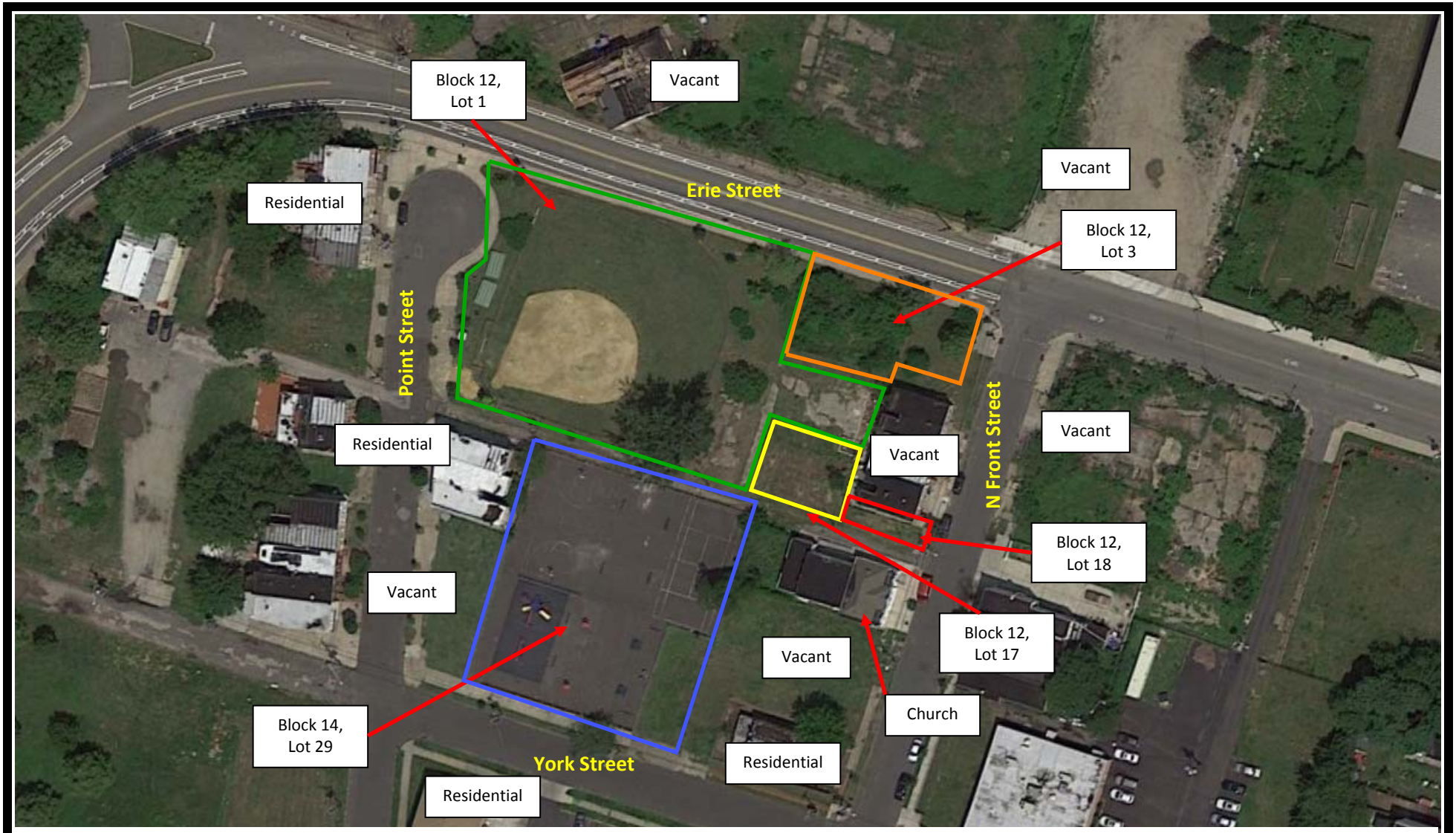

Figure 2.0:

Site Diagram

Andujar Park
Erie and Point Street
Block 12, Lots 1, 3, 17 & 18
Block 14, Lot 29
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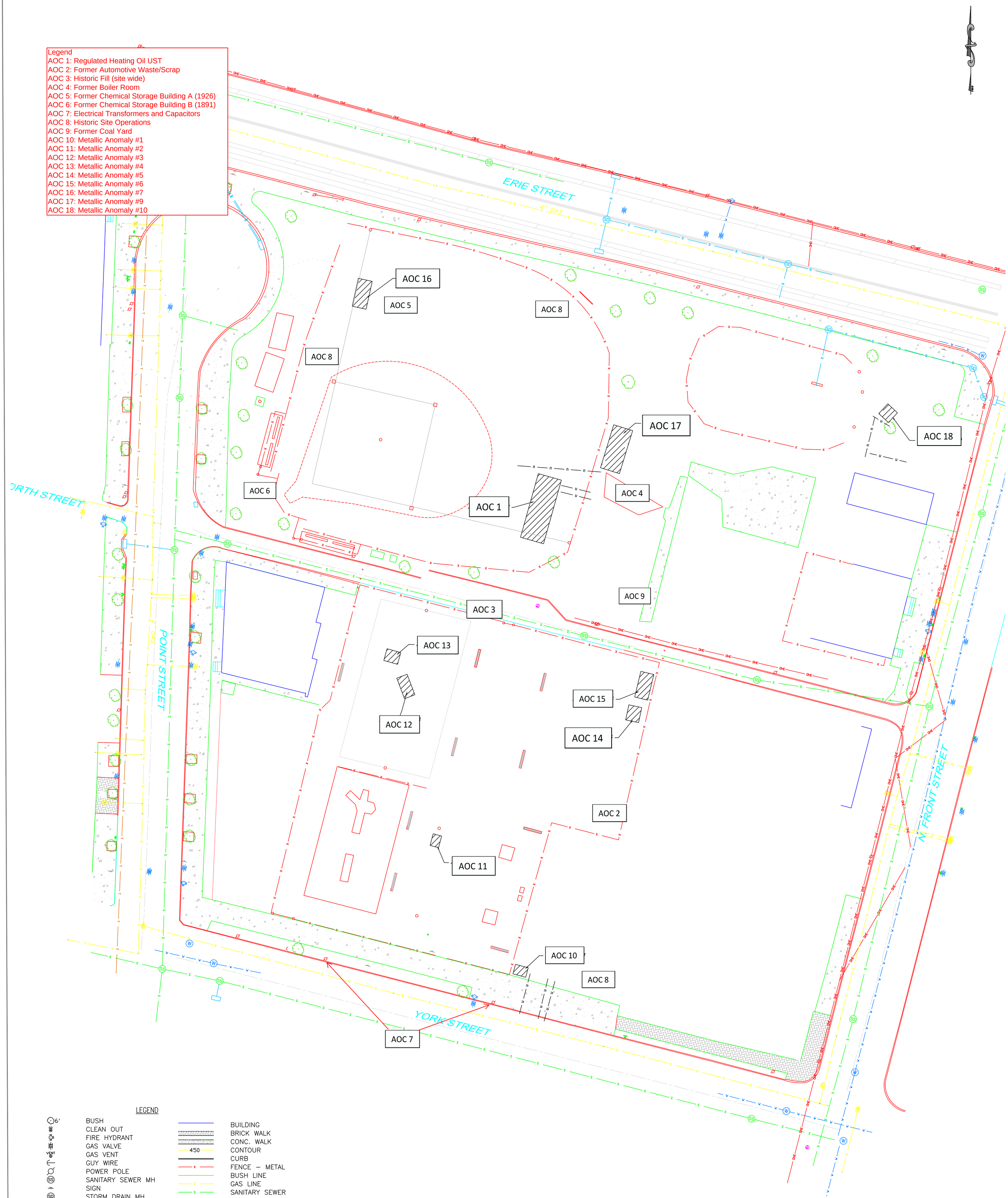
Legend
AOC 1: Regulated Heating Oil UST
AOC 2: Former Automotive Waste/Scrap
AOC 3: Historic Fill (site wide)
AOC 4: Former Boiler Room
AOC 5: Former Chemical Storage Building A (1926)
AOC 6: Former Chemical Storage Building B (1891)
AOC 7: Electrical Transformers and Capacitors
AOC 8: Historic Site Operations
AOC 9: Former Coal Yard
AOC 10: Metallic Anomaly #1
AOC 11: Metallic Anomaly #2
AOC 12: Metallic Anomaly #3
AOC 13: Metallic Anomaly #4
AOC 14: Metallic Anomaly #5
AOC 15: Metallic Anomaly #6
AOC 16: Metallic Anomaly #7
AOC 17: Metallic Anomaly #9
AOC 18: Metallic Anomaly #10



LEGEND

6'	BUSH		BUILDING
	CLEAN OUT		BRICK WALK
	FIRE HYDRANT		CONC. WALK
	GAS VALVE	450	CONTOUR
VENT	GAS VENT		CURB
	GUY WIRE	x	FENCE – METAL
	POWER POLE		BUSH LINE
SS	SANITARY SEWER MH	G	GAS LINE
	SIGN	S	SANITARY SEWER
SD	STORM DRAIN MH	D	STORM DRAIN
T	TELEPHONE MH	T	TELEPHONE LINE
100	TRAVERSE	W	WATER LINE
8'	TREE	U	UNKNOWN UTILITY
MH	UNKNOWN MANHOLE		
W	WATER MANHOLE		
	WATER VALVE		

BC – BOTTOM OF CURB
EP – EDGE OF PAVEMENT
CONC – CONCRETE
INV – INVERT
PVMT. – PAVEMENT
TC – TOP OF CURB

NOTES:

This site plan was produced from data positioned by differential GPS measurments collected in the field. Due to the errors normally present in DGPS data, this document is not intended or represented to be of survey precision. Caution should be used in all field measurments based on this site plan.

As with any geophysical method, it must be stressed that caution be used during any excavation or intrusive testing in proximity of any anomalies indicated in this document The absence of detected signatures does not preclude the possibility that targets exist. The geophysical data and results presented in this site plan are based upon the application of scientific principles and professional judgements to certain facts with resultant subjective interpretations. Professional judgements expressed herein are based on the facts currently available within the limits of the existing data, scope of work, budget, and schedule.

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0 10 20 40 60
GRAPHIC SCALE IN FEET

PROJECT NO.
SHEET NO. 1 OF 1
DRAWING NO. 052918
SCALE 1" = 20'
DATE 05-29-18
CHECKED BY
DRAWN BY MIKE MESAROS

GEOPHYSICAL INVESTIGATION
ANDUJAR PARK, NORTH STREET AND FRONT STREET, CAMDEN, NJ
FOR
TTI ENVIRONMENTAL, INC.

DELTA Geophysics Inc.
738 Front Street, Catasauqua, PA 18032
Phone: (610) 231–73012

DATE	DESCRIPTION	REV.
	REVISIONS	

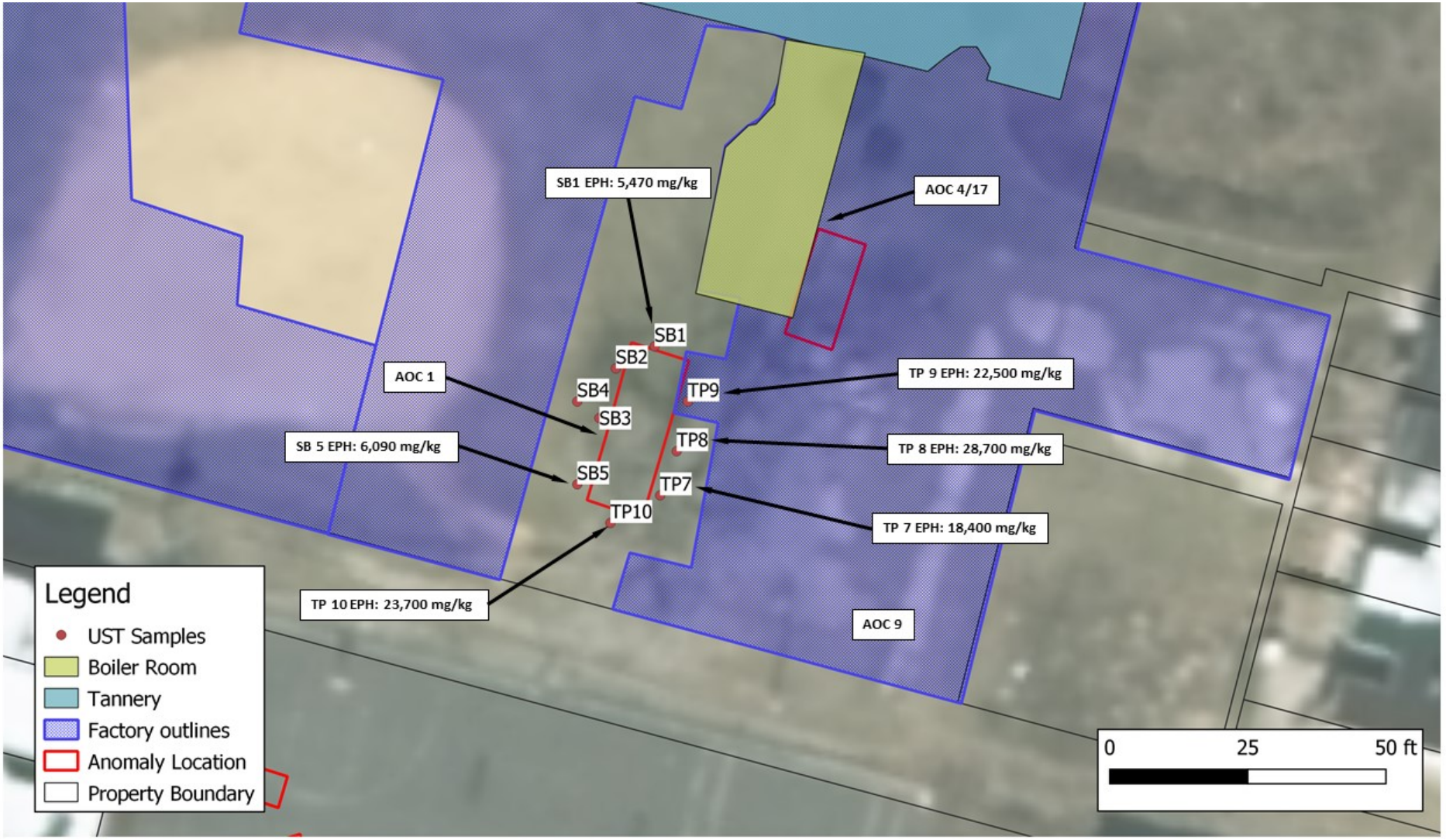

Figure 4.0: AOC 1: 10,000-gallon

UST Sample Location Map

Andujar Park
Erie and Point Street
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Block 14, Lot 29
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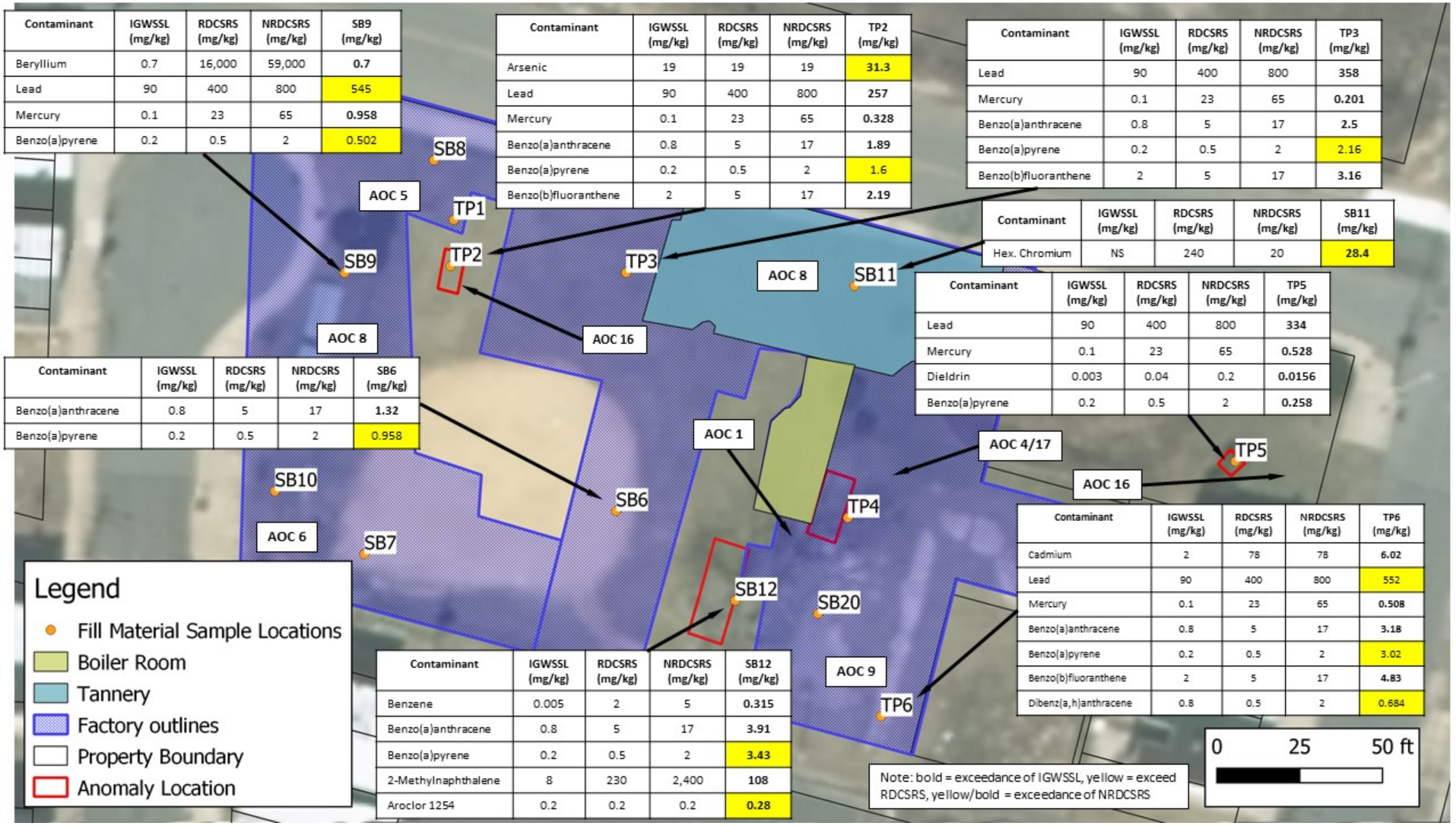

Contaminant	IGWSSL (mg/kg)	RDCSRS (mg/kg)	NRDCSRS (mg/kg)	SB9 (mg/kg)
Beryllium	0.7	16,000	59,000	**0.7**
Lead	90	400	800	**545**
Mercury	0.1	23	65	**0.958**
Benzo(a)pyrene	0.2	0.5	2	**0.502**

Contaminant	IGWSSL (mg/kg)	RDCSRS (mg/kg)	NRDCSRS (mg/kg)	TP2 (mg/kg)
Arsenic	19	19	19	**31.3**
Lead	90	400	800	**257**
Mercury	0.1	23	65	**0.328**
Benzo(a)anthracene	0.8	5	17	**1.89**
Benzo(a)pyrene	0.2	0.5	2	**1.6**
Benzo(b)fluoranthene	2	5	17	**2.19**

Contaminant	IGWSSL (mg/kg)	RDCSRS (mg/kg)	NRDCSRS (mg/kg)	TP3 (mg/kg)
Lead	90	400	800	**358**
Mercury	0.1	23	65	**0.201**
Benzo(a)anthracene	0.8	5	17	**2.5**
Benzo(a)pyrene	0.2	0.5	2	**2.16**
Benzo(b)fluoranthene	2	5	17	**3.16**

Contaminant	IGWSSL (mg/kg)	RDCSRS (mg/kg)	NRDCSRS (mg/kg)	SB11 (mg/kg)
Hex. Chromium	NS	240	20	**28.4**

Contaminant	IGWSSL (mg/kg)	RDCSRS (mg/kg)	NRDCSRS (mg/kg)	TP5 (mg/kg)
Lead	90	400	800	**334**
Mercury	0.1	23	65	**0.528**
Dieldrin	0.003	0.04	0.2	**0.0156**
Benzo(a)pyrene	0.2	0.5	2	**0.258**

Contaminant	IGWSSL (mg/kg)	RDCSRS (mg/kg)	NRDCSRS (mg/kg)	SB6 (mg/kg)
Benzo(a)anthracene	0.8	5	17	**1.32**
Benzo(a)pyrene	0.2	0.5	2	**0.958**

Contaminant	IGWSSL (mg/kg)	RDCSRS (mg/kg)	NRDCSRS (mg/kg)	TP6 (mg/kg)
Cadmium	2	78	78	**6.02**
Lead	90	400	800	**552**
Mercury	0.1	23	65	**0.508**
Benzo(a)anthracene	0.8	5	17	**3.18**
Benzo(a)pyrene	0.2	0.5	2	**3.02**
Benzo(b)fluoranthene	2	5	17	**4.83**
Dibenz(a,h)anthracene	0.8	0.5	2	**0.684**

Contaminant	IGWSSL (mg/kg)	RDCSRS (mg/kg)	NRDCSRS (mg/kg)	SB12 (mg/kg)
Benzene	0.005	2	5	**0.315**
Benzo(a)anthracene	0.8	5	17	**3.91**
Benzo(a)pyrene	0.2	0.5	2	**3.43**
2-Methylnaphthalene	8	230	2,400	**108**
Aroclor 1254	0.2	0.2	0.2	**0.28**

Figure 5.0:

Sample Location Map (Northern Portion of Site)

Andujar Park
Erie and Point Street
Block 12, Lots 1, 3, 17 & 18
Block 14, Lot 29
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18-360	DD	5.0

Figure 6.0:

Sample Location Map (Southern Portion of Site)

Andujar Park
Erie and Point Street
Block 12, Lots 1, 3, 17 & 18
Block 14, Lot 29
Camden, Camden County, New Jersey 08102

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Figure 7.0:

Conceptual Site Model Input

Andujar Park
Erie and Point Street
Block 12, Lots 1, 3, 17 & 18
Block 14, Lot 29
Camden, Camden County, New Jersey 08102

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As shown	City of Camden	5/2019
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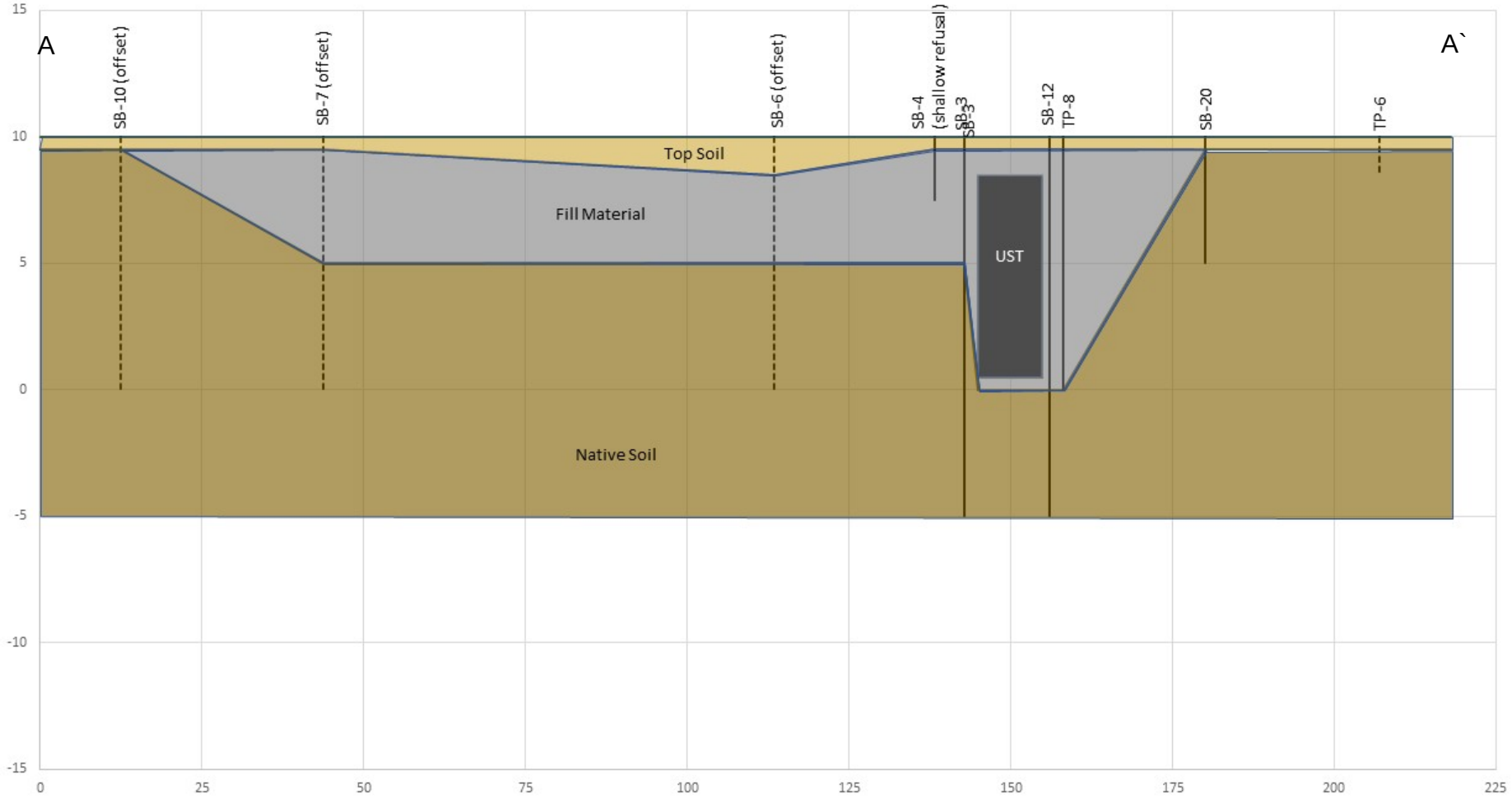

Figure 8.0:

Cross Section A-A`

Andujar Park
Erie and Point Street
Block 12, Lots 1, 3, 17 & 18
Block 14, Lot 29
Camden, Camden County, New Jersey 08102

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SCALE	DRAWN BY	DATE
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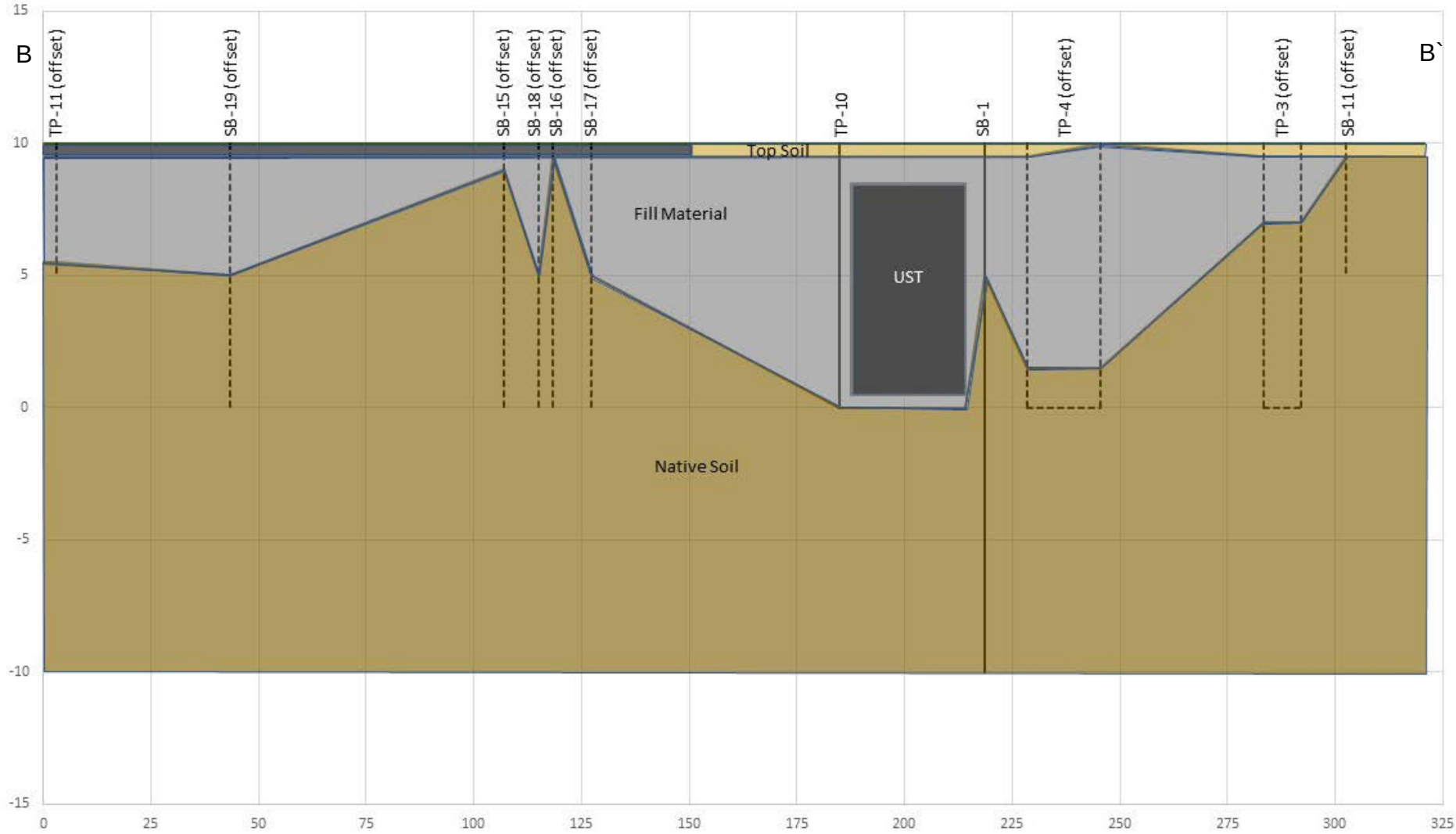

Figure 9.0:

Cross Section B-B`

Andujar Park
Erie and Point Street
Block 12, Lots 1, 3, 17 & 18
Block 14, Lot 29
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SCALE	DRAWN BY	DATE
6X Vertical Exaggeration	AB	5/2019
PROJECT	APP'D BY	DRAWING NO.
18-360	AB	9.0

Tables:

Table 4.0
Full Laboratory Soil Sampling Results
Andujar Park Site Investigation
PI 782823

Lab Sample ID						L1083840-01			L1083840-02			L1083840-03		
Date Collected						03/27/2019			03/27/2019			03/27/2019		
Depth (ft.)						2 - 2.5			3.5 - 4.0			9 - 9.5		
Client Sample ID						TP2@2-2.5			TP3@3.5-4.0			SB1@9-9.5		
Matrix						SS			SS			SS		
Method	Analyte	IGWSRS	RDCSRS	NRDCSRS	Units	Result	RDL	Qualifier	Result	RDL	Qualifier	Result	RDL	Qualifier
2540 G-2011	TOTAL SOLIDS	NS	NS	NS	%	85.8	0.1		85.7	0.1		91.5	0.1	
3060A/7196A	CHROMIUM,HEXAVALENT	NS	240	20	mg/kg	NA			4.9	2.34				
6010D	ALUMINUM	6000	78000	NS	mg/kg	6910	11.7		6180	11.7				
6010D	ANTIMONY	6	31	450	mg/kg	1.55	2.33	J	2.72	2.34				
6010D	ARSENIC	19	19	19	mg/kg	6.53	2.33		31.3	2.34				
6010D	BARIUM	2100	16000	59000	mg/kg	95.2	0.583		121	0.584				
6010D	BERYLLIUM	0.7	16	140	mg/kg	0.413	0.233		0.564	0.234				
6010D	CADMIUM	2	78	78	mg/kg	1.83	0.583		1.96	0.584				
6010D	CALCIUM	NS	NS	NS	mg/kg	24400	117		4520	117				
6010D	CHROMIUM	NS	NS	NS	mg/kg	95.8	1.17		214	1.17				
6010D	COBALT	90	1600	590	mg/kg	3.91	1.17		9.02	1.17				
6010D	COPPER	11000	3100	45000	mg/kg	42.6	2.33		170	2.34				
6010D	IRON	NS	NS	NS	mg/kg	13200	11.7		31000	11.7				
6010D	LEAD	90	400	800	mg/kg	257	0.583		358	0.584				
6010D	MAGNESIUM	NS	NS	NS	mg/kg	1870	117		1840	117				
6010D	MANGANESE	65	11000	5900	mg/kg	191	1.17		113	1.17				
6010D	NICKEL	48	1600	23000	mg/kg	10.9	2.33		17.4	2.34				
6010D	POTASSIUM	NS	NS	NS	mg/kg	869	117		1570	117				
6010D	SELENIUM	11	390	5700	mg/kg	0.786	2.33	J	1.18	2.34	J			
6010D	SILVER	1	390	5700	mg/kg	ND	1.17		ND	1.17				
6010D	SODIUM	NS	NS	NS	mg/kg	159	117	B	254	117	B			
6010D	THALLIUM	3	NS	NS	mg/kg	ND	2.33		ND	2.34				
6010D	VANADIUM	NS	78	1100	mg/kg	19.6	2.33		25.9	2.34				
6010D	ZINC	930	23000	110000	mg/kg	259	5.83		172	5.84				
7471B	MERCURY	0.1	23	65	mg/kg	0.328	0.0233		0.201	0.0234				
8081B	ALDRIN	0.2	0.04	0.2	mg/kg	NA			ND	0.0234				
8081B	ALPHA BHC	0.002	0.1	0.5	mg/kg	NA			ND	0.00292				
8081B	BETA BHC	0.002	0.4	2	mg/kg	NA			ND	0.00292				
8081B	DELTA BHC	NS	NS	NS	mg/kg	NA			ND	0.0234				
8081B	GAMMA BHC	0.002	0.4	2	mg/kg	NA			ND	0.00292				
8081B	CHLORDANE	0.05	0.2	1	mg/kg	NA			ND	0.234				
8081B	ALPHA-CHLORDANE	NS	NS	NS	mg/kg	NA			ND	0.0234				
8081B	GAMMA-CHLORDANE	NS	NS	NS	mg/kg	NA			ND	0.0234				
8081B	4,4-DDD	4	3	13	mg/kg	NA			ND	0.0234				
8081B	4,4-DDE	18	2	9	mg/kg	NA			ND	0.0234				
8081B	4,4-DDT	11	2	8	mg/kg	NA			ND	0.0234				
8081B	DIELDRIN	0.003	0.04	0.2	mg/kg	NA			ND	0.0035				
8081B	ENDOSULFAN I	4	NS	NS	mg/kg	NA			ND	0.0234				
8081B	ENDOSULFAN II	4	NS	NS	mg/kg	NA			ND	0.0234				
8081B	ENDOSULFAN SULFATE	2	470	6800	mg/kg	NA			ND	0.0234				
8081B	ENDRIN	1	23	340	mg/kg	NA			ND	0.0234				
8081B	ENDRIN ALDEHYDE	NS	NS	NS	mg/kg	NA			ND	0.0234				
8081B	ENDRIN KETONE	NS	NS	NS	mg/kg	NA			ND	0.0234				
8081B	HEXACHLOROBENZENE	0.2	0.3	1	mg/kg	NA			ND	0.0234				
8081B	HEPTACHLOR	0.5	0.1	0.7	mg/kg	NA			ND	0.0234				
8081B	HEPTACHLOR EPOXIDE	0.01	0.07	0.3	mg/kg	NA			ND	0.0117				
8081B	METHOXYCHLOR	160	390	5700	mg/kg	NA			ND	0.0234				
8081B	TOXAPHENE	0.3	0.6	3	mg/kg	NA			ND	0.467				
8082 A	PCB 1016	0.2	0.2	1	mg/kg	NA			ND	0.0198				
8082 A	PCB 1221	0.2	0.2	1	mg/kg	NA			ND	0.0198				
8082 A	PCB 1232	0.2	0.2	1	mg/kg	NA			ND	0.0198				
8082 A	PCB 1242	0.2	0.2	1	mg/kg	NA			ND	0.0198				
8082 A	PCB 1248	0.2	0.2	1	mg/kg	NA			ND	0.0198				
8082 A	PCB 1254	0.2	0.2	1	mg/kg	NA			0.243	0.0198				
8082 A	PCB 1260	0.2	0.2	1	mg/kg	NA			ND	0.0198				
8260C	ACETONE	19	70000		mg/kg	NA			0.0393	0.0706	J			
8260C	BENZENE	0.005	2	5	mg/kg	NA			ND	0.00117				
8260C	BROMOCHLOROMETHANE	NS	NS	NS	mg/kg	NA			ND	0.00117				
8260C	BROMODICHLOROMETHANE	0.005	1	3	mg/kg	NA			ND	0.00117				
8260C	BROMOFORM	0.03	81	280	mg/kg	NA			ND	0.00117				
8260C	BROMOMETHANE	0.04	25	59	mg/kg	NA			ND	0.00584				
8260C	CARBON DISULFIDE	6	7800	110000	mg/kg	NA			ND	0.00117				
8260C	CARBON TETRACHLORIDE	0.005	2	4	mg/kg	NA			ND	0.00117				
8260C	CHLOROBENZENE	0.6	510	7400	mg/kg	NA			ND	0.00117				
8260C	CHLORODIBROMOMETHANE	0.005	3	8	mg/kg	NA			ND	0.00117				
8260C	CHLOROETHANE	NS	220	1100	mg/kg	NA			ND	0.00584				
8260C	CHLOROFORM	0.4	0.6	2	mg/kg	NA			ND	0.00584				
8260C	CHLOROMETHANE	NS	4	12	mg/kg	NA			ND	0.00292				
8260C	CYCLOHEXANE	NS	NS	NS	mg/kg	NA			ND	0.00117				
8260C	1,2-DIBROMO-3-CHLOROPROPANE	0.005	0.08	0.2	mg/kg	NA			ND	0.0035				
8260C	1,2-DIBROMOETHANE	0.005	0.008	0.04	mg/kg	NA			ND	0.00117				
8260C	DICHLORODIFLUOROMETHANE	39	490	230000	mg/kg	NA			ND	0.00584				
8260C	1,1-DICHLOROETHANE	0.2	8	24	mg/kg	NA			ND	0.00117				
8260C	1,2-DICHLOROETHANE	0.005	0.9	3	mg/kg	NA			ND	0.00117				
8260C	1,2-DICHLOROBENZENE	17	5300	59000	mg/kg	NA			ND	0.00117				
8260C	1,3-DICHLOROBENZENE	19	5300	59000	mg/kg	NA			ND	0.00117				
8260C	1,4-DICHLOROBENZENE	2	5	13	mg/kg	NA			ND	0.00117				
8260C	1,1-DICHLOROETHENE	0.008	11	150	mg/kg	NA			ND	0.00117				
8260C	CIS-1,2-DICHLOROETHENE	0.3	230	560	mg/kg	NA			ND	0.00117				
8260C	TRANS-1,2-DICHLOROETHENE	0.6	300	720	mg/kg	NA			ND	0.00117				
8260C	1,2-DICHLOROPROPANE	0.005	2	5	mg/kg	NA			ND	0.00117				
8260C	CIS-1,3-DICHLOROPROPENE	NS	NS	NS	mg/kg	NA			ND	0.00117				
8260C	TRANS-1,3-DICHLOROPROPENE	NS	NS	NS	mg/kg	NA			ND	0.00117				
8260C	ETHYLBENZENE	13	7800	110000	mg/kg	NA			ND	0.00117				
8260C	2-HEXANONE	NS	NS	NS	mg/kg	NA			ND	0.0117				
8260C	ISOPROPYLBENZENE	NS	NS	NS	mg/kg	NA			ND	0.0117				
8260C	2-BUTANONE (MEK)	0.9	3100	44000	mg/kg	NA			ND	0.0117				
8260C	METHYL ACETATE	22	78000	NS	mg/kg	NA			0.0174	0.0283	J J0 J4			
8260C	METHYL CYCLOHEXANE	NS	NS	NS	mg/kg	NA			ND	0.00117				
8260C	METHYLENE CHLORIDE	0.01	46	230	mg/kg	NA			ND	0.00584				
8260C	4-METHYL-2-PENTANONE (MIBK)	NS	NS	NS	mg/kg	NA			ND	0.0117				
8260C	METHYL TERT-BUTYL ETHER	0.2	110	320	mg/kg	NA			ND	0.00117				
8260C	STYRENE	3	90	260	mg/kg	NA			ND	0.00117				
8260C	1,1,2,2-TETRACHLOROETHANE	0.007	1	3	mg/kg	NA			ND	0.00117				
8260C	TETRACHLOROETHENE	0.005	43	1500	mg/kg	NA			ND	0.00117				
8260C	TOLUENE	7	6300	91000	mg/kg	NA			0.000723	0.00584	J			
8260C	1,2,3-TRICHLOROBENZENE	NS	NS	NS	mg/kg	NA			ND	0.00117				
8260C	1,2,4-TRICHLOROBENZENE	0.7	73	820	mg/kg	NA			ND	0.00117				
8260C	1,1,1-TRICHLOROETHANE	0.3	160000	NS	mg/kg	NA			ND	0.00117				
8260C	1,1,2-TRICHLOROETHANE	0.02	2	6	mg/kg	NA			ND	0.00117				
8260C	TRICHLOROETHENE	0.01	3	10	mg/kg	NA			ND	0.00117				
8260C	TRICHLOROFLUOROMETHANE	34	23000	340000	mg/kg	NA			ND	0.00584				
8260C	1,1,2-TRICHLOROTRIFLUOROETHANE	NS	NS	NS	mg/kg	NA			ND	0.00117				
8260C	VINYL CHLORIDE	0.005	0.7	2	mg/kg	NA			ND	0.00117				
8260C	XYLENES, TOTAL	19	12000	170000	mg/kg	NA			ND	0.0035				
8260C	NAPHTHALENE	25	6	17	mg/kg	NA			NA					
8260C	TERT-BUTYL ALCOHOL	0.3	1400	11000	mg/kg	NA			NA					
8270D	ANTHRACENE	2400	17000	30000	mg/kg	0.515	0.385		0.653	0.385	J4			
8270D	ACENAPHTHENE	110	3400	37000	mg/kg	0.128	0.385	J	0.281	0.385	J J3 J4			
8270D	ACENAPHTHYLENE	NS	NS	300000	mg/kg	0.555	0.385		0.292	0.385	J J3 J4			
8270D	BENZO(A)ANTHRACENE	0.8	5	17	mg/kg	1.89	0.385		2.5	0.385				
8270D	BENZO(A)PYRENE	0.2	0.5	2	mg/kg	1.6	0.385		2.16	0.385				
8270D	BENZO(B)FLUORANTHENE	2	5	17	mg/kg	2.19	0.385		3.16	0.385				
8270D	BENZO(G,H,I)PERYLENE	NS	380000	30000	mg/kg	1.45	0.385		1.31	0.385				
8270D	BENZO(K)FLUORANTHENE	25	45	170	mg/kg	0.655	0.385		0.973	0.385				
8270D	CHRYSENE	80	450	1700	mg/kg	1.78	0.385		2.65	0.385	J4			
8270D	DIBENZ(A,H)ANTHRACENE	0.8	0.5	2	mg/kg	0.446	0.385		0.39	0.385				
8270D	FLUORANTHENE	1300	2300	24000	mg/kg	3.64	0.385		5.08	0.385				
8270D	FLUORENE	170	2300	24000	mg/kg	0.333	0.385	J	0.274	0.385	J J4			
8270D	INDENO(1,2,3-CD)PYRENE	7	5	17	mg/kg	1.01	0.385		1.52	0.385				
8270D	NAPHTHALENE	25	6	17	mg/kg	0.148	0.385	J	0.371	0.385	J J3 J4			
8270D	PHENANTHRENE	NS	NS	300000	mg/kg	2.48	0.385		3.44	0.385	J4			
8270D	PYRENE	840	1700	18000	mg/kg	2.65	0.385		4.49	0.385				
8270D	ACETOPHENONE	3	2	5	mg/kg	NA			ND	1.75	J3 J4			
8270D	ATRAZINE	0.2	210	2400	mg/kg	NA			ND	1.75				
8270D	BENZALDEHYDE	NS	6100	68000	mg/kg	NA			ND	1.75	J3			
8270D	BIPHENYL	140	61	240	mg/kg	NA			ND	1.75	J3 J4			
8270D	BIS(2-CHLORETHOXY)METHANE	NS	NS	NS	mg/kg	NA			ND	1.75	J3 J4			
8270D	BIS(2-CHLOROETHYL)ETHER	0.2	0.4	2	mg/kg	NA			ND	1.75	J3 J4			
8270D	BIS(2-CHLOROISOPROPYL)ETHER	5	23	67	mg/kg	NA			ND	1.75	J3 J4			
8270D	4-BROMOPHENYL-PHENYLETHER	NS	NS	NS	mg/kg	NA			ND	1.75	J4			
8270D	CAPROLACTAM	12	31000	340000	mg/kg	NA			ND	1.75				
8270D	CARBAZOLE	NS	24	96	mg/kg	NA			0.386	1.75	J			
8270D	4-CHLOROANILINE	NS	NS	NS	mg/kg	NA			ND	1.75	J3 J4			
8270D	2-CHLORONAPHTHALENE	NS	NS	NS	mg/kg	NA			ND	0.385	J3 J4			
8270D	4-CHLOROPHENYL-PHENYLETHER	NS	NS	NS	mg/kg	NA			ND	1.75	J4			
8270D	DIBENZOFURAN	NS	NS	NS	mg/kg	NA			0.205	1.75	J J3 J4			
8270D	3,3-DICHLOROBENZIDINE	0.2	1	4	mg/kg	NA			ND	1.75				
8270D	2,4-DINITROTOLUENE	NS	0.7	3	mg/kg	NA			ND	1.75	J4			
8270D	2,6-DINITROTOLUENE	NS	0.7	3	mg/kg	NA			ND	1.75	J4			
8270D	HEXACHLOROBENZENE	0.2	0.3	1	mg/kg	NA			ND	1.75	J4			
8270D	HEXACHLORO-1,3-BUTADIENE	0.9	6	25	mg/kg	NA			ND	1.75	J3 J4			
8270D	HEXACHLOROCYCLOPENTADIENE	320	45	110	mg/kg	NA			ND	1.75	J0 J3			
8270D	HEXACHLOROETHANE	0.2	12	48	mg/kg	NA			ND	1.75	J3			
8270D	ISOPHORONE	0.2	510	2000	mg/kg	NA			0.0898	1.75	J J3 J4			
8270D	2-METHYLNAPHTHALENE	8	230	2400	mg/kg	NA			0.128	0.385	J J3 J4			
8270D	2-NITROANILINE	NS	39	23000	mg/kg	NA			ND	1.75	J4			
8270D	3-NITROANILINE	NS	NS	NS	mg/kg	NA			ND	1.75	J4			

Lab Sample ID	L1083840-04			L1083840-05			L1083840-06			L1083840-07		
Date Collected	03/27/2019			03/27/2019			03/27/2019			03/27/2019		
Depth (ft.)	6.5 - 7			0.5 - 1			9 - 9.5			8 - 8.5		
Client Sample ID	TP5@6.5-7			TP6@0.5-1.0			SB5@9.0-9.5			TB7@8.0-8.5		
Matrix	SS			SS			SS			SS		
Analyte	Result	RDL	Qualifier	Result	RDL	Qualifier	Result	RDL	Qualifier	Result	RDL	Qualifier
TOTAL SOLIDS	91.2	0.1		79.5	0.1		91.7	0.1		91.5	0.1	
CHROMIUM,HEXAVALENT	NA			0.805	2.51	J	NA			NA		
ALUMINUM	4890	11		8100	12.6		NA			NA		
ANTIMONY	5.9	2.19		2.63	2.51		NA			NA		
ARSENIC	9.58	2.19		11.5	2.51		NA			NA		
BARIUM	146	0.548		176	0.629		NA			NA		
BERYLLIUM	0.312	0.219		0.646	0.251		NA			NA		
CADMIUM	0.603	0.548		6.02	0.629		NA			NA		
CALCIUM	6030	110		25300	126		NA			NA		
CHROMIUM	17	1.1		109	1.26		NA			NA		
COBALT	4.07	1.1		8.98	1.26		NA			NA		
COPPER	44.8	2.19		93.1	2.51		NA			NA		
IRON	11100	11		36700	12.6		NA			NA		
LEAD	334	0.548		552	0.629		NA			NA		
MAGNESIUM	1590	110		4580	126		NA			NA		
MANGANESE	169	1.1		461	1.26		NA			NA		
NICKEL	8.08	2.19		28.5	2.51		NA			NA		
POTASSIUM	810	110		976	126		NA			NA		
SELENIUM	ND	2.19		ND	2.51		NA			NA		
SILVER	1.72	1.1		ND	1.26		NA			NA		
SODIUM	120	110	B	208	126	B	NA			NA		
THALLIUM	ND	2.19		ND	2.51		NA			NA		
VANADIUM	13.2	2.19		35.6	2.51		NA			NA		
ZINC	215	5.48		557	6.29		NA			NA		
MERCURY	0.528	0.0219		0.508	0.0251	J6	NA			NA		
ALDRIN	ND	0.0219		NA			NA			NA		
ALPHA BHC	ND	0.00274		NA			NA			NA		
BETA BHC	ND	0.00274		NA			NA			NA		
DELTA BHC	ND	0.0219		NA			NA			NA		
GAMMA BHC	ND	0.00274		NA			NA			NA		
CHLORDANE	ND	0.219		NA			NA			NA		
ALPHA-CHLORDANE	ND	0.0219	J3	NA			NA			NA		
GAMMA-CHLORDANE	ND	0.0219	J3	NA			NA			NA		
4,4-DDD	ND	0.0219	J3 J5	NA			NA			NA		
4,4-DDE	0.0624	0.0219	J3 J5	NA			NA			NA		
4,4-DDT	0.386	0.0219	J3 V	NA			NA			NA		
DIELDRIN	0.0156	0.00329	J3 J5	NA			NA			NA		
ENDOSULFAN I	ND	0.0219	J3	NA			NA			NA		
ENDOSULFAN II	ND	0.0219		NA			NA			NA		
ENDOSULFAN SULFATE	ND	0.0219		NA			NA			NA		
ENDRIN	ND	0.0219		NA			NA			NA		
ENDRIN ALDEHYDE	ND	0.0219		NA			NA			NA		
ENDRIN KETONE	ND	0.0219	J3	NA			NA			NA		
HEXACHLOROBENZENE	ND	0.0219		NA			NA			NA		
HEPTACHLOR	ND	0.0219		NA			NA			NA		
HEPTACHLOR EPOXIDE	ND	0.011		NA			NA			NA		
METHOXYCHLOR	ND	0.0219		NA			NA			NA		
TOXAPHENE	ND	0.438		NA			NA			NA		
PCB 1016	ND	0.0186		NA			NA			NA		
PCB 1221	ND	0.0186		NA			NA			NA		
PCB 1232	ND	0.0186		NA			NA			NA		
PCB 1242	ND	0.0186		NA			NA			NA		
PCB 1248	ND	0.0186		NA			NA			NA		
PCB 1254	ND	0.0186		NA			NA			NA		
PCB 1260	ND	0.0186	J3 J5	NA			NA			NA		
ACETONE	0.115	0.0773		NA			NA			NA		
BENZENE	0.00059	0.0011	J	NA			NA			NA		
BROMOCHLOROMETHANE	ND	0.0011		NA			NA			NA		
BROMODICHLOROMETHANE	ND	0.0011		NA			NA			NA		
BROMOFORM	ND	0.0011		NA			NA			NA		
BROMOMETHANE	ND	0.00548		NA			NA			NA		
CARBON DISULFIDE	0.000477	0.0011	J	NA			NA			NA		
CARBON TETRACHLORIDE	ND	0.0011		NA			NA			NA		
CHLOROBENZENE	ND	0.0011		NA			NA			NA		
CHLORODIBROMOMETHANE	ND	0.0011		NA			NA			NA		
CHLOROETHANE	ND	0.00548		NA			NA			NA		
CHLOROFORM	ND	0.00548		NA			NA			NA		
CHLOROMETHANE	ND	0.00274		NA			NA			NA		
CYCLOHEXANE	ND	0.0011		NA			NA			NA		
1,2-DIBROMO-3-CHLOROPROPANE	ND	0.00329		NA			NA			NA		
1,2-DIBROMOETHANE	ND	0.0011		NA			NA			NA		
DICHLORODIFLUOROMETHANE	ND	0.00548		NA			NA			NA		
1,1-DICHLOROETHANE	ND	0.0011		NA			NA			NA		
1,2-DICHLOROETHANE	ND	0.0011		NA			NA			NA		
1,2-DICHLOROBENZENE	ND	0.0011		NA			NA			NA		
1,3-DICHLOROBENZENE	ND	0.0011		NA			NA			NA		
1,4-DICHLOROBENZENE	ND	0.0011		NA			NA			NA		
1,1-DICHLOROETHENE	ND	0.0011		NA			NA			NA		
CIS-1,2-DICHLOROETHENE	ND	0.0011		NA			NA			NA		
TRANS-1,2-DICHLOROETHENE	ND	0.0011		NA			NA			NA		
1,2-DICHLOROPROPANE	ND	0.0011		NA			NA			NA		
CIS-1,3-DICHLOROPROPENE	ND	0.0011		NA			NA			NA		
TRANS-1,3-DICHLOROPROPENE	ND	0.0011		NA			NA			NA		
ETHYLBENZENE	ND	0.0011		NA			NA			NA		
2-HEXANONE	ND	0.011		NA			NA			NA		
ISOPROPYLBENZENE	ND	0.011		NA			NA			NA		
2-BUTANONE (MEK)	ND	0.011		NA			NA			NA		
METHYL ACETATE	ND	0.559		NA			NA			NA		
METHYL CYCLOHEXANE	ND	0.0011		NA			NA			NA		
METHYLENE CHLORIDE	ND	0.00548		NA			NA			NA		
4-METHYL-2-PENTANONE (MIBK)	ND	0.011		NA			NA			NA		
METHYL TERT-BUTYL ETHER	ND	0.0011		NA			NA			NA		
STYRENE	ND	0.0011		NA			NA			NA		
1,1,2,2-TETRACHLOROETHANE	ND	0.0011		NA			NA			NA		
TETRACHLOROETHENE	0.00218	0.0011		NA			NA			NA		
TOLUENE	0.00721	0.00548		NA			NA			NA		
1,2,3-TRICHLOROBENZENE	ND	0.0011		NA			NA			NA		
1,2,4-TRICHLOROBENZENE	ND	0.0011		NA			NA			NA		
1,1,1-TRICHLOROETHANE	ND	0.0011		NA			NA			NA		
1,1,2-TRICHLOROETHANE	ND	0.0011		NA			NA			NA		
TRICHLOROETHENE	ND	0.0011		NA			NA			NA		
TRICHLOROFLUOROMETHANE	ND	0.00548		NA			NA			NA		
1,1,2-TRICHLOROTRIFLUOROETHANE	ND	0.0011		NA			NA			NA		
VINYL CHLORIDE	ND	0.0011		NA			NA			NA		
XYLENES, TOTAL	ND	0.00329		NA			NA			NA		
NAPHTHALENE	NA			NA			NA			NA		
TERT-BUTYL ALCOHOL	NA			NA			NA			NA		
ANTHRACENE	0.132	0.0723	J4	0.719	0.415		NA			NA		
ACENAPHTHENE	0.0503	0.0723	J J3 J4	0.196	0.415	J	NA			NA		
ACENAPHTHYLENE	0.0794	0.0723	J3 J4	0.686	0.415		NA			NA		
BENZO(A)ANTHRACENE	0.272	0.0723		3.18	0.415		NA			NA		
BENZO(A)PYRENE	0.258	0.0723		3.02	0.415		NA			NA		
BENZO(B)FLUORANTHENE	0.401	0.0723		4.83	0.415		NA			NA		
BENZO(G,H,I)PERYLENE	0.214	0.0723		2.24	0.415		NA			NA		
BENZO(K)FLUORANTHENE	0.137	0.0723		1.57	0.415		NA			NA		
CHRYSENE	0.333	0.0723	J4	4.11	0.415		NA			NA		
DIBENZ(A,H)ANTHRACENE	0.0575	0.0723	J	0.684	0.415		NA			NA		
FLUORANTHENE	0.595	0.0723		9.24	0.415		NA			NA		
FLUORENE	0.0517	0.0723	J J4	0.36	0.415	J	NA			NA		
INDENO(1,2,3-CD)PYRENE	0.227	0.0723		2.07	0.415		NA			NA		
NAPHTHALENE	0.607	0.0723	J3 J4	0.319	0.415	J	NA			NA		
PHENANTHRENE	0.543	0.0723	J4	6.7	0.415		NA			NA		
PYRENE	0.544	0.0723		6.93	0.415		NA			NA		
ACETOPHENONE	ND	0.329	J3 J4	NA			NA			NA		
ATRAZINE	ND	0.329		NA			NA			NA		
BENZALDEHYDE	0.226	0.329	J J3	NA			NA			NA		
BIPHENYL	0.0568	0.329	J J3 J4	NA			NA			NA		
BIS(2-CHLORETHOXY)METHANE	ND	0.329	J3 J4	NA			NA			NA		
BIS(2-CHLOROETHYL)ETHER	ND	0.329	J3 J4	NA			NA			NA		
BIS(2-CHLOROISOPROPYL)ETHER	ND	0.329	J3 J4	NA			NA			NA		
4-BROMOPHENYL-PHENYLETHER	ND	0.329	J4	NA			NA			NA		
CAPROLACTAM	ND	0.329		NA			NA			NA		
CARBAZOLE	0.0504	0.329	J	NA			NA			NA		
4-CHLOROANILINE	ND	0.329	J3 J4	NA			NA			NA		
2-CHLORONAPHTHALENE	ND	0.0723	J3 J4	NA			NA			NA		
4-CHLOROPHENYL-PHENYLETHER	ND	0.329	J4	NA			NA			NA		
DIBENZOFURAN	0.135	0.329	J J3 J4	NA			NA			NA		
3,3-DICHLOROBENZIDINE	ND	0.329		NA			NA			NA		
2,4-DINITROTOLUENE	ND	0.329	J4	NA			NA			NA		
2,6-DINITROTOLUENE	ND	0.329	J4	NA			NA			NA		
HEXACHLOROBENZENE	ND	0.329	J4	NA			NA			NA		
HEXACHLORO-1,3-BUTADIENE	ND	0.329	J3 J4	NA			NA			NA		
HEXACHLOROCYCLOPENTADIENE	ND	0.329	J0 J3	NA			NA			NA		
HEXACHLOROETHANE	ND	0.329	J3	NA			NA			NA		
ISOPHORONE	ND	0.329	J3 J4	NA			NA			NA		
2-METHYLNAPHTHALENE	0.258	0.0723	J3 J4	NA			NA			NA		
2-NITROANILINE	ND	0.329	J4	NA			NA			NA		
3-NITROANILINE	ND	0.329	J4	NA			NA			NA		

Lab Sample ID	L1083840-08			L1083840-09			L1083840-10			L1083840-11		
Date Collected	03/27/2019			03/27/2019			03/27/2019			03/27/2019		
Depth (ft.)	8 - 8.5			8 - 8.5			4.5 - 5			7.5 - 8		
Client Sample ID	TP8@8.0-8.5			TP9@8.0-8.5			SB6@4.5-5.0			SB7@7.5-8.0		
Matrix	SS			SS			SS			SS		
Analyte	Result	RDL	Qualifier	Result	RDL	Qualifier	Result	RDL	Qualifier	Result	RDL	Qualifier
TOTAL SOLIDS	93	0.1		90.3	0.1		92.5	0.1		89.2	0.1	
CHROMIUM,HEXAVALENT	NA			NA			NA			NA		
ALUMINUM	NA			NA			4980	10.8		6810	11.2	
ANTIMONY	NA			NA			ND	2.16		ND	2.24	
ARSENIC	NA			NA			2.52	2.16		2.05	2.24	J
BARIUM	NA			NA			29.1	0.54		21.4	0.561	
BERYLLIUM	NA			NA			0.273	0.216		0.5	0.224	
CADMIUM	NA			NA			0.118	0.54	J	0.0848	0.561	J
CALCIUM	NA			NA			23400	108		441	112	
CHROMIUM	NA			NA			23.7	1.08		19.2	1.12	
COBALT	NA			NA			2.62	1.08		4.97	1.12	
COPPER	NA			NA			11.1	2.16		6.19	2.24	
IRON	NA			NA			10600	10.8		14500	11.2	
LEAD	NA			NA			46.9	0.54		4.11	0.561	
MAGNESIUM	NA			NA			5800	108		1590	112	
MANGANESE	NA			NA			129	1.08		152	1.12	
NICKEL	NA			NA			6.87	2.16		11.6	2.24	
POTASSIUM	NA			NA			1190	108		1370	112	
SELENIUM	NA			NA			0.762	2.16	J	ND	2.24	
SILVER	NA			NA			ND	1.08		ND	1.12	
SODIUM	NA			NA			162	108	B	90.8	112	B J
THALLIUM	NA			NA			ND	2.16		ND	2.24	
VANADIUM	NA			NA			14.3	2.16		16.1	2.24	
ZINC	NA			NA			26.3	5.4		24.3	5.61	
MERCURY	NA			NA			0.0744	0.0216		0.00618	0.0224	J
ALDRIN	NA			NA			ND	0.0216		ND	0.0224	
ALPHA BHC	NA			NA			ND	0.0027		ND	0.0028	
BETA BHC	NA			NA			ND	0.0027		ND	0.0028	
DELTA BHC	NA			NA			ND	0.0216		ND	0.0224	
GAMMA BHC	NA			NA			ND	0.0027		ND	0.0028	
CHLORDANE	NA			NA			ND	0.216		ND	0.224	
ALPHA-CHLORDANE	NA			NA			ND	0.0216		ND	0.0224	
GAMMA-CHLORDANE	NA			NA			ND	0.0216		ND	0.0224	
4,4-DDD	NA			NA			ND	0.0216		ND	0.0224	
4,4-DDE	NA			NA			ND	0.0216		ND	0.0224	
4,4-DDT	NA			NA			0.00353	0.0216	J	ND	0.0224	
DIELDRIN	NA			NA			ND	0.00324		ND	0.00336	
ENDOSULFAN I	NA			NA			ND	0.0216		ND	0.0224	
ENDOSULFAN II	NA			NA			ND	0.0216		ND	0.0224	
ENDOSULFAN SULFATE	NA			NA			ND	0.0216		ND	0.0224	
ENDRIN	NA			NA			ND	0.0216		ND	0.0224	
ENDRIN ALDEHYDE	NA			NA			ND	0.0216		ND	0.0224	
ENDRIN KETONE	NA			NA			ND	0.0216		ND	0.0224	
HEXACHLOROBENZENE	NA			NA			ND	0.0216		ND	0.0224	
HEPTACHLOR	NA			NA			ND	0.0216		ND	0.0224	
HEPTACHLOR EPOXIDE	NA			NA			ND	0.0108		ND	0.0112	
METHOXYCHLOR	NA			NA			ND	0.0216		ND	0.0224	
TOXAPHENE	NA			NA			ND	0.432		ND	0.449	
PCB 1016	NA			NA			ND	0.0184		ND	0.0191	
PCB 1221	NA			NA			ND	0.0184		ND	0.0191	
PCB 1232	NA			NA			ND	0.0184		ND	0.0191	
PCB 1242	NA			NA			ND	0.0184		ND	0.0191	
PCB 1248	NA			NA			ND	0.0184		ND	0.0191	
PCB 1254	NA			NA			ND	0.0184		ND	0.0191	
PCB 1260	NA			NA			ND	0.0184		ND	0.0191	
ACETONE	NA			NA			0.0244	0.054	J	ND	0.0561	
BENZENE	NA			NA			ND	0.00108		ND	0.00112	
BROMOCHLOROMETHANE	NA			NA			ND	0.00108		ND	0.00112	
BROMODICHLOROMETHANE	NA			NA			ND	0.00108		ND	0.00112	
BROMOFORM	NA			NA			ND	0.00108		ND	0.00112	
BROMOMETHANE	NA			NA			ND	0.0054		ND	0.00561	
CARBON DISULFIDE	NA			NA			0.000431	0.00108	J	ND	0.00112	
CARBON TETRACHLORIDE	NA			NA			ND	0.00108		ND	0.00112	
CHLOROBENZENE	NA			NA			ND	0.00108		ND	0.00112	
CHLORODIBROMOMETHANE	NA			NA			ND	0.00108		ND	0.00112	
CHLOROETHANE	NA			NA			ND	0.0054		ND	0.00561	
CHLOROFORM	NA			NA			ND	0.0054		ND	0.00561	
CHLOROMETHANE	NA			NA			ND	0.0027		ND	0.0028	
CYCLOHEXANE	NA			NA			ND	0.00108		ND	0.00112	
1,2-DIBROMO-3-CHLOROPROPANE	NA			NA			ND	0.00324		ND	0.00336	
1,2-DIBROMOETHANE	NA			NA			ND	0.00108		ND	0.00112	
DICHLORODIFLUOROMETHANE	NA			NA			ND	0.0054		ND	0.00561	
1,1-DICHLOROETHANE	NA			NA			ND	0.00108		ND	0.00112	
1,2-DICHLOROETHANE	NA			NA			ND	0.00108		ND	0.00112	
1,2-DICHLOROBENZENE	NA			NA			ND	0.00108		ND	0.00112	
1,3-DICHLOROBENZENE	NA			NA			ND	0.00108		ND	0.00112	
1,4-DICHLOROBENZENE	NA			NA			ND	0.00108		ND	0.00112	
1,1-DICHLOROETHENE	NA			NA			ND	0.00108		ND	0.00112	
CIS-1,2-DICHLOROETHENE	NA			NA			ND	0.00108		ND	0.00112	
TRANS-1,2-DICHLOROETHENE	NA			NA			ND	0.00108		ND	0.00112	
1,2-DICHLOROPROPANE	NA			NA			ND	0.00108		ND	0.00112	
CIS-1,3-DICHLOROPROPENE	NA			NA			ND	0.00108		ND	0.00112	
TRANS-1,3-DICHLOROPROPENE	NA			NA			ND	0.00108		ND	0.00112	
ETHYLBENZENE	NA			NA			ND	0.00108		ND	0.00112	
2-HEXANONE	NA			NA			ND	0.0108		ND	0.0112	
ISOPROPYLBENZENE	NA			NA			ND	0.0108		ND	0.0112	
2-BUTANONE (MEK)	NA			NA			ND	0.0108		ND	0.0112	
METHYL ACETATE	NA			NA			ND	0.0216	J4	ND	0.0224	J4
METHYL CYCLOHEXANE	NA			NA			0.000425	0.00108	J	ND	0.00112	
METHYLENE CHLORIDE	NA			NA			ND	0.0054		ND	0.00561	
4-METHYL-2-PENTANONE (MIBK)	NA			NA			ND	0.0108		ND	0.0112	
METHYL TERT-BUTYL ETHER	NA			NA			ND	0.00108		ND	0.00112	
STYRENE	NA			NA			ND	0.00108		ND	0.00112	
1,1,2,2-TETRACHLOROETHANE	NA			NA			ND	0.00108		ND	0.00112	
TETRACHLOROETHENE	NA			NA			ND	0.00108		ND	0.00112	
TOLUENE	NA			NA			0.000607	0.0054	J	ND	0.00561	
1,2,3-TRICHLOROBENZENE	NA			NA			ND	0.00108		ND	0.00112	
1,2,4-TRICHLOROBENZENE	NA			NA			ND	0.00108		ND	0.00112	
1,1,1-TRICHLOROETHANE	NA			NA			ND	0.00108		ND	0.00112	
1,1,2-TRICHLOROETHANE	NA			NA			ND	0.00108		ND	0.00112	
TRICHLOROETHENE	NA			NA			ND	0.00108		ND	0.00112	
TRICHLOROFLUOROMETHANE	NA			NA			ND	0.0054		ND	0.00561	
1,1,2-TRICHLOROTRIFLUOROETHANE	NA			NA			ND	0.00108		ND	0.00112	
VINYL CHLORIDE	NA			NA			ND	0.00108		ND	0.00112	
XYLENES, TOTAL	NA			NA			ND	0.00324		ND	0.00336	
NAPHTHALENE	NA			NA			NA			NA		
TERT-BUTYL ALCOHOL	NA			NA			NA			NA		
ANTHRACENE	NA			NA			0.506	0.0713	J4	ND	0.037	J4
ACENAPHTHENE	NA			NA			0.136	0.0713	J3 J4	ND	0.037	J3 J4
ACENAPHTHYLENE	NA			NA			0.125	0.0713	J3 J4	ND	0.037	J3 J4
BENZO(A)ANTHRACENE	NA			NA			1.32	0.0713		ND	0.037	
BENZO(A)PYRENE	NA			NA			0.958	0.0713		ND	0.037	
BENZO(B)FLUORANTHENE	NA			NA			1.36	0.0713		ND	0.037	
BENZO(G,H,I)PERYLENE	NA			NA			0.57	0.0713		ND	0.037	
BENZO(K)FLUORANTHENE	NA			NA			0.484	0.0713		ND	0.037	
CHRYSENE	NA			NA			1.05	0.0713	J4	ND	0.037	J4
DIBENZ(A,H)ANTHRACENE	NA			NA			0.185	0.0713		ND	0.037	
FLUORANTHENE	NA			NA			2.9	0.0713		ND	0.037	
FLUORENE	NA			NA			0.214	0.0713	J4	ND	0.037	J4
INDENO(1,2,3-CD)PYRENE	NA			NA			0.692	0.0713		ND	0.037	
NAPHTHALENE	NA			NA			0.188	0.0713	J3 J4	ND	0.037	J3 J4
PHENANTHRENE	NA			NA			2.71	0.0713	J4	ND	0.037	J4
PYRENE	NA			NA			2.3	0.0713		ND	0.037	
ACETOPHENONE	NA			NA			ND	0.324	J3 J4	ND	0.168	J3 J4
ATRAZINE	NA			NA			ND	0.324		ND	0.168	
BENZALDEHYDE	NA			NA			ND	0.324	J3	ND	0.168	J3
BIPHENYL	NA			NA			0.0252	0.324	J J3 J4	ND	0.168	J3 J4
BIS(2-CHLORETHOXY)METHANE	NA			NA			ND	0.324	J3 J4	ND	0.168	J3 J4
BIS(2-CHLOROETHYL)ETHER	NA			NA			ND	0.324	J3 J4	ND	0.168	J3 J4
BIS(2-CHLOROISOPROPYL)ETHER	NA			NA			ND	0.324	J3 J4	ND	0.168	J3 J4
4-BROMOPHENYL-PHENYLETHER	NA			NA			ND	0.324	J4	ND	0.168	J4
CAPROLACTAM	NA			NA			ND	0.324		ND	0.168	
CARBAZOLE	NA			NA			0.384	0.324		ND	0.168	
4-CHLOROANILINE	NA			NA			ND	0.324	J3 J4	ND	0.168	J3 J4
2-CHLORONAPHTHALENE	NA			NA			ND	0.0713	J3 J4	ND	0.037	J3 J4
4-CHLOROPHENYL-PHENYLETHER	NA			NA			ND	0.324	J4	ND	0.168	J4
DIBENZOFURAN	NA			NA			0.218	0.324	J J3 J4	ND	0.168	J3 J4
3,3-DICHLOROBENZIDINE	NA			NA			ND	0.324		ND	0.168	
2,4-DINITROTOLUENE	NA			NA			ND	0.324	J4	ND	0.168	J4
2,6-DINITROTOLUENE	NA			NA			ND	0.324	J4	ND	0.168	J4
HEXACHLOROBENZENE	NA			NA			ND	0.324	J4	ND	0.168	J4
HEXACHLORO-1,3-BUTADIENE	NA			NA			ND	0.324	J3 J4	ND	0.168	J3 J4
HEXACHLOROCYCLOPENTADIENE	NA			NA			ND	0.324	J0 J3	ND	0.168	J0 J3
HEXACHLOROETHANE	NA			NA			ND	0.324	J3	ND	0.168	J3
ISOPHORONE	NA			NA			ND	0.324	J3 J4	ND	0.168	J3 J4
2-METHYLNAPHTHALENE	NA			NA			0.08	0.0713	J3 J4	ND	0.037	J3 J4
2-NITROANILINE	NA			NA			ND	0.324	J4	ND	0.168	J4
3-NITROANILINE	NA			NA			ND	0.324	J4	ND	0.168	J4

Lab Sample ID	L1083840-13			L1083840-15			L1083840-16			L1083840-17		
Date Collected	03/27/2019			03/27/2019			03/27/2019			03/27/2019		
Depth (ft.)	CRA			8 - 8.5			3 - 3.5			3 - 3.5		
Client Sample ID	TP10@8.0-8.5			SB8@7.5-8.0			SB9@3-3.5			SB10@3-3.5		
Matrix	SS			SS			SS			SS		
Analyte	Result	RDL	Qualifier	Result	RDL	Qualifier	Result	RDL	Qualifier	Result	RDL	Qualifier
TOTAL SOLIDS	92.2	0.1		91.1	0.1		87.9	0.1		92.5	0.1	
CHROMIUM,HEXAVALENT	NA			NA			4.92	2.28		NA		
ALUMINUM	NA			2990	11		7890	11.4		4830	10.8	
ANTIMONY	NA			ND	2.2		ND	2.28		1.01	2.16	J
ARSENIC	NA			0.966	2.2	J	4.86	2.28		2.05	2.16	J
BARIUM	NA			7.89	0.549		183	0.569		26.8	0.541	
BERYLLIUM	NA			0.257	0.22		0.7	0.228		0.323	0.216	
CADMIUM	NA			ND	0.549		0.633	0.569		ND	0.541	
CALCIUM	NA			218	110		2110	114		677	108	
CHROMIUM	NA			8.92	1.1		279	1.14		14.3	1.08	
COBALT	NA			2.31	1.1		15.9	1.14		1.68	1.08	
COPPER	NA			3.27	2.2		78.9	2.28		3.53	2.16	
IRON	NA			7550	11		18400	11.4		12300	10.8	
LEAD	NA			1.95	0.549		545	0.569		4.4	0.541	
MAGNESIUM	NA			555	110		1150	114		1060	108	
MANGANESE	NA			62.9	1.1		705	1.14		46.3	1.08	
NICKEL	NA			4.48	2.2		12	2.28		4.69	2.16	
POTASSIUM	NA			758	110		1000	114		1210	108	
SELENIUM	NA			ND	2.2		ND	2.28		ND	2.16	
SILVER	NA			ND	1.1		ND	1.14		ND	1.08	
SODIUM	NA			77.7	110	B J	119	114	B	79.7	108	B J
THALLIUM	NA			ND	2.2		ND	2.28		ND	2.16	
VANADIUM	NA			7.93	2.2		16.7	2.28		14.5	2.16	
ZINC	NA			11	5.49		195	5.69		19.6	5.41	
MERCURY	NA			ND	0.022		0.958	0.0228		0.00349	0.0216	J
ALDRIN	NA			ND	0.022		ND	0.0228		ND	0.0216	
ALPHA BHC	NA			ND	0.00275		ND	0.00284		ND	0.0027	
BETA BHC	NA			ND	0.00275		ND	0.00284		ND	0.0027	
DELTA BHC	NA			ND	0.022		ND	0.0228		ND	0.0216	
GAMMA BHC	NA			ND	0.00275		ND	0.00284		ND	0.0027	
CHLORDANE	NA			ND	0.22		ND	0.228		ND	0.216	
ALPHA-CHLORDANE	NA			ND	0.022		ND	0.0228		ND	0.0216	
GAMMA-CHLORDANE	NA			ND	0.022		ND	0.0228		ND	0.0216	
4,4-DDD	NA			ND	0.022		ND	0.0228		ND	0.0216	
4,4-DDE	NA			ND	0.022		ND	0.0228		ND	0.0216	
4,4-DDT	NA			ND	0.022		ND	0.0228		ND	0.0216	
DIELDRIN	NA			ND	0.00329		ND	0.00341		ND	0.00324	
ENDOSULFAN I	NA			ND	0.022		ND	0.0228		ND	0.0216	
ENDOSULFAN II	NA			ND	0.022		ND	0.0228		ND	0.0216	
ENDOSULFAN SULFATE	NA			ND	0.022		ND	0.0228		ND	0.0216	
ENDRIN	NA			ND	0.022		ND	0.0228		ND	0.0216	
ENDRIN ALDEHYDE	NA			ND	0.022		ND	0.0228		ND	0.0216	
ENDRIN KETONE	NA			ND	0.022		ND	0.0228		ND	0.0216	
HEXACHLOROBENZENE	NA			ND	0.022		ND	0.0228		ND	0.0216	
HEPTACHLOR	NA			ND	0.022		ND	0.0228		ND	0.0216	
HEPTACHLOR EPOXIDE	NA			ND	0.011		ND	0.0114		ND	0.0108	
METHOXYCHLOR	NA			ND	0.022		ND	0.0228		ND	0.0216	
TOXAPHENE	NA			ND	0.439		ND	0.455		ND	0.432	
PCB 1016	NA			ND	0.0187		ND	0.0193		ND	0.0184	
PCB 1221	NA			ND	0.0187		ND	0.0193		ND	0.0184	
PCB 1232	NA			ND	0.0187		ND	0.0193		ND	0.0184	
PCB 1242	NA			ND	0.0187		ND	0.0193		ND	0.0184	
PCB 1248	NA			ND	0.0187		ND	0.0193		ND	0.0184	
PCB 1254	NA			ND	0.0187		ND	0.0193		ND	0.0184	
PCB 1260	NA			ND	0.0187		ND	0.0193		ND	0.0184	
ACETONE	NA			ND	0.0549		0.184	0.0569		ND	0.0541	
BENZENE	NA			ND	0.00114		ND	0.00114		ND	0.00108	
BROMOCHLOROMETHANE	NA			ND	0.00114		ND	0.00114		ND	0.00108	
BROMODICHLOROMETHANE	NA			ND	0.00114		ND	0.00114		ND	0.00108	
BROMOFORM	NA			ND	0.00114		ND	0.00114		ND	0.00108	
BROMOMETHANE	NA			ND	0.00571		ND	0.00569		ND	0.00541	
CARBON DISULFIDE	NA			ND	0.00114		ND	0.00114		ND	0.00108	
CARBON TETRACHLORIDE	NA			ND	0.00114		ND	0.00114		ND	0.00108	
CHLOROBENZENE	NA			ND	0.00114		ND	0.00114		ND	0.00108	
CHLORODIBROMOMETHANE	NA			ND	0.00114		ND	0.00114		ND	0.00108	
CHLOROETHANE	NA			ND	0.00571		ND	0.00569		ND	0.00541	
CHLOROFORM	NA			ND	0.00571		ND	0.00569		ND	0.00541	
CHLOROMETHANE	NA			ND	0.00285		ND	0.00284		ND	0.0027	
CYCLOHEXANE	NA			ND	0.00114		ND	0.00114		ND	0.00108	
1,2-DIBROMO-3-CHLOROPROPANE	NA			ND	0.00343		ND	0.00341		ND	0.00324	
1,2-DIBROMOETHANE	NA			ND	0.00114		ND	0.00114		ND	0.00108	
DICHLORODIFLUOROMETHANE	NA			ND	0.00571		ND	0.00569		ND	0.00541	
1,1-DICHLOROETHANE	NA			ND	0.00114		ND	0.00114		ND	0.00108	
1,2-DICHLOROETHANE	NA			ND	0.00114		ND	0.00114		ND	0.00108	
1,2-DICHLOROBENZENE	NA			ND	0.00114		ND	0.00114		ND	0.00108	
1,3-DICHLOROBENZENE	NA			ND	0.00114		ND	0.00114		ND	0.00108	
1,4-DICHLOROBENZENE	NA			ND	0.00114		ND	0.00114		ND	0.00108	
1,1-DICHLOROETHENE	NA			ND	0.00114		ND	0.00114		ND	0.00108	
CIS-1,2-DICHLOROETHENE	NA			ND	0.00114		ND	0.00114		ND	0.00108	
TRANS-1,2-DICHLOROETHENE	NA			ND	0.00114		ND	0.00114		ND	0.00108	
1,2-DICHLOROPROPANE	NA			ND	0.00114		ND	0.00114		ND	0.00108	
CIS-1,3-DICHLOROPROPENE	NA			ND	0.00114		ND	0.00114		ND	0.00108	
TRANS-1,3-DICHLOROPROPENE	NA			ND	0.00114		ND	0.00114		ND	0.00108	
ETHYLBENZENE	NA			ND	0.00114		ND	0.00114		ND	0.00108	
2-HEXANONE	NA			ND	0.0114		ND	0.0114		ND	0.0108	
ISOPROPYLBENZENE	NA			ND	0.0114		ND	0.0114		ND	0.0108	
2-BUTANONE (MEK)	NA			ND	0.0114		0.0295	0.0114		ND	0.0108	
METHYL ACETATE	NA			ND	0.022	J4	ND	0.0228	J4	ND	0.0216	J4
METHYL CYCLOHEXANE	NA			ND	0.00114		ND	0.00114		ND	0.00108	
METHYLENE CHLORIDE	NA			ND	0.00571		ND	0.00569		ND	0.00541	
4-METHYL-2-PENTANONE (MIBK)	NA			ND	0.0114		ND	0.0114		ND	0.0108	
METHYL TERT-BUTYL ETHER	NA			ND	0.00114		ND	0.00114		ND	0.00108	
STYRENE	NA			ND	0.00114		ND	0.00114		ND	0.00108	
1,1,2,2-TETRACHLOROETHANE	NA			ND	0.00114		ND	0.00114		ND	0.00108	
TETRACHLOROETHENE	NA			ND	0.00114		0.00165	0.00114		ND	0.00108	
TOLUENE	NA			ND	0.00571		ND	0.00569		ND	0.00541	
1,2,3-TRICHLOROBENZENE	NA			ND	0.00114		ND	0.00114		ND	0.00108	
1,2,4-TRICHLOROBENZENE	NA			ND	0.00114		ND	0.00114		ND	0.00108	
1,1,1-TRICHLOROETHANE	NA			ND	0.00114		ND	0.00114		ND	0.00108	
1,1,2-TRICHLOROETHANE	NA			ND	0.00114		ND	0.00114		ND	0.00108	
TRICHLOROETHENE	NA			ND	0.00114		ND	0.00114		ND	0.00108	
TRICHLOROFLUOROMETHANE	NA			ND	0.00571		ND	0.00569		ND	0.00541	
1,1,2-TRICHLOROTRIFLUOROETHANE	NA			ND	0.00114		ND	0.00114		ND	0.00108	
VINYL CHLORIDE	NA			ND	0.00114		ND	0.00114		ND	0.00108	
XYLENES, TOTAL	NA			ND	0.00343		ND	0.00341		ND	0.00324	
NAPHTHALENE	NA			NA			NA			NA		
TERT-BUTYL ALCOHOL	NA			NA			NA			NA		
ANTHRACENE	NA			ND	0.0362	J4	ND	0.751	J4	ND	0.0357	J4
ACENAPHTHENE	NA			ND	0.0362	J3 J4	ND	0.751	J3 J4	ND	0.0357	J3 J4
ACENAPHTHYLENE	NA			ND	0.0362	J3 J4	ND	0.751	J3 J4	ND	0.0357	J3 J4
BENZO(A)ANTHRACENE	NA			ND	0.0362		0.509	0.751	J	0.0103	0.0357	J
BENZO(A)PYRENE	NA			ND	0.0362		0.502	0.751	J	0.00804	0.0357	J
BENZO(B)FLUORANTHENE	NA			ND	0.0362		0.716	0.751	J	0.0137	0.0357	J
BENZO(G,H,I)PERYLENE	NA			ND	0.0362		0.311	0.751	J	ND	0.0357	
BENZO(K)FLUORANTHENE	NA			ND	0.0362		0.229	0.751	J	ND	0.0357	
CHRYSENE	NA			ND	0.0362	J4	0.583	0.751	J J4	0.00911	0.0357	J J4
DIBENZ(A,H)ANTHRACENE	NA			ND	0.0362		ND	0.751		ND	0.0357	
FLUORANTHENE	NA			ND	0.0362		1.03	0.751		0.0198	0.0357	J
FLUORENE	NA			ND	0.0362	J4	ND	0.751	J4	ND	0.0357	J4
INDENO(1,2,3-CD)PYRENE	NA			ND	0.0362		0.355	0.751	J	ND	0.0357	
NAPHTHALENE	NA			ND	0.0362	J3 J4	ND	0.751	J3 J4	ND	0.0357	J3 J4
PHENANTHRENE	NA			ND	0.0362	J4	0.591	0.751	J J4	0.0103	0.0357	J J4
PYRENE	NA			ND	0.0362		0.885	0.751		0.0157	0.0357	J
ACETOPHENONE	NA			ND	0.165	J3 J4	ND	3.41	J3 J4	ND	0.162	J3 J4
ATRAZINE	NA			ND	0.165		ND	3.41		ND	0.162	
BENZALDEHYDE	NA			ND	0.165	J3	ND	3.41	J3	ND	0.162	J3
BIPHENYL	NA			ND	0.165	J3 J4	ND	3.41	J3 J4	ND	0.162	J3 J4
BIS(2-CHLORETHOXY)METHANE	NA			ND	0.165	J3 J4	ND	3.41	J3 J4	ND	0.162	J3 J4
BIS(2-CHLOROETHYL)ETHER	NA			ND	0.165	J3 J4	ND	3.41	J3 J4	ND	0.162	J3 J4
BIS(2-CHLOROISOPROPYL)ETHER	NA			ND	0.165	J3 J4	ND	3.41	J3 J4	ND	0.162	J3 J4
4-BROMOPHENYL-PHENYLETHER	NA			ND	0.165	J4	ND	3.41	J4	ND	0.162	J4
CAPROLACTAM	NA			ND	0.165		ND	3.41		ND	0.162	
CARBAZOLE	NA			ND	0.165		ND	3.41		ND	0.162	
4-CHLOROANILINE	NA			ND	0.165	J3 J4	ND	3.41	J3 J4	ND	0.162	J3 J4
2-CHLORONAPHTHALENE	NA			ND	0.0362	J3 J4	ND	0.751	J3 J4	ND	0.0357	J3 J4
4-CHLOROPHENYL-PHENYLETHER	NA			ND	0.165	J4	ND	3.41	J4	ND	0.162	J4
DIBENZOFURAN	NA			ND	0.165	J3 J4	ND	3.41	J3 J4	ND	0.162	J3 J4
3,3-DICHLOROBENZIDINE	NA			ND	0.165		ND	3.41		ND	0.162	
2,4-DINITROTOLUENE	NA			ND	0.165	J4	ND	3.41	J4	ND	0.162	J4
2,6-DINITROTOLUENE	NA			ND	0.165	J4	ND	3.41	J4	ND	0.162	J4
HEXACHLOROBENZENE	NA			ND	0.165	J4	ND	3.41	J4	ND	0.162	J4
HEXACHLORO-1,3-BUTADIENE	NA			ND	0.165	J3 J4	ND	3.41	J3 J4	ND	0.162	J3 J4
HEXACHLOROCYCLOPENTADIENE	NA			ND	0.165	J0 J3	ND	3.41	J0 J3	ND	0.162	J0 J3
HEXACHLOROETHANE	NA			ND	0.165	J3	ND	3.41	J3	ND	0.162	J3
ISOPHORONE	NA			ND	0.165	J3 J4	ND	3.41	J3 J4	ND	0.162	J3 J4
2-METHYLNAPHTHALENE	NA			ND	0.0362	J3 J4	ND	0.751	J3 J4	ND	0.0357	J3 J4
2-NITROANILINE	NA			ND	0.165	J4	ND	3.41	J4	ND	0.162	J4
3-NITROANILINE	NA			ND	0.165	J4	ND	3.41	J4	ND	0.162	J4

Lab Sample ID	L1083840-18			L1083840-22			L1083840-25			L1083840-26		
Date Collected	03/27/2019			03/28/2019			03/28/2019			03/28/2019		
Depth (ft.)	4 - 4.5			9.5 - 10			8.5 - 9			8.5 - 9		
Client Sample ID	SB11@4-4.5			SB12@9.5-10			SB16@8.5-9.0			SB17@8.5-9.0		
Matrix	SS			SS			SS			SS		
Analyte	Result	RDL	Qualifier	Result	RDL	Qualifier	Result	RDL	Qualifier	Result	RDL	Qualifier
TOTAL SOLIDS	89.8	0.1		92	0.1		90.3	0.1		88.3	0.1	
CHROMIUM,HEXAVALENT	28.4	2.23		NA			NA			NA		
ALUMINUM	4320	11.1		4080	10.9		5190	11.1		NA		
ANTIMONY	ND	2.23		ND	2.17		ND	2.21		NA		
ARSENIC	ND	2.23		2.62	2.17		4.77	2.21		NA		
BARIUM	60.7	0.557		7.99	0.543		14.2	0.554		NA		
BERYLLIUM	0.173	0.223	J	0.21	0.217	J	0.479	0.221		NA		
CADMIUM	ND	0.557		ND	0.543		0.101	0.554	J	NA		
CALCIUM	1360	111		479	109		301	111		NA		
CHROMIUM	2230	1.11		19.1	1.09		11.4	1.11		NA		
COBALT	0.758	1.11	J	1.94	1.09		5.39	1.11		NA		
COPPER	9.91	2.23		6.28	2.17		6.87	2.21		NA		
IRON	8840	11.1		9960	10.9		14400	11.1		NA		
LEAD	35.8	0.557		2.81	0.543		4.83	0.554		NA		
MAGNESIUM	810	111		863	109		1640	111		NA		
MANGANESE	22.7	1.11		35.9	1.09		232	1.11		NA		
NICKEL	3.43	2.23		6.96	2.17		10.5	2.21		NA		
POTASSIUM	776	111		799	109		1620	111		NA		
SELENIUM	1.05	2.23	J	ND	2.17		ND	2.21		NA		
SILVER	ND	1.11		ND	1.09		ND	1.11		NA		
SODIUM	72.5	111	B J	78.3	109	B J	88.3	111	B J	NA		
THALLIUM	1.13	2.23	J	ND	2.17		ND	2.21		NA		
VANADIUM	5.3	2.23		12.9	2.17		12.6	2.21		NA		
ZINC	17.5	5.57		15.8	5.43		24.9	5.54		NA		
MERCURY	0.0609	0.0223		0.0201	0.0217	J	ND	0.0221		NA		
ALDRIN	ND	0.0223		ND	0.435		ND	0.0221		NA		
ALPHA BHC	ND	0.00278		ND	0.0543		ND	0.00277		NA		
BETA BHC	ND	0.00278		ND	0.0543		ND	0.00277		NA		
DELTA BHC	ND	0.0223		ND	0.435		ND	0.0221		NA		
GAMMA BHC	ND	0.00278		ND	0.0543		ND	0.00277		NA		
CHLORDANE	ND	0.223		ND	4.35		ND	0.221		NA		
ALPHA-CHLORDANE	ND	0.0223		ND	0.435		ND	0.0221		NA		
GAMMA-CHLORDANE	ND	0.0223		ND	0.435		ND	0.0221		NA		
4,4-DDD	ND	0.0223		ND	0.435		ND	0.0221		NA		
4,4-DDE	ND	0.0223		ND	0.435		ND	0.0221		NA		
4,4-DDT	ND	0.0223		ND	0.435		ND	0.0221		NA		
DIELDRIN	ND	0.00334		ND	0.0652		ND	0.00332		NA		
ENDOSULFAN I	ND	0.0223		ND	0.435		ND	0.0221		NA		
ENDOSULFAN II	ND	0.0223		ND	0.435		ND	0.0221		NA		
ENDOSULFAN SULFATE	ND	0.0223		ND	0.435		ND	0.0221		NA		
ENDRIN	ND	0.0223		ND	0.435		ND	0.0221		NA		
ENDRIN ALDEHYDE	ND	0.0223		ND	0.435		ND	0.0221		NA		
ENDRIN KETONE	ND	0.0223		ND	0.435		ND	0.0221		NA		
HEXACHLOROBENZENE	ND	0.0223		ND	0.435		ND	0.0221		NA		
HEPTACHLOR	ND	0.0223		ND	0.435		ND	0.0221		NA		
HEPTACHLOR EPOXIDE	ND	0.0111		ND	0.217		ND	0.0111		NA		
METHOXYCHLOR	ND	0.0223		ND	0.435		ND	0.0221		NA		
TOXAPHENE	ND	0.445		ND	8.69		ND	0.443		NA		
PCB 1016	ND	0.0189		ND	0.0185		ND	0.0188		NA		
PCB 1221	ND	0.0189		ND	0.0185		ND	0.0188		NA		
PCB 1232	ND	0.0189		ND	0.0185		ND	0.0188		NA		
PCB 1242	ND	0.0189		ND	0.0185		ND	0.0188		NA		
PCB 1248	ND	0.0189		ND	0.0185		ND	0.0188		NA		
PCB 1254	ND	0.0189		ND	0.0185		ND	0.0188		NA		
PCB 1260	ND	0.0189		ND	0.0185		ND	0.0188		NA		
ACETONE	ND	0.0557		ND	27.2		0.0268	0.0554	J	NA		
BENZENE	ND	0.00111		0.315	0.543	J	ND	0.00111		NA		
BROMOCHLOROMETHANE	ND	0.00111		ND	0.543		ND	0.00111		NA		
BROMODICHLOROMETHANE	ND	0.00111		ND	0.543		ND	0.00111		NA		
BROMOFORM	ND	0.00111		ND	0.543		ND	0.00111		NA		
BROMOMETHANE	ND	0.00557		ND	2.72		ND	0.00554		NA		
CARBON DISULFIDE	ND	0.00111		ND	0.543		ND	0.00111		NA		
CARBON TETRACHLORIDE	ND	0.00111		ND	0.543		ND	0.00111		NA		
CHLOROBENZENE	ND	0.00111		ND	0.543		ND	0.00111		NA		
CHLORODIBROMOMETHANE	ND	0.00111		ND	0.543		ND	0.00111		NA		
CHLOROETHANE	ND	0.00557		ND	2.72		ND	0.00554		NA		
CHLOROFORM	ND	0.00557		ND	2.72		ND	0.00554		NA		
CHLOROMETHANE	ND	0.00278		ND	1.36		ND	0.00277		NA		
CYCLOHEXANE	ND	0.00111		0.543	0.543	J	ND	0.00111		NA		
1,2-DIBROMO-3-CHLOROPROPANE	ND	0.00334		ND	1.63		ND	0.00332		NA		
1,2-DIBROMOETHANE	ND	0.00111		ND	0.543		ND	0.00111		NA		
DICHLORODIFLUOROMETHANE	ND	0.00557		ND	2.72		ND	0.00554		NA		
1,1-DICHLOROETHANE	ND	0.00111		ND	0.543		ND	0.00111		NA		
1,2-DICHLOROETHANE	ND	0.00111		ND	0.543		ND	0.00111		NA		
1,2-DICHLOROBENZENE	ND	0.00111		ND	0.543		ND	0.00111		NA		
1,3-DICHLOROBENZENE	ND	0.00111		ND	0.543		ND	0.00111		NA		
1,4-DICHLOROBENZENE	ND	0.00111		ND	0.543		ND	0.00111		NA		
1,1-DICHLOROETHENE	ND	0.00111		ND	0.543		ND	0.00111		NA		
CIS-1,2-DICHLOROETHENE	ND	0.00111		ND	0.543		ND	0.00111		NA		
TRANS-1,2-DICHLOROETHENE	ND	0.00111		ND	0.543		ND	0.00111		NA		
1,2-DICHLOROPROPANE	ND	0.00111		ND	0.543		ND	0.00111		NA		
CIS-1,3-DICHLOROPROPENE	ND	0.00111		ND	0.543		ND	0.00111		NA		
TRANS-1,3-DICHLOROPROPENE	ND	0.00111		ND	0.543		ND	0.00111		NA		
ETHYLBENZENE	ND	0.00111		0.211	0.543	J	ND	0.00111		NA		
2-HEXANONE	ND	0.0111		ND	5.43		ND	0.0111		NA		
ISOPROPYLBENZENE	ND	0.0111		0.899	5.43	J	ND	0.0111		NA		
2-BUTANONE (MEK)	ND	0.0111		ND	5.43		ND	0.0111		NA		
METHYL ACETATE	ND	0.0223	J4	ND	10.9	J4	ND	0.0221	J4	NA		
METHYL CYCLOHEXANE	ND	0.00111		2.6	0.543		ND	0.00111		NA		
METHYLENE CHLORIDE	ND	0.00557		ND	2.72		ND	0.00554		NA		
4-METHYL-2-PENTANONE (MIBK)	ND	0.0111		ND	5.43		ND	0.0111		NA		
METHYL TERT-BUTYL ETHER	ND	0.00111		ND	0.543		ND	0.00111		NA		
STYRENE	ND	0.00111		ND	0.543		ND	0.00111		NA		
1,1,2,2-TETRACHLOROETHANE	ND	0.00111		ND	0.543		ND	0.00111		NA		
TETRACHLOROETHENE	ND	0.00111		ND	0.543		ND	0.00111		NA		
TOLUENE	ND	0.00557		ND	2.72		ND	0.00554		NA		
1,2,3-TRICHLOROBENZENE	ND	0.00111		ND	0.543		ND	0.00111		NA		
1,2,4-TRICHLOROBENZENE	ND	0.00111		ND	0.543		ND	0.00111		NA		
1,1,1-TRICHLOROETHANE	ND	0.00111		ND	0.543		ND	0.00111		NA		
1,1,2-TRICHLOROETHANE	ND	0.00111		ND	0.543		ND	0.00111		NA		
TRICHLOROETHENE	ND	0.00111		ND	0.543		ND	0.00111		NA		
TRICHLOROFLUOROMETHANE	ND	0.00557		ND	2.72		ND	0.00554		NA		
1,1,2-TRICHLOROTRIFLUOROETHANE	ND	0.00111		ND	0.543		ND	0.00111		NA		
VINYL CHLORIDE	ND	0.00111		ND	0.543		ND	0.00111		NA		
XYLENES, TOTAL	ND	0.00334		ND	1.63		ND	0.00332		NA		
NAPHTHALENE	NA			NA			NA			NA		
TERT-BUTYL ALCOHOL	NA			NA			NA			NA		
ANTHRACENE	0.0252	0.0735	J J4	ND	1.79	J4	ND	0.0365	J4	NA		
ACENAPHTHENE	ND	0.0735	J3 J4	6.71	1.79	J3 J4	ND	0.0365	J3 J4	NA		
ACENAPHTHYLENE	ND	0.0735	J3 J4	1.21	1.79	J J3 J4	ND	0.0365	J3 J4	NA		
BENZO(A)ANTHRACENE	0.0504	0.0735	J	3.91	1.79		ND	0.0365		NA		
BENZO(A)PYRENE	0.0403	0.0735	J	3.43	1.79		ND	0.0365		NA		
BENZO(B)FLUORANTHENE	0.0512	0.0735	J	1.24	1.79	J	ND	0.0365		NA		
BENZO(G,H,I)PERYLENE	0.021	0.0735	J	1.89	1.79		ND	0.0365		NA		
BENZO(K)FLUORANTHENE	0.013	0.0735	J	ND	1.79		ND	0.0365		NA		
CHRYSENE	0.047	0.0735	J J4	7.02	1.79	J4	ND	0.0365	J4	NA		
DIBENZ(A,H)ANTHRACENE	ND	0.0735		ND	1.79		ND	0.0365		NA		
FLUORANTHENE	0.096	0.0735		ND	1.79		ND	0.0365		NA		
FLUORENE	ND	0.0735	J4	9.44	1.79	J4	ND	0.0365	J4	NA		
INDENO(1,2,3-CD)PYRENE	0.0268	0.0735	J	ND	1.79		ND	0.0365		NA		
NAPHTHALENE	ND	0.0735	J3 J4	ND	1.79	J3 J4	ND	0.0365	J3 J4	NA		
PHENANTHRENE	0.104	0.0735	J4	36.1	1.79	J4	ND	0.0365	J4	NA		
PYRENE	0.0787	0.0735		17.3	1.79		ND	0.0365		NA		
ACETOPHENONE	ND	0.334	J3 J4	ND	8.15	J3 J4	ND	0.166	J3 J4	NA		
ATRAZINE	ND	0.334		ND	8.15		ND	0.166		NA		
BENZALDEHYDE	ND	0.334	J3	ND	8.15	J3	ND	0.166	J3	NA		
BIPHENYL	ND	0.334	J3 J4	ND	8.15	J3 J4	ND	0.166	J3 J4	NA		
BIS(2-CHLORETHOXY)METHANE	ND	0.334	J3 J4	ND	8.15	J3 J4	ND	0.166	J3 J4	NA		
BIS(2-CHLOROETHYL)ETHER	ND	0.334	J3 J4	ND	8.15	J3 J4	ND	0.166	J3 J4	NA		
BIS(2-CHLOROISOPROPYL)ETHER	ND	0.334	J3 J4	ND	8.15	J3 J4	ND	0.166	J3 J4	NA		
4-BROMOPHENYL-PHENYLETHER	ND	0.334	J4	ND	8.15	J4	ND	0.166	J4	NA		
CAPROLACTAM	ND	0.334		ND	8.15		ND	0.166		NA		
CARBAZOLE	0.0151	0.334	J	ND	8.15		ND	0.166		NA		
4-CHLOROANILINE	ND	0.334	J3 J4	ND	8.15	J3 J4	ND	0.166	J3 J4	NA		
2-CHLORONAPHTHALENE	ND	0.0735	J3 J4	ND	1.79	J3 J4	ND	0.0365	J3 J4	NA		
4-CHLOROPHENYL-PHENYLETHER	ND	0.334	J4	ND	8.15	J4	ND	0.166	J4	NA		
DIBENZOFURAN	0.0122	0.334	J J3 J4	ND	8.15	J3 J4	ND	0.166	J3 J4	NA		
3,3-DICHLOROBENZIDINE	ND	0.334		ND	8.15		ND	0.166		NA		
2,4-DINITROTOLUENE	ND	0.334	J4	ND	8.15	J4	ND	0.166	J4	NA		
2,6-DINITROTOLUENE	ND	0.334	J4	ND	8.15	J4	ND	0.166	J4	NA		
HEXACHLOROBENZENE	ND	0.334	J4	ND	8.15	J4	ND	0.166	J4	NA		
HEXACHLORO-1,3-BUTADIENE	ND	0.334	J3 J4	ND	8.15	J3 J4	ND	0.166	J3 J4	NA		
HEXACHLOROCYCLOPENTADIENE	ND	0.334	J0 J3	ND	8.15	J0 J3	ND	0.166	J0 J3	NA		
HEXACHLOROETHANE	ND	0.334	J3	ND	8.15	J3	ND	0.166	J3	NA		
ISOPHORONE	ND	0.334	J3 J4	ND	8.15	J3 J4	ND	0.166	J3 J4	NA		
2-METHYLNAPHTHALENE	ND	0.0735	J3 J4	108	3.59	J3 J4	0.0179	0.0365	J J3 J4	NA		
2-NITROANILINE	ND	0.334	J4	ND	8.15	J4	ND	0.166	J4	NA		
3-NITROANILINE	ND	0.334	J4	ND	8.15	J4	ND	0.166	J4	NA		

Lab Sample ID	L1083840-28			L1083840-29			L1083840-31		
Date Collected	03/28/2019			03/28/2019			03/28/2019		
Depth (ft.)	8.5 - 9			2 - 2.5			5.5 - 6		
Client Sample ID	SB19@8.5-9			SB20@2.0-2.5			SB13 @ 5.5-6		
Matrix	SS			SS			SS		
Analyte	Result	RDL	Qualifier	Result	RDL	Qualifier	Result	RDL	Qualifier
TOTAL SOLIDS	96.4	0.1		90.2	0.1		95.5	0.1	
CHROMIUM,HEXAVALENT	NA			NA			NA		
ALUMINUM	2810	10.4		NA			3610	10.5	J5
ANTIMONY	ND	2.07		NA			ND	2.09	J6
ARSENIC	2.09	2.07		NA			1.54	2.09	J
BARIUM	7.22	0.518		NA			12.5	0.523	
BERYLLIUM	0.216	0.207		NA			0.274	0.209	
CADMIUM	ND	0.518		NA			ND	0.523	
CALCIUM	142	104		NA			217	105	
CHROMIUM	7.15	1.04		NA			20.1	1.05	
COBALT	2.52	1.04		NA			3.3	1.05	
COPPER	2.94	2.07		NA			5.95	2.09	
IRON	6780	10.4		NA			9430	10.5	V
LEAD	2.24	0.518		NA			2.51	0.523	
MAGNESIUM	560	104		NA			779	105	
MANGANESE	73.5	1.04		NA			144	1.05	
NICKEL	4.15	2.07		NA			6.55	2.09	
POTASSIUM	708	104		NA			869	105	
SELENIUM	ND	2.07		NA			ND	2.09	
SILVER	ND	1.04		NA			ND	1.05	
SODIUM	75.3	104	B J	NA			77.3	105	B J
THALLIUM	ND	2.07		NA			ND	2.09	
VANADIUM	6.19	2.07		NA			9.52	2.09	
ZINC	9.66	5.18		NA			13.1	5.23	
MERCURY	ND	0.0207		NA			0.0179	0.0209	B J
ALDRIN	ND	0.0207		NA			ND	0.0209	
ALPHA BHC	ND	0.00259		NA			ND	0.00262	
BETA BHC	ND	0.00259		NA			ND	0.00262	
DELTA BHC	ND	0.0207		NA			ND	0.0209	
GAMMA BHC	ND	0.00259		NA			ND	0.00262	
CHLORDANE	ND	0.207		NA			ND	0.209	
ALPHA-CHLORDANE	ND	0.0207		NA			ND	0.0209	
GAMMA-CHLORDANE	ND	0.0207		NA			ND	0.0209	
4,4-DDD	ND	0.0207		NA			ND	0.0209	
4,4-DDE	ND	0.0207		NA			ND	0.0209	
4,4-DDT	ND	0.0207		NA			ND	0.0209	
DIELDRIN	ND	0.00311		NA			ND	0.00314	
ENDOSULFAN I	ND	0.0207		NA			ND	0.0209	
ENDOSULFAN II	ND	0.0207		NA			ND	0.0209	
ENDOSULFAN SULFATE	ND	0.0207		NA			ND	0.0209	
ENDRIN	ND	0.0207		NA			ND	0.0209	
ENDRIN ALDEHYDE	ND	0.0207		NA			ND	0.0209	
ENDRIN KETONE	ND	0.0207		NA			ND	0.0209	
HEXACHLOROBENZENE	ND	0.0207		NA			ND	0.0209	
HEPTACHLOR	ND	0.0207		NA			ND	0.0209	
HEPTACHLOR EPOXIDE	ND	0.0104		NA			ND	0.0105	
METHOXYCHLOR	ND	0.0207		NA			ND	0.0209	
TOXAPHENE	ND	0.415		NA			ND	0.419	
PCB 1016	ND	0.0176		NA			ND	0.0178	J3
PCB 1221	ND	0.0176		NA			ND	0.0178	
PCB 1232	ND	0.0176		NA			ND	0.0178	
PCB 1242	ND	0.0176		NA			ND	0.0178	
PCB 1248	ND	0.0176		NA			ND	0.0178	
PCB 1254	ND	0.0176		NA			ND	0.0178	
PCB 1260	ND	0.0176		NA			ND	0.0178	J3
ACETONE	ND	0.0518		NA			0.0198	0.0523	J
BENZENE	ND	0.00104		NA			ND	0.00105	J3 J6
BROMOCHLOROMETHANE	ND	0.00104		NA			ND	0.00105	J3 J6
BROMODICHLOROMETHANE	ND	0.00104		NA			ND	0.00105	J3 J6
BROMOFORM	ND	0.00104		NA			ND	0.00105	
BROMOMETHANE	ND	0.00518		NA			ND	0.00523	J3
CARBON DISULFIDE	ND	0.00104		NA			ND	0.00105	J3 J6
CARBON TETRACHLORIDE	ND	0.00104		NA			ND	0.00105	J3 J6
CHLOROBENZENE	ND	0.00104		NA			ND	0.00105	J6
CHLORODIBROMOMETHANE	ND	0.00104		NA			ND	0.00105	J6
CHLOROETHANE	ND	0.00518		NA			ND	0.00523	J3
CHLOROFORM	ND	0.00518		NA			ND	0.00523	J3 J6
CHLOROMETHANE	ND	0.00259		NA			ND	0.00262	
CYCLOHEXANE	ND	0.00104		NA			ND	0.00105	J3 J6
1,2-DIBROMO-3-CHLOROPROPANE	ND	0.00311		NA			ND	0.00314	
1,2-DIBROMOETHANE	ND	0.00104		NA			ND	0.00105	J6
DICHLORODIFLUOROMETHANE	ND	0.00518		NA			ND	0.00523	J3
1,1-DICHLOROETHANE	ND	0.00104		NA			ND	0.00105	J3 J6
1,2-DICHLOROETHANE	ND	0.00104		NA			ND	0.00105	J3 J6
1,2-DICHLOROBENZENE	ND	0.00104		NA			ND	0.00105	J6
1,3-DICHLOROBENZENE	ND	0.00104		NA			ND	0.00105	J3 J6
1,4-DICHLOROBENZENE	ND	0.00104		NA			ND	0.00105	J3 J6
1,1-DICHLOROETHENE	ND	0.00104		NA			ND	0.00105	J3 J6
CIS-1,2-DICHLOROETHENE	ND	0.00104		NA			ND	0.00105	J3 J6
TRANS-1,2-DICHLOROETHENE	ND	0.00104		NA			ND	0.00105	J3 J6
1,2-DICHLOROPROPANE	ND	0.00104		NA			ND	0.00105	J3 J6
CIS-1,3-DICHLOROPROPENE	ND	0.00104		NA			ND	0.00105	J3 J6
TRANS-1,3-DICHLOROPROPENE	ND	0.00104		NA			ND	0.00105	J6
ETHYLBENZENE	ND	0.00104		NA			ND	0.00105	J3 J6
2-HEXANONE	ND	0.0104		NA			ND	0.0105	J3
ISOPROPYLBENZENE	ND	0.0104		NA			ND	0.0105	J3 J6
2-BUTANONE (MEK)	ND	0.0104		NA			ND	0.0105	J3
METHYL ACETATE	ND	0.0207	J4	NA			ND	0.0209	J4
METHYL CYCLOHEXANE	ND	0.00104		NA			ND	0.00105	J3 J6
METHYLENE CHLORIDE	ND	0.00518		NA			ND	0.00523	J3 J6
4-METHYL-2-PENTANONE (MIBK)	ND	0.0104		NA			ND	0.0105	J3
METHYL TERT-BUTYL ETHER	ND	0.00104		NA			ND	0.00105	J3 J6
STYRENE	ND	0.00104		NA			ND	0.00105	J6
1,1,2,2-TETRACHLOROETHANE	ND	0.00104		NA			ND	0.00105	J6
TETRACHLOROETHENE	ND	0.00104		NA			ND	0.00105	J3 J6
TOLUENE	ND	0.00518		NA			ND	0.00523	J3 J6
1,2,3-TRICHLOROBENZENE	ND	0.00104		NA			ND	0.00105	J6
1,2,4-TRICHLOROBENZENE	ND	0.00104		NA			ND	0.00105	J6
1,1,1-TRICHLOROETHANE	ND	0.00104		NA			ND	0.00105	J3 J6
1,1,2-TRICHLOROETHANE	ND	0.00104		NA			ND	0.00105	J3 J6
TRICHLOROETHENE	ND	0.00104		NA			ND	0.00105	J3 J6
TRICHLOROFLUOROMETHANE	ND	0.00518		NA			ND	0.00523	J3
1,1,2-TRICHLOROTRIFLUOROETHANE	ND	0.00104		NA			ND	0.00105	J3 J6
VINYL CHLORIDE	ND	0.00104		NA			ND	0.00105	J3 J6
XYLENES, TOTAL	ND	0.00311		NA			ND	0.00314	J3 J6
NAPHTHALENE	NA			NA			NA		
TERT-BUTYL ALCOHOL	NA			NA			NA		
ANTHRACENE	ND	0.0342	J4	NA			ND	0.0345	J4 J6
ACENAPHTHENE	ND	0.0342	J3 J4	NA			ND	0.0345	J3 J4 J6
ACENAPHTHYLENE	ND	0.0342	J3 J4	NA			ND	0.0345	J3 J4 J6
BENZO(A)ANTHRACENE	ND	0.0342		NA			ND	0.0345	J6
BENZO(A)PYRENE	ND	0.0342		NA			ND	0.0345	J6
BENZO(B)FLUORANTHENE	ND	0.0342		NA			ND	0.0345	J6
BENZO(G,H,I)PERYLENE	ND	0.0342		NA			ND	0.0345	J6
BENZO(K)FLUORANTHENE	ND	0.0342		NA			ND	0.0345	J6
CHRYSENE	ND	0.0342	J4	NA			ND	0.0345	J4 J6
DIBENZ(A,H)ANTHRACENE	ND	0.0342		NA			ND	0.0345	J6
FLUORANTHENE	ND	0.0342		NA			ND	0.0345	J6
FLUORENE	ND	0.0342	J4	NA			ND	0.0345	J3 J4 J6
INDENO(1,2,3-CD)PYRENE	ND	0.0342		NA			ND	0.0345	J6
NAPHTHALENE	ND	0.0342	J3 J4	NA			ND	0.0345	J3 J4 J6
PHENANTHRENE	ND	0.0342	J4	NA			ND	0.0345	J4 J6
PYRENE	ND	0.0342		NA			ND	0.0345	J6
ACETOPHENONE	ND	0.156	J3 J4	NA			ND	0.157	J3 J4 J6
ATRAZINE	ND	0.156		NA			ND	0.157	J6
BENZALDEHYDE	ND	0.156	J3	NA			ND	0.157	
BIPHENYL	ND	0.156	J3 J4	NA			ND	0.157	J3 J4 J6
BIS(2-CHLORETHOXY)METHANE	ND	0.156	J3 J4	NA			ND	0.157	J3 J4 J6
BIS(2-CHLOROETHYL)ETHER	ND	0.156	J3 J4	NA			ND	0.157	J3 J4 J6
BIS(2-CHLOROISOPROPYL)ETHER	ND	0.156	J3 J4	NA			ND	0.157	J3 J4 J6
4-BROMOPHENYL-PHENYLETHER	ND	0.156	J4	NA			ND	0.157	J4 J6
CAPROLACTAM	ND	0.156		NA			ND	0.157	
CARBAZOLE	ND	0.156		NA			ND	0.157	J6
4-CHLOROANILINE	ND	0.156	J3 J4	NA			ND	0.157	J4 J6
2-CHLORONAPHTHALENE	ND	0.0342	J3 J4	NA			ND	0.0345	J3 J4 J6
4-CHLOROPHENYL-PHENYLETHER	ND	0.156	J4	NA			ND	0.157	J3 J4 J6
DIBENZOFURAN	ND	0.156	J3 J4	NA			ND	0.157	J3 J4 J6
3,3-DICHLOROBENZIDINE	ND	0.156		NA			ND	0.157	J6
2,4-DINITROTOLUENE	ND	0.156	J4	NA			ND	0.157	J4 J6
2,6-DINITROTOLUENE	ND	0.156	J4	NA			ND	0.157	J3 J4 J6
HEXACHLOROBENZENE	ND	0.156	J4	NA			ND	0.157	J4 J6
HEXACHLORO-1,3-BUTADIENE	ND	0.156	J3 J4	NA			ND	0.157	J3 J4 J6
HEXACHLOROCYCLOPENTADIENE	ND	0.156	J0 J3	NA			ND	0.157	J0 J3
HEXACHLOROETHANE	ND	0.156	J3	NA			ND	0.157	J3
ISOPHORONE	ND	0.156	J3 J4	NA			ND	0.157	J4 J6
2-METHYLNAPHTHALENE	ND	0.0342	J3 J4	NA			ND	0.0345	J3 J4 J6
2-NITROANILINE	ND	0.156	J4	NA			ND	0.157	J4 J6
3-NITROANILINE	ND	0.156	J4	NA			ND	0.157	J4 J6

Table 4.0
Full Laboratory Soil Sampling Results
Andujar Park Site Investigation
PI 782823

8270D	4-NITROANILINE	NS	NS	NS	mg/kg	NA			ND	1.75	J4				ND	0.329	J4	NA			NA			NA			NA			NA			ND	0.324	J4	ND	0.168	J4	NA			ND	0.165	J4	ND	3.41	J4	ND	0.162	J4	ND	0.334	J4	ND	8.15	J4	ND	0.166	J4	NA			ND	0.156	J4	NA			ND	0.157	J4 J6
8270D	NITROBENZENE	0.2	5	14	mg/kg	NA			ND	1.75	J3 J4				ND	0.329	J3 J4	NA			NA			NA			NA			NA			ND	0.324	J3 J4	ND	0.168	J3 J4	NA			ND	0.165	J3 J4	ND	3.41	J3 J4	ND	0.162	J3 J4	ND	0.334	J3 J4	ND	8.15	J3 J4	ND	0.166	J3 J4	NA			ND	0.156	J3 J4	NA			ND	0.157	J3 J4 J6
8270D	N-NITROSODIPHENYLAMINE	0.4	99	390	mg/kg	NA			ND	1.75					ND	0.329		NA			NA			NA			NA			NA			ND	0.324		ND	0.168		NA			ND	0.165		ND	3.41		ND	0.162		ND	0.334		ND	8.15		ND	0.166		NA			ND	0.156		NA			ND	0.157	
8270D	N-NITROSODI-N-PROPYLAMINE	0.2	0.2	0.3	mg/kg	NA			ND	1.75	J3 J4				ND	0.329	J3 J4	NA			NA			NA			NA			NA			ND	0.324	J3 J4	ND	0.168	J3 J4	NA			ND	0.165	J3 J4	ND	3.41	J3 J4	ND	0.162	J3 J4	ND	0.334	J3 J4	ND	8.15	J3 J4	ND	0.166	J3 J4	NA			ND	0.156	J3 J4	NA			ND	0.157	J4 J6
8270D	BENZYLBUTYL PHTHALATE	230	1200	14000	mg/kg	NA			ND	1.75					**0.0244**	0.329	J	NA			NA			NA			NA			NA			ND	0.324		ND	0.168		NA			ND	0.165		ND	3.41		ND	0.162		ND	0.334		ND	8.15		ND	0.166		NA			ND	0.156		NA			ND	0.157	J6
8270D	BIS(2-ETHYLHEXYL)PHTHALATE	1200	35	140	mg/kg	NA			**0.815**	1.75	J				**0.216**	0.329	J	NA			NA			NA			NA			NA			**0.0826**	0.324	J	ND	0.168		NA			ND	0.165		ND	3.41		ND	0.162		ND	0.334		ND	8.15		ND	0.166		NA			ND	0.156		NA			ND	0.157	J6
8270D	DI-N-BUTYL PHTHALATE	760	6100	68000	mg/kg	NA			ND	1.75					**0.152**	0.329	J	NA			NA			NA			NA			NA			**0.0334**	0.324	J	ND	0.168		NA			ND	0.165		ND	3.41		ND	0.162		ND	0.334		ND	8.15		ND	0.166		NA			ND	0.156		NA			ND	0.157	J6
8270D	DIETHYL PHTHALATE	88	49000	550000	mg/kg	NA			ND	1.75	J4				ND	0.329	J4	NA			NA			NA			NA			NA			ND	0.324	J4	ND	0.168	J4	NA			ND	0.165	J4	ND	3.41	J4	ND	0.162	J4	ND	0.334	J4	ND	8.15	J4	ND	0.166	J4	NA			ND	0.156	J4	NA			ND	0.157	J4 J6
8270D	DIMETHYL PHTHALATE	NS	NS	NS	mg/kg	NA			ND	1.75	J4				ND	0.329	J4	NA			NA			NA			NA			NA			ND	0.324	J4	ND	0.168	J4	NA			ND	0.165	J4	ND	3.41	J4	ND	0.162	J4	ND	0.334	J4	ND	8.15	J4	ND	0.166	J4	NA			ND	0.156	J4	NA			ND	0.157	J4 J6
8270D	DI-N-OCTYL PHTHALATE	3300	2400	27000	mg/kg	NA			ND	1.75					ND	0.329		NA			NA			NA			NA			NA			ND	0.324		ND	0.168		NA			ND	0.165		ND	3.41		ND	0.162		ND	0.334		ND	8.15		ND	0.166		NA			ND	0.156		NA			ND	0.157	J6
8270D	1,2,4,5-TETRACHLOROBENZENE	NS	NS	NS	mg/kg	NA			ND	1.75	J3 J4				ND	0.329	J3 J4	NA			NA			NA			NA			NA			ND	0.324	J3 J4	ND	0.168	J3 J4	NA			ND	0.165	J3 J4	ND	3.41	J3 J4	ND	0.162	J3 J4	ND	0.334	J3 J4	ND	8.15	J3 J4	ND	0.166	J3 J4	NA			ND	0.156	J3 J4	NA			ND	0.157	J3 J4 J6
8270D	4-CHLORO-3-METHYLPHENOL	NS	NS	NS	mg/kg	NA			ND	1.75	J4				ND	0.329	J4	NA			NA			NA			NA			NA			ND	0.324	J4	ND	0.168	J4	NA			ND	0.165	J4	ND	3.41	J4	ND	0.162	J4	ND	0.334	J4	ND	8.15	J4	ND	0.166	J4	NA			ND	0.156	J4	NA			ND	0.157	J4 J6
8270D	2-CHLOROPHENOL	0.8	310	2200	mg/kg	NA			ND	1.75	J3 J4				ND	0.329	J3 J4	NA			NA			NA			NA			NA			ND	0.324	J3 J4	ND	0.168	J3 J4	NA			ND	0.165	J3 J4	ND	3.41	J3 J4	ND	0.162	J3 J4	ND	0.334	J3 J4	ND	8.15	J3 J4	ND	0.166	J3 J4	NA			ND	0.156	J3 J4	NA			ND	0.157	J4 J6
8270D	2-METHYLPHENOL	NS	310	3400	mg/kg	NA			ND	1.75	J3 J4				ND	0.329	J3 J4	NA			NA			NA			NA			NA			ND	0.324	J3 J4	ND	0.168	J3 J4	NA			ND	0.165	J3 J4	ND	3.41	J3 J4	ND	0.162	J3 J4	ND	0.334	J3 J4	ND	8.15	J3 J4	ND	0.166	J3 J4	NA			ND	0.156	J3 J4	NA			ND	0.157	J4 J6
8270D	3&4-METHYL PHENOL	NS	NS	NS	mg/kg	NA			ND	1.75	J3				**0.035**	0.329	J J3	NA			NA			NA			NA			NA			ND	0.324	J3	ND	0.168	J3	NA			ND	0.165	J3	ND	3.41	J3	ND	0.162	J3	ND	0.334	J3	ND	8.15	J3	ND	0.166	J3	NA			ND	0.156	J3	NA			ND	0.157	
8270D	2,4-DICHLOROPHENOL	0.2	180	2100	mg/kg	NA			ND	1.75	J3 J4				ND	0.329	J3 J4	NA			NA			NA			NA			NA			ND	0.324	J3 J4	ND	0.168	J3 J4	NA			ND	0.165	J3 J4	ND	3.41	J3 J4	ND	0.162	J3 J4	ND	0.334	J3 J4	ND	8.15	J3 J4	ND	0.166	J3 J4	NA			ND	0.156	J3 J4	NA			ND	0.157	J4 J6
8270D	2,4-DIMETHYLPHENOL	1	1200	14000	mg/kg	NA			ND	1.75	J3 J4				ND	0.329	J3 J4	NA			NA			NA			NA			NA			ND	0.324	J3 J4	ND	0.168	J3 J4	NA			ND	0.165	J3 J4	ND	3.41	J3 J4	ND	0.162	J3 J4	ND	0.334	J3 J4	ND	8.15	J3 J4	ND	0.166	J3 J4	NA			ND	0.156	J3 J4	NA			ND	0.157	J4 J6
8270D	4,6-DINITRO-2-METHYLPHENOL	0.3	6	68	mg/kg	NA			ND	2.34	J4				ND	0.438	J4	NA			NA			NA			NA			NA			ND	0.432	J4	ND	0.224	J4	NA			ND	0.22	J4	ND	4.55	J4	ND	0.216	J4	ND	0.445	J4	ND	10.9	J4	ND	0.221	J4	NA			ND	0.207	J4	NA			ND	0.209	J4 J6
8270D	2,4-DINITROPHENOL	0.3	120	1400	mg/kg	NA			ND	2.34	J3				ND	0.438	J3	NA			NA			NA			NA			NA			ND	0.432	J3	ND	0.224	J3	NA			ND	0.22	J3	ND	4.55	J3	ND	0.216	J3	ND	0.445	J3	ND	10.9	J3	ND	0.221	J3	NA			ND	0.207	J3	NA			ND	0.209	
8270D	2-NITROPHENOL	NS	NS	NS	mg/kg	NA			ND	1.75	J3 J4				ND	0.329	J3 J4	NA			NA			NA			NA			NA			ND	0.324	J3 J4	ND	0.168	J3 J4	NA			ND	0.165	J3 J4	ND	3.41	J3 J4	ND	0.162	J3 J4	ND	0.334	J3 J4	ND	8.15	J3 J4	ND	0.166	J3 J4	NA			ND	0.156	J3 J4	NA			ND	0.157	J3 J4 J6
8270D	4-NITROPHENOL	NS	NS	NS	mg/kg	NA			ND	1.75					ND	0.329		NA			NA			NA			NA			NA			ND	0.324		ND	0.168		NA			ND	0.165		ND	3.41		ND	0.162		ND	0.334		ND	8.15		ND	0.166		NA			ND	0.156		NA			ND	0.157	
8270D	PENTACHLOROPHENOL	0.3	0.9	3	mg/kg	NA			ND	1.75					ND	0.329		NA			NA			NA			NA			NA			ND	0.324		ND	0.168		NA			ND	0.165		ND	3.41		ND	0.162		ND	0.334		ND	8.15		ND	0.166		NA			ND	0.156		NA			ND	0.157	
8270D	PHENOL	8	18000	210000	mg/kg	NA			ND	1.75	J3				ND	0.329	J3	NA			NA			NA			NA			NA			ND	0.324	J3	ND	0.168	J3	NA			ND	0.165	J3	ND	3.41	J3	ND	0.162	J3	ND	0.334	J3	ND	8.15	J3	ND	0.166	J3	NA			ND	0.156	J3	NA			ND	0.157	
8270D	2,4,5-TRICHLOROPHENOL	68	6100	68000	mg/kg	NA			ND	1.75	J4				ND	0.329	J4	NA			NA			NA			NA			NA			ND	0.324	J4	ND	0.168	J4	NA			ND	0.165	J4	ND	3.41	J4	ND	0.162	J4	ND	0.334	J4	ND	8.15	J4	ND	0.166	J4	NA			ND	0.156	J4	NA			ND	0.157	J3 J4 J6
8270D	2,4,6-TRICHLOROPHENOL	0.2	19	74	mg/kg	NA			ND	1.75	J3 J4				ND	0.329	J3 J4	NA			NA			NA			NA			NA			ND	0.324	J3 J4	ND	0.168	J3 J4	NA			ND	0.165	J3 J4	ND	3.41	J3 J4	ND	0.162	J3 J4	ND	0.334	J3 J4	ND	8.15	J3 J4	ND	0.166	J3 J4	NA			ND	0.156	J3 J4	NA			ND	0.157	J3 J4 J6
9012B	CYANIDE	20	47	680	mg/kg	NA			**0.182**	0.292	J				**0.201**	0.274	J	NA			NA			NA			NA			NA			**0.0992**	0.27	J	**0.085**	0.28	J	NA			**0.0449**	0.275	J J6	**0.176**	0.284	J	**0.0587**	0.27	J	**0.112**	0.278	J	**0.0763**	0.272	J	**0.111**	0.277	J	NA			ND	0.259	P1	NA			ND	0.262	J6
Calc.	CHROMIUM,TRIVALENT	NS	120000	NS	mg/kg	NA			**209**	1.17					NA			**109**	1.26		NA			NA			NA			NA			NA						NA			NA			**274**	1.14		NA			**2200**	1.11		NA			NA			NA						NA					
NJDEP EPH	C9-C12 ALIPHATICS				mg/kg	NA			ND	11.7					ND	11		NA			NA			NA			NA			NA			NA						NA			NA			NA			NA			NA			NA			ND	11.1		ND	11.3		ND	10.4		NA			ND	10.5	
NJDEP EPH	C12-C16 ALIPHATICS				mg/kg	NA			ND	11.7					ND	11		NA			NA			NA			NA			NA			NA						NA			NA			NA			NA			NA			NA			ND	11.1		ND	11.3		ND	10.4		NA			ND	10.5	
NJDEP EPH	C16-C21 ALIPHATICS				mg/kg	NA			ND	11.7					ND	11		NA			NA			NA			NA			NA			NA						NA			NA			NA			NA			NA			NA			ND	11.1		ND	11.3		ND	10.4		NA			ND	10.5	
NJDEP EPH	C21-C40 ALIPHATICS				mg/kg	NA			**32.6**	11.7					**22.3**	11		NA			NA			NA			NA			NA			NA						NA			NA			NA			NA			NA			NA			ND	11.1		ND	11.3		**4.56**	10.4	J	NA			ND	10.5	
NJDEP EPH	C10 - C12 AROMATICS				mg/kg	NA			ND	11.7					ND	11		NA			NA			NA			NA			NA			NA						NA			NA			NA			NA			NA			NA			ND	11.1		ND	11.3		ND	10.4		NA			ND	10.5	
NJDEP EPH	C12-C16 AROMATICS				mg/kg	NA			ND	11.7					ND	11		NA			NA			NA			NA			NA			NA						NA			NA			NA			NA			NA			NA			ND	11.1		ND	11.3		ND	10.4		NA			ND	10.5	
NJDEP EPH	C16-C21 AROMATICS				mg/kg	NA			**27.1**	11.7					**6.96**	11	J	NA			NA			NA			NA			NA			NA						NA			NA			NA			NA			NA			NA			**4.94**	11.1	J	ND	11.3		**4.75**	10.4	J	NA			**5.01**	10.5	J
NJDEP EPH	C21-C36 AROMATICS				mg/kg	NA			**83.9**	11.7					**36.2**	11		NA			NA			NA			NA			NA			NA						NA			NA			NA			NA			NA			NA			ND	11.1		ND	11.3		ND	10.4		NA			ND	10.5	
NJDEP EPH	TOTAL EPH				mg/kg	NA			**144**	11.7					**65.4**	11		NA			NA			NA			NA			NA			NA						NA			NA			NA			NA			NA			NA			**4.94**	11.1	J	**0**	11.3		**9.31**	10.4	J	NA			**5.01**	10.5	J
NJDEP EPH	EPH SCREEN				mg/kg	NA			NA			**5740**	8200	J	NA			NA			**6090**	2730		**18400**	68300	J	**28700**	67200	J	**22500**	69200	J	NA						**23700**	67800	J	NA			NA			NA			NA			NA			NA			NA						**22.7**	555	J			

Legend
B: The same analyte is found in the associated blank.
J: The identification of the analyte is acceptable; the reported value is an estimate.
J0: The identification of the analyte is acceptable, but the reported concentration is an estimate. The calibration met method criteria.
J1: Surrogate recovery limits have been exceeded; values are outside upper control limits.
J2: Surrogate recovery limits have been exceeded; values are outside lower control limits
J3: The associated batch QC was outside the established quality control range for precision.
J4: The associated batch QC was outside the established quality control range for accuracy
J5: The sample matrix interfered with the ability to make any accurate determination; spike value is high
J6: The sample matrix interfered with the ability to make any accurate determination; spike value is low
J7: Surrogate recovery cannot be used for control limit evaluation due to dilution

P1: RPD value not applicable for sample concentrations less than 5 times the reporting limit.
V: The sample concentration is too high to evaluate accurate spike recoveries.
ND: Non-detect
NA: Not Analyzed
NS: No Standard

Table 5.0
Soil Sampling Results Exceeding Standards
Andujar Park Site Investigation
PI 782823

Lab Sample ID						L1083840-01			L1083840-02			L1083840-04			L1083840-05			L1083840-10			L1083840-16			L1083840-18			L1083840-22		
Date Collected						03/27/2019			03/27/2019			03/27/2019			03/27/2019			03/27/2019			03/27/2019			03/27/2019			03/28/2019		
Depth (ft.)						2 - 2.5			3.5 - 4.0			6.5 - 7			0.5 - 1			4.5 - 5			3 - 3.5			4 - 4.5			9.5 - 10		
Client Sample ID						TP2@2-2.5			TP3@3.5-4.0			TP5@6.5-7			TP6@0.5-1.0			SB6@4.5-5.0			SB9@3-3.5			SB11@4-4.5			SB12@9.5-10		
Matrix						SS			SS			SS			SS			SS			SS			SS			SS		
Method	Analyte	IGWSSL	DRCSRS	NRDCSRS	Units	Result	RDL	Qualifier	Result	RDL	Qualifier	Result	RDL	Qualifier	Result	RDL	Qualifier	Result	RDL	Qualifier	Result	RDL	Qualifier	Result	RDL	Qualifier	Result	RDL	Qualifier
3060A/7196A	CHROMIUM,HEXAVALENT	NS	240	20	mg/kg																			**28.4**	2.23				
6010D	ARSENIC	19	19	19	mg/kg				31.3	2.34																			
6010D	BERYLLIUM	0.7	16	140	mg/kg																0.7	0.228							
6010D	CADMIUM	2	78	78	mg/kg										6.02	0.629				J									
6010D	LEAD	90	400	800	mg/kg	257	0.583		358	0.584		334	0.548		552	0.629					545	0.569							
7471B	MERCURY	0.1	23	65	mg/kg	0.328	0.0233		0.201	0.0234		0.528	0.0219		0.508	0.0251	J6				0.958	0.0228							
8081B	DIELDRIN	0.003	0.04	0.2	mg/kg							0.0156	0.00329	J3 J5															
8082 A	PCB 1254	0.2	0.2	1	mg/kg				**0.243**	0.0198																			
8260C	BENZENE	0.005	2	5	mg/kg																						0.315	0.543	J
8270D	BENZO(A)ANTHRACENE	0.8	5	17	mg/kg	1.89	0.385		2.5	0.385					3.18	0.415		1.32	0.0713								3.91	1.79	
8270D	BENZO(A)PYRENE	0.2	0.5	2	mg/kg	1.6	0.385		2.16	0.385		0.258	0.0723		3.02	0.415		0.958	0.0713		0.502	0.751	J				3.43	1.79	
8270D	BENZO(B)FLUORANTHENE	2	5	17	mg/kg	2.19	0.385		3.16	0.385					4.83	0.415													
8270D	DIBENZ(A,H)ANTHRACENE	0.8	0.5	2	mg/kg	**0.446**	0.385								0.684	0.415													
8270D	2-METHYLNAPHTHALENE	8	230	2400	mg/kg																						108	3.59	J3 J4

Legend
B: The same analyte is found in the associated blank.
J: The identification of the analyte is acceptable; the reported value is an estimate.
J0: The identification of the analyte is acceptable, but the reported concentration is an estimate. The calibration met method criteria.
J1: Surrogate recovery limits have been exceeded; values are outside upper control limits.
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P1: RPD value not applicable for sample concentrations less than 5 times the reporting limit.
V: The sample concentration is too high to evaluate accurate spike recoveries.
ND: Non-detect
NA: Not Analyzed
NS: No Standard

Appendix A: Site Investigation Workplan

TTI ENVIRONMENTAL, INC.
1253 NORTH CHURCH STREET, MOORESTOWN, NJ 08057

TTI Project No. 18-360

November 7, 2018

Site Investigation Work Plan

Prepared by:

Andrew Basehoar, P.G.
Project Manager

Reviewed by:

Kristin Heimburger, LSRP
Director of Environmental Consulting

SITE LOCATION:
Dominick Andujar Park
Erie and Point Street
Camden, New Jersey
Block 12, Lots 1, 3, 17 & 18
Block 14, Lot 29

PREPARED FOR:
Camden Redevelopment Agency
520 Market Street, Suite 1300
Camden, New Jersey 08102
Attention: Mr. James Harveson

TABLE OF CONTENTS

1 INTRODUCTION

TTI Environmental, Inc. (TTI) conducted a Preliminary Assessment (PA) dated June 27, 2018 for Block 12, Lots 1, 3, 17 and 18 and Block 14, Lot 29 (subject site) property located in Camden, Camden County, New Jersey. The subject site consists of approximately 1.54 acres. The subject site currently operates as Dominick Andujar Park. The subject site formerly operated as several industrial uses including boat building, bottling, and leather tanning, from prior to 1885 until the 1970s on the northern portion, and automotive repair operations from the 1920s until the 1990s on the southern portions. A total of 18 Areas of Concern (AOCs) were identified in the PA. The AOCs are included in **Table 1** (see **Figure 1.0** for regional site location, **Figure 2.0** for a site map and **Figure 3.0** for an AOC map):

Table 1.0: AOC Status

Block/Lot	No Further Action	AOCs for Site Investigation
Block 12/Lot 1	-	AOC 1: Regulated Heating Oil Underground Storage Tank (UST) (Metallic Anomaly #8)
	-	AOC 4: Former Boiler Room
	-	AOC 5: Former Chemical Storage Building A (1926)
	-	AOC 6: Former Chemical Storage Building B (1891)
	-	AOC 9: Former Coal Yard
	-	AOC 16: Metallic Anomaly #7
	-	AOC 17: Metallic Anomaly #9
Block 14/Lot 29	AOC 7: Electrical Transformers and Capacitors	AOC 2: Historic Automotive Waste/Scrap Piles
	-	AOC 10: Metallic Anomaly #1
	-	AOC 11: Metallic Anomaly #2
	-	AOC 12: Metallic Anomaly #3
	-	AOC 13: Metallic Anomaly #4
	-	AOC 14: Metallic Anomaly #5
	-	AOC 15: Metallic Anomaly #6
Block 12/Lot 3	-	AOC 18: Metallic Anomaly #10
Site Wide	-	AOC 3: Historic Fill
	-	AOC 8: Historic Site Operations

TTI has developed the following Site Investigation Workplan (SIWP) to include the scope of work to investigate 17 AOCs. The SIWP includes investigation methodology, sample frequency, analytical parameters, remediation standards, and estimated costs to complete the investigative tasks.

2 SITE CHARACTERISTICS

This section provides a brief summary of the general site characteristics including site location and site description. Physical characteristics such as description of soil, geology, hydrogeology, and topography are also provided.

2.1 Site Location

The subject site is located in a mixed use industrial and residential portion of Camden, New Jersey. The subject site is an irregularly shaped, approximately 1.6-acre parcel identified by the City of Camden as Block 12, Lots 1, 3, 17 and 18 and Block 14, Lot 29 (TTI notes that for the purposes of this Preliminary Assessment Report (PAR), (the five (5) adjoining lots shall be identified as subject site). The subject site is enclosed by four (4) streets; Point Street to the west, Erie Street to the north, York Street to the south and North Front Street to the east. Block 12 and Block 14 are separated by an alley (North Street).

Block 14, Lot 29 includes an approximately 0.45-acre playground and park on the western portion. The remaining 0.05 acres is unimproved vegetated land on the southeastern corner. Block 12, Lot 1 includes an approximately 0.56-acre baseball field on the western portion, with the remaining approximately 0.25 acres being unimproved vegetated land and debris from historic site operations. Block 12, Lot 3 (approximately 0.15 acres) 17 (approximately 0.06 acres) and 18 (approximately 0.02 acres) are all unimproved vegetated parcels. A stormwater basin overgrown with vegetation is also located on Block 12, Lot 3.

A Regional Site Location map of the subject site and surrounding area is provided as **Figure 1.0**. A Site map with Blocks and Lots is provided as **Figure 2.0**.

2.1.1 Topography

The site is generally flat. The elevation at the subject property is approximately 16 feet above mean sea level, according to the United States Geological Survey (USGS) 2014 Camden, NJ 7.5 Minute topographic quadrangle map.

2.1.2 Geology

The site is located within the Coastal Plain physiographic province of New Jersey. The dominant formation in this province is the Potomac Formation, which consists of fine to coarse grained sand, interbedded with white, red or yellow clay.

According to NJ-GeoWeb, surficial geology consists of salt-marsh and estuarine deposits, as well as Cape May formation. Surficial geology generally consists of sand, silt, peat clay cobble gravel and pebble gravel. These deposits are generally from the late Pleistocene to Holocene eras.

2.1.3 Soil

Soils at the subject site are identified as urban land. Soils at the subject site consist of surface covered by pavement, concrete, buildings and other structures underlain by disturbed and natural soil material.

2.1.4 Hydrogeology

NJ-GeoWeb identifies the subject property as underlain by the Potomac-Raritan-Magothy aquifer system. Based on topography, groundwater is expected to flow in a northwesterly direction. Depth to groundwater is estimated to be less than 15 feet, based on general knowledge of the area.

2.1.5 Surface Water and Wetlands

Surface water runoff is directed via sheet flow to storm drains along York Street, North Front Street, Point Street and Erie Street.

There are no federal or state designated wetlands on or adjacent to the site.

2.2 Areas of Concern

TTI identified a total of 18 AOCs in the PA and geophysical survey conducted by Delta Geophysics (Delta). A Site Investigation is recommended for all AOCs except AOC 7: Electrical Transformers and Capacitors. AOC narratives are listed below. AOCs have been grouped by block and lot. An AOC map is included as **Figure 3.0**.

AOCs: Block 12, Lot 1

- **AOC 1 – Regulated Heating Oil UST**
  A metallic anomaly was identified on the southeastern portion of Block 12, Lot 1. The dimensions of the anomaly measures approximately 30 feet in length and 11 feet in width. These dimensions are consistent with an approximately 12,000-gallon UST. This UST is associated with "**Metallic Anomaly #8**" in the Delta geophysical report. This anomaly was confirmed by finding a fill port buried under shallow soil. This UST is located to the west of the former boiler house location, therefore, TTI assumes the UST contained heating oil. Based on the former use of the operation (i.e. industrial) and the presumed size of the UST, this UST would be regulated with the New Jersey Department of Environmental Protection (NJDEP). USTs present a threat to the subsurface environment due to the potential for the tank to leak its contents or overfill from historical tank fillings.

- **AOC 4 – Former Boiler Rooms**
  The 1885 through 1977 Sanborn maps depict a boiler room on Block 12, Lot 1 for the former tannery. Historical aerial photographs and bird's eye view photograph also depict a stack associated with this former boiler room. The boiler room was located to the east of the heating oil UST (AOC 1). This boiler room was not present during TTI's site inspection. As such, TTI was unable to observe the condition of the boiler room and determine if there were any historical releases that could impact the subsurface environment.

- **AOC 5 – Former Chemical Storage Building A (1926)**
  The 1926 Sanborn map depicts a chemical storage building on the northwestern corner of Block 12, Lot 1. This building was associated with the former tannery operation located on the subject site. Tanneries are known to utilize a variety of hazardous materials including chromium, resins, lacquers, and acids. This building was not present during TTI's site inspection.
  As such, TTI was unable to observe the floor to determine if any historic releases within this building could impact the subsurface environment.

- **AOC 6 – Former Chemical Storage Building B (1891)**
  The 1891 Sanborn map depicts Lauper & Doughton Chemicals on the southwestern corner of Block 12, Lot 1. This structure was associated with F. Cramer, an anchor, chain and boat building operation. The chemicals stored within this structure are unknown. This building was not present during TTI's site inspection. Sanborn maps indicate the building was demolished prior to 1926. As such, TTI was unable to observe the floor to determine if any historic releases within this building could impact the subsurface environment.

- **AOC 9 – Former Coal Yard**
  The 1885 and 1891 Sanborn map depicts a coal yard on the southeastern corner of Block 12, Lot 1. This coal yard is suspected to have stored coal for the former tannery on this portion of the subject site prior to utilizing heating oil. It is assumed that coal was stored on bare soil. Coal is known to contain hazardous materials, including mercury, polycyclic aromatic hydrocarbons (PAHs) and heavy metals. These compounds enter the environment due to rainwater washing over the coal, allowing the dissolved compounds to enter soil and groundwater; this runoff can be acidic. The compounds present in this runoff are toxic, persistent and can bioaccumulate in the environment (i.e. mercury).

- **AOC 17 – Metallic Anomaly #9**
  Delta observed a metallic anomaly on the eastern portion of Block 12, Lot 1. The anomaly measures approximately 20.5 feet in length and approximately six and a nine (9) feet in width. The anomaly appears to be associated with reinforced concrete.

AOCs: Block 14, Lot 29

- **AOC 2 – Historic Automotive Waste/Scrap Piles**
  The 1974 aerial photographs identified waste and scrap piles to the north of a historic automotive repair facility on the southeastern corner of Block 14, Lot 29. The waste piles appear to be associated with automotive debris in the photographs. Delta identified Metallic Anomalies 5 and 6 in this area, both buried approximately two (2) and four (4) feet below grade. Potentially buried and historically stockpiled automotive waste represents a threat to the subsurface environment due to the potential for oils and solvents to leak.

- **AOC 7 – Electrical Transformers and Capacitors**
  TTI observed three (3) pole mounted transformers on the southern portion of Block 14, Lot 29. No evidence of leaks or stains were observed at the base of the transformers.

- **AOC 10 – Metallic Anomaly #1**
  Delta observed a metallic anomaly on the southeastern corner of Block 14, Lot 29. The anomaly measures approximately six (6) feet in length and approximately four and a half (4.5) feet in width (possible UST). The anomaly is buried approximately one (1) to two (2) feet below grade.

- **AOC 11 – Metallic Anomaly #2**
  Delta observed a metallic anomaly on the southern corner of Block 14, Lot 29. The anomaly measures approximately five and a half (5.5) feet in length and approximately four (4) feet in width. The anomaly is buried approximately two (2) to three (3) feet below grade.

- **AOC 12 – Metallic Anomaly #3**
  Delta observed a metallic anomaly on the northwestern corner of Block 14, Lot 29. The anomaly measures approximately ten (10) feet in length and approximately five (5) feet in width. The anomaly is buried approximately two (2) to four (4) feet below grade.

- **AOC 13 – Metallic Anomaly #4**
  Delta observed a metallic anomaly on the northwestern corner of Block 14, Lot 29. The anomaly measures approximately six and a half (6.5) feet in length and approximately five and a half (5.5) feet in width. The anomaly is buried approximately two (2) to four (4) feet below grade.

- **AOC 14 – Metallic Anomaly #5**
  Delta observed a metallic anomaly on the northeastern corner of Block 14, Lot 29. The anomaly measures approximately seven (7) feet in length and approximately six (6) feet in width. The anomaly is buried approximately four (4) feet below grade. This is suspected to be associated with historic automotive scrap and debris (AOC 2).

- **AOC 15 – Metallic Anomaly #6**
  Delta observed a metallic anomaly on the northeastern corner of Block 14, Lot 29. The anomaly measures approximately 12 feet in length and approximately six (6) feet in width. Delta was unable to confirm the depth of this anomaly. This is suspected to be associated with historic automotive scrap and debris (AOC 2).

AOCs: Block 12, Lot 3

- **AOC 18 – Metallic Anomaly #10**
  Delta observed a metallic anomaly on the northeastern corner of Block 12, Lot 3. The anomaly measures approximately six (6) feet in length and six (6) feet in width. The anomaly is buried approximately four (4) feet below grade. The anomaly appears to be two (2) cylindrical features (possibly buried drums).

AOCs: Site Wide

- **AOC 3 – Historic Fill or any other Fill Material**
  While not in an area of mapped historic fill, the geophysical survey returned evidence of disturbed soils and several metallic anomalies. Additionally, TTI was also provided with a soil sampling map that was prepared by JMS Sorge, Inc. (JMS) for Trust for Public Land dated March 20, 2018. The map depicted the location where four (4) surficial soil samples were collected in the area of the baseball field located on Block 12, Lot 1.

  The soil samples returned concentrations above NJDEP Residential Direct Contact Soil Remediation Standards (RDCSRS) for Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, Lead, and Polychlorinated Biphenols (PCBs). In addition, Arsenic, Benzo(a)anthracene, Benzo(a)pyrene, and Benzo(b)fluoranthene were identified above the NJDEP Non-Residential Direct Contact Soil Remediation Standards (NRDCSRS). TTI notes that each of the compounds are common contaminants associated with non-indigenous fill material. Historic fill presents a potential threat to the subsurface environment as the fill may be contaminated with hazardous materials or petroleum product.

- **AOC 8 – Historic Site Operations**
  The subject site has been historically utilized for industrial and commercial purposes. Specifically, Block 12, Lot 1 has been utilized as a tannery, chemical storage, and boat building operations, and the southeastern corner of Block14, Lot 29 operated as an automotive repair facility. These operations were conducted on the subject site from the mid-1880s until the mid-1990s. A majority of these operations were conducted prior to environmental regulations, including RCRA. No historic releases would have been reported and the disposal of any hazardous materials would not have been tracked. These historic site operations are known to utilize a variety of hazardous materials and petroleum products.

3 WORK PLAN RATIONALE

This section of the work plan describes the rationale for conducting the Site Investigation. The applicable remediation standards and data quality objectives are identified. The approach for the investigation is also provided for each area of concern. According to N.J.A.C. 7:26E-3.3 "The purpose of a site investigation is to determine if additional remediation is necessary because contaminants are present at the site or area of concern, or because contaminants have emanated or are emanating from the site or area of concern, above any applicable remediation standard or criterion."

The sections below summarize the proposed actions for each AOC, including the media investigated, proposed sample depths, and analytical and investigative purposes.

3.1 Identification of Applicable Remediation Standards

It is TTI's understanding that the redevelopment plan for the subject site is to remain a public park with a baseball field, basketball courts, all-weather soccer field, benches and seating areas. Future construction activities will most likely include disturbance of on-site soils. Polycyclic Aromatic Hydrocarbons (PAHs), Polychlorinated Biphenols (PCBs) and metals have previously been detected in surficial soils at levels exceeding the RDCSRS, as noted in the PA. For purposes of the site investigation, TTI shall compare soil sampling results to the RDCSRS, Non-residential Direct Contact Soil Remediation Standards (NRDCSRS) and the Default Impact to Groundwater Soil Screening Levels (DIGWSSL).

Groundwater standards shall be the Groundwater Quality Standards (GWQS) for Class IIA aquifers.

3.2 Data Quality Objectives

Data Quality Objectives (DQOs) help environmental professionals plan to collect data of the right type, quality, and quantity to support defensible site decisions. The DQOs for the site investigation are to collect sufficient data of acceptable quality for comparison with the NJDEP soil and groundwater remediation standards to assess compliance with the standards.

3.3 Investigation Approach by Subsurface Media

There are currently 17 AOCs identified at the subject site for which site investigation has been recommended. Site investigation activities shall include a combination of installation and soil sampling from test pits, installation and sampling of soil borings, and installation and sampling of groundwater monitoring wells. Proposed soil borings are displayed on **Figure 4.0** and test pit locations are displayed in **Figure 5.0.**

Soils

Test pits shall be installed using a backhoe with capability to excavate to approximately 10 to 12 feet below grade. Soils excavated during test pit installation shall be temporarily stockpiled adjacent to the test pit on plastic sheeting. Soils shall be continuously observed during test pit installation by an Environmental Scientist or Field Geologist and logged for soil type. Soils shall also be screened using a calibrated Photoionization Device (PID). Soil samples shall be collected at appropriate depths depending on field observations and screening. Soil samples shall be collected in laboratory supplied bottleware, immediately placed in coolers with ice and transferred to the laboratory under proper chain of custody protocols. Following excavation and soil sampling, each test pit shall be backfilled with material removed from the test pit during excavation. Test pits shall be compacted to the best ability of the backhoe.

Soil borings shall be installed using hydraulic direct push (Geoprobe) techniques where a five (5)-foot by two (2)-inch diameter hollow stainless steel macrocore sampler is driven into the subsurface. Soil will be returned to the surface in dedicated acetate liners. Macrocores shall be advanced in five (5) foot sections to the soil/groundwater interface, or 15 feet below grade if no evidence of contamination is detected. Soil boring installations shall be continuously observed by an Environmental Scientist or Field Geologist and logged for soil type. Soils shall also be screened using a calibrated PID. In an effort to conduct the Site Investigation in a cost-effective manner, soil samples shall be collected at locations that exhibit the highest degree of contamination during field screening activities. Soil samples shall be collected in laboratory supplied bottleware, immediately placed in coolers with ice and transferred to the laboratory under proper chain of custody protocols. Following logging and sampling of soils, borehole shall be backfilled with cuttings from the soil cores and sealed at the surface with top soil, cold patch asphalt or concrete.

Groundwater

If soil analytical results trigger a groundwater investigation, permanent groundwater monitoring wells shall be installed. Factors that may trigger a groundwater investigation would include: impact of potential receptors, detection of free-phase product, discharge detected near or below water table, contaminants are considered mobile, contamination is detected within two (2) feet of water table or bedrock, contaminants have had time to migrate through unsaturated zone to the water table.

Groundwater monitoring wells shall be installed by a NJDEP licensed well driller. Since the monitoring wells shall be used for multiple rounds of sampling, permanent monitoring wells shall be installed. The monitoring wells shall be permitted following NJDEP protocols. It is anticipated that groundwater monitoring wells shall be constructed to a depth of 20 feet below ground surface with 10 feet of two-inch diameter PVC well screen and 10 feet of two-inch diameter solid riser pipe. Exact well construction specifications shall be determined based on depth to saturated soils at the site. It is anticipated that groundwater monitoring wells shall be installed using hollow-stem auger techniques.

Following well installation, the wells shall be developed via pumping and surging to remove silt and fine materials from the well bore and filter pack. The monitoring wells shall be finished at the surface with flush mount manholes and locking well caps. Groundwater monitoring wells shall be surveyed for location and elevation for the creation of groundwater flow maps and for the completion of NJDEP Form Bs. Investigative Derived Wastes (IDW) from well installation activities, such as soil cuttings and well development water, shall be containerized in 55-gallon steel drums and staged at an area of the subject site approved by the client. Drums shall be removed from the site as soon as possible following drilling activities by the selected disposal contractor. TTI requests that waste manifests are signed by an officer of CRA prior to removal from the site.

Following a two-week stabilization period, initial groundwater samples shall be collected. Groundwater samples shall be collected using low-flow groundwater sampling techniques. Groundwater samples shall be collected by TTI personnel trained for analyze immediately parameters under TTI's Laboratory Certification (NJDEP Cert. 03050). Samples shall be collected following the stabilization of groundwater parameters; temperature, Oxidation-Reduction Potential (ORP), pH, dissolved oxygen, conductivity, and turbidity. Groundwater samples shall be bottled in laboratory supplied glassware and handled under proper chain of custody protocols. A second round of groundwater samples shall be collected at least 30 but no more than 45 days following the initial round of groundwater sampling. For budgetary purposes, TTI has added QA/QC analysis to the groundwater sample quantity. Groundwater QA/QC samples shall include a trip blank, field blank, and blind duplicate for each groundwater sampling event.

3.4 Scope of Work

AOC 1 – Regulated Heating Oil UST (Block 12, Lot 1) – TTI proposes installing a total of eight (8) soil borings around the UST; six (6) borings shall be installed long side-walls of the UST (three [3] per side), and two (2) borings shall be installed along the end-wall (one [1] per end) in accordance with NJDEP's *Technical Guidance for Investigation of Underground Storage Tank Systems*, July 31, 2012. TTI assumes the UST was used for No. 2 heating oil based on the proximity to the former boiler house for the tannery operation. Samples shall be collected at the depth of the suspected invert (approximately 10-12 feet below grade), half foot above the soil/groundwater interface, or at the highest PID reading.

AOC 2 – Historic Automotive Waste/Scrap Piles (Block 14, Lot 29) – TTI proposes Metallic Anomalies 5 and 6 shall be investigated through the installation of test pits to determine the type of buried metallic objects detected during the geophysical survey. At least one (1) soil sample shall be collected to evaluate soils in the areas of metallic anomalies 5 and 6.

AOC 3 – Historic Fill or any other Fill Material (site-wide) - TTI proposes to conduct historic fill investigation through a combination of test pits and soil borings. According to the NJDEP's Historic Fill Material Technical Guidance (April 2013), a minimum of two (2) samples shall be collected per acre. The subject site is approximately 1.6 acres. It is TTI's opinion that samples to characterize historic fill can be collected during the site investigation for other AOCs identified at the subject site, such as metallic anomalies.

AOCs 4 & 17 – Boiler Rooms/Metallic Anomaly #9 (Block 12, Lot 1) - TTI proposes to evaluate the former boiler room area identified on Sanborn Maps through the installation of soil borings and analysis of soil samples. Soil borings shall be located around the approximate footprint of the former boiler room, which is located in the proximity of metallic anomaly #9.

AOC 5 & 6 – Chemical Storage Building A & B (Block 12, Lot 1) – TTI proposes to evaluate the former chemical storage buildings identified on Sanborn Maps through the installation of soil borings and analysis of soil samples. Soil borings shall be located around the approximate footprint of the former chemical storage buildings.

AOC 8 – Historical Site Operations (Block 12, Lot 1) – TTI proposes to evaluate the former site operations through the installation of a combination of test pits, soil borings and analysis of soil samples. This investigation shall focus on the northern portion of the subject site that contained former industrial uses, including a tannery, and the southeastern portion of the subject site that contained a former automotive repair. Samples shall be collected if obvious signs of contamination are observed during test pit/soil boring installation.

AOC 9 – Former Coal Yard (Block 12, Lot 1) – TTI proposes to evaluate the former coal yard through surficial and shallow soil sampling. It is assumed that coal was stockpiled on bare surface soil and impacts would be greater at or just below ground surface.

AOC 10 – Metallic Anomaly #1 (Block 14, Lot 29) – TTI proposes to daylight the potential UST via a test pit. Following confirmation that the anomaly is a UST, TTI shall install soil borings around the UST with one soil boring per side of the UST. If the anomaly is not identified as a UST, samples shall be collected if obvious signs of contamination are observed during test pit installation.

AOC 11, 12, 13, 14, & 15 – Metallic Anomalies #2, 3, 4, 5, 6 (Block 14, Lot 29) – TTI proposes to evaluate these anomalies that appeared consistent with metallic debris through installation of test pits to determine the type of buried metallic objects detected during the geophysical survey. Samples shall be collected if obvious signs of waste burial or contamination are observed during test pit installation.

AOC 16 – Metallic Anomaly #7 (Block 12, Lot 1) - TTI proposes to daylight the potential UST via installation of a test pit. Following confirmation that the anomaly is a UST, TTI shall install soil borings around the UST with one soil boring per side of the UST. If the anomaly is not identified as a UST, samples shall be collected if obvious signs of waste burial or contamination are observed during test pit installation.

AOC 18 – Metallic Anomaly #10 (Block 12, Lot 3) – TTI proposes to daylight the potential buried drums via installation of test pits to determine the type of buried metallic objects detected during the geophysical survey. Samples shall be collected if obvious signs of waste burial or contamination are observed during test pit installation.

Sampling and Analysis Breakdown

Laboratory analytical parameters for soil shall meet NJDEP requirements for each of the AOCs to be investigated. Analysis shall include Extractable Petroleum Hydrocarbons (EPH) Category 1 (non-fractionated) and Category 2 (fractionated), Target Compound List (TCL) Volatile Organic Compounds (VOCs), TCL Semi-Volatile Organic Compounds (SVOCs), Naphthalene and 2-Methylnephthalene, PAHs, Organochlorine pesticides, PCBs, and Target Analyte List (TAL) Metals.

Table 2.0: Proposed Investigation of Areas of Concern

Area of Concern	Investigation	Sample Depths	Boring	Test Pit	Samples	Analysis
AOC 1 Regulated Heating Oil UST	Install soil borings to determine presence of contaminated soil	Soil samples shall be collected at obvious signs of contamination	8		8	EPH Cat. 1, 25% of samples with EPH above 1,000mg/kg analyzed for Naphthalene & 2-Methylnaphthalene
AOC 2 Historic Automotive Waste/Scrap Piles	Install test pits to determine type of metallic debris	Soil samples shall be collected at obvious signs of contamination	0	2	1	EPH Cat 2, 25% of samples with EPH detected analyzed for VOCs, SVOCs, PCBs, TAL Metals
AOC 3 Historic Fill Material	Install test pits and soil borings to determine presence or absence of suspected historic fill material	Soil samples shall be collected within discrete zones of observed historic fill material	To be evaluated during investigation of other AOCs		4	PAH, TAL Metals; EPH Cat.2 with full TAL/TCL analysis
AOCs 4 & 17 Former Boiler Room and Reinforced Concrete Pad	Install soil borings to determine presence of contaminated soil	Soil samples shall be collected at obvious signs of contamination	4	0	1	EPH Cat. 1, EPH above 1,000mg/kg analyzed for Naphthalene & 2-Methylnaphthalene
AOC 5 & 6 Former Chemical Storage Buildings A & B	Install soil borings to determine presence of contaminated soil	Soil samples shall be collected at locations and depths displaying obvious signs of contamination or half foot above groundwater	4	0	2	Full TAL/TCL analysis
AOC 8 Historical Site Operations	Install soil borings to determine presence of contaminated soil	Soil samples shall be collected at locations and depths displaying obvious signs of contamination or half foot above groundwater	4	0	6	Full TAL/TCL analysis

Table 2.0: Proposed Investigation of Areas of Concern						
Area of Concern	**Investigation**	**Sample Depths**	**Boring**	**Test Pit**	**Samples**	**Analysis**
AOC 9 Former Coal Yard	Surficial Soils collection via hand tools	Soil samples shall be collected from surface to a depth of one foot	Surficial Samples		1	PAHs, TAL Metals
AOC 10 Metallic Anomaly #1 (Potential UST)	Install test pit to confirm UST, soil borings to determine presence of contaminated soil	Soil samples shall be collected at obvious signs of contamination	4	1	1	EPH Cat 2, 25% of samples with EPH detected analyzed for VOCs, SVOCs, PCBs, TAL Metals
AOC 11, 12, 13, 14 & 15 Metallic Anomalies 2,3,4,5,&6	Install test pits to determine type of metallic debris	Soil samples shall be collected at obvious signs of contamination	0	5	5	Full TAL/TCL
AOC 16 Metallic Anomaly #7 (potential UST)	Install test pit to confirm UST, soil borings to determine presence of contaminated soil	Soil samples shall be collected at obvious signs of contamination	4	1	1	EPH Cat 2, 25% of samples with EPH detected analyzed for VOCs, SVOCs, PCBs, TAL Metals
AOC 18 Metallic Anomaly #10 (potential buried drums)	Install test pits to determine type of metallic debris	Soil samples shall be collected at obvious signs of contamination	0	1	1	Full TAL/TCL analysis
Total			28	10	31	

Groundwater – Groundwater is not currently considered an AOC, but if a groundwater investigation is triggered following soil analysis, permanent monitoring wells shall be installed. TTI proposes to install three (3) monitoring wells at the subject site. Monitoring wells shall be placed at locations exhibiting the highest degree of impact based on soil screening. Likely monitoring well locations are the central portion of the site near AOC 1, the northwestern corner of the property near AOCs 5 and 6, and the southeastern portion of the site near AOC 10.

Laboratory analytical parameters for groundwater are as follows: TCL VOCs, TCL SVOCs, PCBs, and TAL Metals.

4 DATA MANAGEMENT

4.1 Data Quality Objectives

The data quality objectives are to develop data of adequate quality for comparison with soil and groundwater standards to prove compliance with the NJDEP soil and groundwater quality standards.

4.2 Sampling Location and Field Positioning

Sample locations will be marked on the surface prior to conducting any intrusive work. A utility mark out call will be made to The New Jersey One-Call system. Facility drawings of utility locations will also be consulted prior to placing subsurface sampling locations.

The sample locations will be field located using a GPS instrument. The location data will be recorded in the instrument memory and downloaded at the conclusion of the sampling event. If location by a GPS instrument is not possible, triangulating measurements will be taken from nearby features such as fire hydrants, water valve caps, building edges, etc. The measurement data will be recorded in the field log book and a site sketch will also be drawn in the field log book. The location data will be used to prepare figures for inclusion in reports prepared for the project.

4.3 Sample Identification and Nomenclature Procedures

Each sample will be assigned a specific alpha-numeric identification. The type of sample will be identified using two letters, such as SB for soil boring and MW for monitoring well. The next part of the identifier will be a number designating the number of sample locations beginning with 01 and continuing until all the samples are collected in a sampling event. The depth interval will be recorded in the logbook and in the sample ID (e.g. SB-01 @ 1-1.5).

4.4 Sample Handling and Storage Procedures

Groundwater samples will be collected in accordance with the 2005 NJDEP Field Sampling Procedures Manual. The typical sampling procedure will be conducted using low-flow sampling techniques, the recording of physiochemical parameters throughout the purging/sampling process.

After sample collection, the sample containers will be wiped with paper towels to remove any dirt, mud or moisture from the container. The containers will be placed in the shipping cooler provided by the laboratory. A sufficient amount of bagged ice will be placed in the cooler to preserve the samples to a temperature to 4º Celsius. The shipping cooler shall be kept in a location out of the direct sun and where the container will not be damaged by vehicular traffic. Upon completion of the days sampling event and completion of the chain-of-custody, the sample container shall be transferred to the laboratory courier.

4.5 Chain of Custody Procedures

A laboratory supplied chain-of-custody document will be prepared for each sample cooler containing samples for delivery to the laboratory. The samples will remain in the custody of the field team leader until custody is transferred to the laboratory courier, or until the samples are delivered to an over-night delivery service, if the samples are shipped to the laboratory.

Sample custody shall be relinquished by signing the C-O-C in the appropriate location and writing the date and time custody is relinquished.

The person accepting custody shall also sign the C-O-C document in the appropriate location and writing in the date and time that custody is accepted. One copy of the C-O-C document shall be kept by the field team leader after both parties have signed the C-O-C.

4.6 Documentation and Record Keeping

The field investigation activities will be documented in a bound field log book. Information will be recorded daily, including the weather conditions, arrival and departure time, subcontractors and visitors on the site, sample location information, sampling times, soil descriptions, instrument readings, observations of discolored soil or petroleum sheen on water, etc. Copies of the field book pages will be placed in the project file. The field log notes will be used by the project team to prepare reports that document the investigation, results, and conclusions and recommendations.

4.7 Data Reporting Procedures

The laboratory will analyze samples submitted and prepare a data package of the analytical results assembled by analytical category, i.e. volatile organics, semi-volatile organics, inorganics, etc. The analytical data will be compared to the appropriate NJDEP remediation standard, either the soil remediation standards or the groundwater quality standards. EPH results will be compared the applicable further action criteria and remedial action criteria, as appropriate. The laboratory analytical data will be used to evaluate the need for additional investigation, conduct a remedial action or close the site remediation case.

4.8 Quality Assurance/Quality Control Sampling

TTI shall document all Quality Assurance/Quality Control (QA/QC) sampling in our Quality Assurance Project Plan under separate cover. QA/QC samples shall be collected daily during sampling activities. QA/QC shall include collection of a trip blank, field blank, equipment blank, and blind duplicate.

5 REPORTING

5.1 Reporting Requirements

Reports required by the NJDEP Site Remediation Program will be prepared after the completion of the site investigation. The Site Investigation Report shall be prepared in accordance with N.J.A.C. 7:26E-1.6 and 3.13. The client will be provided an electronic copy of the draft report for review. Voluminous attachments to the report, such as laboratory data packages, will be provided in Adobe .pdf file format on CD. The draft report will be revised based on comments received from the client and USEPA. After revision, the reports will be submitted to the client in final version with discussion by area of concern, recommendations for either remediation or no further remediation per N.J.A.C 7:26E-3.13.

6 COST ESTIMATE

TTI has developed a cost estimate to investigate the AOCs identified during the PA. Unit costs are based on prices included in the original contract with the exception of the addition of EPH Category 1 and 2, and Naphthalene and 2-Methylnaphathalene sample costs that were not requested in the original bid request. Cost estimates are based on the anticipated time and materials to complete the tasks outlined in the scope of work in **Section 3.4**.

It is the City of Camden's desire to keep the park operational during environmental investigations. A contingency of 20% has been factored into the cost estimate to cover additional expenses that result from AOCs that require immediate remedial investigation in order to protect human health of persons who occupy the park.

The cost estimate was completed in the NJDEP Hazardous Discharge Site Remediation Fund spreadsheet provided by the client. The cost spreadsheet has been provided to the client in electronic format and is also included as **Appendix A.**

Figures:

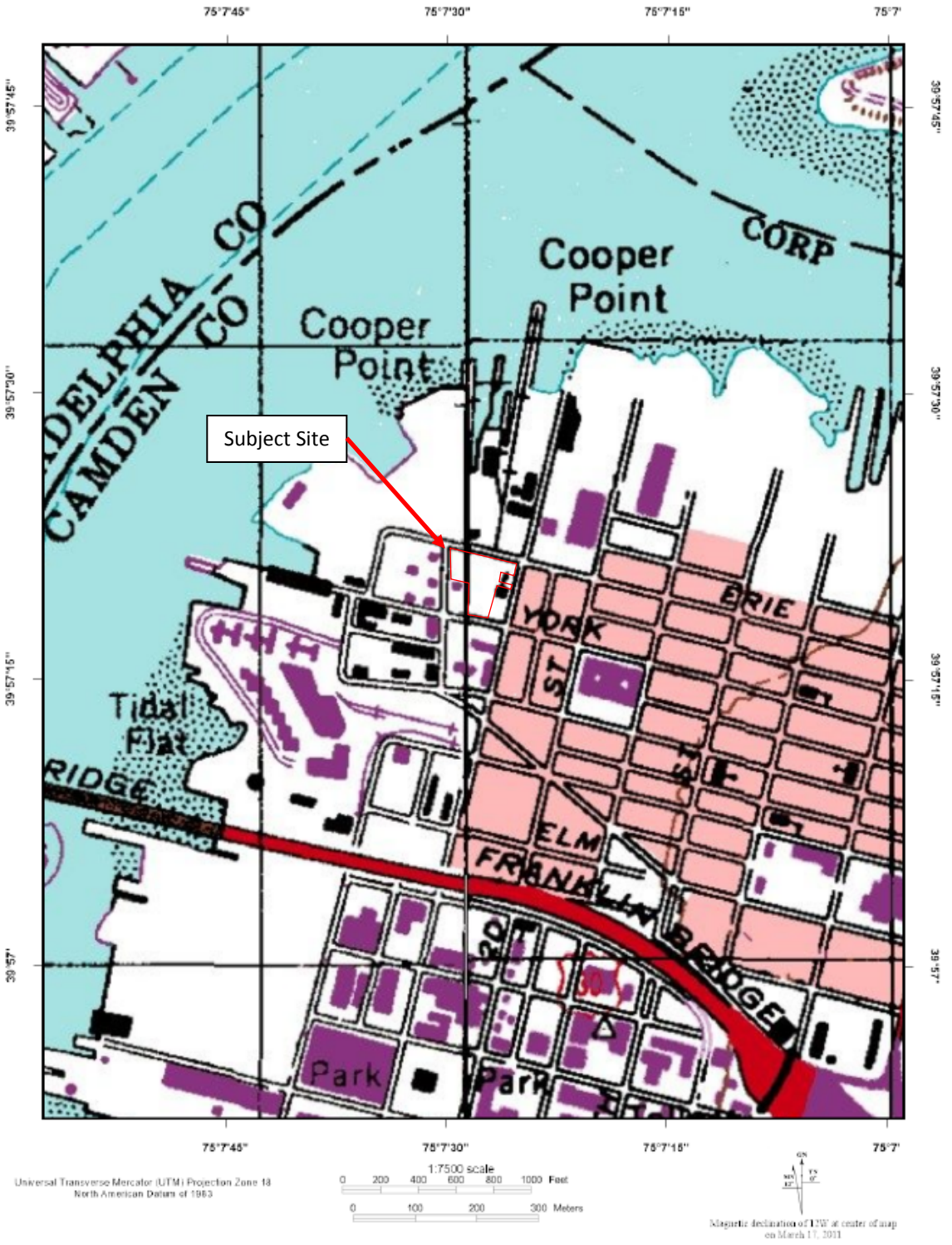

Figure 1.0:

Regional Site Location Map

Andujar Park
Erie and Point Street
Block 12, Lots 1, 3, 17 & 18
Block 14, Lot 29
Camden, Camden County, New Jersey 08102

TTI Environmental, Inc.
www.ttienv.com

SCALE	DRAWN BY	DATE
As Shown	USGS	6/2018
PROJECT	APP'D BY	DRAWING NO.
18-360	DD	1.0

Figure 2.0:

Site Diagram

Andujar Park
Erie and Point Street
Block 12, Lots 1, 3, 17 & 18
Block 14, Lot 29
Camden, Camden County, New Jersey 08102

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SCALE	DRAWN BY	DATE
As Shown	DD	6/2018
PROJECT	APP'D BY	DRAWING NO.
18-360	DD	2.0

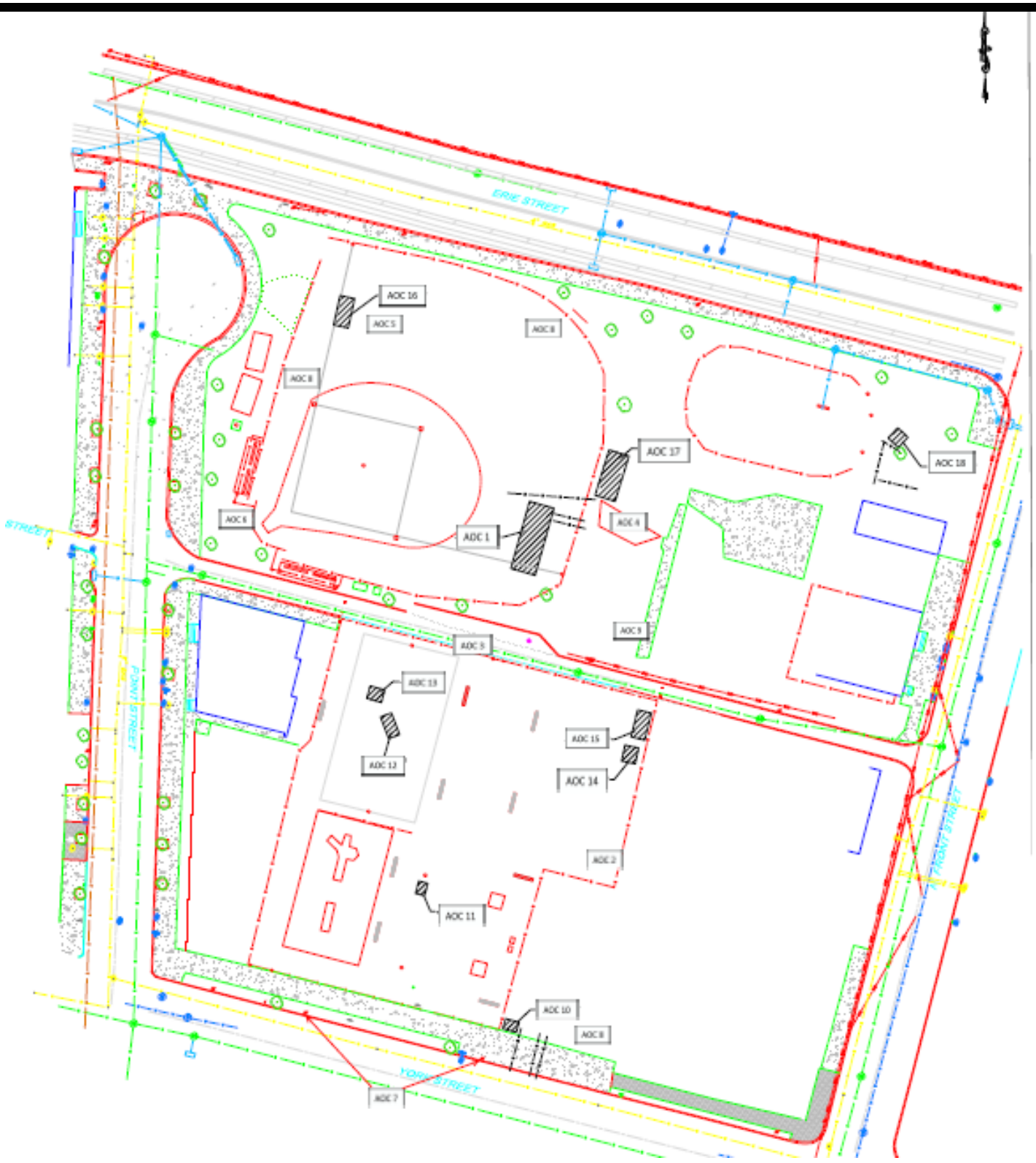

Figure 3.0:

AOC Map

Andujar Park
Erie and Point Street
Block 12, Lots 1, 3, 17 & 18
Block 14, Lot 29
Camden, Camden County, New Jersey 08102

TTI Environmental, Inc.
www.ttienv.com

SCALE	DRAWN BY	DATE
As Shown	Delta Geophysics	6/2018
PROJECT	APP'D BY	DRAWING NO.
18-360	DD	2.0

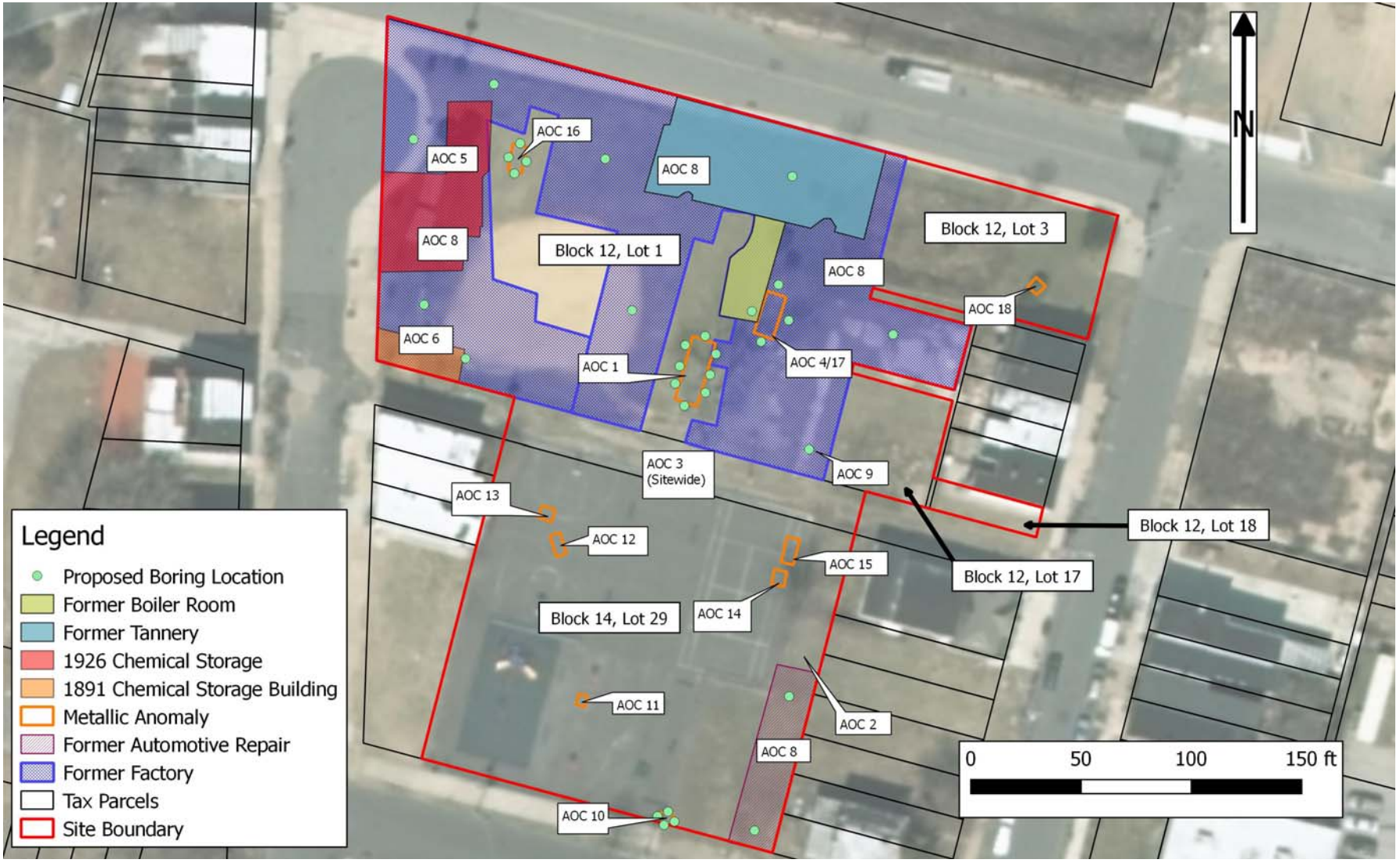

Figure 4.0:

Proposed Boring Location Map

Andujar Park
Erie and Point Street
Block 12, Lots 1, 3, 17 & 18
Block 14, Lot 29
Camden, Camden County, New Jersey 08102

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SCALE	DRAWN BY	DATE
As Shown	DD	8/2018
PROJECT	APP'D BY	DRAWING NO.
18-360	DD	2.0

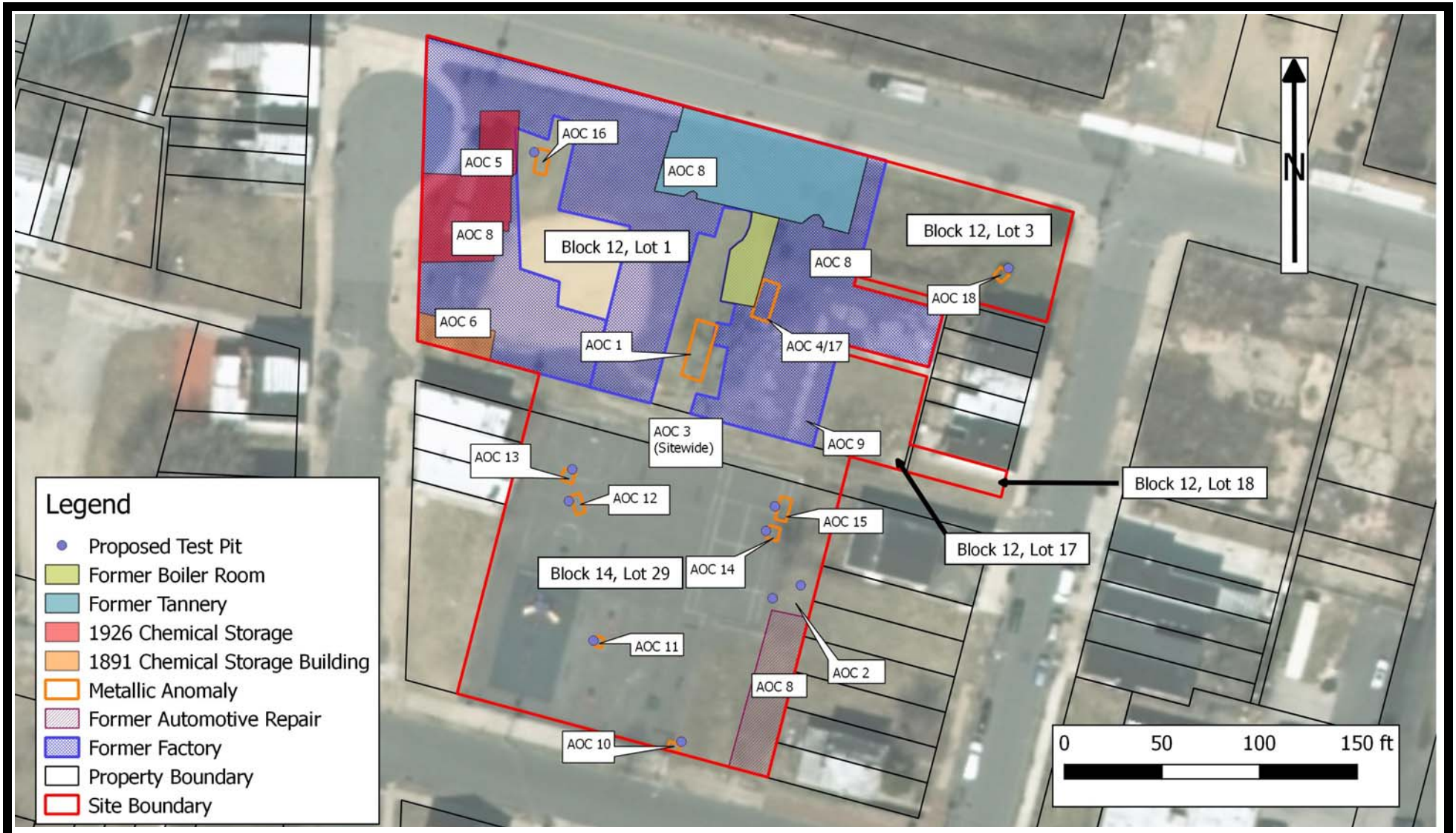

Figure 5.0:

Proposed Test Pit Locations

Andujar Park
Erie and Point Street
Block 12, Lots 1, 3, 17 & 18
Block 14, Lot 29
Camden, Camden County, New Jersey 08102

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SCALE	DRAWN BY	DATE
As Shown	DD	8/2018
PROJECT	APP'D BY	DRAWING NO.
18-360	DD	2.0

Appendix A: Cost Spreadsheet

Site Investigation
Dominick Andujar Park
Camden, NJ

New Jersey Department of Environmental Protection
Site Remediation Program

HDSRF APPLICATION – COST ESTIMATE FORMAT – PART VI

Activity	*Quantity*	*Days*	*Weeks*	*Unit Price*	*Total*
SUB-CONTRACTORS					
Geoprobe/Drilling					
Soil Borings	28	2		$2,300	$4,600
Macrocore sleves	28			$10.80	$302.40
Equipment/Instrument					
Backhoe	1	2		$1,300	$2,600
Material Disposal					
Disposal, Loading, Transportation	1	12		$200	$2,400
Others					
Laboratory Services					
EPH Cat. 1	2			$87	$174
EPH Cat. 2	4			$173	$692
VO including QA/QC	15			$87	$1,305
BN+15 including QA/QC	14			$127	$1,778
PAH including QA/QC	6			$75	$450
PCBs including QA/QC	14			$75	$1,050
TAL METALS including QA/QC	18			$127	$2,286
Organochlorine Pesticides	10			$92	$920
Naphthalene & 2-Methylnaphthalene	2			$75	$150
Waste Classification	1			$700	$700
Subtotal Sub-contractor Costs					$19,407
CONSULTING/ENGINEERING COSTS	**Hours**			**Rate**	**Total**
Test Pit Investigation (10 test pits)					
Environmental Associate II	16			$85	$1,360
Project Manager	4			$95	$380
Soil Boring Investigation (28 soil borings)					
Environmental Associate II	16			$85	$1,360
Environmental Associate I	16			$65	$1,040
Project Manager	4			$95	$380
Field Vehicle	1	2		$50	$100
PID/FID	1	2		$75	$150
Report Preparation					
Clerical/Administrative Support	2			$62	$124
Cad Operator	8			$65	$520
Environmental Associate II	8			$85	$680
Environmental Associate I	20			$65	$1,300
Project Manager	4			$95	$380
Director/LSRP	2			$130	$260
Senior Project Manager	2			$120	$240
Subtotal Consulting/Engineering Costs					$8,274
Subtotal Soil Investigation Costs					**$27,681**

New Jersey Department of Environmental Protection
Site Remediation Program

HDSRF APPLICATION – COST ESTIMATE FORMAT – PART VI

AREAS OF CONCERN SAMPLING PARAMETERS TABLE

Areas of Concern	*EPH Cat. 1*	*EPH Cat. 2*	*TAL Metals*	*VOA*	*BN+10*	*PCB*	*Organochlorine Pesticides*	*Naphthalene & 2-Methylnaphthalene*	*PAH*	*PAH SIM*
AOC 1 Regulated Heating Oil UST	1							1		
AOC 2 Historic Automotive Waste/Scrap Piles		1	1	1	1	1				
AOC 3 Historic Fill Material		1	4	1	1	1	1		4	
AOCs 4 & 17 Former Boiler Room and Reinforced Concrete Pad	1							1		
AOC 5 & 6 Former Chemical Storage Buildings A & B			1	1	1	1	1			
AOC 8 Historical Site Operations			2	2	2	2				
AOC 9 Former Coal Yard			1						1	
AOC 10 Metallic Anomaly #1 (Potential UST)		1	1	1	1	1				
AOC 11, 12, 13, 14 & 15 Metallic Anomalies 2,3,4,5,&6			5	5	5	5				
AOC 16 Metallic Anomaly #7 (potential UST)		1	1	1	1	1				
AOC 18 Metallic Anomaly #10 (potential buried drums)			1	1	1	1				
Groundwater			10	12	10	10	10			10
Total Number of Samples	**2**	**4**	**27**	**25**	**23**	**23**	**12**	**2**	**5**	**10**

Appendix B: Soil Boring Logs

TTI Environmental, Inc.

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BORING LOG

Site Name	Dominick Andujar Park	**Boring ID**	**SB-1**
Address	Pointe and Erie Street	**Permit No**	NA
City	Camden	**Date Drld**	3/27/2019
State	Camden	**Method**	Direct Push
Project No	19-403	**Driller**	Unitech Drilling Company

Depth (feet bgs)	Recovery (feet)	PID (ppm)	DESCRIPTION	REMARKS
1	2.5	0.0	Topsoil	
2		0.0	Black ash and sand	Appears to be consistent with historic fill
3		0.0		
4		0.0		
5		0.0		
6	3.0	0.0	Brown sand. At 8.0 feet, soil is saturated with product	Heavy petroleum odor. Sample SB1 @ 9.0 - 95 feet EPH Category 1
7		0.0		
8		0.0		
9		53.0		
10		NR		
11	3.5	NR	Brown sand with rounded pebbles. Groundwater at 9.0 feet.	Heavy petroleum odor.
12		NR		
13		NR		
14		NR		
15		NR		
16	3.5	NR		
17		NR		
18		NR		
19		NR		
20		NR		

Notes	NR - no reading due to obvious contamination	**bgs**	below ground surface
Casing	5-foot, 2-inch macro-cores with liners	**PID**	photoionization detector
Groundwater Level	9.0 ft.	**ppm**	parts per million

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BORING LOG

Site Name	Dominick Andujar Park	**Boring ID**	**SB-2**
Address	Pointe and Erie Street	**Permit No**	NA
City	Camden	**Date Drld**	3/27/2019
State	Camden	**Method**	Direct Push
Project No	19-403	**Driller**	Unitech Drilling Company

Depth (feet bgs)	Recovery (feet)	PID (ppm)	DESCRIPTION	REMARKS
1	2.0	0.0	**Topsoil**	
2		0.0	**Black ash and sand.**	**Consistent with fill material**
3		0.0		
4		0.0	**Brown sand**	**Brown sand**
5		0.0		
6	0.0	0.0	**No return**	**No return**
7		0.0		
8		0.0		
9		0.0		
10		0.0		

Notes		**bgs**	below ground surface
Casing	5-foot, 2-inch macro-cores with liners	**PID**	photoionization detector
Groundwater Level		**ppm**	parts per million

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BORING LOG

Site Name	Dominick Andujar Park	**Boring ID**	**SB-3**
Address	Pointe and Erie Street	**Permit No**	NA
City	Camden	**Date Drld**	3/27/2019
State	Camden	**Method**	Direct Push
Project No	19-403	**Driller**	Unitech Drilling Company

Depth (feet bgs)	Recovery (feet)	PID (ppm)	DESCRIPTION	REMARKS
1	2.5	0.0	**Topsoil**	
2		0.0	**Black ash and sand.**	**Consistent with fill material**
3		0.0		
4		0.0	**Brown sand**	**Brown sand**
5		0.0		
6	0.0	0.0	**No return**	**No return**
7		0.0		
8		0.0		
9		0.0		
10		0.0		

Notes		**bgs**	below ground surface
Casing	5-foot, 2-inch macro-cores with liners	**PID**	photoionization detector
Groundwater Level		**ppm**	parts per million

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BORING LOG

Site Name	Dominick Andujar Park	**Boring ID**	**SB-4**
Address	Pointe and Erie Street	**Permit No**	NA
City	Camden	**Date Drld**	3/27/2019
State	Camden	**Method**	Direct Push
Project No	19-403	**Driller**	Unitech Drilling Company

Depth (feet bgs)	Recovery (feet)	PID (ppm)	DESCRIPTION	REMARKS
1	0.0	0.0	No return	No return
2		0.0		
3		0.0		
4		0.0		
5		0.0		

Notes		**bgs**	below ground surface
Casing	5-foot, 2-inch macro-cores with liners	**PID**	photoionization detector
Groundwater Level		**ppm**	parts per million

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BORING LOG

Site Name	Dominick Andujar Park	**Boring ID**	**SB-5**
Address	Pointe and Erie Street	**Permit No**	NA
City	Camden	**Date Drld**	3/27/2019
State	Camden	**Method**	Direct Push
Project No	19-403	**Driller**	Unitech Drilling Company

Depth (feet bgs)	Recovery (feet)	PID (ppm)	DESCRIPTION	REMARKS
1	3.5	0.0	**Topsoil**	
2		0.0	**Black ash and sand**	**Appears to be consistent with historic fill**
3		0.0		
4		0.0		
5		0.0		
6	4.0	0.0	**Brown sand. At 7.5 feet, soil is saturated with product**	**Heavy petroleum odor. Sample SB5 @ 9.0 - 95 feet EPH Category 1**
7		0.0		
8		0.0		
9		54.0		
10		36.8		

Notes		**bgs**	below ground surface
Casing	5-foot, 2-inch macro-cores with liners	**PID**	photoionization detector
Groundwater Level		**ppm**	parts per million

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BORING LOG

Site Name	Dominick Andujar Park	**Boring ID**	**SB-6**
Address	Pointe and Erie Street	**Permit No**	NA
City	Camden	**Date Drld**	3/27/2019
State	Camden	**Method**	Direct Push
Project No	19-403	**Driller**	Unitech Drilling Company

Depth (feet bgs)	Recovery (feet)	PID (ppm)	DESCRIPTION	REMARKS
1	3.0	0.0	**Coarse Sand**	
2		0.0	**Brown Sand**	
3		0.0	**Brick and ash**	**Consistent with fill material. Sample SB6 at 4.5 - 5.0 feet TCL/TAL**
4		0.0		
5		0.0		

Notes		**bgs**	below ground surface
Casing	5-foot, 2-inch macro-cores with liners	**PID**	photoionization detector
Groundwater Level		**ppm**	parts per million

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BORING LOG

Site Name	Dominick Andujar Park	**Boring ID**	**SB-7**
Address	Pointe and Erie Street	**Permit No**	NA
City	Camden	**Date Drld**	3/27/2019
State	Camden	**Method**	Direct Push
Project No	19-403	**Driller**	Unitech Drilling Company

Depth (feet bgs)	Recovery (feet)	PID (ppm)	DESCRIPTION	REMARKS
1	3.5	0.0	**Topsoil**	
2		0.0	**Brick and ash layer**	**Consistent with historic fill**
3		0.0		
4		0.0		
5		0.0		
6	3.5	0.0	**Brown coarse sand. Saturated at ~8.5 ft.**	**Sample SB7 at 7.5 - 8.0 feet TCL/TAL** **Sample SB03719 t 7.5 - 8.0 feet TCL/TAL**
7		0.0		
8		0.0		
9		0.0		
10		0.0		

Notes		**bgs**	below ground surface
Casing	5-foot, 2-inch macro-cores with liners	**PID**	photoionization detector
Groundwater Level	~8.5 ft	**ppm**	parts per million

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BORING LOG

Site Name	Dominick Andujar Park	**Boring ID**	**SB-8**
Address	Pointe and Erie Street	**Permit No**	NA
City	Camden	**Date Drld**	3/27/2019
State	Camden	**Method**	Direct Push
Project No	19-403	**Driller**	Unitech Drilling Company

Depth (feet bgs)	Recovery (feet)	PID (ppm)	DESCRIPTION	REMARKS
1	3.5	0.0	**Topsoil**	
2		0.0	**Brown coarse sand. Saturated at ~8.5 ft.**	**Sample SB8 at 7.5 - 8.0 feet TCL/TAL**
3		0.0		
4		0.0		
5		0.0		
6	3.5	0.0		
7		0.0		
8		0.0		
9		0.0		
10		0.0		

Notes		bgs	below ground surface
Casing	5-foot, 2-inch macro-cores with liners	**PID**	photoionization detector
Groundwater Level	~8.5 ft	**ppm**	parts per million

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BORING LOG

Site Name	Dominick Andujar Park	**Boring ID**	**SB-9**
Address	Pointe and Erie Street	**Permit No**	NA
City	Camden	**Date Drld**	3/27/2019
State	Camden	**Method**	Direct Push
Project No	19-403	**Driller**	Unitech Drilling Company

Depth (feet bgs)	Recovery (feet)	PID (ppm)	DESCRIPTION	REMARKS
1	2.5	0.0	**Topsoil**	
2		0.0	**Brown sand.**	**Sampl SB9 at 3.0 - 3.5 TCL/TAL**
3		0.0		
4		0.0		
5		0.0		
6	0.0	0.0	**No Return**	**No Return**
7		0.0		
8		0.0		
9		0.0		
10		0.0		
11	3.5	0.0	**Brown coarse sand. Saturated**	
12		0.0		
13		0.0		
14		0.0		
15		0.0		

Notes		**bgs**	below ground surface
Casing	5-foot, 2-inch macro-cores with liners	**PID**	photoionization detector
Groundwater Level	9.0 ft.	**ppm**	parts per million

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BORING LOG

Site Name	Dominick Andujar Park	**Boring ID**	**SB-10**
Address	Pointe and Erie Street	**Permit No**	NA
City	Camden	**Date Drld**	3/27/2019
State	Camden	**Method**	Direct Push
Project No	19-403	**Driller**	Unitech Drilling Company

Depth (feet bgs)	Recovery (feet)	PID (ppm)	DESCRIPTION	REMARKS
1	3.5	0.0	**Topsoil**	
2		0.0	**Brown coarse sand. Saturated at ~8.5 ft.**	**Sample SB8 at 3.0 - 3.5 feet TCL/TAL**
3		0.0		
4		0.0		
5		0.0		
6	3.5	0.0		
7		0.0		
8		0.0		
9		0.0		
10		0.0		

Notes			
Casing	5-foot, 2-inch macro-cores with liners	**bgs**	below ground surface
Groundwater Level	~8.5 ft	**PID**	photoionization detector
		ppm	parts per million

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BORING LOG

Site Name	Dominick Andujar Park	**Boring ID**	**SB-11**
Address	Pointe and Erie Street	**Permit No**	NA
City	Camden	**Date Drld**	3/27/2019
State	Camden	**Method**	Direct Push
Project No	19-403	**Driller**	Unitech Drilling Company

Depth (feet bgs)	Recovery (feet)	PID (ppm)	DESCRIPTION	REMARKS
1	3.5	0.0	**Topsoil**	
2		0.0	**Brown coarse sand. Saturated at ~5.5 ft.**	**Sample SB11 at 4.0 - 4.5 feet TCL/TAL**
3		0.0		
4		0.0		
5		0.0		
	0.5	0.0		

Notes		**bgs**	below ground surface
Casing	5-foot, 2-inch macro-cores with liners	**PID**	photoionization detector
Groundwater Level	~5.5 ft	**ppm**	parts per million

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BORING LOG

Site Name	Dominick Andujar Park	**Boring ID**	**SB-12**
Address	Pointe and Erie Street	**Permit No**	NA
City	Camden	**Date Drld**	3/27/2019
State	Camden	**Method**	Direct Push
Project No	19-403	**Driller**	Unitech Drilling Company

Depth (feet bgs)	Recovery (feet)	PID (ppm)	DESCRIPTION	REMARKS
1	1.5	0.0	**Topsoil**	
			Fill Material	
2		0.0	**Brown sand. Saturated at ~10.5 ft. Soil is stained with petroleum at ~5.5 ft.**	**Heavy petroleum odor resent. Sample SB12 @ 9.5 - 10.0 TCL/TAL**
3		0.0		
4		0.0		
5		2.2		
6	2.0	-		
7		-		
8		-		
9		-		
10		-		
11	3.0	NR		
12		32.1		
13		23.6		
14		28.7		
15		27.3		

Notes	NR - no reading due to presence of groundwater	**bgs**	below ground surface
Casing	5-foot, 2-inch macro-cores with liners	**PID**	photoionization detector
Groundwater Level	9.0 ft.	**ppm**	parts per million

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BORING LOG

Site Name	Dominick Andujar Park	**Boring ID**	**SB-13**
Address	Pointe and Erie Street	**Permit No**	NA
City	Camden	**Date Drld**	3/27/2019
State	Camden	**Method**	Direct Push
Project No	19-403	**Driller**	Unitech Drilling Company

Depth (feet bgs)	Recovery (feet)	PID (ppm)	DESCRIPTION	REMARKS
1	2.0	0.0	Topsoil	
2		0.0	Fill Material	
3		0.0		
4		0.0		
5		0.0		
6	3.0	0.0	Brown sand. Saturated at ~9.5 ft., saturated at 10 ft.	
7		0.0		
8		0.0		
9		0.0		
10		0.0		
11	3.5	0.0		
12		0.0		
13		0.0		
14		0.0		
15		0.0		

Notes			
Casing	5-foot, 2-inch macro-cores with liners	**bgs**	below ground surface
Groundwater Level	10.0 ft.	**PID**	photoionization detector
		ppm	parts per million

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BORING LOG

Site Name	Dominick Andujar Park	**Boring ID**	**SB-14**
Address	Pointe and Erie Street	**Permit No**	NA
City	Camden	**Date Drld**	3/27/2019
State	Camden	**Method**	Direct Push
Project No	19-403	**Driller**	Unitech Drilling Company

Depth (feet bgs)	Recovery (feet)	PID (ppm)	DESCRIPTION	REMARKS
1	2.5	0.0	**Topsoil**	
			Fill Material, brick ash and clay	
2		0.0		
3		0.0		
4		0.0		
5		0.0		
6	2.5	0.0		
7		0.0		
8		0.0		
9		0.0		
10		0.0		
11	4.0	0.0		
12		0.0		
13		0.0		
14		0.0		
15		0.0		

Brown sand, moist at ~9.5 ft., saturated at ~10.0 ft.

Notes		bgs	below ground surface
Casing	5-foot, 2-inch macro-cores with liners	**PID**	photoionization detector
Groundwater Level	10.0 ft.	**ppm**	parts per million

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BORING LOG

Site Name	Dominick Andujar Park	**Boring ID**	**SB-15**
Address	Pointe and Erie Street	**Permit No**	NA
City	Camden	**Date Drld**	3/27/2019
State	Camden	**Method**	Direct Push
Project No	19-403	**Driller**	Unitech Drilling Company

Depth (feet bgs)	Recovery (feet)	PID (ppm)	DESCRIPTION	REMARKS
1	3.0	0.0	**Topsoil**	
			Fill Material, brick ash and clay	
2		0.0	**Brown silty sand**	
3		0.0		
4		0.0		
5		0.0		
6	3.0	0.0	**Brown soarse sand with rounded pebbles**	
7		0.0		
8		0.0		
9		0.0		
10		0.0		

Notes		bgs	below ground surface
Casing	5-foot, 2-inch macro-cores with liners	**PID**	photoionization detector
Groundwater Level		**ppm**	parts per million

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BORING LOG

Site Name	Dominick Andujar Park	**Boring ID**	**SB-16**
Address	Pointe and Erie Street	**Permit No**	NA
City	Camden	**Date Drld**	3/27/2019
State	Camden	**Method**	Direct Push
Project No	19-403	**Driller**	Unitech Drilling Company

Depth (feet bgs)	Recovery (feet)	PID (ppm)	DESCRIPTION	REMARKS
1	3.0	0.0	**Topsoil**	
2		0.0	**Brown silty sand**	
3		0.0		
4		0.0		
5		0.0		
6	3.0	0.0	**Brown soarse sand with rounded pebbles. Groundwater at ~9.5 ft.**	**Sample SB16 at 8.5 - 9/0 ft. TCL/TAL**
7		0.0		
8		0.0		
9		0.0		
10		0.0		

Notes		**bgs**	below ground surface
Casing	5-foot, 2-inch macro-cores with liners	**PID**	photoionization detector
Groundwater Level	~9.5 ft	**ppm**	parts per million

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BORING LOG

Site Name	Dominick Andujar Park	**Boring ID**	**SB-17**
Address	Pointe and Erie Street	**Permit No**	NA
City	Camden	**Date Drld**	3/27/2019
State	Camden	**Method**	Direct Push
Project No	19-403	**Driller**	Unitech Drilling Company

Depth (feet bgs)	Recovery (feet)	PID (ppm)	DESCRIPTION	REMARKS
1	2.5	0.0	**Topsoil**	
2		0.0		
3		0.0	**Fill Material, brick ash and clay**	
4		0.0		
5		0.0		
6	3.0	0.0		
7		0.0		
8		0.0	**Brown sand, saturated at ~9.5 ft.**	**Sample SB17 at 8.5 - 9.0 EPH Cat. 2**
9		0.0		
10		0.0		

Notes		**bgs**	below ground surface
Casing	5-foot, 2-inch macro-cores with liners	**PID**	photoionization detector
Groundwater Level		**ppm**	parts per million

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BORING LOG

Site Name	Dominick Andujar Park	**Boring ID**	**SB-18**
Address	Pointe and Erie Street	**Permit No**	NA
City	Camden	**Date Drld**	3/27/2019
State	Camden	**Method**	Direct Push
Project No	19-403	**Driller**	Unitech Drilling Company

Depth (feet bgs)	Recovery (feet)	PID (ppm)	DESCRIPTION	REMARKS
1	2.5	0.0	**Topsoil**	
2		0.0		
3		0.0	**Fill Material, brick ash and clay**	
4		0.0		
5		0.0		
6	3.0	0.0		
7		0.0		
8		0.0	**Brown sand, saturated at ~9.5 ft.**	
9		0.0		
10		0.0		

Notes		**bgs**	below ground surface
Casing	5-foot, 2-inch macro-cores with liners	**PID**	photoionization detector
Groundwater Level		**ppm**	parts per million

TTI Environmental, Inc.

1253 N. Church St., Moorestown, New Jersey 08057

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Fax: 856.840.8814

BORING LOG

Site Name	Dominick Andujar Park	**Boring ID**	**SB-19**
Address	Pointe and Erie Street	**Permit No**	NA
City	Camden	**Date Drld**	3/27/2019
State	Camden	**Method**	Direct Push
Project No	19-403	**Driller**	Unitech Drilling Company

Depth (feet bgs)	Recovery (feet)	PID (ppm)	DESCRIPTION	REMARKS
1	2.5	0.0	**Topsoil**	
2		0.0		
3		0.0	**Fill Material, brick ash and clay**	
4		0.0		
5		0.0		
6	3.0	0.0		
7		0.0		
8		0.0	**Brown sand, saturated at ~9.5 ft.**	**Sample SB19 at 8.5 - 9.0 ft. TCL/TAL**
9		0.0		
10		0.0		

Notes		**bgs**	below ground surface
Casing	5-foot, 2-inch macro-cores with liners	**PID**	photoionization detector
Groundwater Level		**ppm**	parts per million

TTI Environmental, Inc.

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BORING LOG

Site Name	Dominick Andujar Park	**Boring ID**	**SB-20**
Address	Pointe and Erie Street	**Permit No**	NA
City	Camden	**Date Drld**	3/27/2019
State	Camden	**Method**	Direct Push
Project No	19-403	**Driller**	Unitech Drilling Company

Depth (feet bgs)	Recovery (feet)	PID (ppm)	DESCRIPTION	REMARKS
1	3.0	0.0	**Topsoil**	
2		0.0	**Brown sand**	**Sample SB 20 at 2.0 - 2.5 ft. EPH Cat. 1**
3		0.0		
4		0.0		
5		0.0		

Notes		**bgs**	below ground surface
Casing	5-foot, 2-inch macro-cores with liners	**PID**	photoionization detector
Groundwater Level	~9.5 ft	**ppm**	parts per million

Appendix C: Quality Assurance Project Plan (QAPP)

Quality Assurance Project Plan (QAPP) for the

Site Investigation (SI)

At the Dominick Andujar Park Site

Camden, Camden County, New Jersey

January 2019

Prepared for:

Mr. James Harveson
Camden Redevelopment Agency
520 Market Street, Suite 1300
Camden, New Jersey 08102

Mr. Adly Michael
Quality Assurance Officer
US EPA

Prepared by:

TTI ENVIRONMENTAL, INC.
1253 North Church Street
Moorestown, NJ 08057

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Figures and Appendices

Dominick Andujar Park Quality Assurance Project Plan (QAPP)
Project Name/Property Name: Dominick Andujar Park
Property/Site Location: Erie and Point Streets; Block 12, Lots 1, 3, 17 & 18, Block 14, Lot 29, Camden, Camden County, New Jersey
Revision Number: N/A
Revision Date: N/A

Brownfields Cooperative Agreement Number:_____

Camden Redevelopment Agency
Brownfields Recipient

TTI Environmental, Inc.
Prepared by: Andrew Basehoar, P.G., Project Manager
1253 North Church Street, Moorestown, NJ 08057
andyb@ttienv.com
610-334-4414

4 January 2019
Preparation Date (Day/Month/Year)

Brownfields Recipient Program Manager: _____
Signature

James Harveson, Camden Redevelopment Agency
Printed Name/Organization/Date

Environmental Consultant Quality Assurance Officer: (QAO)

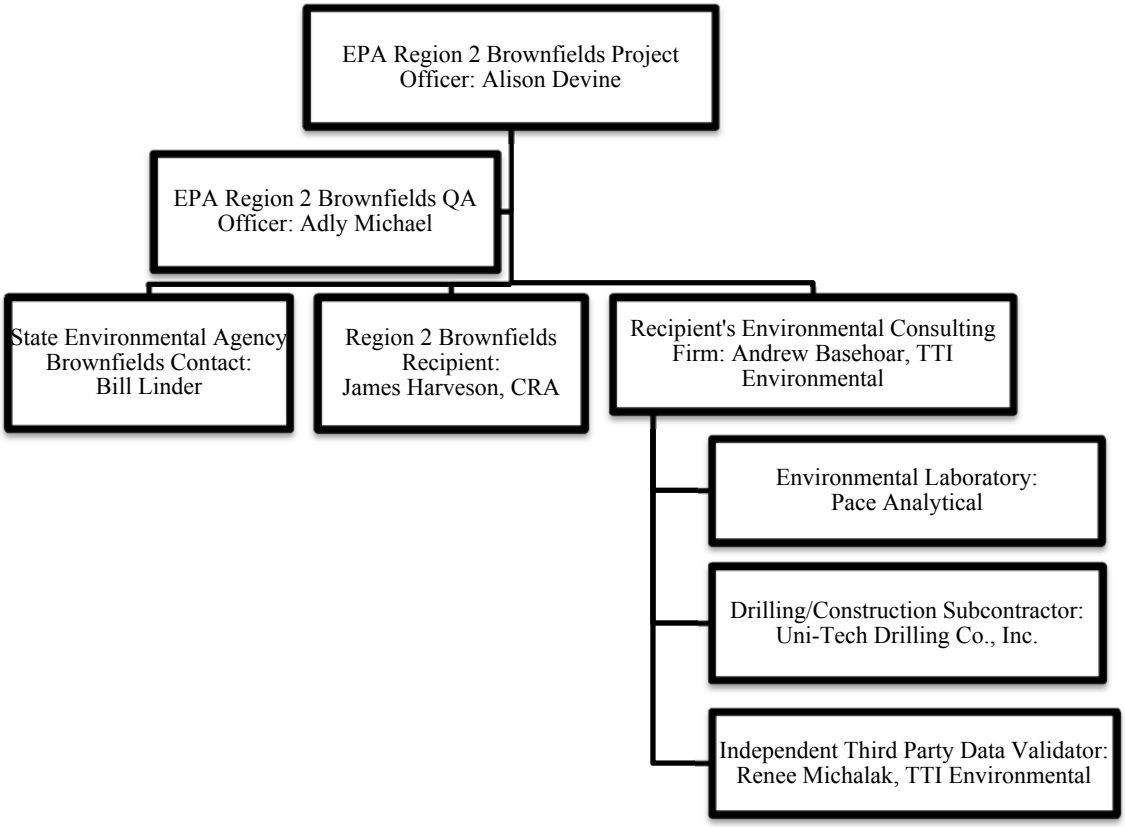
Signature

Andrew Basehoar, P.G., TTI Environmental, Inc.
Printed Name/Organization/Date

EPA Region 2 Brownfields Project Officer: _____
Signature

Alison Devine, EPA Region 2 Brownfields Project Officer
Printed Name/Organization/Date

WORKSHEET #2A PROJECT ORGANIZATIONAL CHART



WORKSHEET #2B PERSONNEL RESPONSIBILITIES

Personnel Responsibilities				
Name	**Title**	**Telephone Number**	**Organizational Affiliation**	**Responsibilities**
Andrew Basehoar	Project Manager	610-334-4414	TTI Environmental, Inc.	Project Management, oversight of sampling operations
David DiPascale	Environmental Associate II	856-840-8800	TTI Environmental, Inc.	Field investigation and sampling team leader
Alec Halbruner	Environmental Associate I	856-840-8800	TTI Environmental, Inc.	Field Sampling Technician
Anna Ternova	Environmental Associate I	856-840-8800	TTI Environmental, Inc.	Field Sampling Technician
James Harveson	Director of Economic Development		Camden Redevelopment Agency	Project oversight
Bill Linder	State Brownfields Contact	609-292-1251	NJDEP	Brownfield Redevelopment
Alison Devine	EPA Brownfields Project Officer (BPO)		EPA Region 2	Brownfields project oversight
Adly Michael	EPA Brownfields Quality Assurance Officer (QAO)		EPA Region 2	Brownfields quality assurance
Alan Harvill	Environmental Laboratory Contact	615-773-9787	Name of Environmental Laboratory	Laboratory Project Manager
Renee Michalak	Environmental Associate II Third Party Data Validator[2]	856-840-8800	TTI Environmental, Inc.	Data validation (independent from project)

WORKSHEET #3A PROBLEM DEFINITION/PROJECT DESCRIPTION

PROBLEM DEFINITION

The subject site consists of approximately 1.54 acres. The subject site currently operates as Dominick Andujar Park. The subject site formerly operated as several industrial uses including boat building, bottling, and leather tanning, from prior to 1885 until the 1970s on the northern portion, and automotive repair operations from the 1920s until the 1990s on the southern portions. A total of 18 Areas of Concern (AOCs) were identified and further investigation was recommended for 17 AOCs. Camden Redevelopment Agency (CRA) wishes to investigate the AOCs in order to protect the environment and human health of users of the park.

PROJECT DESCRIPTION

Site Location and Description

The subject site is located in a mixed use industrial and residential portion of Camden, New Jersey. The subject site is an irregularly shaped, approximately 1.6-acre parcel identified by the City of Camden as Block 12, Lots 1, 3, 17 and 18 and Block 14, Lot 29 (the five (5) adjoining lots shall be identified as the "subject site"). The subject site is enclosed by four (4) streets; Point Street to the west, Erie Street to the north, York Street to the south and North Front Street to the east. Block 12 and Block 14 are separated by an alley (North Street).

Block 14, Lot 29 includes an approximately 0.45-acre playground and park on the western portion. The remaining 0.05 acres is unimproved vegetated land on the southeastern corner. Block 12, Lot 1 includes an approximately 0.56-acre baseball field on the western portion, with the remaining approximately 0.25 acres being unimproved vegetated land and debris from historic site operations. Block 12, Lot 3 (approximately 0.15 acres), 17 (approximately 0.06 acres), and 18 (approximately 0.02 acres) are all unimproved vegetated parcels. A stormwater basin overgrown with vegetation is also located on Block 12, Lot 3. A regional site location map is included as **Figure 1.0**, a parcel map is included as **Figure 2.0**, and area of concern map is included as **Figure 3.0**.

There are currently 17 AOCs identified at the subject site for which site investigation has been recommended. Site investigation activities shall include a combination of installation and sampling from test pits, and installation and sampling of soil borings. Proposed soil borings are displayed on **Figure 4.0** and test pit locations are displayed in **Figure 5.0.**

Previous geophysical surveys of the site indicate metallic anomalies are near surface. Therefore, test pits shall be installed using a backhoe with capability to excavate to approximately 10 to 12 feet below grade. Soils excavated during test pit installation shall be temporarily stockpiled adjacent to the test pit on plastic sheeting. Soils shall be continuously observed during test pit installation by an Environmental Scientist or Field Geologist and logged for soil type. Soils shall also be screened using a calibrated Photoionization Device (PID). Soil samples shall be collected at appropriate depths depending on field observations and screening. Soil samples shall be collected in laboratory supplied bottleware, immediately placed in coolers with ice and

transferred to the laboratory under proper chain of custody protocols. Following excavation and soil sampling, each test pit shall be backfilled with material removed from the test pit during excavation. Test pits shall be compacted to the best ability of the backhoe.

Soil borings shall be installed using hydraulic direct push (Geoprobe) techniques where a five (5)-foot by two (2)-inch diameter hollow stainless steel macrocore sampler is driven into the subsurface. Soil will be returned to the surface in dedicated acetate liners. Macrocores shall be advanced in five (5) foot sections to the soil/groundwater interface, or 15 feet below grade if no evidence of contamination is detected. Soil boring installations shall be continuously observed by an Environmental Scientist or Field Geologist and logged for soil type. Soils shall also be screened using a calibrated PID. In an effort to conduct the Site Investigation in a cost-effective manner, soil samples shall be collected at locations that exhibit the highest degree of contamination during field screening activities. Soil samples shall be collected in laboratory supplied bottleware, immediately placed in coolers with ice and transferred to the laboratory under proper chain of custody protocols. Following logging and sampling of soils, borehole shall be backfilled with cuttings from the soil cores and sealed at the surface with top soil, cold patch asphalt or concrete.

TTI proposes the collection of 31 soil samples through the installation of 28 soil borings and 10 test pits. Contaminants of concern include petroleum products, polycyclic aromatic hydrocarbons (PAHs), heavy metals, volatile organic compounds (VOCs), base/neutral semi-volatile organic compounds (B/Ns), polychlorinated biphenyls (PCBs), and organochlorine pesticides. All samples shall be analyzed by Pace Analytical Laboratories of Mt. Juliet, Tennessee (NJDEP Cert. No. TN002). Below is a proposed sampling schedule. TTI proposes to install soil borings in areas with a known AOC (i.e. AOC 1 has a known UST); any location with an unknown feature or a feature that requires further investigation shall have a test pit and borings collected. The AOC Map is included as **Figure 3.0**. The test pit and soil boring location maps are included as **Figure 4.0** and **Figure 5.0**, respectively.

TTI notes that no groundwater investigations are proposed at this time. A groundwater investigation shall be triggered if any soil exceedances are identified. TTI proposes the installation of permanent monitoring wells should a groundwater investigation be necessary. A revised QAPP will be submitted if a groundwater investigation becomes necessary.

Site History

The northern portion of the subject site has operated as several industrial operations from at least 1885 until the 1970s. Specific operations included England Walton & Co. (~1895 – 1920), McNeely Co. (1920 – 1926) and Allied Kid Company (1926 – 1970). These operations included leather tanning and suede manufacturing and were predominately conducted in the north-central portion of the property. Also operating on the northwestern portion of the property was Kensington Boat & Ferry Co. (1874 - ~1895) and WM Lusk Bottling Works (~1895 – 1920). These operations appear to have included anchor and boat building operations, as well as bottle storage and manufacturing. In 1920, the tannery operation appears to have included the northwestern portion of the property and utilized the buildings for chemical storage until 1977. In 1977, the City of Camden purchased the northern portion of the subject site and constructed a recreational baseball field.

The remainder of the subject site, which includes the southern and northeastern portions, historically operated as residential row homes. An automotive repair operation also operated on the southeastern portion of the subject site from approximately 1926 until approximately 1994. All buildings, including residential homes and the automotive repair were demolished by the mid-1990s. A playground was constructed on the southern portion of the subject site in 1988.

PROJECT DECISION STATEMENTS

A recreational park is planned for the subject site. If contaminants of concern are detected in soil sample data above the New Jersey Department of Environmental Protection (NJDEP) Residential and/or Non-Residential Direct Contact Soil Remediation Standards (DCSRS), then it can be concluded the site is not clean, additional remedial investigation shall be required and a cleanup remedy shall be performed to protect human health and the environment.

If contaminants of concern are detected in soil sample data above the NJDEP Impact to Groundwater Soil Screening Levels (IGWSSL), then a groundwater investigation must be conducted in order to determine the presence of groundwater contamination to protect offsite receptors.

WORKSHEET #3B PROJECT QUALITY OBJECTIVES/SYSTEMATIC PLANNING PROCESS STATEMENTS

Overall project objectives include:
The overall objective of this soil sampling event is to determine if contaminants of concern are below the NJDEP Residential/Non-Residential Soil Remediation Standards at the site. Samples will be collected and evaluated in accordance with the following (at a minimum):

- NJDEP Field Sampling Guide, August 2005
- Technical Requirements for Site Remediation, NJAC 7:26E, Adopted May 7, 2012
- Site Remediation Reform Act (SRRA), NJSA 58:10C-1 et seq
- Brownfield and Contaminated Sites Act (Brownfield Act)
- Spill Compensation and Control Act (Spill Act)
- Industrial Site Recovery Act (ISRA)
- Administrative Requirements for the Remediation of Contaminated Sites (ARRCS), NJAC 7:26C, last amended May 7, 2012
- Underground Storage Tank Rules, NJAC 7:14B, amended May 7, 2012
- Remediation Standards, NJAC 7:26D, last amended May 7, 2012
- General Site Remediation Program (SRP) Guidance Documents, http://www.nj.gov/dep/srp/guidance

Who will use the data?
Data will be used by the EPA Region 2 Brownfields Recipient (CRA) and TTI.

What will the data be used for?
Data will be used by the EPA Region 2 Brownfields Recipient (CRA) to determine if remedial investigation is necessary.

What types of data are needed?
- Physical observation of site subsurface conditions
- Field screening using a photoionization detector for detection of VOCs
- Discrete sampling for laboratory analysis of soil samples collected from AOCs exhibiting obvious signs of contamination (potential USTs, metallic anomalies, non-native [historic] fill material, former coal storage areas). The following analyses will be completed: TCL volatile (method 8260) and semivolatile organics (method 8270), pesticides (method 8081), PCBs (method 8082) and Total Analyte List metals (method 610/7471).
- QA samples including blind duplicates, equipment blanks, field blanks, and trip blanks analyzed for one or more of TCL volatile (method 8260) and semivolatile organics (method 8270), pesticides (method 8081), PCBs (method 8082) and Total Analyte List metals (method 610/7471), collected in accordance with the requirements stated in this QAPP.

How "good" do the data need to be in order to support the environmental decision?
The data will be compared to NJDEP Residential and/or Non-Residential Direct Contact Soil Remediation Standards (DCSRS) and Impact to Groundwater Soil Screening Levels (IGWSSL); the data must be of sufficient quality to allow for this comparison. The quality of data is

determined by establishing criteria for performance measures that include precision, accuracy/bias, sensitivity (quantitation limit), data comparability, representativeness, and completeness. Please refer to **Worksheet #5d**.

How much data are needed?
TTI has proposed the collection of:

- 31 soil samples analyzed for TCL volatile (method 8260) and semivolatile organics (method 8270), pesticides (method 8081), PCBs (method 8082) and Total Analyte List metals (method 610/7471
- QA samples including blind duplicates, instrument blanks, field blanks, and trip blanks analyzed for one or more of TCL volatile (method 8260) and semivolatile organics (method 8270), pesticides (method 8081), PCBs (method 8082) and Total Analyte List metals (method 610/7471), collected in accordance with the requirements stated in this QAPP.

Where, when, and how should the data be collected/generated?
Test pit locations are displayed on **Figure 4.0** and soil boring locations are depicted on **Figure 5.0**. Soil samples shall be collected immediately following installation of test pits and soil borings in order to eliminate volatilization of VOCs to the atmosphere. The Site Investigation is planned to be conducted during the first quarter of 2019.

Who will collect and generate the data?
TTI Environmental shall collect the soil samples.

How will the data be reported?
TTI will summarize and present the data as components of the final reports. All data will be reported in laboratory reports generated by Pace Analytical and tables generated by TTI Environmental. Electronic data deliverables shall also be generated by Pace Analytical and submitted to NJDEP.

How will the data be archived?
Data will be archived on Pace Analytical's online data servers, on TTI Environmental's servers, in electronic deliverable to CRA, and NJDEP's records.

WORKSHEET #4 PROJECT SCHEDULE/TIMELINE

Activities	Organization	Dates (MM/DD/YY)		Deliverable	Deliverable Due Date
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
Preparation of QAPP	TTI Environmental	12/17/2018	12/28/2018	QAPP	1/4/2019
Review of QAPP	Alison Devine Adly Michael	1/2/2019	2/1/2019	Approved QAPP by EPA Region BPO	2/4/2019
Preparation of Health and Safety Plan	TTI Environmental	1/14/2019	1/21/2019	HASP	1/21/2019
Procurement of Equipment	TTI Environmental	2/1/2019	2/5/2019	N/A	N/A
Laboratory Request	TTI Environmental	2/1/2019	2/5/2019	N/A	N/A
Field Reconnaissance/Access	TTI Environmental	2/6/2019	2/6/2019	N/A	N/A
Collection of Field Samples	TTI Environmental	2/6/2019	2/8/2019	N/A	N/A
Laboratory Package Received	TTI Environmental	2/18/2019	2/22/2019	Unvalidated data package	N/A
Validation of Laboratory Results	TTI Environmental	2/25/2019	3/1/2019	Validated data Packages	N/A
Data Evaluation/ Preparation of Final Report	TTI Environmental	2/11/2019	3/15/2019	Final Report	3/15/2019

WORKSHEET #5A SAMPLING METHODS AND LOCATIONS

All site locations that will be sampled are provided below. TTI notes that AOC7 is identified as "Electrical Transformers and Capacitors," which are two (2) pole mounted transformers on the southern portion of the subject site. No evidence of leaks or spills were observed at the base of the transformers; therefore, no further action was recommended.

Matrix	Sampling Location(s)	Depth (*feet*)	Analytical Group[1]	No. of Samples (*identify field duplicates*)	Sampling SOP Reference	Rationale for Sampling Location
Soil	AOC 1 Regulated Heating Oil Underground Storage Tank (UST) (Metallic Anomaly #8)	13 ft	EPH Cat 1, contingent Naphthalene & 2-Methylnaphthanele for EPH over 1,000 mg/kg	8 (1) – soil borings	NJAC 7:26	Below depth of UST invert. In accordance with NJDEP's Technical Guidance for Investigation of Underground Storage Tank Systems, July 31, 2012. Six (6) borings shall be installed along the side walls and two (2) shall be at each end. Soils shall be sampled for EPH category 1 with 25% of samples with EPH over 1,000 mg/kg expanded for naphthalene and 2-methyl naphthalene (assumed to have contained No. 2 heating oil).
Soil	AOC 2 Historic Automotive Waste/Scrap Piles	5	EPH Cat 2, 25% of samples with EPH detected analyzed for VOCs, SVOCs, PCBs, TAL Metals	1 – test pit	NJAC 7:26	Historic automotive waste/scrap piles. Installation of two (2) test pits to identify any buried debris associated with former automotive operations. Samples shall be analyzed for EPH Cat 2, with 25% of samples with EPH detected analyzed for VOCs, SVOCs, PCBs, TAL Metals, per NJDEP Table 2-1.
Soil	AOC 3 (sitewide where encountered) Historic Fill	2-10	PAH, TAL Metals; EPH Cat.2 with full TAL/TCL analysis	4 – evaluated during investigation of other AOCs	NJAC 7:26	Historic fill. Assumed to be site-wide. Based on boring and test pit observations, TTI shall select four (4) samples to be analyzed for PAHs, metals and EPH Category 2, with 25% of samples analyzed for TCL/TAL, per NJDEP *Historic Fill Technical Guidance,* April 29, 2013.
Soil	AOC 4 &17 Former Boiler Room	4	EPH Cat. 1, EPH above 1,000mg/kg analyzed for Naphthalene & 2-Methylnaphthalene	1 – soil borings	NJAC 7:26	Former boiler house and reinforced concrete pad. Selected based on the findings of the geophysical survey and historic Sanborn maps. Assumed to be associated with AOC 1, therefore utilized No. 2 heating oil to heat the former building. Analyze sample with evidence of contamination for EPH category 1 with 25% of samples with EPH over 1,000 mg/kg expanded for naphthalene and 2-methyl naphthalene.
Soil	AOC 5 & 6 Former Chemical Storage Building A (1189 & 1926)	5-15	Full TAL/TCL analysis	2 - soil borings	NJAC 7:26	Former chemical storage buildings A & B. Identified from historic Sanborn maps, chemicals stored in the buildings is unknown. Collect to evaluate historic releases. Sample for full TCL/TAL.
Soil	AOC 8 Historic Site Operations	2-15	Full TAL/TCL analysis	6 (1) – soil borings	NJAC 7:26	Historical site operations (tannery). Collect within the former tannery areas to evaluate historic releases associated with former operations. Chemicals historically utilized are unknown. Sample for full TCL/TAL

Matrix	Sampling Location(s)	Depth (*feet*)	Analytical Group[1]	No. of Samples (*identify field duplicates*)	Sampling SOP Reference	Rationale for Sampling Location
Soil	AOC 9 Former Coal Yard	0-1	PAH, TAL Metals	1 – surficial soil sample	NJAC 7:26	Former coal yard. Identified in historic Sanborn maps. No coal is assumed to have been buried. Samples shall be analyzed for PAHs and metals.
Soil	AOC 10 Metallic Anomaly #1	8	EPH Cat 2, 25% of samples with EPH detected analyzed for VOCs, SVOCs, PCBs, TAL Metals	1 – soil borings and test pits	NJAC 7:26	Below potential UST invert. Appears to be consistent with an UST; a test pit shall be installed to confirm the anomaly is an UST. Soil borings shall be installed to determine if contamination is present. Assumed to have been a No. 2 heating oil UST. Soils shall be sampled for EPH category 1 with 25% of samples with EPH over 1,000 mg/kg expanded for naphthalene and 2-methyl naphthalene
Soil	AOC 11, 12, 13, 14, & 15 Metallic Anomaly #2 – 6	2-10	Full TAL/TCL	5(1) – test pits	NJAC 7:26	Unknown metallic anomalies. All were near surface metallic anomalies. Test pits shall determine what the anomalies are. TTI shall analyze soils that show obvious signs of contamination. Samples shall be analyzed for full TCL/TAL.
Soil	AOC 16 Metallic Anomaly #2 – 6	8	EPH Cat 2, 25% of samples with EPH detected analyzed for VOCs, SVOCs, PCBs, TAL Metals	1 – soil borings and test pits	NJAC 7:26	Below potential UST invert. Appears to be consistent with an UST; a test pit shall be installed to confirm the anomaly is an UST. Soil borings shall be installed to determine if contamination is present. Assumed to have been a No. 2 heating oil UST. Soils shall be sampled for EPH category 1 with 25% of samples with EPH over 1,000 mg/kg expanded for naphthalene and 2-methyl naphthalene
Soil	AOC 18 Metallic Anomaly #10	6	Full TAL/TCL analysis	1(1) – test pits	NJAC 7:26	Below potential buried drums. Appears to be consistent with buried drums; material would be unknown. Install one (1) test pit to determine the nature of the anomaly. Collect one (1) sample for full TCL/TAL.

The following procedures will be performed during collection of soil samples:

1. TTI shall screen all soils with a calibrated PID. Soils collected via a Geoprobe shall be screened at half foot intervals. Sample depths shall be selected based on evidence of contamination (i.e. elevated PID response, staining, odor, etc.).
2. Grab samples shall be collected from dedicated macrocores or decontaminated stainless steel trowels (depending on soil boring, test pit or surficial sample, see above table) and transferred into the appropriate laboratory supplied containers.
3. Sample jars will be labeled with the following information: project name, project number, location identification, sample depth interval, date and requested analysis. This information will also be recorded in the field log book.
4. All laboratory samples will be stored in an ice-packed cooler to maintain samples at 4^{o}C.
5. Duplicate soil samples for will be collected at a rate of 5 percent (%) per sample batch or one minimum per day, whichever is larger. Equipment blanks will be collected at a rate of 5% per sample batch or one minimum per day, whichever is larger. TTI will also provide the laboratory with sufficient aliquots of soil at a rate of 5% per sample batch or one minimum per day (whichever is larger) to serve as laboratory matrix spike/matrix spike duplicate (MS/MSD) samples for site-specific matrix interference assessment. All sample spiking will be performed by the laboratory.

WORKSHEET #5B ANALYTICAL METHODS AND REQUIREMENTS

TTI will provide on-site screening of soil samples while off-site laboratory analytical work will be provided by Pace Analytical of Mt. Juliet, Tennessee (NJDEP Certification No. TN002). Samples shall be collected by a laboratory courier and shipped to the laboratory for analysis.

Matrix	**Analytical Group**	**Concentration Level**	**Analytical & Preparation Method/ SOP Reference**	**Sample Volume**	**Containers (*number, size, type*)**	**Preservation Requirements (*chemical, temperature, light protected)***	**Maximum Holding Time (*preparation/ analysis)***
Soil	VOCs	Low/med	SW-846 Method 8260 Volatile Organic Compounds by GC/MS (EPA8260B,8260C, 624, 624.1 And SM6200B), Document No. 330363, Revision date January 2, 2018 R25	30 grams sample, 2oz %wt	(3) 40 ml VOA vials, 1 2 oz. jar	(2) sodium bicarbonate vials, (1) methanol vial, cool to 4°C	14 days
Soil	B/Ns	Low/med	Method 8270 Semi-Volatile Organic Compounds by GC/MS (EPA Methods 8270C, 8270D 625, 625.1 and SM6410B), Including Provisions for Analysis in SIM Mode, Document No. 330345, date March 22, 2018 R26	4 oz.	4 oz. jar	No preservative, cool to 4°C	14 days
Soil	PAHs	Low/med	Method 8270 Semi-Volatile Organic Compounds by GC/MS (EPA Methods 8270C, 8270D 625, 625.1 and SM6410B), Including Provisions for Analysis in SIM Mode, Document No. 330345, date March 22, 2018 R26	4 oz.	4 oz. jar	No preservative, cool to 4°C	14 days
Soil	TAL Metals	Low/med	Method 6010/7471 Mercury in Solid Waste (Cold-Vapor Technique) (EPA Methods 7471A & 7471B), Document No. 340384B, Revision date January 27, 2018 R13 Determination of Metals and Trace Elements in Various Matrices by ICP-AES (EPA Methods 6010B, 6010C, 6010D, [ICP-OES], and 200.7) Including Hardness (EPA Methods 200.7 and 6010B/C/D and SM2340 B), Document No. 340386, date September 10, 2018 R21	2 oz.	2 oz. jar	No preservative, cool to 4°C	Method 6010 – 180 days Method 7471 – 28 days

Matrix	Analytical Group	Concentration Level	Analytical & Preparation Method/ SOP Reference	Sample Volume	Containers (*number, size, type*)	Preservation Requirements (*chemical, temperature, light protected*)	Maximum Holding Time (*preparation/ analysis*)
Soil	PCBs	Low/med	Method 8082 Polychlorinated Biphenyls (PCBs) by Gas Chromatography (Soil, Water & Oil) (EPA Methods 608, 608.3, 8082 & 8082 A) SM 6431B), Document No. 330343, date March 23, 2018 R17	4 oz	4 oz. jar	No preservative, cool to 4°C	14 days
Soil	Organo-chlorine pesticides	Low/med	Method 8081 Pesticides by Gas Chromatography (EPA Methods 608, 608.3, 8081A, 8081B , SM6630C), Document No. 330344, date July 17, 2018 R21	4 oz.	4 oz. jar	No preservative, cool to 4°C	14 days
Soil	EPH	Low/med/high	NJDEP EPH	4 oz	4 oz jar (amber)	No preservative, cool to 4°C	14 days

WORKSHEET #5C REFERENCE LIMITS AND EVALUATION TABLE

Reporting limits shall be at or below the NJDEP Default Impact to Groundwater Screening Levels (DIGWSSL), Residential or Non-Residential Direct Contact Soil Remediation Standards, whichever is lower per DKNP. DIGWSSL, RDCSRS and NRDCSRS values are included in **Appendix A**.

Abbreviations used in the tables below:
NJDEP – NJ Department of Environmental Protection
IGWSSL – Impact to Groundwater Soil Screening Levels
RDCSRS – Residential Direct Contact Soil Remediation Standard
NRDCSRS – Non-Residential Direct Contact Soil Remediation Standards
mg/kg – milligrams per kilogram
NS – No Standard

Matrix: Soil
Analytical Group: VOC
Concentration Level: Low/Med
Analytical Method: SW-846 8260B

Compound	Cas Number	IGWSSL	NRDCSRS	RDCSRS	Units
1,1,1-Trichloroethane	71-55-6	0.3	NS	160000	mg/kg
1,1,2,2-Tetrachloroethane	79-34-5	0.007	3	1	mg/kg
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	NS	NS	NS	mg/kg
1,1,2-Trichloroethane	79-00-5	0.02	6	2	mg/kg
1,1-Dichloroethane	75-34-3	0.2	24	8	mg/kg
1,1-Dichloroethene	75-35-4	0.008	150	11	mg/kg
1,2,3-Trichlorobenzene	87-61-6	NS	NS	NS	mg/kg
1,2,4-Trichlorobenzene	120-82-1	0.7	820	73	mg/kg
1,2-Dibromo-3-chloropropane	96-12-8	0.005	0.2	0.08	mg/kg
1,2-Dibromoethane	106-93-4	0.005	0.04	0.008	mg/kg
1,2-Dichlorobenzene	95-50-1	17	59000	5300	mg/kg
1,2-Dichloroethane	107-06-2	0.005	3	0.9	mg/kg
1,2-Dichloroethene (total)	540-59-0	NS	NS	NS	mg/kg
1,2-Dichloropropane	78-87-5	0.005	5	2	mg/kg
1,3-Dichlorobenzene	541-73-1	19	59000	5300	mg/kg
1,3-Dichloropropene, Total	542-75-6	0.005	NS	NS	mg/kg
1,4-Dichlorobenzene	106-46-7	2	13	5	mg/kg
1,4-Dioxane	123-91-1	NS	NS	NS	mg/kg
2-Butanone	78-93-3	0.9	44000	3100	mg/kg
2-Hexanone	591-78-6	NS	NS	NS	mg/kg
4-Methyl-2-pentanone	108-10-1	NS	NS	NS	mg/kg
Acetone	67-64-1	19	NS	70000	mg/kg
Benzene	71-43-2	0.005	5	2	mg/kg
Bromochloromethane	74-97-5	NS	NS	NS	mg/kg

Compound	Cas Number	IGWSSL	NRDCSRS	RDCSRS	Units
Bromodichloromethane	75-27-4	0.005	3	1	mg/kg
Bromoform	75-25-2	0.03	280	81	mg/kg
Bromomethane	74-83-9	0.04	59	25	mg/kg
Carbon disulfide	75-15-0	6	110000	7800	mg/kg
Carbon tetrachloride	56-23-5	0.005	4	2	mg/kg
Chlorobenzene	108-90-7	0.6	7400	510	mg/kg
Chloroethane	75-00-3	NS	1100	220	mg/kg
Chloroform	67-66-3	0.4	2	0.6	mg/kg
Chloromethane	74-87-3	NS	12	4	mg/kg
cis-1,2-Dichloroethene	156-59-2	0.3	560	230	mg/kg
cis-1,3-Dichloropropene	10061-01-5	0.005	7	2	mg/kg
Cyclohexane	110-82-7	NS	NS	NS	mg/kg
Dibromochloromethane	124-48-1	0.005	8	3	mg/kg
Dichlorodifluoromethane	75-71-8	39	230000	490	mg/kg
Ethylbenzene	100-41-4	13	110000	7800	mg/kg
Isopropylbenzene	98-82-8	NS	NS	NS	mg/kg
Methyl Acetate	79-20-9	22	NS	78000	mg/kg
Methyl cyclohexane	108-87-2	NS	NS	NS	mg/kg
Methyl tert butyl ether	1634-04-4	0.2	320	110	mg/kg
Methylene chloride	75-09-2	0.01	230	46	mg/kg
o-Xylene	95-47-6	19	170000	12000	mg/kg
p/m-Xylene	179601-23-1	19	170000	12000	mg/kg
Styrene	100-42-5	3	260	90	mg/kg
Tetrachloroethene	127-18-4	0.005	1500	43	mg/kg
Toluene	108-88-3	7	91000	6300	mg/kg
trans-1,2-Dichloroethene	156-60-5	0.6	720	300	mg/kg
trans-1,3-Dichloropropene	10061-02-6	0.005	7	2	mg/kg
Trichloroethene	79-01-6	0.01	10	3	mg/kg
Trichlorofluoromethane	75-69-4	34	340000	23000	mg/kg
Vinyl chloride	75-01-4	0.005	2	0.7	mg/kg
Xylene (Total)	1330-20-7	19	170000	12000	mg/kg

Matrix: Soil
Analytical Group: SVOC
Concentration Level: Low/Med
Analytical Method: 8270

Compound	Cas Number	IGWSSL	NRDCSRS	RDCSRS	Units
1,2,4,5-Tetrachlorobenzene	95-94-3	NS	NS	NS	mg/kg
2,3,4,6-Tetrachlorophenol	58-90-2	NS	NS	NS	mg/kg
2,4,5-Trichlorophenol	95-95-4	68	68000	6100	mg/kg
2,4,6-Trichlorophenol	88-06-2	0.2	74	19	mg/kg
2,4-Dichlorophenol	120-83-2	0.2	2100	180	mg/kg
2,4-Dimethylphenol	105-67-9	1	14000	1200	mg/kg
2,4-Dinitrophenol	51-28-5	0.3	1400	120	mg/kg

Compound	Cas Number	IGWSSL	NRDCSRS	RDCSRS	Units
2,4-Dinitrotoluene	121-14-2	NS	3	0.7	mg/kg
2,6-Dinitrotoluene	606-20-2	NS	3	0.7	mg/kg
2-Chloronaphthalene	91-58-7	NS	NS	NS	mg/kg
2-Chlorophenol	95-57-8	0.8	2200	310	mg/kg
2-Methylnaphthalene	91-57-6	8	2400	230	mg/kg
2-Methylphenol	95-48-7	NS	3400	310	mg/kg
2-Nitroaniline	88-74-4	NS	23000	39	mg/kg
2-Nitrophenol	88-75-5	NS	NS	NS	mg/kg
3,3'-Dichlorobenzidine	91-94-1	0.2	4	1	mg/kg
3-Methylphenol/4-Methylphenol	108-39-4	NS	340	31	mg/kg
3-Nitroaniline	99-09-2	NS	NS	NS	mg/kg
4,6-Dinitro-o-cresol	534-52-1	0.3	68	6	mg/kg
4-Bromophenyl phenyl ether	101-55-3	NS	NS	NS	mg/kg
4-Chloroaniline	106-47-8	NS	NS	NS	mg/kg
4-Chlorophenyl phenyl ether	7005-72-3	NS	NS	NS	mg/kg
4-Nitroaniline	100-01-6	NS	NS	NS	mg/kg
4-Nitrophenol	100-02-7	NS	NS	NS	mg/kg
Acenaphthene	83-32-9	110	37000	3400	mg/kg
Acenaphthylene	208-96-8	NS	300000	NS	mg/kg
Acetophenone	98-86-2	3	5	2	mg/kg
Anthracene	120-12-7	2400	30000	17000	mg/kg
Atrazine	1912-24-9	0.2	2400	210	mg/kg
Benzaldehyde	100-52-7		68000	6100	mg/kg
Benzo(a)anthracene	56-55-3	0.8	17	5	mg/kg
Benzo(a)pyrene	50-32-8	0.2	2	0.5	mg/kg
Benzo(b)fluoranthene	205-99-2	2	17	5	mg/kg
Benzo(ghi)perylene	191-24-2	NS	30000	380000	mg/kg
Benzo(k)fluoranthene	207-08-9	25	170	45	mg/kg
Biphenyl	92-52-4	140	240	61	mg/kg
Bis(2-chloroethoxy)methane	111-91-1	NS	NS	NS	mg/kg
Bis(2-chloroethyl)ether	111-44-4	0.2	2	0.4	mg/kg
Bis(2-chloroisopropyl)ether	108-60-1	5	67	23	mg/kg
Bis(2-ethylhexyl)phthalate	117-81-7	1200	140	35	mg/kg
Butyl benzyl phthalate	85-68-7	230	14000	1200	mg/kg
Caprolactam	105-60-2	12	340000	31000	mg/kg
Carbazole	86-74-8	NS	96	24	mg/kg
Chrysene	218-01-9	80	1700	450	mg/kg
Di-n-butylphthalate	84-74-2	760	68000	6100	mg/kg
Di-n-octylphthalate	117-84-0	3300	27000	2400	mg/kg
Dibenzo(a,h)anthracene	53-70-3	0.8	2	0.5	mg/kg
Dibenzofuran	132-64-9	NS	NS	NS	mg/kg
Diethyl phthalate	84-66-2	88	550000	49000	mg/kg
Dimethyl phthalate	131-11-3	NS	NS	NS	mg/kg
Fluoranthene	206-44-0	1300	24000	2300	mg/kg
Fluorene	86-73-7	170	24000	2300	mg/kg
Hexachlorobenzene	118-74-1	0.2	1	0.3	mg/kg
Hexachlorobutadiene	87-68-3	0.9	25	6	mg/kg

Compound	Cas Number	IGWSSL	NRDCSRS	RDCSRS	Units
Hexachlorocyclopentadiene	77-47-4	320	110	45	mg/kg
Hexachloroethane	67-72-1	0.2	48	12	mg/kg
Indeno(1,2,3-cd)pyrene	193-39-5	7	17	5	mg/kg
Isophorone	78-59-1	0.2	2000	510	mg/kg
n-Nitrosodi-n-propylamine	621-64-7	0.2	0.3	0.2	mg/kg
Naphthalene	91-20-3	25	17	6	mg/kg
NDPA/DPA	86-30-6	0.4	390	99	mg/kg
Nitrobenzene	98-95-3	0.2	14	5	mg/kg
p-Chloro-m-cresol	59-50-7	NS	NS	NS	mg/kg
Pentachlorophenol	87-86-5	0.3	3	0.9	mg/kg
Phenanthrene	85-01-8	NS	300000	NS	mg/kg
Phenol	108-95-2	8	210000	18000	mg/kg
Pyrene	129-00-0	840	18000	1700	mg/kg

Matrix: Soil
Analytical Group: Organochloride Pesticides
Concentration Level: Low/Med
Analytical Method: 8081

Compound	Cas Number	IGWSSL	NRDCSRS	RDCSRS	Units
4,4'-DDD	72-54-8	4	13	3	mg/kg
4,4'-DDE	72-55-9	18	9	2	mg/kg
4,4'-DDT	50-29-3	11	8	2	mg/kg
Aldrin	309-00-2	0.2	0.2	0.04	mg/kg
Alpha-BHC	319-84-6	0.002	0.5	0.1	mg/kg
Beta-BHC	319-85-7	0.002	2	0.4	mg/kg
Chlordane	57-74-9	0.05	1	0.2	mg/kg
cis-Chlordane	5103-71-9	0.05	1	0.2	mg/kg
Delta-BHC	319-86-8	NS	NS	NS	mg/kg
Dieldrin	60-57-1	0.003	0.2	0.04	mg/kg
Endosulfan I	959-98-8	4	6800	470	mg/kg
Endosulfan II	33213-65-9	4	6800	470	mg/kg
Endosulfan sulfate	1031-07-8	2	6800	470	mg/kg
Endrin	72-20-8	1	340	23	mg/kg
Endrin aldehyde	7421-93-4	NS	NS	NS	mg/kg
Endrin ketone	53494-70-5	NS	NS	NS	mg/kg
Heptachlor	76-44-8	0.5	0.7	0.1	mg/kg
Heptachlor epoxide	1024-57-3	0.01	0.3	0.07	mg/kg
Lindane	58-89-9	0.002	2	0.4	mg/kg
Methoxychlor	72-43-5	160	5700	390	mg/kg
Toxaphene	8001-35-2	0.3	3	0.6	mg/kg
trans-Chlordane	5103-74-2	0.05	1	0.2	mg/kg

Matrix: Soil
Analytical Group: PCBs
Concentration Level: Low/Med
Analytical Method: 8082

Compound	Cas Number	IGWSSL	NRDCSRS	RDCSRS	Units
Aroclor 1016	12674-11-2	0.2	1	0.2	mg/kg
Aroclor 1221	11104-28-2	0.2	1	0.2	mg/kg
Aroclor 1232	11141-16-5	0.2	1	0.2	mg/kg
Aroclor 1242	53469-21-9	0.2	1	0.2	mg/kg
Aroclor 1248	12672-29-6	0.2	1	0.2	mg/kg
Aroclor 1254	11097-69-1	0.2	1	0.2	mg/kg
Aroclor 1260	11096-82-5	0.2	1	0.2	mg/kg
Aroclor 1262	37324-23-5	0.2	1	0.2	mg/kg
Aroclor 1268	11100-14-4	0.2	1	0.2	mg/kg
PCBs, Total	1336-36-3	0.2	1	0.2	mg/kg

Matrix: Soil
Analytical Group: Metals
Concentration Level: Low/Med
Analytical Method: 8082

Compound	Cas Number	IGWSSL	NRDCSRS	RDCSRS	Units
Aluminum, Total	7429-90-5	6000		78000	mg/kg
Antimony, Total	7440-36-0	6	450	31	mg/kg
Arsenic, Total	7440-38-2	19	19	19	mg/kg
Barium, Total	7440-39-3	2100	59000	16000	mg/kg
Beryllium, Total	7440-41-7	0.7	140	16	mg/kg
Cadmium, Total	7440-43-9	2	78	78	mg/kg
Calcium, Total	7440-70-2	NS	NS	NS	mg/kg
Chromium, Total	7440-47-3	NS	NS	NS	mg/kg
Cobalt, Total	7440-48-4	90	590	1600	mg/kg
Copper, Total	7440-50-8	11000	45000	3100	mg/kg
Iron, Total	7439-89-6	NS	NS	NS	mg/kg
Lead, Total	7439-92-1	90	800	400	mg/kg
Magnesium, Total	7439-95-4	NS	NS	NS	mg/kg
Manganese, Total	7439-96-5	65	5900	11000	mg/kg
Mercury, Total	7439-97-6	0.1	65	23	mg/kg
Nickel, Total	7440-02-0	48	23000	1600	mg/kg
Potassium, Total	7440-09-7	NS	NS	NS	mg/kg
Selenium, Total	7782-49-2	11	5700	390	mg/kg
Silver, Total	7440-22-4	1	5700	390	mg/kg
Sodium, Total	7440-23-5	NS	NS	NS	mg/kg
Thallium, Total	7440-28-0	3	NS	NS	mg/kg
Vanadium, Total	7440-62-2	NS	1100	78	mg/kg
Zinc, Total	7440-66-6	930	110000	23000	mg/kg

Matrix: Soil

Analytical Group: EPH
Concentration Level: Low/Med/High
Analytical Method: 8081

Type	Category 1		Category 2	
Exposure scenario	**Residential**	**Non-Residential**	**Residential**	**Non-Residential**
EPH Soil Remediation Criterion	5,100 mg/kg	54,000 mg/kg	NJDEP EPH Calculator	NJDEP EPH Calculator
EPH Trigger Concentration for Contingency Analysis	1,000 mg/kg	1,000 mg/kg	Pursuant to NJDEP Table 2-1	Pursuant to NJDEP Table 2-1
Contingency Analysis	Naphthalene and 2-methyl naphthalene	Naphthalene and 2-methyl naphthalene	Pursuant to NJDEP Table 2-1	Pursuant to NJDEP Table 2-1
EPH Product Determination	8,000 mg/kg or greater	8,000 mg/kg or greater	17,000 mg/kg or greater	17,000 mg/kg or greater

WORKSHEET #5D ANALYTICAL LABORATORY SENSITIVITY AND PROJECT CRITERIA

Analytical laboratory sensitivity and project criteria follow the NJDEP Data of Known Quality Protocols (DKNP) (April 2014). Measurement performance criteria and QC sample information is included in DKNP.

Matrix: Soil
Analytical Group: Volatiles
Analytical Method: SW-846 8260B
Concentration: Low/medium

Data Quality Indicator (DQI)	QC Measure for Sampling (S), Analytical (A), or both (S&A)	QC Sample or Activity	QC Acceptance Limits (Measurement Performance Criteria)
Accuracy	A	BFB Tune	Method tune criteria based on criteria in Table 4 of USEPA-SW846 Method 8260B
Accuracy	A	Initial Calibration (ICAL)	Minimum 5-standards; must contain all targets and lowest standard ≤ RL; Full Scan: RF for SPCCs Section 7.3.5.4; %RSD ≤ 15% for all compounds except CCC's which must be ≤30% RSD or "r" ≥ 0.99; SIM: %RSD ≤ 20% or "r" ≥ 0.99 for all compounds; regression analysis, if used, must not be forced through the origin
Accuracy/ Sensitivity	A	Method Blank	Targets analytes must be < RL except for common laboratory contaminates (acetone, methylene chloride and MEK) which must be < 5x RL, surrogates in criteria
Accuracy	A	Matrix Spike/ Matrix Spike Duplicate [Site-specific QC]	Must contain all target analytes, performed on Site field sample, % recovery 70-130% except for difficult analytes** which must exhibit % recovery between 40-160%
Precision	A	Matrix Spike/ Matrix Spike Duplicate [Site-specific QC]	Must contain all target analytes, performed on Site field sample, recovery criteria same as MS; RPDs ≤ 20% for waters and ≤ 30% for solids
Accuracy	A	Laboratory Control Sample (LCS)	Must contain all target analytes, be matrix-matched; % Recovery 70- 130% except for difficult analytes ** must exhibit percent recoveries between 40-160%.
Precision	A	Sample Duplicate (DUP)	Must be performed on a Site field sample. RPDs ≤ 20% for waters and ≤ 30% for solids for results > 2x RL
Accuracy	A	Surrogates	Minimum of 3 surrogates at retention times across GC run for all matrices; surrogates must be between 70- 130% for all compounds.
Accuracy	A	Internal Standards (IS)	Minimum of 3 IS , Areas 50-200% of the most recent midpoint CCV standard; RTs ± 30 sec. from midpoint ICAL standard
Accuracy	A	Continuing Calibration Verification (CCV)	Concentration level near mid-point of ICAL curve containing all target compounds; *Full Scan and SIM*: min RRF criteria met; %D or % Drift ≤ 20% for all compounds
Accuracy	A	Quantitation	RL ≤ results ≤ upper calibration range on a sample-specific basis; IS must be used; and average response factors or curve-statistics generated from the ICAL must be used for quantitation. Results reported between the MDL and RL qualified "J"

Data Quality Indicator (DQI)	QC Measure for Sampling (S), Analytical (A), or both (S&A)	QC Sample or Activity	QC Acceptance Limits (Measurement Performance Criteria)
Sensitivity	A	Reporting of Non-Detects	Reported at the sample-specific RL which must be ≤ PRL
Overall Precision & Representativeness	S & A	Field Duplicate Samples [Site-specific QC]	RPD ≤ 30% for waters or RPD ≤ 50% for solids w/results > 2x RL; Professional judgment for results < 2xRL
Accuracy (preservation)	S	Temperature Blank or other Cooler Temperature Reading	≤ 6º C; allow for < 2º C if samples intact sample preservation per SW- 846 Chapter 4 Table 4-1
Accuracy/ Sensitivity	S & A	Holding Time (HT)	Analyses within 14 days of collection (7 days if unpreserved). Aqueous samples adjust pH to < 2 with HCL or per SW-846 Table 4-1 preservatives.
Accuracy/ Sensitivity	S	Equipment Blank [Site-specific QC]	Target analytes < RL
Data Completeness	S & A	Calculate from valid/usable data collected	≥ 90% Overall
Comparability	S & A	Based on Method (SOP) and QAPP/FSP protocols	Comparison between historical data for qualitative integrity of the data. Comparison between spatially similar samples.

Matrix: Soil
Analytical Group: Semi-Volatiles
Analytical Method: SW-846 8270C
Concentration: Low/medium

Data Quality Indicator (DQI)	QC Measure for Sampling (S), Analytical (A), or both (S&A)	QC Sample or Activity	QC Acceptance Limits (Measurement Performance Criteria)
Accuracy	A	DFTPP Tune	Method tune criteria based on criteria in Table 3 of USEPA-SW846 Method 8270C
Accuracy	A	Initial Calibration (ICAL)	Minimum 5-standards; must contain all targets and lowest standard ≤ RL; Full Scan: RF ≥ 0.05 for SPCCs; %RSD ≤ 15% for all compounds except CCCs which must be ≤20% RSD or "r" ≥ 0.99; SIM: %RSD ≤ 20% or "r" ≥ 0.99 for all compounds
Accuracy/ Sensitivity	A	Method Blank	Must be matrix matched; Phthalates < 5xRL; All other Targets < RL, surrogates in criteria
Accuracy	A	Matrix Spike/ Matrix Spike Duplicate [Site-specific QC]	Must contain all target analytes, performed on Site field sample, % recovery 70-130% except for difficult analytes** which must exhibit % recovery between 20-160%
Precision	A	Matrix Spike/ Matrix Spike Duplicate [Site-specific QC]	Must contain all target analytes, performed on Site field sample, % recovery criteria same as MS. RPDs ≤ 20% for waters and ≤ 30% for solids
Accuracy	A	Laboratory Control Sample (LCS)	Must contain all target analytes, be matrix-matched; % Recovery 70- 130% except for difficult analytes ** must exhibit percent recoveries between 20-160%.
Precision	A	Sample Duplicate (DUP)	Must be performed on a Site field sample. RPD ≤ 20% for waters and ≤ 30% for solids for results > 2x RL
Accuracy	A	Surrogates	Minimum of 3 base-neutral and 3 acid surrogates at

Data Quality Indicator (DQI)	QC Measure for Sampling (S), Analytical (A), or both (S&A)	QC Sample or Activity	QC Acceptance Limits (Measurement Performance Criteria)
			RTs across GC run; for solids matrices must be between 30-130% for all compounds; for water matrices 30-130% for BN surrogates and 15- 110% for Acid surrogates
Accuracy	A	Internal Standards (IS)	Minimum of 6 IS , Areas 50-200% of the most recent CCV standard; RTs ± 30 sec. from midpoint ICAL standard
Accuracy	A	Continuing Calibration Verification (CCV)	Concentration level near mid-point of ICAL curve containing all target compounds; *Full Scan*: %D or %Drift ≤ 20% for CCCs and ≤ 30% for all other compounds *SIM*: %D or %Drift ≤ 30%
Accuracy	A	Quantitation	RL ≤results ≤ upper calibration range on a sample-specific basis; IS must be used; and average response factors or curve-statistics generated from the ICAL must be used for quantitation. Results reported between the MDL and RL qualified "J"
Sensitivity	A	Reporting of Non-Detects	Reported at the sample-specific RL which must be ≤ PRL
Overall Precision & Representativeness	S & A	Field Duplicate Samples [Site-specific QC]	RPD ≤ 30% for waters or RPD ≤ 50% for solids w/results > 2x RL; Professional judgment for results < 2xRL
Accuracy (preservation)	S	Temperature Blank or other Cooler Temperature Reading	≤ 6º C; allow for < 2º C if samples intact sample preservation per SW- 846 Chapter 4 Table 4-1
Accuracy/Sensitivity	S & A	Holding Time (HT)	Aqueous samples extracted within 7 days of collection; extract analyzed within 40 days of extraction. Soil/Sediment samples extracted within 14 days of collection; extract analyzed within 40 days of extraction. If Soil/Sediment samples are frozen, HT arrested and extraction HT continues when thawed. Solid samples can be maintained frozen for 1 year from collection.
Accuracy/Sensitivity	S	Equipment Blank	Target analytes < RL
Data Completeness	S & A	Calculate from valid/usable data collected	≥ 90% Overall
Comparability	S & A	Based on Method (SOP) and QAPP/FSP protocols	Comparison between historical data for qualitative integrity of the data. Comparison between spatially similar samples.
Accuracy	A	DFTPP Tune	Method tune criteria based on criteria in Table 3 of USEPA-SW846 Method 8270D
Accuracy	A	Initial Calibration (ICAL)	Minimum 5-standards; must contain all targets and lowest standard ≤ RL; *Full Scan*: RF see Table 4 for minimum RF; %RSD ≤ 20% for all compounds or "r" ≥ 0.99; *SIM*: %RSD ≤ 20% or "r" ≥ 0.99 for all compounds
Accuracy/Sensitivity	A	Method Blank	Must be matrix matched; Phthalates < 5xRL; All other Targets < RL, surrogates in criteria
Accuracy	A	Matrix Spike/ Matrix Spike Duplicate [Site-specific QC]	Must contain all target analytes, performed on Site field sample, % recovery 70-130% except for difficult analytes** which must exhibit % recovery between 20-160%

Data Quality Indicator (DQI)	QC Measure for Sampling (S), Analytical (A), or both (S&A)	QC Sample or Activity	QC Acceptance Limits (Measurement Performance Criteria)
Precision	A	Matrix Spike/ Matrix Spike Duplicate [Site-specific QC]	Must contain all target analytes, performed on Site field sample, % recovery criteria same as MS. RPDs ≤ 20% for waters and ≤ 30% for solids
Accuracy	A	Laboratory Control Sample (LCS)	Must contain all target analytes, be matrix-matched; % Recovery 70- 130% except for difficult analytes ** must exhibit percent recoveries between 20-160%.
Precision	A	Sample Duplicate (DUP)	Must be performed on a Site field sample. RPD ≤ 20% for waters and ≤ 30% for solids for results > 2x RL
Accuracy	A	Surrogates	Minimum of 3 base-neutral and 3 acid surrogates at RTs across GC run; for solids matrices must be between 30-130% for all compounds; for water matrices 30-130% for BN surrogates and 15- 110% for acid surrogates
Accuracy	A	Internal Standards (IS)	Minimum of 6 IS, Areas 50-200% of the most recent t CCV standard; RTs ± 30 sec. from midpoint ICAL standard
Accuracy	A	Continuing Calibration Verification (CCV)	Concentration level near mid-point of ICAL curve containing all target compounds; *Full Scan*: %D or %Drift ≤ 20% for CCCs and ≤ 30% for all other compounds; *SIM*: %D or %Drift ≤ 30%
Accuracy	A	Quantitation	RL ≤results ≤ upper calibration range on a sample-specific basis; IS must be used; and RL ≤results ≤ upper calibration range on a sample-specific basis; IS must be used; and average response factors or curve-statistics generated from the ICAL must be used for quantitation. Results reported between the MDL and RL qualified "J"
Sensitivity	A	Reporting of Non-Detects	Reported at the sample-specific RL which must be ≤ PRL
Overall Precision & Representative- ness	S & A	Field Duplicate Samples [Site-specific QC]	RPD ≤ 30% for waters or RPD ≤ 50% for solids w/results > 2x RL; Professional judgment for results < 2xRL
Accuracy (preservation)	S	Temperature Blank or other Cooler Temperature Reading	≤ 6º C; allow for < 2º C if samples intact sample preservation per SW- 846 Chapter 4 Table 4-1
Accuracy/ Sensitivity	S & A	Holding Time (HT)	Aqueous samples extracted within 7 days of collection; extract analyzed within 40 days of extraction. Soil/Sediment samples extracted within 14 days of collection; extract analyzed within 40 days of extraction. If Soil/Sediment samples are frozen, HT arrested and extraction HT continues when thawed. Solid samples can be maintained frozen for 1 year from collection.
Accuracy/ Sensitivity	S	Equipment Blank [Site-specific QC]	Target analytes < RL
Data Completeness	S & A	Calculate from valid/usable data collected	≥ 90% Overall
Comparability	S & A	Based on Method (SOP) and QAPP/FSP protocols	Comparison between historical data for qualitative integrity of the data. Comparison between spatially similar samples.

NOTES:

1. This table was prepared by NJDEP, January 2011 to be compliant with EPA Region 2 guidance and meet the data quality needs of the Department.
2. Semivolatile Organic Compound analyses via USEPA SW-846 Method 8270D (*Quality Assurance and Quality Control Requirements for SW- 846 Method* 8270D *Semivolatile Organic Compounds by Gas Chromatography/Mass Spectroscopy [GC/MS]).* 8270D:

** Potentially "difficult" analytes include: Benzenthiol, Benzoic Acid, 2,4-Dintrophenol, 3&4 – Methylphenol, 4-Nitrophenol, Pentachlorophenol, Phenol, Aniline, Aramite, A,A-Dimethylphenethylamine, Benzidine, Benzaldehyde, Benzyl Alcohol, Caprolactam, Chlorobenzilate, 3,3'- Dimethylbenzidine, 1,4-Dioxane, 7,12-Dimethylbenz(a)anthracene, Diallate, Dibenz(a,j)acridine, Diphenylamine, Disulfoton, p- (dimethylamine)azobenzene, Decane, Famphur, Hexachlorocyclopentadiene, Hexachloroethane, Hexachlorophene, Hexachloropropene, Kepone, 4,4'-methylenebis(2-chloroaniline), Methapyrilene, Methyl methanesulfonate, Methyl parathion, n-Nitrosodimethylamine, 4-Nitroquinoline-1-oxide, 2-Picoline, Parathion, Pentachloroethane, Pentachlorobenzene, Pentachloronitrobenzene, Phorate, Pronamide, Pyridine, p-Phenylenediamine, o- tricresyl phosphate and Tetraethyl. Please note that many of the surrogates fall outside or the 15 – 110% range 2-Fluorophenol, Phenol-d5, 2,4,6-Tribromophenol and Terphenyl-d14.

Matrix: Soil
Analytical Group: Metals
Analytical Method: SW-846 6010B
Concentration: Low/medium

Data Quality Indicator (DQI)	QC Measure for Sampling (S), Analytical (A), or both (S&A)	QC Sample or Activity	QC Acceptance Limits (Measurement Performance Criteria)
Accuracy	A	Linear Dynamic Range (LDR)	A minimum of 3 different concentration standards across the ICP range; one should be near the upper limit of the range.
Accuracy	A	Initial Calibration	Minimum of a calibration blank plus a standard per manufacturing recommended procedures; RL standard may be included in multi- point calibration curve; linear curve fit with correlation coefficient >0.995.
Accuracy	A	Initial Calibration Verification (ICV)	Separate-source from calibration standards; must contain all target analytes ICV: 90-110% recovery
Accuracy	A	Initial Calibration Blanks (ICB)	Must be matrix-matched (and same concentration of acid found in standards and samples); ICB: < ± RL
Accuracy	A	Continuing Calibration Verification (CCV)	Same source as calibration standards; conc. near mid-point of calibration curve; must contain all target analytes CCV: 90 - 110% recovery
Sensitivity	A	Continuing Calibration Blanks (CCB)	Must be matrix-matched (and same conc. of acid found in standards and samples); CCB: < ± RL
Accuracy & Sensitivity (Contamination)	A	Method Blank (MB)	Must be digested with samples using same preparation method and amount of acids; MB: < RL

Data Quality Indicator (DQI)	QC Measure for Sampling (S), Analytical (A), or both (S&A)	QC Sample or Activity	QC Acceptance Limits (Measurement Performance Criteria)
Accuracy	A	Interference Check Standards (ICSA and ICSAB)	ICSA & ICSB: 80-120% recovery ICSA: non-spiked analytes ≤ 2x RL
Accuracy	A	Laboratory Control Sample (LCS)	Must contain all target analytes and be matrix-specific; Aq. LCS: 80- 120% recovery; Soil/Sediment/solid LCS: vendor control limits (95% confidence limits)
Precision	A	Sample Duplicate (DUP)	Must be performed on a Site field sample. For soil and aqueous samples: Results ≥ 5xRL, RPD ≤ 20% aqueous, 35% solids; Results < 5xRL: absolute difference between results ≤ RL.
Accuracy	S & A	Matrix Spike (MS) [Site-specific QC]	Must be performed on a Site field sample; MS: 75-125% recovery; professional judgment if sample concentration > 4x spike level
Precision	S & A	Matrix Spike Duplicate (MSD) [Site-specific QC]	Must be performed on a Site field sample. For soil and aqueous samples: Results ≥ 5xRL, RPD ≤ 20% aqueous, 35% solids; Results < 5xRL: absolute difference between results ≤ RL.
Accuracy	A	Post digestion spike	Should be performed if MS/MSD recoveries were unacceptable: 80- 120% recovery
Accuracy	A	Serial Dilution	Perform 5x dilution on same sample used for MS. % Difference ≤ 10% for results >50x IDL (which will most likely equate to 10X RL).
Accuracy	A	Quantitation	RL ≤ results ≤ linear calibration range on a sample-specific basis. Report all Aq. results in µg/L or mg/L and all Soil/Sediment results in mg/Kg on a dry-weight basis.
Overall Precision & Representativeness	S & A	Field Duplicate Sample [Site-specific QC]	Aq.: Results ≥ 5xRL: RPD ≤ 30%; Results < 5xRL: professional judgment; Soil/Sediment: Results ≥ 5xRL: RPD ≤ 50%; Results < 5xRL: professional judgment
Accuracy (preservation)	S & A	Sample preservation	Aq.: Total Metals: HNO_3 pH < 2; (Dissolved Metals: filter on site or at the lab then HNO_3 pH < 2 but cannot be used for regulatory compliance) Soil/Sediment: collect unpreserved per SW-846 Chapter 3 Table 3-2
Data Completeness	S & A	Calculate from valid/usable data collected	Minimum ≥ 90% Overall
Accuracy/Sensitivity	S & A	Holding Time (HT)	For aqueous and soil samples six months. If Soil/Sediment samples are frozen, HT arrested and HT begins when thawed. Samples can be maintained frozen for 1 year from collection.
Accuracy & Sensitivity (Contamination)	S & A	Equipment Rinsate Blank (EB)	Aqueous EB: < RL Soil/Sediment EB <RL on solid equivalent basis
Comparability	S & A	Based on Method (SOP) and QAPP/FSP protocols	Comparison between historical data for qualitative integrity of the data. Comparison between spatially similar samples.

NOTES:

1. This table was prepared by NJDEP, April 2014 to be compliant with EPA Region 2 guidance and meet the data quality needs of the Department.
2. Method References = USEPA SW-846 Method 6010B (*Inductively Coupled Plasma-Mass Spectrometry*, December 1996 and February 2007) and (*Quality Assurance and Quality Control Requirements and Performance Standards for SW846 Method 6010B, Trace Metals by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP)*).

Data Quality Indicator (DQI)	QC Measure for Sampling (S), Analytical (A), or both (S&A)	QC Sample or Activity	QC Acceptance Limits (Measurement Performance Criteria)
Accuracy	A	Linear Dynamic Range (LDR)	A minimum of 3 different concentration standards across the ICP range one should be near the upper limit of the range.
Accuracy	A	Initial Calibration	Minimum of a calibration blank plus a standard per manufacturing recommended procedures; RL standard may be included in multi- point calibration curve; linear curve fit with correlation coefficient $\geq$0.998.
Accuracy	A	Initial Calibration Verification (ICV)	Separate-source from calibration standards; must contain all target analytes ICV: 90-110% recovery
Sensitivity	A	Low Level Initial Calibration Verification	Same source as calibration standards; must contain all target analytes at the RL 70-130% recovery
Accuracy	A	Initial Calibration Blanks (ICB)	Must be matrix-matched (and same conc. of acid found in standards and samples); ICB: < ± RL
Accuracy	A	Continuing Calibration Verification (CCV)	Same source as calibration standards; conc. near mid-point of calibration curve; must contain all target analytes CCV: 90 - 110% recovery
Sensitivity	A	Low Level Continuing Calibration Verification	Same source as initial calibration standards; must contain all target analytes at the RL 70-130% recovery
Sensitivity	A	Continuing Calibration Blanks (CCB)	Must be matrix-matched (and same conc. of acid found in standards and samples); CCB: < ± RL
Accuracy & Sensitivity (Contamination)	A	Method Blank (MB)	Must be digested with samples using same preparation method and amount of acids; MB: < RL
Accuracy	A	Interference Check Standards (ICSA and ICSAB)	ICSA & ICSB: 80-120% recovery ICSA: non-spiked analytes $\leq$ 2x RL
Accuracy	A	Laboratory Control Sample (LCS)	Must contain all target analytes and be matrix-specific; Aq. LCS: 80- 120% recovery; Soil/Sediment/sol-id LCS: vendor control limits (95% confidence limits)

Data Quality Indicator (DQI)	QC Measure for Sampling (S), Analytical (A), or both (S&A)	QC Sample or Activity	QC Acceptance Limits (Measurement Performance Criteria)
Precision	A	Sample Duplicate (DUP)	Must be performed on a Site field sample. For soil and aqueous samples: Results ≥ 5xRL, RPD ≤ 20% aqueous, 35% solids; Results < 5xRL: absolute difference between results ≤ RL.
Accuracy	S & A	Matrix Spike (MS) [Site-specific QC]	Must be performed on a Site field sample; MS: 75-125% recovery; professional judgment if sample concentration > 4x spike level
Precision	S & A	Matrix Spike Duplicate (MSD) [Site-specific QC]	Must be performed on a Site field sample. For soil and aqueous samples: Results ≥ 5xRL, RPD ≤ 20% aqueous, 35% solids; Results < 5xRL: absolute difference between results ≤ RL.
Accuracy	A	Post digestion spike	Should be performed if MS/MSD recoveries were unacceptable: 80- 120% recovery
Accuracy	A	Serial Dilution	Perform 5x dilution on same sample used for MS % Difference < 10% for results >10x RL.
Accuracy	A	Quantitation	RL ≤ results ≤ linear calibration range on a sample-specific basis. Report all Aq. results in µg/L or mg/L and all Soil/Sediment results in mg/Kg on a dry-weight basis.
Overall Precision & Representativeness	S & A	Field Duplicate Sample [Site-specific QC]	Aq.: Results ≥ 5xRL: RPD ≤ 30%; Results < 5xRL: professional judgment; Soil/Sediment: Results ≥ 5xRL: RPD ≤ 50%; Results < 5xRL: professional judgment
Accuracy (preservation)	S & A	Sample preservation	Aq.: Total Metals: HNO_3 pH < 2; (Dissolved Metals: filter on site or at the lab then HNO_3 pH < 2 but cannot be used for regulatory compliance) Soil/Sediment: collect unpreserved per SW-846 Chapter 3 Table 3-2
Data Completeness	S & A	Calculate from valid/usable data collected	Minimum ≥ 90% Overall
Accuracy/ Sensitivity	S & A	Holding Time (HT)	For aqueous and soil samples six months. If Soil/Sediment samples are frozen, HT arrested and HT begins when thawed. Samples can be maintained frozen for 1 year from collection.
Accuracy & Sensitivity (Contamination	S & A	Equipment Rinsate Blank (EB)	Aqueous EB: < RL Soil/Sediment EB <RL on solid equivalent basis
Comparability	S & A	Based on Method (SOP) and QAPP/FSP protocols	Comparison between historical data for qualitative integrity of the data. Comparison between spatially similar samples.

NOTES:

1. This table was prepared by NJDEP, January 2012 to be compliant with EPA Region 2 guidance and meet the data quality needs of the Department.
2. Method References = USEPA SW-846 Method 6010C (*Inductively Coupled Plasma-Mass Spectrometry*, Revision 3 February 2007).

Matrix: Soil
Analytical Group: Pesticides
Analytical Method: SW-846 8081 A&B
Concentration: Low/medium

Data Quality Indicator (DQI)	QC Measure for Sampling (S), Analytical (A), or both (S&A)	QC Sample or Activity	QC Acceptance Limits (Measurement Performance Criteria)
Accuracy/ Sensitivity	A	Method Blank	All Target compounds < RL, surrogates in criteria
Accuracy	A	Matrix Spike/ Matrix Spike Duplicate [Site-specific QC]	Must contain all single-component target analytes, performed on Site field sample; 30-150% recovery for all compounds.
Precision	A	Matrix Spike/ Matrix Spike Duplicate [Site-specific QC]	Must contain all single-component target analytes, performed on Site field sample; 30-150% recovery for all compounds; RPD ≤ 30% for solids and RPD ≤ 20% for waters
Accuracy	A	Laboratory Control Sample (LCS)	Must contain all single-component target analytes, concentration should be the same as MS if appropriate, be matrix-matched, 40-140% recovery for all target analytes.
Precision	A	Sample Duplicate (DUP)	Must be performed on a site sample, RPD ≤ 30% for solids and RPD ≤ 20% for waters for results > 2x RL
Accuracy	A	Surrogates	Minimum of 2 (recommend TCMX and DCB); 30-150% recovery on both GC columns
Accuracy	A	Internal Standards (IS) (optional)	Minimum of 1 IS , Areas 50-200% of CCV; RTs ± 30 sec from ICAL
Accuracy	A	Endrin/DDT Breakdown	% Breakdown ≤ 15% based on peak areas
Accuracy	A	Initial Calibration (ICAL)	Minimum 5-levels for single- component analytes and single-level for multi-component analytes using peak height or peak area; must contain all targets and lowest level ≤ RL; %RSD ≤ 20% or "r" ≥ 0.99 for all compounds; regression analysis, if used, must not be forced through the origin
Accuracy	A	Continuing Calibration Verification(CCV)	Concentration level near mid-point of ICAL curve containing all single- component target compounds; %D ≤ 20% and analytes fall within expected retention time windows; Multi-component analytes must be verified within 12 hours of being detected in a sample
Accuracy	A	Quantitation	RL ≤ results ≤ upper calibration range on a sample-specific basis; average response factors or curve- statistics generated from the ICAL must be used for quantitation and peak height or peak area, as used for ICAL, must be used for sample. Report the highest concentration from the two GC columns and results reported between the MDL and RL qualified "J"
Precision	A	Quantitation	RPD or %D < 40% between two dissimilar GC Columns
Sensitivity	A	Reporting of Non-Detects	Reported at the sample-specific RL which must be ≤ PRL

Data Quality Indicator (DQI)	QC Measure for Sampling (S), Analytical (A), or both (S&A)	QC Sample or Activity	QC Acceptance Limits (Measurement Performance Criteria)
Overall Precision & Representative- ness	S & A	Field Duplicate Samples [Site-specific QC]	RPD ≤ 30% for waters or RPD ≤ 50% for solids w/results > 2x RL; Professional judgment for results < 2xRL
Accuracy (preservation)	S	Temperature Blank or other Cooler Temperature Reading	Cool to ≤ 6º C; allow for < 2º C if samples intact
Accuracy/ Sensitivity	S & A	Holding Time (HT)	Aqueous samples extracted within 7 days of collection; extract analyzed within 40 days of extraction. Soil/Sediment samples extracted within 14 days of collection; extract analyzed within 40 days of extraction. If Soil/Sediment samples are frozen, HT arrested and extraction HT continues when thawed. Solid samples can be maintained frozen for 1 year from collection.
Accuracy/ Sensitivity	S	Equipment Blank [Site-specific QC]	Target analytes < RL
Data Completeness	S & A	Calculate from valid/usable data collected	≥ 90% Overall
Comparability	S & A	Based on Method (SOP) and QAPP/FSP protocols	Comparison between historical data for qualitative integrity of the data. Comparison between spatially similar samples.

NOTES:

1. This table was prepared by NJDEP, April 2014 to be compliant with EPA Region 2 guidance, and meet the data quality needs of the Department.
2. Pesticide Compound analyses via USEPA SW-846 Method 8081A&B (*Quality Assurance and Quality Control Requirements for SW-846 Method 8081A and 8081B Chlorinated Pesticides by Gas Chromatography [GC]).*

Matrix: Soil
Analytical Group: PCBs Aroclors
Analytical Method: SW-846 8082 and 8082 A
Concentration: Low/medium

Data Quality Indicator (DQI)	QC Measure for Sampling (S), Analytical (A), or both (S&A)	QC Sample or Activity	QC Acceptance Limits (Measurement Performance Criteria)
Accuracy	A	Quantitation	RL ≤ results ≤ upper calibration range on a sample-specific basis; average response factors or curve-statistics generated from the ICAL must be used for quantitation and peak height or peak area, as used for ICAL, must be used for sample. Report the highest concentration from the two GC columns and results reported between the MDL and RL qualified "J"
Precision	A	Quantitation	RPD or %D < 40% between two dissimilar GC Columns

Data Quality Indicator (DQI)	QC Measure for Sampling (S), Analytical (A), or both (S&A)	QC Sample or Activity	QC Acceptance Limits (Measurement Performance Criteria)
Sensitivity	A	Reporting of Non-Detects	Reported at the sample-specific RL which must be ≤ PRL
Overall Precision & Representativeness	S & A	Field Duplicate Samples [Site-specific QC]	RPD ≤ 30% for waters or RPD ≤ 50% for solids w/results > 2x RL; Professional judgment for results < 2xRL
Accuracy (preservation)	S	Temperature Blank or other Cooler Temperature Reading	Cool to ≤ 6º C; allow for < 2º C if samples intact
Accuracy/Sensitivity	S & A	Holding Time (HT)	Aqueous samples extracted within 7 days of collection; extract analyzed within 40 days of extraction. Soil/Sediment samples extracted within 14 days of collection; extract analyzed within 40 days of extraction. If Soil/Sediment samples are frozen, HT arrested and extraction HT continues when thawed. Samples can be maintained frozen for 1 year from collection.
Accuracy/Sensitivity	S	Equipment Blank [Site-specific QC]	Target analytes < RL
Data Completeness	S & A	Calculate from valid/usable data collected	≥ 90% Overall
Comparability	S & A	Based on Method (SOP) and QAPP/FSP protocols	Comparison between historical data for qualitative integrity of the data. Comparison between spatially similar samples.

NOTES:

1. This table was prepared by NJDEP, April 2014 to be compliant with EPA Region 2 guidance, and meet the data quality needs of the Department
2. PCB Aroclor Compound analysis via USEPA SW-846 Method 8082 and 8082A (*Quality Assurance and Quality Control Requirements for SW- 846, Polychlorinated Biphenyls (PCBs) by Gas Chromatography [GC]).*

Matrix: Soil
Analytical Group: NJDEP EPH Methodology
Analytical Method: NJDEP EPH
Concentration: Low/medium/high

Data Quality Indicator (DQI)	QC Measure for Sampling (S), Analytical (A), or both (S&A)	QC Sample or Activity	QC Acceptance Limits (Measurement Performance Criteria)
Accuracy/ Sensitivity	A	Method Blank	Blank concentration < 5X value of the MDL (additional action noted in section 9.1.4 of the method)
Accuracy	A	Matrix Spike(sample not fractionated) [Site-specific QC]	Must contain all aliphatic and aromatic compounds defined in method section 6.8.6; 40 - 140% recovery for all compounds (only up to & including C28 for #2 fuel/diesel).
Accuracy	A	Matrix Spike/	Must contain all aliphatic and aromatic compounds

Data Quality Indicator (DQI)	QC Measure for Sampling (S), Analytical (A), or both (S&A)	QC Sample or Activity	QC Acceptance Limits (Measurement Performance Criteria)
		(sample fractionated]	defined in method section 6.8.6; 40 - 140% recovery for all compounds (only up to & including C28 for # 2 fuel/diesel).
Accuracy	A	Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD) (#2 fuel/diesel)	Must contain #2 fuel/diesel, 40-140% recovery for # 2 fuel/diesel. (continued below)
Precision	A	Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD) (#2 fuel/diesel)	RPDs ≤ 25%
Accuracy	A	Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD) (non-#2 fuel/diesel)	Must contain all aliphatic and aromatic compounds defined in method section 6.8.6; 40 - 140% recovery for all compounds except n-nonane @ > 25% (continued below)
Precision	A	Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) (non-#2 fuel/diesel)	RPDs for the aliphatic and aromatic carbon range concentrations (the sum of the individual compounds' concentrations within a carbon range) must be ≤ 25% (continued below).
Accuracy	A	Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD) (fractionated samples)	Naphthalene & 2-methyl- naphthalene: concentration or each in aliphatic fraction < 5 % of total concentration
Precision	A	Sample Duplicate (DUP)	Must be performed on a site sample, RPD ≤ 50%
Accuracy	A	Surrogates	OTP and COD, 40 – 140 % recovery; samples undergoing fractionation: no COD in aromatic fraction and/or no OTP observed in aliphatic fraction
Accuracy	A	Fractionating Surrogates	2-bromonaphthalene & 2- fluorobiphenyl 40 – 140 % recovery
Accuracy	A	Initial Calibration (ICAL)	5-point calibration must contain all compounds and lowest standard ≤ RL; CFs established for each compound and, when fractionated, also for each aliphatic and aromatic carbon range; % RSD for all individual CFs ≤ 25% and when fractionated, also for each aliphatic and aromatic carbon range.
Accuracy	A	Continuing Calibration (CCAL)	Concentration level at mid-point of ICAL curve containing all compounds: %D ≤ 25% for total range, ≤ 30% any single compound; for samples undergoing fractionation: %D ≤ 25% for each carbon range, ≤ 30% any single compound in a range
Accuracy	A	Quantitation	RL ≤ results ≤ upper calibration range on a sample-specific basis; average response factors generated from the ICAL must be used for quantitation and peak area, as used for ICAL, must be used for sample. Results reported between the MDL and RL qualified

Data Quality Indicator (DQI)	QC Measure for Sampling (S), Analytical (A), or both (S&A)	QC Sample or Activity	QC Acceptance Limits (Measurement Performance Criteria)
			"J".
Sensitivity	A	Reporting of Non-Detects	Reported at the sample-specific RL which must meet site specific DQOs.
Overall Precision & Representative- ness	S & A	Field Duplicate Samples [Site-specific QC]	RPD $\leq$ 30% for waters or RPD $\leq$ 50% for solids w/results > 2x RL; Professional judgment for results < 2xRL
Accuracy (preservation)	S	Temperature Blank or other Cooler Temperature Reading	Cool to $\leq$ 6º C; allow for < 2º C if samples intact
Accuracy (preservation)	S	pH for aqueous samples	pH < 2
Accuracy/ Sensitivity	S & A	Holding Time (HT)	Samples extracted within 14 days of collection; extract analyzed within 40 days of extraction.
Accuracy/ Sensitivity	S	Equipment Blank [Site-specific QC]	Compounds < RL
Data Completeness	S & A	Calculate from valid/usable data collected	$\geq$ 90% Overall
Comparability	S & A	Based on Method (SOP) and QAPP protocols/DQ Os	Comparison between historical data for qualitative integrity of the data. Comparison between spatially similar samples.

NOTES:

1. This table was prepared by NJDEP, April 2014 to be compliant with EPA Region 2 guidance, and meet the data quality needs of the Department.
2. Method reference = NJDEP Analysis of Extractable Petroleum Hydrocarbon Compounds (EPH) in Aqueous and Soil/Sediment/Sludge.

WORKSHEET #5E SECONDARY DATA CRITERIA AND LIMITATIONS TABLE

No secondary sources of data shall be used for this project as this is the initial site investigation for the subject site and no other data is available.

WORKSHEET #6 PROJECT SPECIFIC METHOD AND STANDARD OPERATING PROCEDURES (SOPS) REFERENCE TABLE

Copies of the Laboratory SOPs are provided as **Appendix B**. Copies of the Field Sampling SOPs are included as **Appendix C**.

ANALYTICAL METHOD REFERENCE (*Include document title, method name/number, revision number, date)*
1a. Volatile Organic Compounds by GC/MS (EPA8260B,8260C, 624, 624.1 And SM6200B), Document No. 330363, Revision date January 2, 2018 R25
2a.Mercury in Solid Waste (Cold-Vapor Technique) (EPA Methods 7471A & 7471B), Document No. 340384B, Revision date January 27, 2018 R13
3a.Determination of Metals and Trace Elements in Various Matrices by ICP-AES (EPA Methods 6010B, 6010C, 6010D, [ICP-OES], and 200.7) Including Hardness (EPA Methods 200.7 and 6010B/C/D and SM2340 B), Document No. 340386, date September 10, 2018 R21
4a. Semi-Volatile Organic Compounds by GC/MS (EPA Methods 8270C, 8270D 625, 625.1 and SM6410B), Including Provisions for Analysis in SIM Mode, Document No. 330345, date March 22, 2018 R26
5a. Polychlorinated Biphenyls (PCBs) by Gas Chromatography (Soil, Water & Oil) (EPA Methods 608, 608.3, 8082 & 8082 A) SM 6431B), Document No. 330343, date March 23, 2018 R17
6a. Pesticides by Gas Chromatography (EPA Methods 608, 608.3, 8081A, 8081B , SM6630C), Document No. 330344, date July 17, 2018 R21
ANALYTICAL LABORATORY SOPs (*Include document title, date, revision number, and originators name)*
1b. Volatile Organic Compounds by GC/MS (EPA8260B,8260C, 624, 624.1 And SM6200B), Document No. 330363, Revision date January 2, 2018 R25
2b. Mercury in Solid Waste (Cold-Vapor Technique) (EPA Methods 7471A & 7471B), Document No. 340384B, Revision date January 27, 2018 R13
3b. Determination of Metals and Trace Elements in Various Matrices by ICP-AES (EPA Methods 6010B, 6010C, 6010D, [ICP-OES], and 200.7) Including Hardness (EPA Methods 200.7 and 6010B/C/D and SM2340 B), Document No. 340386, date September 10, 2018 R21
4b.Semi-Volatile Organic Compounds by GC/MS (EPA Methods 8270C, 8270D 625, 625.1 and SM6410B), Including Provisions for Analysis in SIM Mode, Document No. 330345, date March 22, 2018 R26

5b. Polychlorinated Biphenyls (PCBs) by Gas Chromatography (Soil, Water & Oil) (EPA Methods 608, 608.3, 8082 & 8082 A) SM 6431B), Document No. 330343, date March 23, 2018 R17
6b. Pesticides by Gas Chromatography (EPA Methods 608, 608.3, 8081A, 8081B , SM6630C), Document No. 330344, date July 17, 2018 R21
FIELD SAMPLING SOPs [1] (*Include document title, date, revision number, and originator=s name)*
1c. NJDEP Field Sampling Procedures Manual, August 2005, Last revision February 1, 2011
2c. Soil Sampling SOP, July 2016
[1] Project Sampling SOPs include sample collection, sample preservation, equipment decontamination, preventive maintenance, etc.

WORKSHEET #7 FIELD EQUIPMENT CALIBRATION, MAINTENANCE, TESTING, AND INSPECTION

Field Equipment	Calibration Activity	Maintenance Activity	Testing/ Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	SOP Reference
PID	Calibrate with isobutylene gas	N/A	N/A	Prior to the start of each field day; once every 4 hours	±10% of true value	Re-calibrate	NJDEP Field Procedures Manual

WORKSHEET #8 ANALYTICAL LABORATORY INSTRUMENT AND EQUIPMENT MAINTENANCE, TESTING, AND INSPECTION

Instrument/ Equipment	Maintenance Activity	Testing/ Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	Analytical SOP Reference
GC/MS	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	Acceptable tuning and calibrations	Inspect the system, correct problem, recalibrate and/or reanalyze samples	Department Manager	330363
GC-ECD SW846 8081B SW846 8082A	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	Acceptable breakdown performance. Acceptable Calibration	Inspect the system, correct problem, recalibrate and/or reanalyze samples	Department Manager	330343 330344
GC-MSSW846 8270D	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	Acceptable tuning and calibrations	Inspect the system, correct problem, recalibrate and/or reanalyze samples	Department Manager	330345
GC-FID 8015D	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	Acceptable tuning and calibrations	Inspect the system, correct problem, recalibrate and/or reanalyze samples	Department Manager	330350A
ICP-AES	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	Acceptable tuning and calibrations	Inspect the system, correct problem, recalibrate and/or reanalyze samples	Department Manager	340386
Mercury Analyzer	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	Acceptable tuning and calibrations	Inspect the system, correct problem, recalibrate and/or reanalyze samples	Department Manager	340384A 340384B

Analytical Laboratory Instrument Calibration

Instrument/ Equipment	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Responsible Person	Analytical SOP Reference
GC/MS (VOCs by 8260)	Tune	Prior to ICAL, every 12 hrs.	Method specifications	Re-tune	Analyst	330363
	Initial Calibration	At instrument setup, when CCV fails, prior to sample analysis	≤15%RSD; R^2≥0.99 linear regression	Correct problems then recalibrate		
	CCV	Daily before samples, after every 12 hours at the end of the batch run	All reported analytes and surrogates within ±20% of true value	Recalibrate as required by method; note outliers in narrative		
GC/MS (SOVCs by 8260, PCBs by 8082 and pesticides by 8081)	Tune	Prior to ICAL, every 12 hrs.	Method specifications	Re-tune	Analyst	330345
	Initial Calibration	At instrument setup, when CCV fails, prior to sample analysis	≤15%RSD; R^2≥0.99 linear regression	Correct problems then recalibrate		
	CCV	Daily before samples, after every 12 hours at the end of the batch run	All reported analytes and surrogates within ±20% of true value	Recalibrate as required by method; note outliers in narrative		
GC-ECD (SOVCs by 8260, PCBs by 8082 and pesticides by 8081)	Breakdown check	Before sample analysis and at the beginning of each 12 hour shift	Degredation of DDT and Endrin must each be ≤15%	Correct problem, then repeat breakdown checks	Analyst	330344 & 330343
	Initial Calibration	At instrument setup and after ICV or CCV failure, prior to sample analysis	≤20% RSD; R^2≥0.99 for linear regression	Correct problem then recalibrate		
	CCV	Before sample analysis, after every 10 field samples and at the end of analysis sequence with the exception of CCVs for pesticides multicomponent analytes (toxaphene, chlordane and Aroclors other than 1016/1260) which are only required before sample analysis	All reported analytes and surrogates within established RT windows. All reported analytes and surrogates within ±20% of true value	Recalibrate as required by method; note outliers in narrative		
Thermo 7400 DUO ICP (6010 Metals and Mercury)	ICAL	Daily ICAL prior to sample analysis	If more than one calibration standard is used, R^2≥0.99	Correct problem, then recalibrate	Analyst	340386
	ICV	Once after each ICAL, analysis of a second source standard prior to sample analysis	±10% of true value	Correct problem. Rerun ICV. If that fails, repeat ICAL		
	CCV	After each 10 field samples, and at the end of analysis sequence	±10% of true value	Immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails or if two consecutive CCVs cannot be run, perform corrective actions and repeat the CCV and all associated samples since the last		

Instrument/ Equipment	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Responsible Person	Analytical SOP Reference
				successful CCV. Alternately, recalibrate if necessary; then reanalyze all associated samples since the last acceptable CCV.		
Leeman Hydra II AA Teledyne Quicktrace 7600 (6010 Metals and Mercury)	ICAL	Daily	Correlation coefficient $R^2 \geq 0.99$	Correct problem then recalibrate	Analyst	340384A 340384B
	ICV	Once after each ICAL analysis of a second sources standard prior to sample analysis	±10% of true value	Correct problem. Rerun ICV. If that fails, repeat ICAL		
	CCV	Beginning of every run, every 10 samples and end of run.	±10% of true value	Immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails or if two consecutive CCVs cannot be run, perform corrective actions and repeat the CCV and all associated samples since the last successful CCV. Alternately, recalibrate if necessary; then reanalyze all associated samples since the last acceptable CCV.		
GC/FIND Detector (EPHNJ)	ICAL	At instrument setup, after ICV or CCV failure. Prior to sample analysis	≤25% RSD; linear regression fit not acceptable	Correct problem, re-calibrate	Analyst	330353
	ICV	Once after each ICAL, analysis of a second source standard prior to sample analysis	±25% of true value	Correct problem, rerun ICV. If still fails, re-calibrate		
	CCV	Prior to samples, every 20 samples or every 24 hours whatever is more frequent, and at the end of the analytical sequence	Concentration level at mid-point of ICL curve containing all compounds %D ≤25% for total range, ≤30% any single compound for samples undergoing fractionation; %D ≤25% for each carbon range, ≤30% any single compound in range	Recalibrate as required by the method; note outliers in narrative.		

WORKSHEET #9A SAMPLE HANDLING SYSTEM

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): TTI Environmental/Andrew Basehoar
Sample Packaging (Personnel/Organization): TTI Environmental/Andrew Basehoar
Coordination of Shipment (Personnel/Organization): TTI Environmental/Andrew Basehoar
Type of Shipment/Carrier: Fed Ex.
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Pace Analytical/Alan Harvill
Sample Custody and Storage (Personnel/Organization): Pace Analytical/Alan Harvill
Sample Preparation (Personnel/Organization): Pace Analytical/Alan Harvill
Sample Determinative Analysis (Personnel/Organization): Pace Analytical/Alan Harvill
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): Samples to be shipped within 24 hours, and arrive at laboratory within 24 hours (1 day) of sample shipment.
Sample Extract/Digestate Storage (No. of days from extraction/digestion): As per analytical methodology.
SAMPLE DISPOSAL
Personnel/Organization: Pace Analytical/Alan Harvill
Number of Days from Analysis: Until analysis and QA/QC checks are completed; as per analytical methodology.

WORKSHEET #9B SAMPLE CUSTODY REQUIREMENTS

Sample Identification Procedures: Samples shall be labeled by AOC number, boring number and depth of sample collection. Example: AOC 1 – 1 @ 5-5.5

Field Sample Custody/Tracking Procedures (sample collection, packaging, shipment, and delivery to laboratory): Sampling information shall be recorded in field books to include sample identification, sample depth and sample collection time. Example: AOC 1 – 1 @ 5-5.5 collected at 900.

Laboratory Sample Custody/Tracking Procedures (receipt of samples, archiving, and disposal): Samples shall be logged in to the laboratory and given a lab specific tracking number. Example: L123456-1

Chain-of-Custody Procedures: All samples (sample name, time of sample collection, date, time and sample depth) shall be logged on chain of custody documents. All samples shall be handled and transferred from sampling technicians to laboratory personnel under signature of release and acceptance of samples including date and time of release and acceptance of samples.

WORKSHEET #10 FIELD AND ANALYTICAL LABORATORY QUALITY CONTROL SUMMARY

The below table outlines the field QC samples that will be collected and sent to the laboratory, and the QC samples performed by the laboratory. QC samples will be collected in accordance with the NJDEP *Field Sampling Procedures Manual* and *Data of Known Quality Protocols Technical Guidance*.

Matrix	Soil
Analytical Group	VOCs
Concentration Level	Low/Medium - mg/kg (ppm)
Sampling SOP(s)	NJDEP Field Sampling Guide, August 2005
Analytical Method/SOP Reference	Method 8260
Sampler's Name	Andy Basehoar/Dave DiPascale/Anna Ternova/Alec Halbruner
Field Sampling Organization	TTI Environmental
Analytical Organization	Pace Analytical
No. of Sample Locations	15

Matrix	Soil
Analytical Group	B/Ns
Concentration Level	Low/Medium - mg/kg (ppm)
Sampling SOP(s)	NJDEP Field Sampling Guide, August 2005
Analytical Method/SOP Reference	Method 8270
Sampler's Name	Andy Basehoar/Dave DiPascale/Anna Ternova/Alec Halbruner
Field Sampling Organization	TTI Environmental
Analytical Organization	Pace Analytical
No. of Sample Locations	16

Matrix	Soil
Analytical Group	PAHs
Concentration Level	Low/Medium - mg/kg (ppm)
Sampling SOP(s)	NJDEP Field Sampling Guide, August 2005
Analytical Method/SOP Reference	Method 8270
Sampler's Name	Andy Basehoar/Dave DiPascale/Anna Ternova/Alec Halbruner
Field Sampling Organization	TTI Environmental
Analytical Organization	Pace Analytical
No. of Sample Locations	15

Matrix	Soil
Analytical Group	TAL Metals
Concentration Level	Low/Medium - mg/kg (ppm)
Sampling SOP(s)	NJDEP Field Sampling Guide, August 2005
Analytical Method/SOP Reference	Method 6010/7471
Sampler's Name	Andy Basehoar/Dave DiPascale/Anna Ternova/Alec Halbruner
Field Sampling Organization	TTI Environmental
Analytical Organization	Pace Analytical
No. of Sample Locations	21

Matrix	Soil
Analytical Group	PCBs
Concentration Level	Low/Medium - mg/kg (ppm)
Sampling SOP(s)	NJDEP Field Sampling Guide, August 2005
Analytical Method/SOP Reference	Method 8082
Sampler's Name	Andy Basehoar/Dave DiPascale/Anna Ternova/Alec Halbruner
Field Sampling Organization	TTI Environmental
Analytical Organization	Pace Analytical
No. of Sample Locations	20

Matrix	Soil
Analytical Group	Organochloride Pesticides
Concentration Level	Low/Medium - mg/kg (ppm)
Sampling SOP(s)	NJDEP Field Sampling Guide, August 2005
Analytical Method/SOP Reference	Method 8081
Sampler's Name	Andy Basehoar/Dave DiPascale/Anna Ternova/Alec Halbruner
Field Sampling Organization	TTI Environmental
Analytical Organization	Pace Analytical
No. of Sample Locations	19

Matrix	Soil
Analytical Group	EPH
Concentration Level	Low/Medium/High - mg/kg (ppm)
Sampling SOP(s)	NJDEP Field Sampling Guide, August 2005
Analytical Method/SOP Reference	NJDEP EPH
Sampler's Name	Andy Basehoar/Dave DiPascale/Anna Ternova/Alec Halbruner
Field Sampling Organization	TTI Environmental
Analytical Organization	Pace Analytical
No. of Sample Locations	15

VOCs

Quality Control (QC) Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
BFB Tune	Every 12 hours	Method tune criteria based on criteria in Table 4 of USEPA-SW846 Method 8260B	Perform instrument maintenance; reanalyze until acceptable	Analyst	Accuracy	Method tune criteria based on criteria in Table 4 of USEPA-SW846 Method 8260B
Initial Calibration (ICAL)	Initially and when CCV fails	Minimum 5-standards; must contain all targets and lowest standard ≤ RL; Full Scan: RF for SPCCs Section 7.3.5.4; %RSD ≤ 15% for all compounds except CCC's which must be	Recalibrate as required by method; analysis cannot proceed without a valid initial calibration	Analyst	Accuracy	Minimum 5-standards; must contain all targets and lowest standard ≤ RL; Full Scan: RF for SPCCs Section 7.3.5.4; %RSD ≤ 15% for all compounds except CCC's which must be ≤30% RSD or "r" ≥

Quality Control (QC) Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
		≤30% RSD or "r" ≥ 0.99; SIM: %RSD ≤ 20% or "r" ≥ 0.99 for all compounds; regression analysis, if used, must not be forced through the origin				0.99; SIM: %RSD ≤ 20% or "r" ≥ 0.99 for all compounds; regression analysis, if used, must not be forced through the origin
Method Blank	1 per preparatory batch of up to 20 field samples (matrix-specific)	Targets analytes must be < RL except for common laboratory contaminates (acetone, methylene chloride and MEK) which must be < 5x RL, surrogates in criteria	Reanalyze and, if necessary, re-extract. Report non-conformance in narrative; compounds present in blank should be flagged "B" in samples, if detected.	Analyst	Accuracy/ Sensitivity	Targets analytes must be < RL except for common laboratory contaminates (acetone, methylene chloride and MEK) which must be < 5x RL, surrogates in criteria
Matrix Spike/ Matrix Spike Duplicate [Site-specific QC]	1 per ≤ 20 field samples per matrix	Must contain all target analytes, performed on Site field sample, % recovery 70-130% except for difficult analytes** which must exhibit % recovery between 40-160%	Evaluate LCS, unspiked sample, reanalyze, if necessary, and qualify data and narrate issue	Analyst/Data Reviewer	Accuracy	Must contain all target analytes, performed on Site field sample, % recovery 70-130% except for difficult analytes** which must exhibit % recovery between 40-160%
Matrix Spike/ Matrix Spike Duplicate [Site-specific QC]	1 per ≤ 20 field samples per matrix	Must contain all target analytes, performed on Site field sample, recovery criteria same as MS; RPDs ≤ 20% for waters and ≤ 30% for solids	Reanalyze, if necessary, qualify data and narrate issues of non-conformance	Analyst/Data Reviewer	Precision	Must contain all target analytes, performed on Site field sample, recovery criteria same as MS; RPDs ≤ 20% for waters and ≤ 30% for solids
Laboratory Control Sample (LCS)	1 per preparatory batch of up to 20 samples	Must contain all target analytes, be matrix-matched; % Recovery 70- 130% except for difficult analytes ** must exhibit percent recoveries between 40-160%.	Reanalyze, if necessary, qualify data and narrate issues of non-conformance	Analyst/Data Reviewer	Accuracy	Must contain all target analytes, be matrix-matched; % Recovery 70- 130% except for difficult analytes ** must exhibit percent recoveries between 40-160%.
Sample Duplicate (DUP)	1 per ≤ 20 field samples if a MS/MSD was not performed	Must be performed on a Site field sample. RPDs ≤ 20% for waters and ≤ 30% for solids for results > 2x RL	Reanalyze, if necessary, qualify data and narrate issues of non-conformance	Analyst/Data Reviewer	Precision	Must be performed on a Site field sample. RPDs ≤ 20% for waters and ≤ 30% for solids for results > 2x RL
Surrogates	Every sample including QC	Minimum of 3 surrogates at retention times across GC run for all matrices; surrogates must be	Reanalyze, if necessary, qualify data	Analyst/Data Reviewer	Accuracy	Minimum of 3 surrogates at retention times across GC run for all matrices; surrogates must be between 70-

Quality Control (QC) Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
		between 70- 130% for all compounds.				130% for all compounds.
Internal Standards (IS)	3 per sample including QC	Minimum of 3 IS , Areas 50-200% of the most recent CCV; RTs ±30 sec. from midpoint ICAL standard	Reanalyze and qualify data	Analyst/Data Reviewer	Accuracy	Minimum of 3 IS , Areas 50-200% of the most recent CCV; RTs ±30 sec. from midpoint ICAL standard
Continuing Calibration Verification (CCV)	1 every 12 hours prior to analysis of samples	Concentration level near mid-point of ICAL curve containing all target compounds; *Full Scan and SIM*: min RRF criteria met; %D or % Drift ≤ 20% for all compounds	Recalibrate as required by method; note outliers in narrative.	Analyst	Accuracy	Concentration level near mid-point of ICAL curve containing all target compounds; *Full Scan and SIM*: min RRF criteria met; %D or % Drift ≤ 20% for all compounds
Field Duplicate Samples [Site-specific QC]	1 per 20 field samples	RPD ≤ 30% for waters or RPD ≤ 50% for solids w/results > 2x RL; Professional judgment for results < 2xRL	Potential data usability issue	Data Reviewer	Overall Precision & Representativeness	RPD ≤ 30% for waters or RPD ≤ 50% for solids w/results > 2x RL; Professional judgment for results < 2xRL
Trip Blank (Aqueous samples only)	1 per cooler (containing volatiles)	Target compounds < RL with the exception of common contaminants (i.e., methylene chloride, acetone, 2-butanone) which should be <5x RL	Potential data usability issue	Data Reviewer	Representativeness	Target compounds < RL with the exception of common contaminants (i.e., methylene chloride, acetone, 2-butanone) which should be <5x RL

NOTES:

1. This table was prepared by NJDEP, April 2014, to be compliant with EPA Region 2 guidance and meets the data quality needs of the Department.
2. Volatile Organic Compound analyses via USEPA SW-846 Method 8260B (*Quality Assurance and Quality Control Requirements for SW-846 Method 8260B* or 8260C *Volatile Organic Compounds by Gas Chromatography/Mass Spectroscopy [GC/MS]).*

SVOCs

Data Quality Indicator (DQI)	QC Sample or Activity	Frequency / Number	QC Acceptance Limits (Measurement Performance Criteria)	Corrective Action (CA)	Person(s) Responsible for CA
Precision	Matrix Spike/ Matrix Spike Duplicate [Site-specific QC]	1 per ≤ 20 field per matrix samples	Must contain all target analytes, performed on Site field sample, % recovery criteria same as MS. RPDs ≤ 20% for waters and ≤ 30% for solids	Reanalyze, if necessary, qualify data and narrate issues of non- conformance	Analyst/Data Reviewer

Data Quality Indicator (DQI)	QC Sample or Activity	Frequency / Number	QC Acceptance Limits (Measurement Performance Criteria)	Corrective Action (CA)	Person(s) Responsible for CA
Accuracy	Laboratory Control Sample (LCS)	1 per extraction batch of up to 20 samples	Must contain all target analytes, be matrix-matched; % Recovery 70-130% except for difficult analytes ** must exhibit percent recoveries between 20-160%.	Reanalyze, if necessary, qualify data and narrate issues of non- conformance	Analyst/Data Reviewer
Precision	Sample Duplicate (DUP)	1 per < 20 field samples if an MS/MSD was not performed	Must be performed on a Site field sample. RPD ≤ 20% for waters and ≤ 30% for solids for results > 2x RL	Reanalyze, if necessary, qualify data and narrate issues of non- conformance	Analyst/Data Reviewer
Accuracy	Surrogates	Every sample including QC	Minimum of 3 base-neutral and 3 acid surrogates at RTs across GC run; for solids matrices must be between 30-130% for all compounds; for water matrices 30-130% for BN surrogates and 15- 110% for Acid surrogates	Reanalyze, if necessary, qualify data	Analyst/Data Reviewer
Accuracy	Internal Standards (IS)	6 per sample including QC	Minimum of 6 IS , Areas 50-200% of the most recent CCV standard; RTs ± 30 sec. from midpoint ICAL standard	Reanalyze and qualify data	Analyst/Data Reviewer
Accuracy	Continuing Calibration Verification (CCV)	1 every 12 hour prior to analysis of samples	Concentration level near mid-point of ICAL curve containing all target compounds; *Full Scan*: %D or %Drift ≤ 20% for CCCs and ≤ 30% for all other compounds *SIM*: %D or %Drift ≤ 30%	Recalibrate as required by method; note outliers in narrative.	Analyst
Accuracy	Quantitation	Every sample	RL ≤results ≤ upper calibration range on a sample-specific basis; IS must be used; and average response factors or curve-statistics generated from the ICAL must be used for quantitation. Results reported between the MDL and RL qualified "J"	Perform dilution to bring analyte within linear range, qualify data	Analyst/Data Reviewer
Sensitivity	Reporting of Non-Detects	Every sample	Reported at the sample-specific RL which must be ≤ PRL	Potential data usability issue	Data Reviewer
Overall Precision & Representative-ness	Field Duplicate Samples [Site-specific QC]	1 per 20 field samples	RPD ≤ 30% for waters or RPD ≤ 50% for solids w/results > 2x RL; Professional judgment for results < 2xRL	Potential data usability issue	Data Reviewer
Accuracy	Temperature	1 Temperature	≤ 6º C; allow for < 2º C if	Potential data	Data Reviewer

Data Quality Indicator (DQI)	QC Sample or Activity	Frequency / Number	QC Acceptance Limits (Measurement Performance Criteria)	Corrective Action (CA)	Person(s) Responsible for CA
(preservation)	Blank or other Cooler Temperature Reading	reading per cooler to be recorded upon receipt at lab	samples intact sample preservation per SW- 846 Chapter 4 Table 4-1	usability issue	
Accuracy/ Sensitivity	Holding Time (HT)	Every field sample	Aqueous samples extracted within 7 days of collection; extract analyzed within 40 days of extraction. Soil/Sediment samples extracted within 14 days of collection; extract analyzed within 40 days of extraction. If Soil/Sediment samples are frozen, HT arrested and extraction HT continues when thawed. Solid samples can be maintained frozen for 1 year from collection.	Potential data usability issue	Data Reviewer
Accuracy/ Sensitivity	Equipment Blank	Not Required if using dedicated	Target analytes < RL	Potential data usability issue	Data Reviewer
	[Site-specific QC]	sampling equipment. If performing decontamination of equipment, collect 1 EB per 20 field samples collected by the same method			
Data Completeness	Calculate from valid/usable data collected	Not applicable	≥ 90% Overall	Potential data usability / data gap issue	Data Reviewer/ Investigator
Comparability	Based on Method (SOP) and QAPP/FSP protocols	Not applicable	Comparison between historical data for qualitative integrity of the data. Comparison between spatially similar samples.	Potential data usability issue	Data Reviewer/ Investigator

NOTES:

1. This table was prepared by NJDEP, January 2011 to be compliant with EPA Region 2 guidance and meet the data quality needs of the Department.
2. Semivolatile Organic Compound analyses via USEPA SW-846 Method 8270D (*Quality Assurance and Quality Control Requirements for SW- 846 Method* 8270D *Semivolatile Organic Compounds by Gas Chromatography/Mass Spectroscopy [GC/MS]).* 8270D:

** Potentially "difficult" analytes include: benzenthiol, benzoic Acid, 2,4-dintrophenol, 3&4 – methylphenol, 4-nitrophenol, pentachlorophenol, phenol, aniline, aramite, A,A-dimethylphenethylamine, benzidine, benzaldehyde, benzyl Alcohol, caprolactam, chlorobenzilate,

3,3'- Dimethylbenzidine, 1,4-Dioxane, 7,12-Dimethylbenz(a)anthracene, Diallate, Dibenz(a,j)acridine, Diphenylamine, Disulfoton, p- (dimethylamine)azobenzene, decane, famphur, hexachlorocyclopentadiene, hexachloroethane, hexachlorophene, hexachloropropene, kepone, 4,4'-methylenebis(2-chloroaniline), methapyrilene, methyl methanesulfonate, methyl parathion, n-nitrosodimethylamine, 4-nitroquinoline-1-oxide, 2-Picoline, parathion, pentachloroethane, pentachlorobenzene, pentachloronitrobenzene, phorate, pronamide, pyridine, p-phenylenediamine, o- tricresyl phosphate and Tetraethyl. Please note that many of the surrogates may fall outside of the 15 – 110% range 2-Fluorophenol, Phenol-d5, 2,4,6-tribromophenol and terphenyl-d14.

SVOCs

Data Quality Indicator (DQI)	QC Sample or Activity	Frequency / Number	QC Acceptance Limits (Measurement Performance Criteria)	Corrective Action (CA)	Person(s) Responsible for CA
Accuracy	DFTPP Tune	Every 12 hours	Method tune criteria based on criteria in Table 3 of USEPA-SW846 Method 8270D	Perform instrument maintenance; reanalyze until acceptable	Analyst
Accuracy	Initial Calibration (ICAL)	Initially and when CCAL fails	Minimum 5-standards; must contain all targets and lowest standard ≤ RL; *Full Scan*: RF see Table 4 for minimum RF; %RSD ≤ 20% for all compounds or "r" ≥ 0.99; *SIM*: %RSD ≤ 20% or "r" ≥ 0.99 for all compounds	Recalibrate as required by method; analysis cannot proceed without a valid initial calibration	Analyst
Accuracy/ Sensitivity	Method Blank	1 per extraction batch of up to 20 field samples	Must be matrix matched; Phthalates < 5xRL; All other Targets < RL, surrogates in criteria	Reanalyze and, if necessary, re- extract. Report non-conformance in narrative; compounds present in blank should be flagged "B" in samples, if detected.	Analyst
Accuracy	Matrix Spike/ Matrix Spike Duplicate [Site-specific QC]	1 per ≤ 20 field per matrix samples	Must contain all target analytes, performed on Site field sample, % recovery 70-130% except for difficult analytes** which must exhibit % recovery between 20-160%	Evaluate LCS, unspiked sample, reanalyze, if necessary, and qualify data and Narrate issue	Analyst/Data Reviewer
Precision	Matrix Spike/ Matrix Spike Duplicate [Site-specific QC]	1 per ≤ 20 field per matrix samples	Must contain all target analytes, performed on Site field sample, % recovery criteria same as MS. RPDs ≤ 20% for waters and ≤ 30% for solids	Reanalyze, if necessary, qualify data and narrate issues of non- conformance	Analyst/Data Reviewer
Accuracy	Laboratory Control Sample (LCS)	1 per extraction batch of up to 20 samples	Must contain all target analytes, be matrix-matched; % Recovery 70- 130% except for difficult analytes ** must exhibit percent recoveries between 20-160%.	Reanalyze, if necessary, qualify data and narrate issues of non- conformance	Analyst/Data Reviewer
Precision	Sample Duplicate (DUP)	1 per < 20 field samples if an MS/MSD was not performed	Must be performed on a Site field sample. RPD ≤ 20% for waters and < 30% for solids for results > 2x RL	Reanalyze, if necessary, qualify data and narrate issues of non- conformance	Analyst/Data Reviewer
Accuracy	Surrogates	Every sample including QC	Minimum of 3 base-neutral and 3 acid surrogates at RTs across	Reanalyze, if necessary, qualify data	Analyst/Data Reviewer

Data Quality Indicator (DQI)	QC Sample or Activity	Frequency / Number	QC Acceptance Limits (Measurement Performance Criteria)	Corrective Action (CA)	Person(s) Responsible for CA
			GC run; for solids Matrices must be between 30-130% for all compounds; for water matrices 30-130% for BN surrogates and 15- 110% for acid surrogates		
Accuracy	Internal Standards (IS)	6 per sample including QC	Minimum of 6 IS, Areas 50-200% of the most recent t CCV standard; RTs + 30 sec. from midpoint ICAL standard	Reanalyze and qualify data	Analyst/Data Reviewer
Accuracy	Continuing Calibration Verification (CCV)	1 every 12 hour prior to analysis of samples	Concentration level near mid-point of ICAL curve containing all target compounds; Full Scan: %D or %Drift ≤ 20% for CCCs and ≤ 30% for all other compounds; SIM: %D or %Drift ≤ 30%	Recalibrate as required by method; note outliers in narrative.	Analyst
Accuracy	Quantitation	Every sample	RL ≤□results ≤ upper calibration range on a sample-specific basis; IS must be used; and RL ≤□results ≤ upper calibration range on a sample-specific basis; IS must be used; and average response factors or curve-statistics generated from the ICAL must be used for quantitation. Results reported between the MDL and RL qualified "J"	Perform dilution to bring analyte within linear range, qualify data	Analyst/Data Reviewer
Sensitivity	Reporting of Non-Detects	Every sample	Reported at the sample-specific RL which must be ≤ PRL	Potential data usability issue	Data Reviewer
Overall Precision & Representative-ness	Field Duplicate Samples [Site-specific QC]	1 per 20 field samples	RPD < 30% for waters or RPD ≤ 50% for solids w/results > 2x RL; Professional judgment for results < 2xRL	Potential data usability issue	Data Reviewer
Accuracy (preservation)	Temperature Blank or other Cooler Temperature Reading	1 Temperature reading per cooler to be recorded upon receipt at lab	< 6º C; allow for < 2º C if samples intact sample preservation per SW- 846 Chapter 4 Table 4-1	Potential data usability issue	Data Reviewer
Accuracy/ Sensitivity	Holding Time (HT)	Every field sample	Aqueous samples extracted within 7 days of collection; extract analyzed within 40 days of extraction. Soil/Sediment samples extracted within 14 days of collection; extract analyzed within 40 days of extraction. If Soil/Sediment samples are frozen, HT arrested and extraction HT continues when thawed. Solid samples can be maintained frozen for 1 year from collection.	Potential data usability issue	Data Reviewer
Accuracy/ Sensitivity	Equipment Blank [Site-specific QC]	Not Required if using dedicated sampling equipment. If performing	Target analytes < RL	Potential data usability issue	Data Reviewer

Data Quality Indicator (DQI)	QC Sample or Activity	Frequency / Number	QC Acceptance Limits (Measurement Performance Criteria)	Corrective Action (CA)	Person(s) Responsible for CA
		decontaminatio n of equipment, collect 1 EB per 20 field samples collected by the same method			
Data Completeness	Calculate from valid/usable data collected	Not applicable	> 90% Overall	Potential data usability / data gap issue	Data Reviewer/ Investigator
Comparability	Based on Method (SOP) and QAPP/FSP protocols	Not applicable	Comparison between historical data for qualitative integrity of the data. Comparison between spatially similar samples.	Potential data usability issue	Data Reviewer/ Investigator

NOTES:

1. This table was prepared by NJDEP, January 2011 to be compliant with EPA Region 2 guidance and meet the data quality needs of the Department.
2. Semivolatile Organic Compound analyses via USEPA SW-846 Method 8270D (*Quality Assurance and Quality Control Requirements for SW- 846 Method* 8270D *Semivolatile Organic Compounds by Gas Chromatography/Mass Spectroscopy [GC/MS]).* 8270D:

** Potentially "difficult" analytes include: Benzenthiol, Benzoic Acid, 2,4-Dintrophenol, 3&4 – Methylphenol, 4-Nitrophenol, Pentachlorophenol, Phenol, Aniline, Aramite, A,A-Dimethylphenethylamine, Benzidine, Benzaldehyde, Benzyl Alcohol, Caprolactam, Chlorobenzilate, 3,3'- Dimethylbenzidine, 1,4-Dioxane, 7,12-Dimethylbenz(a)anthracene, Diallate, Dibenz(a,j)acridine, Diphenylamine, Disulfoton, p- (dimethylamine)azobenzene, Decane, Famphur, Hexachlorocyclopentadiene, Hexachloroethane, Hexachlorophene, Hexachloropropene, Kepone, 4,4'-methylenebis(2-chloroaniline), Methapyrilene, Methyl methanesulfonate, Methyl parathion, n-Nitrosodimethylamine, 4-Nitroquinoline-1-oxide, 2-Picoline, Parathion, Pentachloroethane, Pentachlorobenzene, Pentachloronitrobenzene, Phorate, Pronamide, Pyridine, p-Phenylenediamine, o- tricresyl phosphate and Tetraethyl. Please note that many of the surrogates fall outside or the 15 – 110% range 2-Fluorophenol, Phenol-d5, 2,4,6-Tribromophenol and Terphenyl-d14.

Metals

Data Quality Indicator (DQI)	QC Sample or Activity	Frequency / Number	QC Acceptance Limits (Measurement Performance Criteria)	Corrective Action (CA)	Person(s) Responsible for CA
Accuracy	Linear Dynamic Range (LDR)	At a minimum, the LDR should be check every 6 months	A minimum of 3 different concentration standards across the ICP range; one should be near the upper limit of the range.	NA	Analyst
Accuracy	Initial Calibration	Daily prior to sample analysis	Minimum of a calibration blank plus a standard per manufacturing recommended	Re-optimize instrument and re-calibrate, repeat	Analyst

Data Quality Indicator (DQI)	QC Sample or Activity	Frequency / Number	QC Acceptance Limits (Measurement Performance Criteria)	Corrective Action (CA)	Person(s) Responsible for CA
			procedures; RL standard may be included in multi- point calibration curve; linear curve fit with correlation coefficient ≥0.995.	until successful	
Accuracy	Initial Calibration Verification (ICV)	Daily after calibration	Separate-source from calibration standards; must contain all target analytes ICV: 90-110% recovery	Re-analyze; if still out, Re-calibrate as required by method; suspend all analysis until ICV meets criteria	Analyst
Accuracy	Initial Calibration Blanks (ICB)	After ICV	Must be matrix-matched (and same concentration of acid found in standards and samples); ICB: < ± RL	Re-analyze ; if still out, Re-calibrate and reanalyze.	Analyst
Accuracy	Continuing Calibration Verification (CCV)	1 of every 10 samples and at end of run	Same source as calibration standards; conc. near mid-point of calibration curve; must contain all target analytes CCV: 90 - 110% recovery	Re-analyze; if still out, Re-calibrate and reanalyze. all samples since last acceptable CCV	Analyst
Sensitivity	Continuing Calibration Blanks (CCB)	After each CCV	Must be matrix-matched (and same conc. of acid found in standards and samples); CCB: < ± RL	Re-calibrate, if still out, Re-calibrate and reanalyze.	Analyst
Accuracy & Sensitivity (Contamination)	Method Blank (MB)	1 per digestion batch - not to exceed 20 field samples	Must be digested with samples using same preparation method and amount of acids; MB: < RL	Re-analyze; if still out redigest & re-analyze all samples unless all detected results > 10x MB level	Analyst
Accuracy	Interference Check Standards (ICSA and ICSAB)	Daily after calibration	ICSA & ICSB: 80-120% recovery ICSA: non-spiked analytes ≤ 2x RL	Re-analyze; if still out; adjust interference and background correction, and/or linear ranges as needed & recalibrate and reanalyze all field samples since last complaint ICSA & ICSB	Analyst/Data Reviewer
Accuracy	Laboratory Control Sample (LCS)	1 per digestion batch - not to exceed 20 field samples	Must contain all target analytes and be matrix-specific; Aq. LCS: 80- 120% recovery; Soil/Sediment/solid LCS: vendor control limits (95% confidence limits)	Re-analyze, if still out; redigest & Re-analyze LCS & all field samples in batch	Analyst/Data Reviewer
Precision	Sample Duplicate (DUP)	1 per ≤ 20 field samples if an MS/MSD was not performed	Must be performed on a Site field sample. For soil and aqueous samples: Results ≥ 5xRL, RPD ≤ 20% aqueous, 35% solids; Results < 5xRL: absolute difference between results ≤ RL.	Re-analyze, qualify data	Analyst/Data Reviewer
Accuracy	Matrix Spike (MS) [Site-specific QC]	1 per ≤ 20 field samples	Must be performed on a Site field sample; MS: 75-125% recovery; professional judgment if sample concentration > 4x spike level	Evaluate LCS, unspiked sample and qualify data	Analyst/Data Reviewer

Data Quality Indicator (DQI)	QC Sample or Activity	Frequency / Number	QC Acceptance Limits (Measurement Performance Criteria)	Corrective Action (CA)	Person(s) Responsible for CA
Precision	Matrix Spike Duplicate (MSD) [Site-specific QC]	1 per < 20 field samples	Must be performed on a Site field sample. For soil and aqueous samples: Results ≥ 5xRL, RPD ≤ 20% aqueous, 35% solids; Results < 5xRL: absolute difference between results ≤ RL.	Lab narrates outlier; qualify data	Analyst/Data Reviewer
Accuracy	Post digestion spike	1 per ≤ 20 field samples if less than acceptable accuracy and precision data are generated	Should be performed if MS/MSD recoveries were unacceptable: 80- 120% recovery	Lab narrates outlier; qualify data	Analyst/Data Reviewer
Accuracy	Serial Dilution	1 per ≤ 20 field samples if less than acceptable accuracy and precision data are generated	Perform 5x dilution on same sample used for MS. % Difference ≤ 10% for results >50x IDL (which will most likely equate to 10X RL).	Lab narrates outlier qualify data	Analyst/Data Reviewer
Accuracy	Quantitation	Not applicable	RL ≤ results ≤ linear calibration range on a sample-specific basis. Report all Aq. results in µg/L or mg/L and all Soil/Sediment results in mg/Kg on a dry-weight basis.	Perform dilution to bring analyte within linear range; report from diluted analysis	Analyst/Data Reviewer
Overall Precision & Representativeness	Field Duplicate Sample [Site-specific QC]	1 per 20 field samples	Aq.: Results ≥ 5xRL: RPD ≤ 30%; Results < 5xRL: professional judgment; Soil/Sediment: Results ≥ 5xRL: RPD ≤ 50%; Results < 5xRL: professional judgment	Potential data usability issue; indication of sample heterogeneity	Data Reviewer
Accuracy (preservation)	Sample preservation	Every field sample	Aq.: Total Metals: HNO_3 pH < 2; (Dissolved Metals: filter on site or at the lab then HNO_3 pH < 2 but cannot be used for regulatory compliance) Soil/Sediment: collect unpreserved per SW-846 Chapter 3 Table 3-2	Lab narrates outlier. Potential data usability issue	Data Reviewer
Data Completeness	Calculate from valid/usable data collected	Not applicable	Minimum ≥ 90% Overall	Potential data usability / data gap issue	Data Reviewer/ Investigator
Accuracy/ Sensitivity	Holding Time (HT)	Every field sample	For aqueous and soil samples six months. If Soil/Sediment samples are frozen, HT arrested and HT begins when thawed. Samples can be maintained frozen for 1 year from collection.	Lab narrates outlier. Potential data usability issue	Data Reviewer
Accuracy & Sensitivity (Contamination)	Equipment Rinsate Blank (EB)	Not Required if using dedicated sampling equipment. If performing decontamination of equipment, collect 1 EB per 20 field samples collected by the same method	Aqueous EB: < RL Soil/Sediment EB <RL on solid equivalent basis	Aqueous Potential data usability issue, Soil/Sediment: non-matrix matched aqueous EB use professional judgment	Data Reviewer
Comparability	Based on	Not applicable	Comparison between historical	Potential data	Data

Data Quality Indicator (DQI)	QC Sample or Activity	Frequency / Number	QC Acceptance Limits (Measurement Performance Criteria)	Corrective Action (CA)	Person(s) Responsible for CA
	Method (SOP) and QAPP/ FSP protocols		data for qualitative integrity of the data. Comparison between spatially similar samples.	usability issue	Reviewer/ Investigator

NOTES:

1. This table was prepared by NJDEP, April 2014 to be compliant with EPA Region 2 guidance and meet the data quality needs of the Department.
2. Method References = USEPA SW-846 Method 6010B (*Inductively Coupled Plasma-Mass Spectrometry*, December 1996 and February 2007) and (*Quality Assurance and Quality Control Requirements and Performance Standards for SW846 Method 6010B, Trace Metals by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP)*).

Data Quality Indicator (DQI)	QC Sample or Activity	Frequency / Number	QC Acceptance Limits (Measurement Performance Criteria)	Corrective Action (CA)	Person(s) Responsible for CA
Accuracy	Linear Dynamic Range (LDR)	At a minimum, the LDR should be check every 6 months	A minimum of 3 different concentration standards across the ICP range one should be near the upper limit of the range.	NA	Analyst
Accuracy	Initial Calibration	Daily prior to sample analysis	Minimum of a calibration blank plus a standard per manufacturing recommended procedures; RL standard may be included in multi- point calibration curve; linear curve fit with correlation coefficient $\geq$0.998.	Re-optimize instrument and re-calibrate, repeat until successful	Analyst
Accuracy	Initial Calibration Verification (ICV)	Daily after calibration	Separate-source from calibration standards; must contain all target analytes ICV: 90-110% recovery	Re-analyze; if still out, Re-calibrate as required by method; suspend all analysis until ICV meets criteria	Analyst
Sensitivity	Low Level Initial Calibration Verification	For method 6010C, LLICV must be analyzed at the beginning of the run before any samples and at the end of the run.	Same source as calibration standards; must contain all target analytes at the RL 70-130% recovery	Re-analyze. If still out, Re-calibrate/ re-analyze. Suspend all analyses until LLICV meets criteria unless all results > 10x RL	Analyst
Accuracy	Initial Calibration Blanks (ICB)	After ICV	Must be matrix-matched (and same conc. of acid found in standards and samples); ICB: < ± RL	Re-analyze ; if still out, Re-calibrate and reanalyze.	Analyst
Accuracy	Continuing Calibration Verification (CCV)	1 every 10 samples and at end of run	Same source as calibration standards; conc. near mid-point of calibration curve; must contain all target analytes CCV: 90 - 110% recovery	Re-analyze; if still out, Re-calibrate and reanalyze. All samples since last acceptable CCV	Analyst
Sensitivity	Low Level Continuing Calibration	For method 6010C, LLCCV must be analyzed at the	Same source as initial calibration standards; must contain all target analytes at the RL 70-130%	Re-analyze. If still out, Re- calibrate/ re-analyze. Suspend all	Analyst

Data Quality Indicator (DQI)	QC Sample or Activity	Frequency / Number	QC Acceptance Limits (Measurement Performance Criteria)	Corrective Action (CA)	Person(s) Responsible for CA
	Verification	beginning of the run before any samples and at the end of the run.	recovery	analyses until LLICV meets criteria unless all results > 10x RL	
Sensitivity	Continuing Calibration Blanks (CCB)	After each CCV	Must be matrix-matched (and same conc. of acid found in standards and samples); CCB: < ± RL	Re-analyze ; if still out, Re-calibrate and reanalyze.	Analyst
Accuracy & Sensitivity (Contamination)	Method Blank (MB)	1 per digestion batch - not to exceed 20 field samples	Must be digested with samples using same preparation method and amount of acids; MB: < RL	Re-analyze; if still out redigest & re-analyze all samples unless all detected results > 10x MB level	Analyst
Accuracy	Interference Check Standards (ICSA and ICSAB)	Daily after calibration	ICSA & ICSB: 80-120% recovery ICSA: non-spiked analytes ≤ 2x RL	Re-analyze; if still out, adjust interference and background correction, and/or linear ranges as needed & recalibrate and reanalyze all field samples since last complaint ICSA & ICSB	Analyst/Data Reviewer
Accuracy	Laboratory Control Sample (LCS)	1 per digestion batch - not to exceed 20 field samples	Must contain all target analytes and be matrix-specific; Aq. LCS: 80- 120% recovery; Soil/Sediment/sol-id LCS: vendor control limits (95% confidence limits)	Re-analyze, if still out, re-digest & re-analyze LCS & all field samples in batch	Analyst/Data Reviewer
Precision	Sample Duplicate (DUP)	1 per < 20 field samples if an MS/MSD was not performed	Must be performed on a Site field sample. For soil and aqueous samples: Results ≥ 5xRL, RPD ≤ 20% aqueous, 35% solids; Results < 5xRL: absolute difference between results ≤ RL.	Re-analyze, qualify data	Analyst/Data Reviewer
Accuracy	Matrix Spike (MS) [Site-specific QC]	1 per ≤ 20 field samples	Must be performed on a Site field sample; MS: 75-125% recovery; professional judgment if sample concentration > 4x spike level	Evaluate LCS, unspiked sample and qualify data	Analyst/Data Reviewer
Precision	Matrix Spike Duplicate (MSD) [Site-specific QC]	1 per < 20 field samples	Must be performed on a Site field sample. For soil and aqueous samples: Results ≥ 5xRL, RPD ≤ 20% aqueous, 35% solids; Results < 5xRL: absolute difference between results ≤ RL.	Lab narrates outlier; qualify data	Analyst/Data Reviewer
Accuracy	Post digestion spike	1 per ≤ 20 field samples if less than acceptable accuracy and precision data are generated	Should be performed if MS/MSD recoveries were unacceptable: 80- 120% recovery	Lab narrates outlier; qualify data	Analyst/Data Reviewer
Accuracy	Serial Dilution	1 per < 20 field samples if less than acceptable accuracy	Perform 5x dilution on same sample used for MS % Difference < 10% for results	Lab narrates outlier qualify data	Analyst/Data Reviewer

Data Quality Indicator (DQI)	QC Sample or Activity	Frequency / Number	QC Acceptance Limits (Measurement Performance Criteria)	Corrective Action (CA)	Person(s) Responsible for CA
		and precision data are generated	>10x RL.		
Accuracy	Quantitation	Not applicable	RL ≤ results ≤ linear calibration range on a sample-specific basis. Report all Aq. results in µg/L or mg/L and all Soil/Sediment results in mg/Kg on a dry-weight basis.	Perform dilution to bring analyte within linear range; report from diluted analysis	Analyst/Data Reviewer
Overall Precision & Representative-ness	Field Duplicate Sample [Site-specific QC]	1 per 20 field samples	Aq.: Results ≥ 5xRL: RPD ≤ 30%; Results < 5xRL: professional judgment; Soil/Sediment: Results ≥ 5xRL: RPD ≤ 50%; Results < 5xRL: professional judgment	Potential data usability issue; indication of sample heterogeneity	Data Reviewer
Accuracy (preservation)	Sample preservation	every field sample	Aq.: Total Metals: HNO_3 pH < 2; (Dissolved Metals: filter on site or at the lab then HNO_3 pH < 2 but cannot be used for regulatory compliance) Soil/Sediment: collect unpreserved per SW-846 Chapter 3 Table 3-2	Lab narrates outlier. Potential data usability issue	Data Reviewer
Data Completeness	Calculate from valid/usable data collected	Not applicable	Minimum ≥90% Overall	Potential data usability / data gap issue	Data Reviewer/ Investigator
Accuracy/ Sensitivity	Holding Time (HT)	Every field sample	For aqueous and soil samples six months. If Soil/Sediment samples are frozen, HT arrested and HT begins when thawed. Samples can be maintained frozen for 1 year from collection.	Lab narrates outlier. Potential data usability issue	Data Reviewer
Accuracy & Sensitivity (Contamination)	Equipment Rinsate Blank (EB)	Not Required if using dedicated sampling equipment. If performing decontamination of equipment, collect 1 EB per 20 field samples collected by the same method	Aqueous EB: < RL Soil/Sediment EB <RL on solid equivalent basis	Aqueous Potential data usability issue, Soil/Sediment: non-matrix matched aqueous EB use professional judgment	Data Reviewer
Comparability	Based on Method (SOP) and QAPP/ FSP protocols	Not applicable	Comparison between historical data for qualitative integrity of the data. Comparison between spatially similar samples.	Potential data usability issue	Data Reviewer/ Investigator

NOTES:

1. This table was prepared by NJDEP, January 2012 to be compliant with EPA Region 2 guidance and meet the data quality needs of the Department.
2. Method References = USEPA SW-846 Method 6010C (*Inductively Coupled Plasma-Mass Spectrometry*, Revision 3 February 2007).

Pesticides

Data Quality Indicator (DQI)	QC Sample or Activity	Frequency / Number	QC Acceptance Limits (Measurement Performance Criteria)	Corrective Action (CA)	Person(s) Responsible for CA
Accuracy/ Sensitivity	Method Blank	1 per extraction batch of up to 20 field samples (matrix-specific)	All Target compounds < RL, surrogates in criteria	Reanalyze and, if necessary, re-extract. Report non-conformance in narrative; compounds present in blank should be flagged "B" in samples, if detected.	Analyst
Accuracy	Matrix Spike/ Matrix Spike Duplicate [Site-specific QC]	1 per ≤ 20 field samples	Must contain all single-component target analytes, performed on Site field sample; 30-150% recovery for all compounds.	Evaluate LCS, unspiked sample, reanalyze, if necessary, and qualify data and narrate issue	Analyst/Data Reviewer
Precision	Matrix Spike/ Matrix Spike Duplicate [Site-specific QC]	1 per < 20 field samples	Must contain all single-component target analytes, performed on Site field sample; 30-150% recovery for all compounds; RPD ≤ 30% for solids and RPD ≤ 20% for waters	Reanalyze, if necessary, qualify data and narrate issues of non-conformance	Analyst/Data Reviewer
Accuracy	Laboratory Control Sample (LCS)	1 per extraction batch of up to 20 samples	Must contain all single-component target analytes, concentration should be the same as MS if appropriate, be matrix-matched, 40-140% recovery for all target analytes.	Reanalyze, if necessary, qualify data and narrate issues of non-conformance	Analyst/Data Reviewer
Precision	Sample Duplicate (DUP)	1 per < 20 field samples if an MS/MSD was not performed	Must be performed on a site sample, RPD ≤ 30% for solids and RPD ≤ 20% for waters for results > 2x RL	Reanalyze, if necessary, qualify data and narrate issues of non-conformance	Analyst/Data Reviewer
Accuracy	Surrogates	Every sample including QC	Minimum of 2 (recommend TCMX and DCB); 30-150% recovery on both GC columns	Reanalyze, if necessary, qualify data	Analyst/Data Reviewer
Accuracy	Internal Standards (IS) (optional)	Every sample including QC (optional)	Minimum of 1 IS , Areas 50-200% of CCV; RTs ± 30 sec from ICAL	Reanalyze and qualify data	Analyst/Data Reviewer
Accuracy	Endrin/DDT Breakdown	Before samples are analyzed and at the beginning of each 12 hour shift	% Breakdown ≤ 15% based on peak areas	Perform instrument maintenance; reanalyze until acceptable	Analyst
Accuracy	Initial Calibration (ICAL)	Initially and when CCV fails	Minimum 5-levels for single-component analytes and single-level for multi-component analytes using peak height or	Recalibrate as required by method; analysis cannot proceed without a	Analyst

Data Quality Indicator (DQI)	QC Sample or Activity	Frequency / Number	QC Acceptance Limits (Measurement Performance Criteria)	Corrective Action (CA)	Person(s) Responsible for CA
			peak area; must contain all targets and lowest level ≤ RL; %RSD ≤ 20% or "r" ≥ 0.99 for all compounds; regression analysis, if used, must not be forced through the origin	valid initial calibration	
Accuracy	Continuing Calibration Verification(CCV)	Prior to samples, every 12 hours or every 20 samples, whichever is more frequent, and at the end of the analytical sequence	Concentration level near mid-point of ICAL curve containing all single- component target compounds; %D ≤ 20% and analytes fall within expected retention time windows; Multi-component analytes must be verified within 12 hours of being detected in a sample	Recalibrate as required by method; note outliers in narrative.	Analyst
Accuracy	Quantitation	Every sample	RL ≤ results ≤ upper calibration range on a sample-specific basis; average response factors or curve- statistics generated from the ICAL must be used for quantitation and peak height or peak area, as used for ICAL, must be used for sample. Report the highest concentration from the two GC columns and results reported between the MDL and RL qualified "J"	Perform dilution to bring analyte within linear range, qualify data	Analyst/Data Reviewer
Precision	Quantitation	Every sample	RPD or %D < 40% between two dissimilar GC Columns	Qualify result and narrate issue except if %D > 100%, then analyze sample at a secondary dilution and qualify data as necessary.	Analyst and Data Reviewer
Sensitivity	Reporting of Non-Detects	Every sample	Reported at the sample-specific RL which must be ≤ PRL	Potential data usability issue	Data Reviewer
Overall Precision & Representative-ness	Field Duplicate Samples [Site-specific QC]	1 per 20 field samples	RPD ≤ 30% for waters or RPD ≤ 50% for solids w/results > 2x RL; Professional judgment for results < 2xRL	Potential data usability issue	Data Reviewer
Accuracy (preservation)	Temperature Blank or other Cooler Temperature Reading	1 Temperature reading per cooler to be recorded upon receipt at lab	Cool to ≤ 6º C; allow for < 2º C if samples intact	Potential data usability issue	Data Reviewer
Accuracy/ Sensitivity	Holding Time (HT)	Every field sample	Aqueous samples extracted within 7 days of collection; extract analyzed within 40 days of extraction. Soil/Sediment samples extracted within 14 days of collection; extract analyzed within 40 days of extraction. If Soil/Sediment samples are frozen, HT arrested and extraction HT continues when thawed. Solid samples can be maintained frozen for 1 year from collection.	Potential data usability issue	Data Reviewer
Accuracy/	Equipment	Not Required if	Target analytes < RL	Potential data	Data

Data Quality Indicator (DQI)	QC Sample or Activity	Frequency / Number	QC Acceptance Limits (Measurement Performance Criteria)	Corrective Action (CA)	Person(s) Responsible for CA
Sensitivity	Blank [Site-specific QC]	using dedicated sampling equipment. If performing decon, collect 1 EB per 20 field samples collected by the same method		usability issue	Reviewer
Data Completeness	Calculate from valid/usable data collected	Not applicable	≥ 90% Overall	Potential data usability / data gap issue	Data Reviewer / Investigator
Comparability	Based on Method (SOP) and QAPP/FSP protocols	Not applicable	Comparison between historical data for qualitative integrity of the data. Comparison between spatially similar samples.	Potential data usability issue	Data Reviewer / Investigator

NOTES:

1. This table was prepared by NJDEP, April 2014 to be compliant with EPA Region 2 guidance, and meet the data quality needs of the Department.
2. Pesticide Compound analyses via USEPA SW-846 Method 8081A&B (*Quality Assurance and Quality Control Requirements for SW-846 Method 8081A and 8081B Chlorinated Pesticides by Gas Chromatography [GC]).*

PCBs

Data Quality Indicator (DQI)	QC Sample or Activity	Frequency / Number	QC Acceptance Limits (Measurement Performance Criteria)	Corrective Action (CA)	Person(s) Responsible for CA
Accuracy/ Sensitivity	Method Blank	1 per extraction batch of up to 20 field samples (matrix-specific)	All Target compounds < RL, surrogates in criteria	Reanalyze and, if necessary, re-extract. Report non-conformance in narrative; compounds present in blank should be flagged "B" in samples, if detected.	Analyst
Accuracy	Matrix Spike/ Matrix Spike Duplicate [Site-specific QC]	1 per < 20 field samples	Must contain Aroclors 1016 and 1260, performed on Site field sample, 40-140% recovery	Evaluate LCS, unspiked sample, reanalyze, if necessary, and qualify data and narrate issue	Analyst/Data Reviewer
Precision	Matrix Spike/ Matrix Spike Duplicate [Site-specific QC]	1 per < 20 field samples	Must contain Aroclors 1016 and 1260, performed on Site field sample; 40-140% recovery; RPD ≤ 30% for solids and RPD ≤ 20% for waters	Reanalyze, if necessary, qualify data and narrate issues of non-conformance	Analyst/Data Reviewer
Accuracy	Laboratory Control Sample (LCS)	1 per extraction batch of up to 20 samples	Must contain Aroclors 1016 and 1260, be matrix-matched, 40-140% recovery	Reanalyze, if necessary, qualify data and narrate issues of non-	Analyst/Data Reviewer

Data Quality Indicator (DQI)	QC Sample or Activity	Frequency / Number	QC Acceptance Limits (Measurement Performance Criteria)	Corrective Action (CA)	Person(s) Responsible for CA
				conformance	
Precision	Sample Duplicate (DUP)	1 per ≤ 20 field samples if an MS/MSD was not performed	Must be performed on a Site samples; RPD ≤ 30% for solids and RPD ≤ 20% for waters for results > 2x RL	Reanalyze, if necessary, qualify data and narrate issues of non-conformance	Analyst/Data Reviewer
Accuracy	Surrogates	Every sample including QC	Minimum of 2 (recommend TCMX and DCB); 30-150% recovery on both GC columns	Reanalyze, if necessary, qualify data	Analyst/Data Reviewer
Accuracy	Initial Calibration (ICAL)	Initially and when CCV fails	Minimum 5-levels for Aroclors 1016 and 1260 and single-level at mid- point concentration for other Aroclors; 3-5 peaks of each Aroclor evaluated using peak height or peak area; lowest level ≤ RL; other Aroclors may be warranted for 5 point calibration if PCB contamination is known. %RSD ≤ 20% or "r" ≥ 0.99 for Aroclors 1016 and 1260; regression analysis, if used, must not be forced through the origin.	Recalibrate as required by method; analysis cannot proceed without a valid initial calibration	Analyst
Accuracy	Continuing Calibration Verification (CCV)	Prior to samples, every 12 hours or every 20 samples, whichever is more frequent, and at the end of the analytical sequence	Concentration level near mid-point of ICAL curve containing Aroclors 1016 and 1260; %D ≤ ± 20% and analytes fall within expected retention time windows; Aroclors other than 1016 and 1260 must be verified within 12 hours of being detected in a sample (unless I.S. quant technique is used)	Recalibrate as required by method; note outliers in narrative.	Analyst
Accuracy	Quantitation	Every sample	RL ≤ □results ≤ upper calibration range on a sample-specific basis; average response factors or curve- statistics generated from the ICAL must be used for quantitation and peak height or peak area, as used for ICAL, must be used for sample. Report the highest concentration from the two GC columns and results reported between the MDL and RL qualified "J"	Perform dilution to bring analyte within linear range, qualify data	Analyst/Data Reviewer
Precision	Quantitation	Every sample	RPD or %D < 40% between two dissimilar GC Columns	Qualify result and narrate issue except if %D > 100% then analyze sample at a secondary dilution and qualify data as necessary.	Analyst and Data Reviewer
Sensitivity	Reporting of Non-Detects	Every sample	Reported at the sample-specific RL which must be ≤ PRL	Potential data usability issue	Data Reviewer
Overall Precision & Representative-	Field Duplicate	1 per 20 field samples	RPD ≤ 30% for waters or RPD ≤ 50% for solids w/results > 2x	Potential data usability issue	Data Reviewer

Data Quality Indicator (DQI)	QC Sample or Activity	Frequency / Number	QC Acceptance Limits (Measurement Performance Criteria)	Corrective Action (CA)	Person(s) Responsible for CA
ness	Samples [Site-specific QC]		RL; Professional judgment for results < 2xRL		
Accuracy (preservation)	Temperature Blank or other Cooler Temperature Reading	1 Temperature reading per cooler to be recorded upon receipt at lab	Cool to ≤ 6º C; allow for < 2º C if samples intact	Potential data usability issue	Data Reviewer
Accuracy/ Sensitivity	Holding Time (HT)	Every field sample	Aqueous samples extracted within 7 days of collection; extract analyzed within 40 days of extraction. Soil/Sediment samples extracted within 14 days of collection; extract analyzed within 40 days of extraction. If Soil/Sediment samples are frozen, HT arrested and extraction HT continues when thawed. Samples can be maintained frozen for 1 year from collection.	Potential data usability issue	Data Reviewer
Accuracy/ Sensitivity	Equipment Blank [Site-specific QC]	Not Required if using dedicated sampling equipment. If performing decontamination of equipment, collect 1 EB per 20 field samples collected by the same method.	Target analytes < RL	Potential data usability issue	Data Reviewer
Data Completeness	Calculate from valid/usable data collected	Not applicable	≥ 90% Overall	Potential data usability / data gap issue	Data Reviewer / Investigator
Comparability	Based on Method (SOP) and QAPP/FSP protocols	Not applicable	Comparison between historical data for qualitative integrity of the data. Comparison between spatially similar samples.	Potential data usability issue	Data Reviewer / Investigator

NOTES:

1. This table was prepared by NJDEP, April 2014 to be compliant with EPA Region 2 guidance, and meet the data quality needs of the Department
2. PCB Aroclor Compound analysis via USEPA SW-846 Method 8082 and 8082A (*Quality Assurance and Quality Control Requirements for SW- 846, Polychlorinated Biphenyls (PCBs) by Gas Chromatography [GC]).*

EPH

Data Quality Indicator (DQI)	QC Sample or Activity	Frequency / Number	QC Acceptance Limits (Measurement Performance Criteria)	Corrective Action (CA)	Person(s) Responsible for CA
Accuracy/ Sensitivity	Method Blank	1 per extraction batch of up to 20 field samples (matrix-specific)	Blank concentration < 5X value of the MDL (additional action noted in section 9.1.4 of the method)	Reanalyze and, if necessary, re-extract. Report non-conformance in narrative; compounds present in blank should be flagged "B" in samples, if detected.	Analyst
Accuracy	Matrix Spike(sample not fractionated) [Site-specific QC]	Minimum of 5% of samples for each matrix	Must contain all aliphatic and aromatic compounds defined in method section 6.8.6; 40 - 140% recovery for all compounds (only up to & including C28 for #2 fuel/diesel).	Reanalyze, if necessary, qualify data and narrate issues of non-conformance	Analyst/Data Reviewer
Accuracy	Matrix Spike/ (sample fractionated]	Minimum of 5% of samples for each matrix	Must contain all aliphatic and aromatic compounds defined in method section 6.8.6; 40 - 140% recovery for all compounds (only up to & including C28 for # 2 fuel/diesel).	Reanalyze, if necessary, qualify data and narrate issues of non-conformance	Analyst/Data Reviewer
Accuracy	Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) (#2 fuel/diesel)	1 per extraction batch (up to 20 samples of similar matrix)	Must contain #2 fuel/diesel, 40-140% recovery for # 2 fuel/diesel. (continued below)	Reanalyze, or re-extract/re-analyze plus associated samples if necessary, qualify data and narrate issues of non- conformance	Analyst/Data Reviewer
Precision	Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) (#2 fuel/diesel)		RPDs ≤ 25%	Reanalyze, or re-extract/re-analyze plus associated samples if necessary, qualify data and narrate issues of non-conformance	Analyst/Data Reviewer
Accuracy	Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) (non-#2 fuel/diesel)	1 per extraction batch (up to 20 samples of similar matrix)	Must contain all aliphatic and aromatic compounds defined in method section 6.8.6; 40 - 140% recovery for all compounds except n-nonane @ > 25% (continued below)	Reanalyze, or re-extract/re-analyze plus associated samples if necessary, qualify data and narrate issues of non- conformance	Analyst/Data Reviewer
Precision	Laboratory Control Sample/ Laboratory Control Sample		RPDs for the aliphatic and aromatic carbon range concentrations (the sum of the individual compounds' concentrations within a carbon range) must be ≤ 25%	Reanalyze, or re-extract/re-analyze plus associated samples if necessary, qualify data and narrate issues of	Analyst/Data Reviewer

Data Quality Indicator (DQI)	QC Sample or Activity	Frequency / Number	QC Acceptance Limits (Measurement Performance Criteria)	Corrective Action (CA)	Person(s) Responsible for CA
	Duplicate (LCS/LCSD) (non-#2 fuel/diesel)		(continued below).	non- conformance	
Accuracy	Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) (fractionated samples)		Naphthalene & 2-methyl-naphthalene: concentration or each in aliphatic fraction < 5 % of total concentration	Reanalyze, or re-fractionate/re-analyze plus associated samples if necessary, qualify data and narrate issues of non-conformance	Analyst/Data Reviewer
Precision	Sample Duplicate (DUP)	5% of samples for each matrix from the site	Must be performed on a site sample, RPD ≤ 50%	Qualify data and narrate issues of non-conformance	Analyst/Data Reviewer
Accuracy	Surrogates	Every sample including QC	OTP and COD, 40 – 140 % recovery; samples undergoing fractionation: no COD in aromatic fraction and/or no OTP observed in aliphatic fraction	Reanalyze, if necessary or re-extract/re-analyze if necessary; re-fractionate and analyze if COD and/or OTP are in "wrong" fraction; qualify data	Analyst/Data Reviewer
Accuracy	Fractionating Surrogates	Every sample undergoing fractionation including QC	2-bromonaphthalene & 2-fluorobiphenyl 40 – 140 % recovery	Re-fractionate and reanalyze; note in non-conformance summary	Analyst/Data Reviewer
Accuracy	Initial Calibration (ICAL)	Initially and when CCAL fails	5-point calibration must contain all compounds and lowest standard ≤ RL; CFs established for each compound and, when fractionated, also for each aliphatic and aromatic carbon range; % RSD for all individual CFs ≤ 25% and when fractionated, also for each aliphatic and aromatic carbon range.	Recalibrate as required by method; analysis cannot proceed without a valid initial calibration	Analyst
Accuracy	Continuing Calibration (CCAL)	Prior to samples, every 20 samples or every 24 hours, whichever is more frequent, and at the end of the analytical sequence	Concentration level at mid-point of ICAL curve containing all compounds: %D ≤ 25% for total range, ≤ 30% any single compound; for samples undergoing fractionation: %D ≤ 25% for each carbon range, ≤ 30% any single compound in a range	Recalibrate as required by method; note outliers in narrative.	Analyst
Accuracy	Quantitation	Every sample	RL ≤ results ≤ upper calibration range on a sample-specific basis; average response factors generated from the ICAL must be used for quantitation and peak area, as used for ICAL, must be used for sample.	Perform dilution to bring analyte within linear range, qualify data	Analyst/Data Reviewer

Data Quality Indicator (DQI)	QC Sample or Activity	Frequency / Number	QC Acceptance Limits (Measurement Performance Criteria)	Corrective Action (CA)	Person(s) Responsible for CA
			Results reported between the MDL and RL qualified "J".		
Sensitivity	Reporting of Non-Detects	Every sample	Reported at the sample-specific RL which must meet site specific DQOs.	Potential data usability issue	Data Reviewer
Overall Precision & Representative-ness	Field Duplicate Samples [Site-specific QC]	5% field for fractionated and 5% field samples for non-fractionated analyses per matrix	RPD $\leq$ 30% for waters or RPD $\leq$ 50% for solids w/results > 2x RL; Professional judgment for results < 2xRL	Potential data usability issue	Data Reviewer
Accuracy (preservation)	Temperature Blank or other Cooler Temperature Reading	1 Temperature reading per cooler to be recorded upon receipt at lab	Cool to $\leq$ 6º C; allow for < 2º C if samples intact	Potential data usability issue	Data Reviewer
Accuracy (preservation)	pH for aqueous samples	Every field sample	pH < 2	Adjust pH as soon as possible; note outliers in narrative	Analyst/Data Reviewer
Accuracy/ Sensitivity	Holding Time (HT)	Every field sample	Samples extracted within 14 days of collection; extract analyzed within 40 days of extraction.	Potential data usability issue	Data Reviewer
Accuracy/ Sensitivity	Equipment Blank [Site-specific QC]	Not Required if using dedicated sampling equipment. If performing de- con, collect 1 EB per 20 field samples collected by the same method	Compounds < RL	Potential data usability issue	Data Reviewer
Data Completeness	Calculate from valid/usable data collected	Not applicable	$\geq$ 90% Overall	Potential data usability / data gap issue	Data Reviewer / Investigator
Comparability	Based on Method (SOP) and QAPP protocols/DQ Os	Not applicable	Comparison between historical data for qualitative integrity of the data. Comparison between spatially similar samples.	Potential data usability issue	Data Reviewer / Investigator

NOTES:

1. This table was prepared by NJDEP, April 2014 to be compliant with EPA Region 2 guidance, and meet the data quality needs of the Department.
2. Method reference = NJDEP Analysis of Extractable Petroleum Hydrocarbon Compounds (EPH) in Aqueous and Soil/Sediment/Sludge.

WORKSHEET #11A DATA MANAGEMENT AND DOCUMENTATION

Field Sample Collection Documents and Records	Analytical Laboratory Documents and Records	Data Assessment Documents and Records	Project File
• Site and field logbooks • Boring logs • Chain-of-Custody (COC) forms • Field Data Sheets	• Sample receipt logs • Internal and external COC forms • Equipment calibration logs • Sample preparation worksheets/logs • Sample analysis worksheets/run logs • Telephone/email logs • Corrective action documentation	• Data validation reports • Field inspection checklist(s) • Laboratory Audit checklist (if performed) • Review forms for electronic entry of data into database • Corrective action documentation	• TTI's project file shall be stored electronically for a period of at least 5 years.

WORKSHEET #11B PROJECT REPORTS

Type of Report	Frequency (Daily, weekly, monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (Title and Organizational Affiliation)	Report Recipient(s) (Title and Organizational Affiliation)
Data Validation	Once upon completion	3/1/2019	TTI Environmental/ Renee Michalak	TTI Environmental
Site Investigation Report	Once upon completion	3/15/19	TTI Environmental/ Andrew Basehoar	CRA/James Harveson
Site Investigation Report	Once upon completion	3/30/19	TTI Environmental/ Andrew Basehoar	Alison Devine

WORKSHEET #12A PLANNED PROJECT ASSESSMENTS TABLE

Project Assessments are not planned for this project.

WORKSHEET #12B ASSESSMENT FINDINGS AND CORRECTIVE ACTION RESPONSES

Assessments and corrective action responses are not planned for this project.

WORKSHEET #13A PROJECT DATA VERIFICATION PROCESS (STEP I) [1]

Verification Input	Description	Internal/ External[2]	Responsible for Verification (Name, Organization)
Methods (sampling and analytical)	TTI Project Manager shall discuss in a kickoff meeting the purpose of sample locations and the analytes to be sampled for. This shall be done prior to all field events. The Project Manager shall discuss all QC samples to the field team prior to sampling events.	I	Andrew Basehoar, TTI Environmental
Reporting Forms	Any and all forms required to be submitted shall be reviewed by TTI Project Manager for accuracy and completeness	I	Andrew Basehoar, TTI Environmental
Sampling Plans	Shall be completed prior to sampling events and reviewed by the Project Manager. Upon return from sampling, the Project Manager shall update all maps for accuracy. Names and identifications of the samples shall be relayed from the project manager to all field personnel.	I	Andrew Basehoar, TTI Environmental
Site/Field Logbooks	Field notes will be prepared daily by Field Personnel. The Project Manager shall review notes for appropriate, legible and pertinent information. Upon completion of field work, logbooks will be placed in the project files.	I	Andrew Basehoar, TTI Environmental
Chains of custody	A COC shall be prepared by the person who collects the samples and reviewed by the Project Manager prior to submission to the laboratory. An original COC will be sent with the samples to the laboratory, while copies are retained for (1) the Sampling Trip Report and (2) the project files.	I	Andrew Basehoar, TTI Environmental
Laboratory analytical data package	Data packages will be reviewed/verified internally by the laboratory performing the work for completeness and technical accuracy prior to submittal.	E	Pace Analytical
Laboratory analytical data package (raw data)	TTI shall review the final laboratory report for any and all non-conformance issues that may affect the accuracy of the data	I	Andrew Basehoar, TTI Environmental
Electronic Data Deliverables	Review the data and add all pertinent information to the data deliverable package (as necessary) to be submitted	I	Renee Michalak, TTI Environmental
Site Investigation Report	TTI shall prepare a Site Investigation Report, which includes the findings and recommendations for further action, as necessary	I	Andrew Basehoar, TTI Environmental

[1]Step I – Completeness Check

[2]Internal or External is in relation to the data generator.

WORKSHEET #13B PROJECT DATA VALIDATION PROCESS (STEPS IIA AND IIB) [1]

Step IIa/IIb[1]	Validation Input	Description	Responsible for Validation (Name, Organization)
IIa	SOPs	Ensure that the sampling methods/procedures outlined in QAPP were followed, and that any deviations were noted/approved.	Andrew Basehoar, TTI Environmental
IIb	SOPs	Determine potential impacts from noted/approved deviations, in regard to PQOs.	Andrew Basehoar, TTI Environmental
IIa	Chains of custody	Examine COC forms against QAPP and the sampling plans.	Andrew Basehoar, TTI Environmental
IIa	Laboratory data package	Examine packages against QAPP and laboratory contract requirements, etc. (e.g., holding times, sample handling, analytical methods, sample identification, data qualifiers, QC samples, etc.).	Renee Michalak, TTI Environmental
IIb	Laboratory data package	Review the laboratory data and confirm all non-conformance issues. Determine if the non-conformance issues impact the validity of the data.	Andrew Basehoar, TTI Environmental Renee Michalak, TTI Environmental
IIa	Electronic Data Deliverables	Review all laboratory data deliverables and submit as necessary. Confirm all results are consistent with those in laboratory reports.	Renee Michalak, TTI Environmental
IIb	Field duplicates	Compare results of field duplicate (or replicate) analyses with RPD criteria	Andrew Basehoar, TTI Environmental Renee Michalak, TTI Environmental
IIa	Sampling Plans	Compare field locations with the sampling plan. Ensure that any deviations from the sampling plan are representative of the AOC being inspected.	Andrew Basehoar, TTI Environmental
IIa	Field Books	Ensure that all field books are stored within the project folder and are separate from other projects. Ensure that all field books are accurate to field conditions.	Andrew Basehoar, TTI Environmental
IIa/IIb	Reporting Forms/Site Investigation Report	After review and validation of the data, preparation of the Site Investigation Report and associated forms summarizing the data. Review the report along with the data to confirm that the report is accurate to the data presented.	Andrew Basehoar, TTI Environmental

[1]Step IIa – Compliance with Methods, Procedures, and Contracts

[1]Step IIb – Comparison with Performance Criteria in QAPP

WORKSHEET #13C PROJECT MATRIX AND ANALYTICAL VALIDATION (STEPS IIA AND IIB) [1] SUMMARY

Step IIa/IIb[1]	Matrix	Analytical Group	Concentration Level	Validation Criteria	Data Validator (title and organizational affiliation)
IIa / IIb	Soil	VOCs	Trace Above NJDEP Stds. Non-Detect	NJDEP Data of Known Quality Protocols Technical Guidance (version 1.0) dated April 2014	Renee Michalak, TTI Environmental
IIa / IIb	Soil	SVOCs/PAHs	Trace Above NJDEP Stds. Non-Detect	NJDEP Data of Known Quality Protocols Technical Guidance (version 1.0) dated April 2014	Renee Michalak, TTI Environmental
IIa / IIb	Soil	Pesticides	Trace Above NJDEP Stds. Non-Detect	NJDEP Data of Known Quality Protocols Technical Guidance (version 1.0) dated April 2014	Renee Michalak, TTI Environmental
IIa / IIb	Soil	PCBs	Trace Above NJDEP Stds. Non-Detect	NJDEP Data of Known Quality Protocols Technical Guidance (version 1.0) dated April 2014	Renee Michalak, TTI Environmental
IIa / IIb	Soil	Metals	Trace Above NJDEP Stds. Non-Detect	NJDEP Data of Known Quality Protocols Technical Guidance (version 1.0) dated April 2014	Renee Michalak, TTI Environmental
IIa / IIb	Soil	EPH	Trace Above NJDEP Stds. Non-Detect	NJDEP Data of Known Quality Protocols Technical Guidance (version 1.0) dated April 2014	Renee Michalak, TTI Environmental

[1]Step IIa – Compliance with Methods, Procedures, and Contracts

[1]Step IIb – Comparison with Performance Criteria in QAPP

WORKSHEET #13D USABILITY ASSESSMENT (STEP III) [1]

Summarize the usability assessment process and all procedures, including interim steps and any statistics, equations, and computer algorithms that will be used:

Samples that are non-detect or well below NJDEP standards with no nonconformance issues shall be accepted. Samples with results above NJDEP Residential and Non-Residential Direct Contact standards with no nonconformance issues shall be accepted. TTI shall evaluate data close to or at NJDEP IGWSSLs using the NJDEP's *Data Quality Assessment and Data Usability Evaluation Technical Guidance* (version 1.0), dated April 2014 to confirm if the data is acceptable.

Describe the evaluative procedures used to assess overall measurement error associated with the project:

TTI shall reference the *NJDEP Data of Known Quality Protocols Technical Guidance (version 1.0) dated April 2014* and NJDEP's *Data Quality Assessment and Data Usability Evaluation Technical Guidance* (version 1.0), dated April 2014 to assess error associated with data.

Identify the personnel responsible for performing the usability assessment:

Andrew Basehoar and Renee Michalak – TTI

Describe the documentation that will be generated during usability assessment and how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies:

The laboratory will analyze samples submitted and prepare a data package of the analytical results assembled by analytical category, i.e. volatile organics, semi-volatile organics, inorganics, etc. The analytical data will be compared to the appropriate NJDEP remediation standard, either the soil remediation standards or the groundwater quality standards. EPH results will be compared the applicable further action criteria and remedial action criteria, as appropriate. The laboratory analytical data will be used to evaluate the need for additional investigation, conduct a remedial action or close the site remediation case. All findings shall be summarized in a Site Investigation Report with recommendations for further action as necessary.

[1]Step III – Usability Assessment

Table 1

Data Elements for Data Review Process				
Item	**Step I - Data Verification**	**Step IIa - Data Validation Compliance**	**Step IIb - Data Validation Comparison**	**Step III - Data Usability**
Planning Documents				
Evidence of approval of QAPP	X			Use outputs from previous steps
Identification of personnel	X			
Laboratory name	X			
Methods (sampling & analytical)	X	X	X	
Performance requirements (including QC criteria)	X	X		
Project quality objectives	X		X	
Reporting forms	X	X		
Sampling plans – locations, maps grids, sample ID numbers	X	X		
Site identification	X			
SOPs (sampling & analytical)	X	X		
Staff training & certification	X			
List of project-specific analytes	X	X		
Analytical Data Package				
Case narrative	X	X	X	Use outputs from previous steps
Internal lab chain of custody	X	X		
Sample condition upon receipt, & storage records	X	X		
Sample chronology (time of receipt, extraction/digestion, analysis)	X	X		
Identification of QC samples (sampling /lab)	X	X		
Associated PE sample results	X	X	X	
Communication Logs	X	X		
Copies of lab notebook, records, prep sheets	X	X		
Corrective action reports	X	X		
Definition of laboratory qualifiers	X	X	X	
Documentation of corrective action results	X	X	X	
Documentation of individual QC results (e.g., spike, duplicate, LCS)	X	X	X	
Documentation of laboratory method deviations	X	X	X	
Electronic data deliverables	X	X		
Instrument calibration reports	X	X	X	
Laboratory name	X	X		
Laboratory sample identification no.	X	X		
QC sample raw data	X	X	X	
QC summary report	X	X	X	
Data Elements for Data Review Process				
Raw data	X	X	X	Use outputs from previous steps
Reporting forms, completed with actual results	X	X	X	
Signatures for laboratory sign-off (e.g., laboratory QA manager)	X	X		
Standards traceability records (to trace standard source form NIST, for example)	X	X	X	
Sampling Documents				
Chain of custody	X	X		Use outputs from
Communication logs	X	X		
Corrective action reports	X	X	X	

Documentation of corrective action results	X	X	X	previous steps
Documentation of deviation from methods	X	X	X	
Documentation of internal QA review	X	X	X	
Electronic data deliverables	X	X		
Identification of QC samples	X	X	X	
Meteorological data from field (e.g., wind, temperature)	X	X	X	
Sampling instrument decontamination records	X	X		
Sampling instrument calibration logs	X	X		
Sampling location and plan	X	X	X	
Sampling notes & drilling logs	X	X	X	
Sampling report (from field team leader to project manager describing sampling activities)	X	X	X	
External Reports				
External audit report	X	X	X	Use outputs from previous steps
External PT sample results	X	X		
Laboratory assessment	X	X		
Laboratory QA plan	X	X		
MDL study information	X	X	X	
NELAP accreditation	X	X		

REFERENCES

New Jersey Department of Environmental Protection. (2005). *Field Sampling Procedures Manual*. Trenton, NJ: NJDEP. doi:https://clu-in.org/download/char/passsamp/New-Jersey-Field-Sampling-Manualfsmp2005.pdf

New Jersey Department of Environmental Protection. (2014). *Data of Known Quality Protocols Technical Guidance*(Vol. 1.0). Tenton, NJ: NJDEP.

Figures:

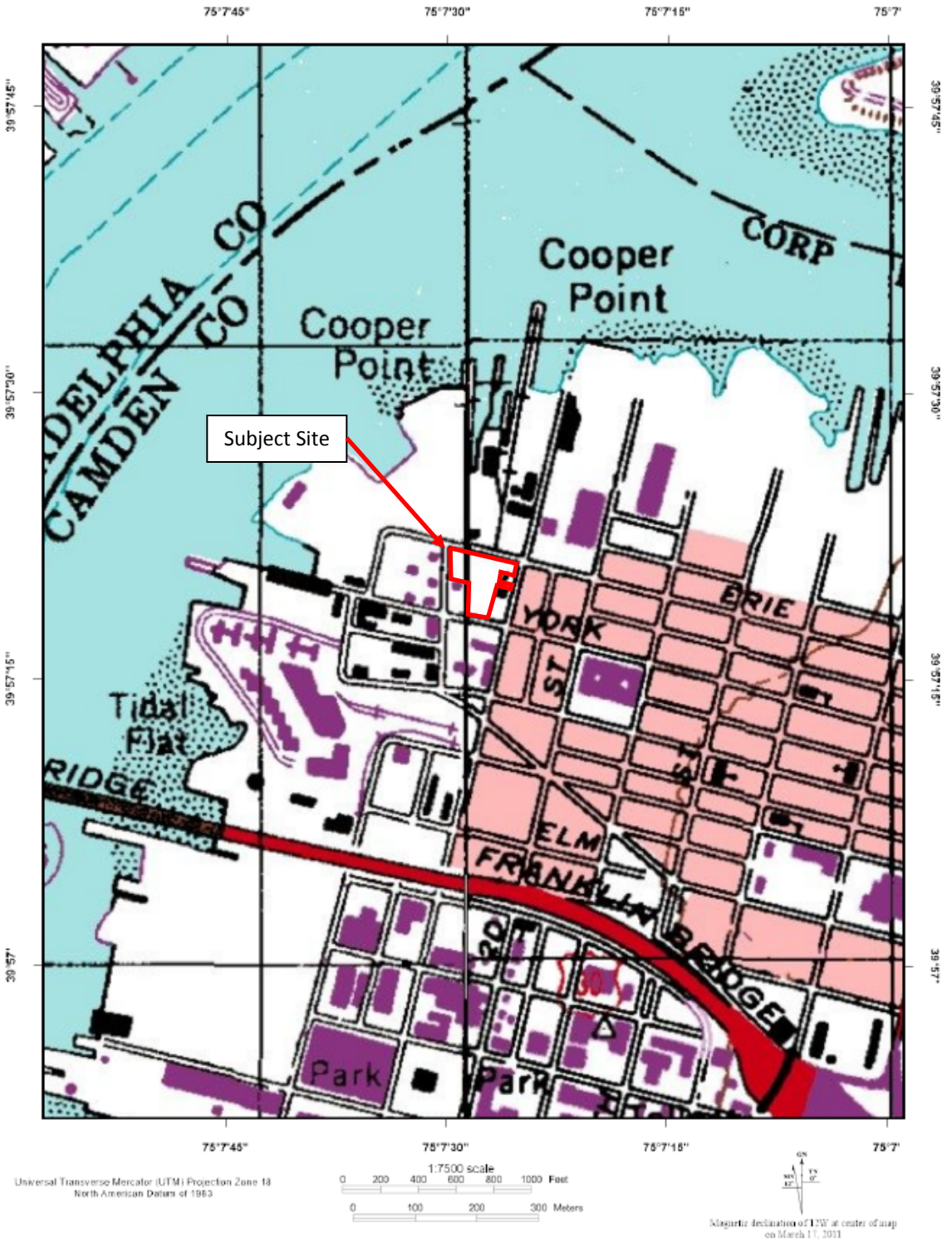


Figure 1.0:

Regional Site Location Map

Andujar Park
Erie and Point Street
Block 12, Lots 1, 3, 17 & 18
Block 14, Lot 29
Camden, Camden County, New Jersey 08102

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PROJECT	APP'D BY	DRAWING NO.
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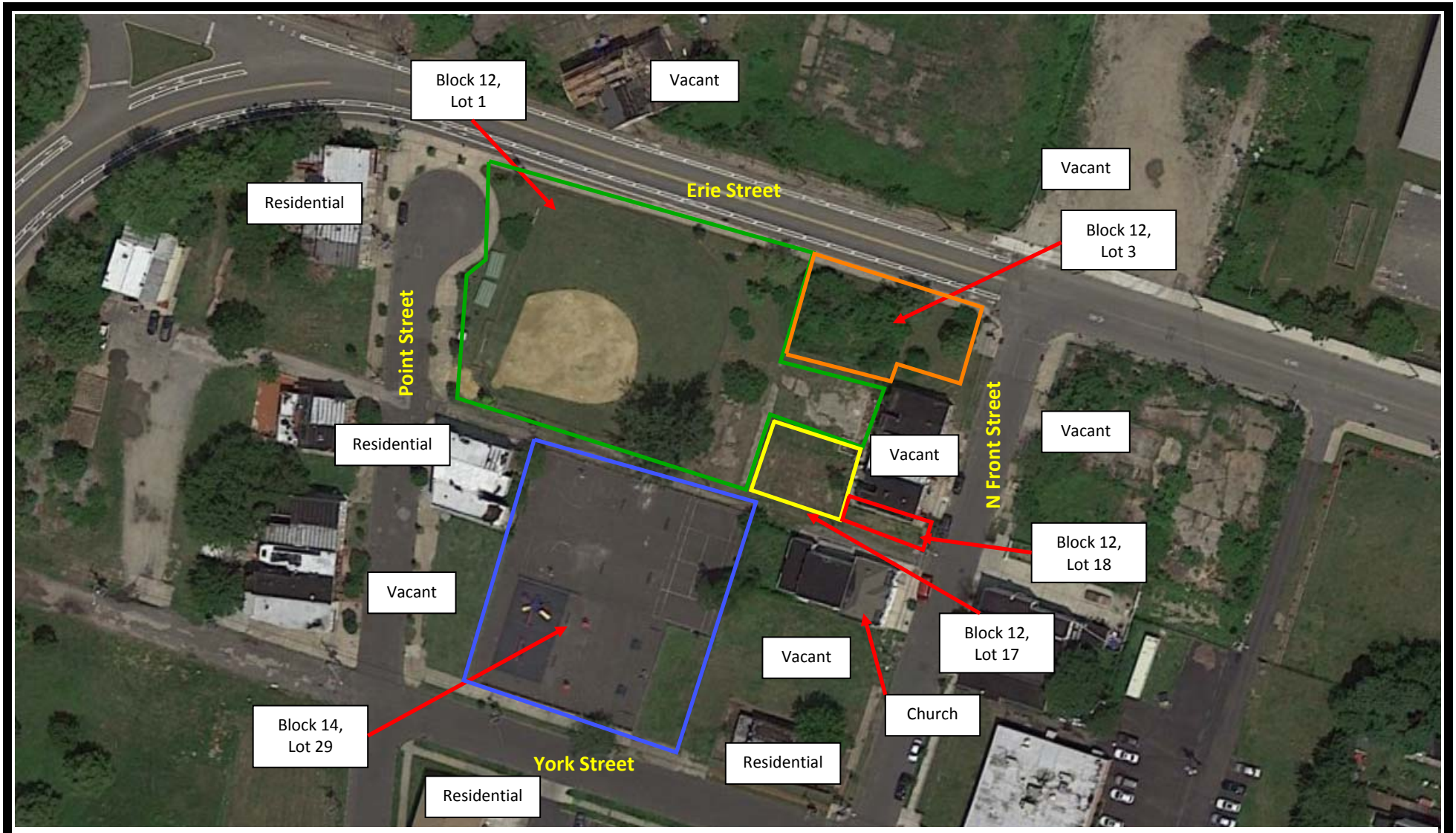

Figure 2.0:

Site Diagram

Andujar Park
Erie and Point Street
Block 12, Lots 1, 3, 17 & 18
Block 14, Lot 29
Camden, Camden County, New Jersey 08102

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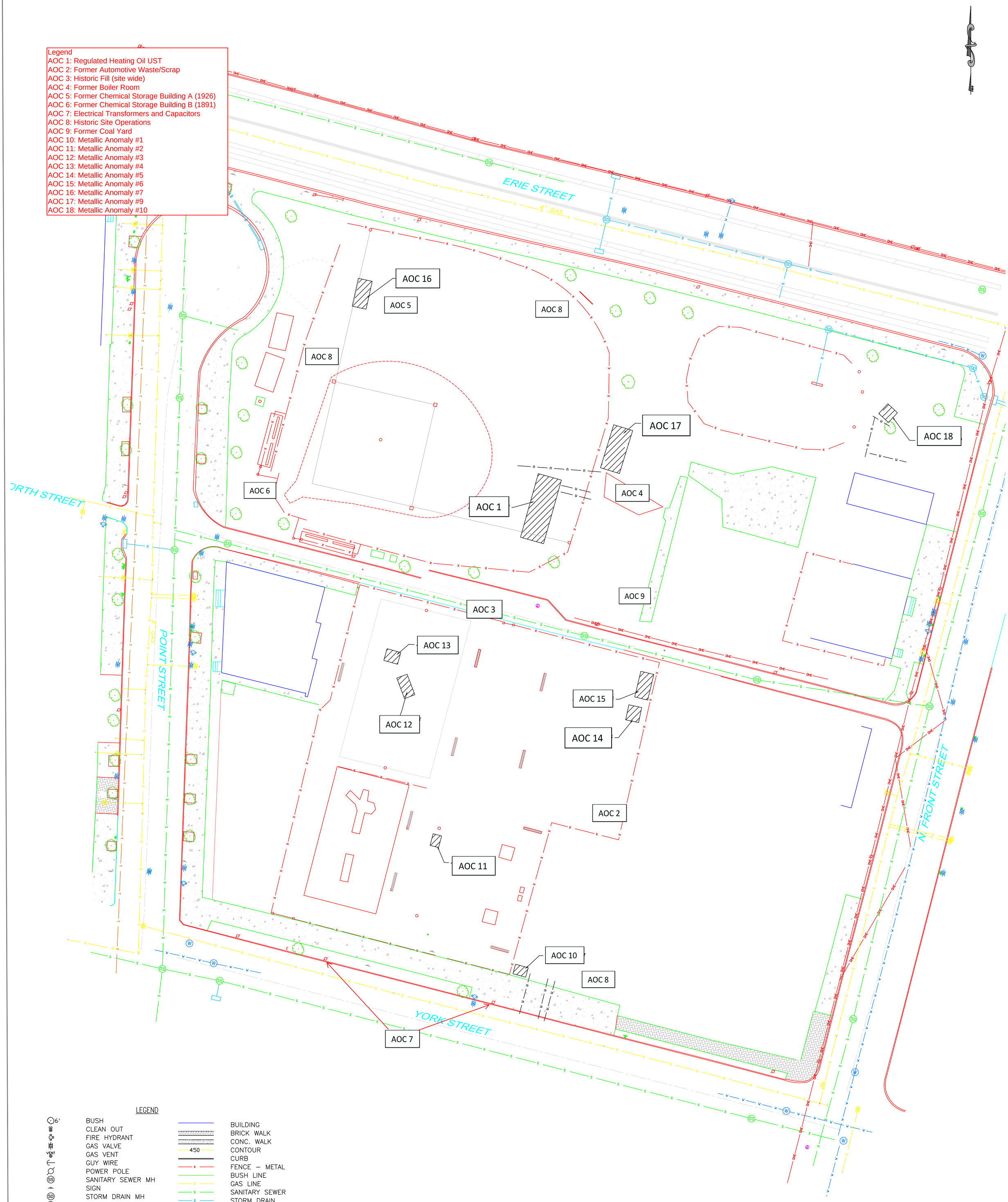
Legend
AOC 1: Regulated Heating Oil UST
AOC 2: Former Automotive Waste/Scrap
AOC 3: Historic Fill (site wide)
AOC 4: Former Boiler Room
AOC 5: Former Chemical Storage Building A (1926)
AOC 6: Former Chemical Storage Building B (1891)
AOC 7: Electrical Transformers and Capacitors
AOC 8: Historic Site Operations
AOC 9: Former Coal Yard
AOC 10: Metallic Anomaly #1
AOC 11: Metallic Anomaly #2
AOC 12: Metallic Anomaly #3
AOC 13: Metallic Anomaly #4
AOC 14: Metallic Anomaly #5
AOC 15: Metallic Anomaly #6
AOC 16: Metallic Anomaly #7
AOC 17: Metallic Anomaly #9
AOC 18: Metallic Anomaly #10



LEGEND

6'	BUSH		BUILDING
	CLEAN OUT		BRICK WALK
	FIRE HYDRANT		CONC. WALK
	GAS VALVE	450	CONTOUR
VENT	GAS VENT		CURB
	GUY WIRE	x	FENCE – METAL
	POWER POLE		BUSH LINE
SS	SANITARY SEWER MH	G	GAS LINE
	SIGN	S	SANITARY SEWER
SD	STORM DRAIN MH	D	STORM DRAIN
T	TELEPHONE MH	T	TELEPHONE LINE
100	TRAVERSE	W	WATER LINE
8'	TREE	U	UNKNOWN UTILITY
MH	UNKNOWN MANHOLE		
W	WATER MANHOLE		
	WATER VALVE		

BC – BOTTOM OF CURB
EP – EDGE OF PAVEMENT
CONC – CONCRETE
INV – INVERT
PVMT. – PAVEMENT
TC – TOP OF CURB

NOTES:

This site plan was produced from data positioned by differential GPS measurments collected in the field. Due to the errors normally present in DGPS data, this document is not intended or represented to be of survey precision. Caution should be used in all field measurments based on this site plan.

As with any geophysical method, it must be stressed that caution be used during any excavation or intrusive testing in proximity of any anomalies indicated in this document The absence of detected signatures does not preclude the possibility that targets exist. The geophysical data and results presented in this site plan are based upon the application of scientific principles and professional judgements to certain facts with resultant subjective interpretations. Professional judgements expressed herein are based on the facts currently available within the limits of the existing data, scope of work, budget, and schedule.

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0 10 20 40 60
GRAPHIC SCALE IN FEET

PROJECT NO.
SHEET NO. 1 OF 1
DRAWING NO. 052918
SCALE 1" = 20'
DATE 05-29-18
CHECKED BY
DRAWN BY MIKE MESAROS

GEOPHYSICAL INVESTIGATION
ANDUJAR PARK, NORTH STREET AND FRONT STREET, CAMDEN, NJ
FOR
TTI ENVIRONMENTAL, INC.

DELTA Geophysics Inc.
738 Front Street, Catasauqua, PA 18032
Phone: (610) 231-73012

DATE	DESCRIPTION	REV.
	REVISIONS	

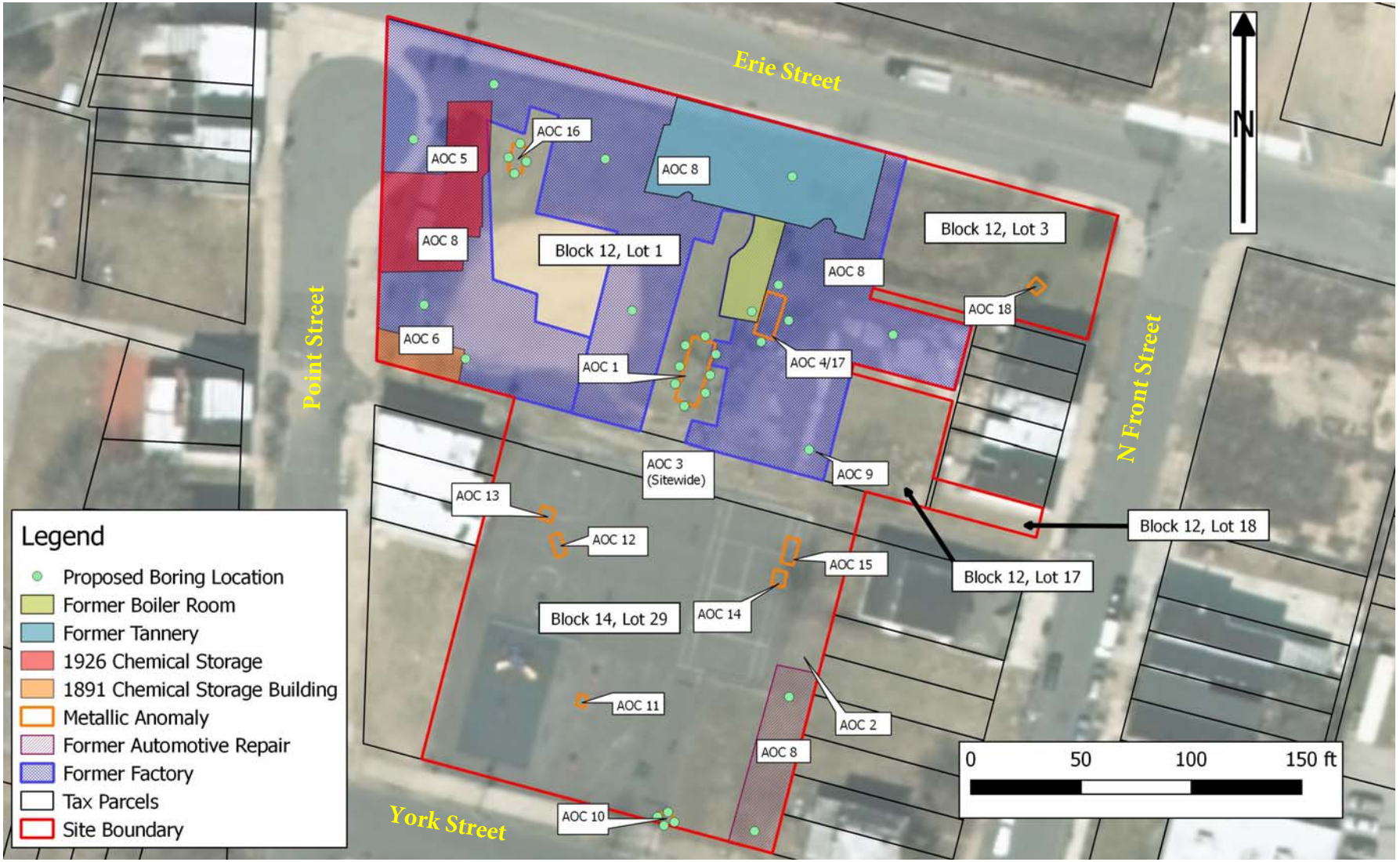

Figure 4.0:

Proposed Boring Location Map

Andujar Park
Erie and Point Street
Block 12, Lots 1, 3, 17 & 18
Block 14, Lot 29
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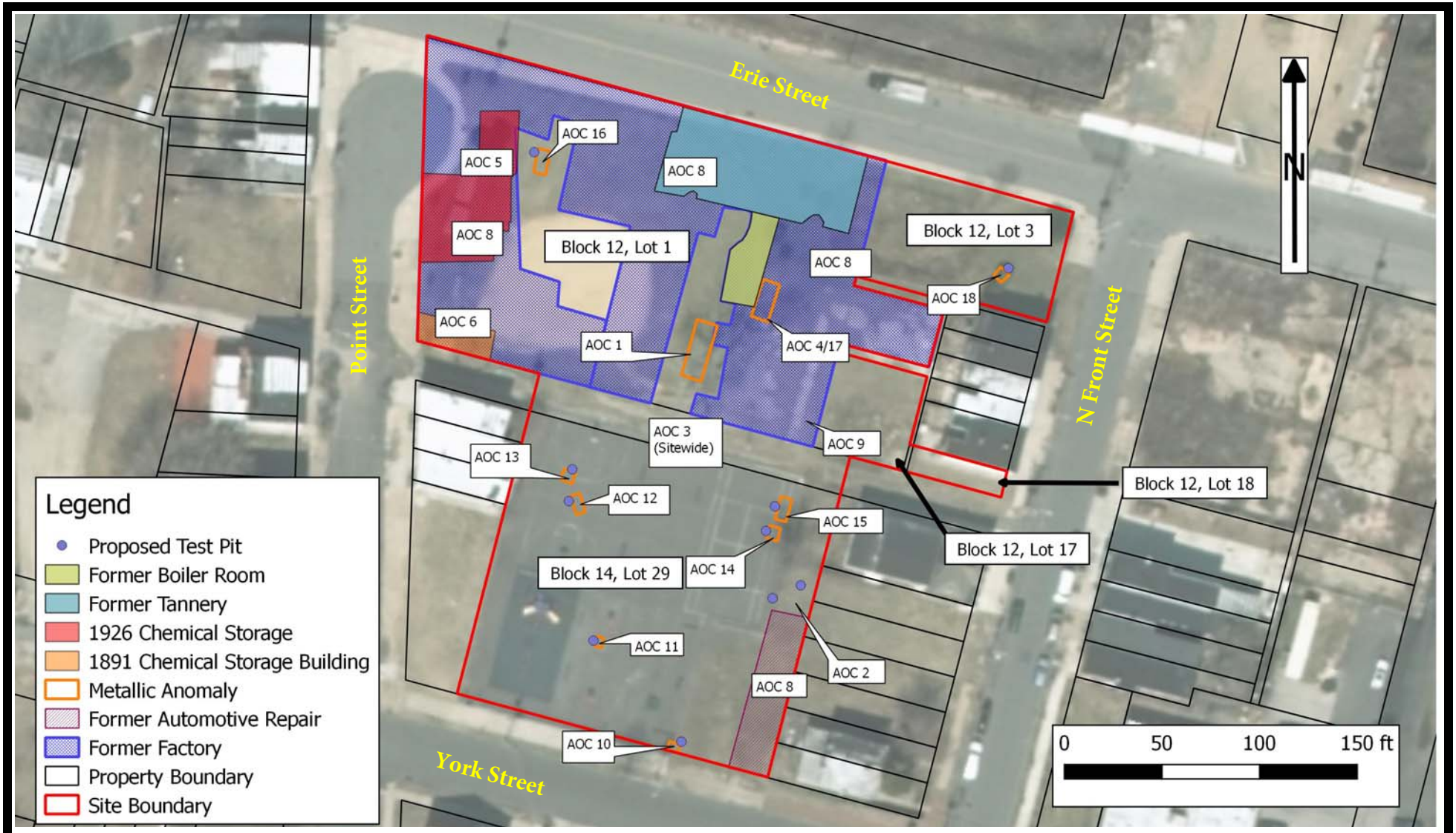

Figure 5.0:

Proposed Test Pit Locations

Andujar Park
Erie and Point Street
Block 12, Lots 1, 3, 17 & 18
Block 14, Lot 29
Camden, Camden County, New Jersey 08102

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Appendix A: NJDEP Soil Remediation Standards and Impact to Groundwater Soil Screening Levels

NOTE: THIS IS A COURTESY COPY OF THIS RULE. ALL OF THE DEPARTMENT'S RULES ARE COMPILED IN TITLE 7 OF THE NEW JERSEY ADMINISTRATIVE CODE.

APPENDIX 1 - SOIL REMEDIATION STANDARDS TABLES

Table 1A - Residential Direct Contact Health Based Criteria and Soil Remediation Standards (mg/kg)

Contaminant	CAS No.	Ingestion-Dermal Health Based Criterion	Inhalation Health Based Criterion	Soil PQL	Residential Direct Contact Soil Remediation Standard
Acenaphthene	83-32-9	3,400	NA	0.2	3,400
Acenaphthylene	208-96-8	NA	NA	0.2	NA
Acetone (2-Propanone)	67-64-1	70,000	NA	0.01	70,000
Acetophenone	98-86-2	6,100	2	0.2	2
Acrolein	107-02-8	39	0.5	0.5	0.5
Acrylonitrile	107-13-1	1	0.9	0.5	0.9
Aldrin	309-00-2	0.04	5	0.002	0.04
Aluminum	7429-90-5	78,000	NA	20	78,000
Anthracene	120-12-7	17,000	380,000	0.2	17,000
Antimony	7440-36-0	31	360,000	6	31
Arsenic	7440-38-2	0.4	980	1	19*
Atrazine	1912-24-9	210	NA	0.2	210
Barium	7440-39-3	16,000	910,000	20	16,000
Benzaldehyde	100-52-7	6,100	NA	0.2	6100
Benzene	71-43-2	3	2	0.005	2
Benzidine	92-87-5	0.002	0.004	0.7	0.7
Benzo(a)anthracene (1,2-Benzanthracene)	56-55-3	5	71,000	0.2	5
Benzo(a)pyrene	50-32-8	0.5	3,600	0.2	0.5
Benzo(b)fluoranthene (3,4-Benzofluoranthene)	205-99-2	5	71,000	0.2	5
Benzo(ghi)perylene	191-24-2	NA	380,000	0.2	380,000
Benzo(k)fluoranthene	207-08-9	45	710,000	0.2	45
Beryllium	7440-41-7	16	1,800	0.5	16
1,1'-Biphenyl	92-52-4	61	NA	0.2	61
Bis(2-chloroethyl)ether	111-44-4	0.4	0.6	0.2	0.4
Bis(2-chloroisopropyl)ether	108-60-1	2,400	23	0.2	23
Bis(2-ethylhexyl) phthalate	117-81-7	35	NA	0.2	35
Bromodichloromethane (Dichlorobromomethane)	75-27-4	10	1	0.005	1
Bromoform	75-25-2	81	98	0.005	81
Bromomethane (Methyl bromide)	74-83-9	110	25	0.005	25
bromide)					
2-Butanone (Methyl ethyl ketone) (MEK)	78-93-3	3,100	NA	0.01	3,100
Butyl benzyl phthalate	85-68-7	1,200	NA	0.2	1,200
Cadmium	7440-43-9	78	1,000	0.5	78
Caprolactam	105-60-2	31,000	NA	0.2	31,000
Carbazole	86-74-8	24	740,000	0.2	24
Carbon disulfide	75-15-0	7,800	NA	0.5	7,800
Carbon tetrachloride	56-23-5	7	2	0.005	2

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Contaminant	CAS No.	Ingestion-Dermal Health Based Criterion	Inhalation Health Based Criterion	Soil PQL	Residential Direct Contact Soil Remediation Standard
Chlordane (alpha and gamma)	57-74-9	0.2	42,000	0.002	0.2
Chlorobenzene	108-90-7	510	NA	0.005	510
Chloroethane (Ethyl chloride)	75-00-3	220	NA	0.005	220
Chloroform	67-66-3	780	0.6	0.005	0.6
Chloromethane (Methyl chloride)	74-87-3	NA	4	0.005	4
2-Chlorophenol (o-Chlorophenol)	95-57-8	310	910	0.2	310
Chrysene	218-01-9	450	NA	0.2	450
Cobalt	7440-48-4	1,600	9,100	5	1,600
Copper	7440-50-8	3,100	NA	3	3,100
Cyanide	57-12-5	47	NA	3	47
4,4'-DDD	72-54-8	3	61,000	0.003	3
4,4'-DDE	72-55-9	2	670	0.003	2
4,4'-DDT	50-29-3	2	44,000	0.003	2
Dibenz(a,h)anthracene	53-70-3	0.5	7,100	0.2	0.5
Dibromochloromethane (Chlorodibromomethane)	124-48-1	8	3	0.005	3
1,2-Dibromo-3-chloropropane	96-12-8	0.3	0.08	0.005	0.08
1,2-Dibromoethane	106-93-4	0.008	0.1	0.005	0.008
1,2-Dichlorobenzene (o-Dichlorobenzene)	95-50-1	5,300	NA	0.005	5,300
1,3-Dichlorobenzene (m-Dichlorobenzene)	541-73-1	5,300	NA	0.005	5,300
1,4-Dichlorobenzene (p-Dichlorobenzene)	106-46-7	610	5	0.005	5
3,3'-Dichlorobenzidine	91-94-1	1	3	0.2	1
Dichlorodifluoromethane	75-71-8	16,000	490	0.005	490
1,1-Dichloroethane	75-34-3	510	8	0.005	8
1,2-Dichloroethane	107-06-2	5	0.9	0.005	0.9
1,1-Dichloroethene	75-35-4	11	61	0.005	11
1,2-Dichloroethene (cis) (c-1,2-Dichloroethylene)	156-59-2	780	230	0.005	230
1,2-Dichloroethene (trans) (t-1,2-Dichloroethylene)	156-60-5	1,300	300	0.005	300
2,4-Dichlorophenol	120-83-2	180	NA	0.2	180
1,2-Dichloropropane	78-87-5	9	2	0.005	2
1,3-Dichloropropene (cis and trans)	542-75-6	6	2	0.005	2
Dieldrin	60-57-1	0.04	1	0.003	0.04
Diethyl phthalate	84-66-2	49,000	NA	0.2	49,000
2,4-Dimethyl phenol	105-67-9	1,200	NA	0.2	1,200
Di-n-butyl phthalate	84-74-2	6,100	NA	0.2	6,100
4,6-Dinitro-2-methylphenol (4,6-Dinitro-o-cresol)	534-52-1	6	730,000	0.3	6
2,4-Dinitrophenol	51-28-5	120	NA	0.3	120
2,4-Dinitrotoluene	121-14-2	0.7	6	0.2	0.7
2,6-Dinitrotoluene	606-20-2	0.7	2	0.2	0.7
2,4-Dinitrotoluene/2,6-Dinitrotoluene (mixture)	25321-14-6	0.7	NA	0.2	0.7
Di-n-octyl phthalate	117-84-0	2,400	NA	0.2	2,400
1,2-Diphenylhydrazine	122-66-7	0.6	5	0.7	0.7

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Contaminant	CAS No.	Ingestion-Dermal Health Based Criterion	Inhalation Health Based Criterion	Soil PQL	Residential Direct Contact Soil Remediation Standard
Endosulfan I and Endosulfan II (alpha and beta)	115-29-7	470	NA	0.003	470
Endosulfan sulfate	1031-07-8	470	NA	0.003	470
Endrin	72-20-8	23	NA	0.003	23
Ethyl benzene	100-41-4	7,800	NA	0.005	7,800
Fluoranthene	206-44-0	2,300	NA	0.2	2,300
Fluorene	86-73-7	2,300	NA	0.2	2,300
alpha-HCH (alpha-BHC)	319-84-6	0.1	0.7	0.002	0.1
beta-HCH (beta-BHC)	319-85-7	0.4	8,000	0.002	0.4
Heptachlor	76-44-8	0.1	6	0.002	0.1
Heptachlor epoxide	1024-57-3	0.07	5	0.002	0.07
Hexachlorobenzene	118-74-1	0.3	1	0.2	0.3
Hexachloro-1,3-butadiene	87-68-3	6	12	0.2	6
Hexachlorocyclopentadiene	77-47-4	370	45	0.2	45
Hexachloroethane	67-72-1	12	NA	0.2	12
Indeno(1,2,3-cd)pyrene	193-39-5	5	71,000	0.2	5
Isophorone	78-59-1	510	NA	0.2	510
Lead	7439-92-1	400	44,000	1	400
Lindane (gamma-HCH) (gamma-BHC)	58-89-9	0.4	3	0.002	0.4
Manganese	7439-96-5	11,000	91,000	2	11,000
Mercury	7439-97-6	23	27	0.1	23
Methoxychlor	72-43-5	390	NA	0.02	390
Methyl acetate	79-20-9	78,000	NA	0.005	78,000
Methylene chloride (Dichloromethane)	75-09-2	46	1,600	0.005	46
2-Methylnaphthalene	91-57-6	230	NA	0.17	230
2-Methylphenol (o-Creosol)	95-48-7	310	NA	0.2	310
4-Methylphenol (p-Creosol)	106-44-5	31	NA	0.2	31
Methyl tert-butyl ether (MTBE)	1634-04-4	780	110	0.005	110
Naphthalene	91-20-3	2,400	6	0.2	6
Nickel (Soluble salts)	7440-02-0	1,600	360,000	4	1,600
2-Nitroaniline	88-74-4	NA	39	0.3	39
Nitrobenzene	98-95-3	120	5	0.2	5
N-Nitrosodimethylamine	62-75-9	0.01	0.02	0.7	0.7
N-Nitrosodi-n-propylamine	621-64-7	0.07	0.2	0.2	0.2
N-Nitrosodiphenylamine	86-30-6	99	NA	0.2	99
Pentachlorophenol	87-86-5	0.9	590	0.3	0.9
Phenanthrene	85-01-8	NA	NA	0.2	NA
Phenol	108-95-2	18,000	NA	0.2	18,000
Polychlorinated biphenyls (PCBs)	1336-36-3	0.2	20	0.03	0.2
Pyrene	129-00-0	1,700	NA	0.2	1,700
Selenium	7782-49-2	390	NA	4	390
Silver	7440-22-4	390	NA	1	390

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Contaminant	CAS No.	Ingestion-Dermal Health Based Criterion	Inhalation Health Based Criterion	Soil PQL	Residential Direct Contact Soil Remediation Standard
Styrene	100-42-5	16,000	90	0.005	90
Tertiary butyl alcohol (TBA)	75-65-0	1,400	4,800	0.1	1,400
1,1,2,2-Tetrachloroethane	79-34-5	3	1	0.005	1
Tetrachloroethene (PCE) (Tetrachloroethylene)	127-18-4	300	43	0.005	43
Toluene	108-88-3	6,300	NA	0.005	6,300
Toxaphene	8001-35-2	0.6	70	0.2	0.6
1,2,4-Trichlorobenzene	120-82-1	73	NA	0.005	73
1,1,1-Trichloroethane	71-55-6	160,000	NA	0.005	160,000
1,1,2-Trichloroethane	79-00-5	31	2	0.005	2
Trichloroethene (TCE) (Trichloroethylene)	79-01-6	14	3	0.005	3
Trichlorofluoromethane	75-69-4	23,000	NA	0.005	23,000
2,4,5-Trichlorophenol	95-95-4	6,100	NA	0.2	6,100
2,4,6-Trichlorophenol	88-06-2	19	340	0.2	19
Vanadium	7440-62-2	78	NA	5	78
Vinyl chloride	75-01-4	2	0.7	0.005	0.7
Xylenes	1330-20-7	12,000	NA	0.005	12,000
Zinc	7440-66-6	23,000	NA	6	23,000

NA = Standard not available

* The direct contact standard for arsenic is based on natural background

Table 1B - Non-Residential Direct Contact Health Based Criteria and Soil Remediation Standards (mg/kg)

Contaminant	CAS No.	Ingestion-Dermal Health Based Criterion	Inhalation Health Based Criterion	Soil PQL	Non-Residential Direct Contact Soil Remediation Standard
Acenaphthene	83-32-9	37,000	300,000	0.2	37,000
Acenaphthylene	208-96-8	NA	300,000	0.2	300,000
Acetone (2-Propanone)	67-64-1	NA	NA	0.01	NA
Acetophenone	98-86-2	68,000	5	0.2	5
Acrolein	107-02-8	570	1	0.5	1
Acrylonitrile	107-13-1	6	3	0.5	3
Aldrin	309-00-2	0.2	14	0.002	0.2
Aluminum	7429-90-5	NA	NA	20	NA
Anthracene	120-12-7	180,000	30,000	0.2	30,000
Antimony	7440-36-0	450	23,000	6	450
Arsenic	7440-38-2	2	76	1	19*
Atrazine	1912-24-9	2,400	NA	0.2	2,400
Barium	7440-39-3	230,000	59,000	20	59,000
Benzaldehyde	100-52-7	68,000	NA	0.2	68,000
Benzene	71-43-2	14	5	0.005	5
Benzidine	92-87-5	0.008	0.01	0.7	0.7
Benzo(a)anthracene (1,2-Benzanthracene)	56-55-3	17	5,500	0.2	17
Benzo(a)pyrene	50-32-8	2	230	0.2	2
Benzo(b)fluoranthene (3,4-Benzofluoranthene)	205-99-2	17	5,500	0.2	17
Benzo(ghi)perylene	191-24-2	NA	30,000	0.2	30,000
Benzo(k)fluoranthene	207-08-9	170	55,000	0.2	170
Beryllium	7440-41-7	230	140	0.5	140
1,1'-Biphenyl	92-52-4	240	140,000	0.2	240
Bis(2-chloroethyl)ether	111-44-4	2	2	0.2	2
Bis(2-chloroisopropyl)ether	108-60-1	27,000	67	0.2	67
Bis(2-ethylhexyl)phthalate	117-81-7	140	140,000	0.2	140
Bromodichloromethane (Dichlorobromomethane)	75-27-4	51	3	0.005	3
Bromoform	75-25-2	400	280	0.005	280
Bromomethane	74-83-9	1,600	59	0.005	59
2-Butanone (Methyl ethyl ketone) (MEK)	78-93-3	44,000	NA	0.01	44,000
Butyl benzyl phthalate	85-68-7	14,000	NA	0.2	14,000
Cadmium	7440-43-9	1,100	78	0.5	78
Caprolactam	105-60-2	340,000	NA	0.2	340,000
Carbazole	86-74-8	96	58,000	0.2	96
Carbon disulfide	75-15-0	110,000	NA	0.5	110,000
Carbon tetrachloride	56-23-5	35	4	0.005	4
Chlordane (alpha and gamma)	57-74-9	1	3,300	0.002	1
Chlorobenzene	108-90-7	7,400	NA	0.005	7,400

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Contaminant	CAS No.	Ingestion-Dermal Health Based Criterion	Inhalation Health Based Criterion	Soil PQL	Non-Residential Direct Contact Soil Remediation Standard
Chloroethane (Ethyl chloride)	75-00-3	1,100	NA	0.005	1,100
Chloroform	67-66-3	11,000	2	0.005	2
Chloromethane (Methyl chloride)	74-87-3	NA	12	0.005	12
2-Chlorophenol (o-Chlorophenol)	95-57-8	3,400	2,000	0.2	2,200
Chrysene	218-01-9	1,700	550,000	0.2	1,700
Cobalt	7440-48-4	23,000	590	5	590
Copper	7440-50-8	45,000	280,000	3	45,000
Cyanide	57-12-5	680	260,000	3	680
4,4'-DDD	72-54-8	13	4,800	0.003	13
4,4'-DDE	72-55-9	9	3,400	0.003	9
4,4'-DDT	50-29-3	8	3,400	0.003	8
Dibenz(a,h)anthracene	53-70-3	2	550	0.2	2
Dibromochloromethane (Chlorodibromomethane)	124-48-1	38	8	0.005	8
1, 2-Dibromo-3-chloropropane	96-12-8	1	0.2	0.005	0.2
1,2-Dibromoethane	106-93-4	0.04	0.3	0.005	0.04
1,2-Dichlorobenzene (o-Dichlorobenzene)	95-50-1	59,000	NA	0.005	59,000
1,3-Dichlorobenzene (m-Dichlorobenzene)	541-73-1	59,000	NA	0.005	59,000
1,4-Dichlorobenzene (p-Dichlorobenzene)	106-46-7	6,800	13	0.005	13
3,3'-Dichlorobenzidine	91-94-1	4	960	0.2	4
Dichlorodifluoromethane	75-71-8	230,000	NA	0.005	230,000
1,1-Dichloroethane	75-34-3	7,400	24	0.005	24
1,2-Dichloroethane	107-06-2	26	3	0.005	3
1,1-Dichloroethene	75-35-4	160	150	0.005	150
1,2-Dichloroethene (cis) (c-1,2-Dichloroethylene)	156-59-2	11,000	560	0.005	560
1,2-Dichloroethene (trans) (t-1,2-Dichloroethylene)	156-60-5	19,000	720	0.005	720
2,4-Dichlorophenol	120-83-2	2,100	NA	0.2	2,100
1,2-Dichloropropane	78-87-5	47	5	0.005	5
1,3-Dichloropropene (cis and trans)	542-75-6	32	7	0.005	7
Dieldrin	60-57-1	0.2	3	0.003	0.2
Diethyl phthalate	84-66-2	550,000	NA	0.2	550,000
2,4-Dimethyl phenol	105-67-9	14,000	NA	0.2	14,000
Di-n-butyl phthalate	84-74-2	68,000	NA	0.2	68,000
4,6-Dinitro-2-methylphenol) (4,6-Dinitro-o-cresol)	534-52-1	68	47,000	0.3	68
2,4-Dinitrophenol	51-28-5	1,400	820,000	0.3	1,400
2,4-Dinitrotoluene	121-14-2	3	16	0.2	3
2,6-Dinitrotoluene	606-20-2	3	7	0.2	3
2,4-Dinitrotoluene/2,6-Dinitrotoluene (mixture)	25321-14-6	3	NA	0.2	3
Di-n-octyl phthalate	117-84-0	27,000	NA	0.2	27,000
1,2-Diphenylhydrazine	122-66-7	2	13	0.7	2
Endosulfan I and Endosulfan II (alpha and beta)	115-29-7	6,800	NA	0.003	6,800

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Contaminant	CAS No.	Ingestion-Dermal Health Based Criterion	Inhalation Health Based Criterion	Soil PQL	Non-Residential Direct Contact Soil Remediation Standard
Endosulfan sulfate	1031-07-8	6,800	NA	0.003	6,800
Endrin	72-20-8	340	120,000	0.003	340
Ethyl benzene	100-41-4	110,000	NA	0.005	110,000
Fluoranthene	206-44-0	24,000	300,000	0.2	24,000
Fluorene	86-73-7	24,000	300,000	0.2	24,000
alpha-HCH (alpha-BHC)	319-84-6	0.5	2	0.002	0.5
beta-HCH (beta-BHC)	319-85-7	2	620	0.002	2
Heptachlor	76-44-8	0.7	18	0.002	0.7
Heptachlor epoxide	1024-57-3	0.3	13	0.002	0.3
Hexachlorobenzene	118-74-1	1	4	0.2	1
Hexachloro-1,3-butadiene	87-68-3	25	35	0.2	25
Hexachlorocyclopentadiene	77-47-4	4,100	110	0.2	110
Hexachloroethane	67-72-1	48	NA	0.2	48
Indeno(1,2,3-cd)pyrene	193-39-5	17	5,500	0.2	17
Isophorone	78-59-1	2,000	NA	0.2	2,000
Lead	7439-92-1	800	12,000	1	800
Lindane (gamma-HCH) (gamma-BHC)	58-89-9	2	10	0.002	2
Manganese	7439-96-5	160,000	5,900	2	5,900
Mercury	7439-97-6	340	65	0.1	65
Methoxychlor	72-43-5	5,700	NA	0.02	5,700
Methyl acetate	79-20-9	NA	NA	0.005	NA
Methylene chloride (Dichloromethane)	75-09-2	230	NA	0.005	230
2-Methylnaphthalene	91-57-6	2,400	300,000	0.17	2,400
2-Methylphenol (o-Creosol)	95-48-7	3,400	NA	0.2	3,400
4-Methylphenol (p-Creosol)	106-44-5	340	NA	0.2	340
Methyl tert-butyl ether	1634-04-4	11,000	320	0.005	320
Naphthalene	91-20-3	25,000	17	0.2	17
Nickel (Soluble salts)	7440-02-0	23,000	23,000	4	23,000
2-Nitroaniline	88-74-4	NA	23,000	0.3	23,000
Nitrobenzene	98-95-3	1,400	14	0.2	14
N-Nitrosodimethylamine	62-75-9	0.06	0.05	0.7	0.7
N-Nitrosodi-n-proplyamine	621-64-7	0.3	0.5	0.2	0.3
N-Nitrosodiphenylamine	86-30-6	390	130,000	0.2	390
Pentachlorophenol	87-86-5	3	1,700	0.3	3
Phenanthrene	85-01-8	NA	300,000	0.2	300,000
Phenol	108-95-2	210,000	NA	0.2	210,000
Polychlorinated biphenyls (PCBs)	1336-36-3	1	57	0.03	1
Pyrene	129-00-0	18,000	300,000	0.2	18,000
Selenium	7782-49-2	5,700	NA	4	5,700
Silver	7440-22-4	5,700	NA	1	5,700

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Contaminant	CAS No.	Ingestion-Dermal Health Based Criterion	Inhalation Health Based Criterion	Soil PQL	Non-Residential Direct Contact Soil Remediation Standard
Styrene	100-42-5	230,000	260	0.005	260
Tertiary butyl	75-65-0	20,000	11,000	0.1	11,000
1,1,2,2-Tetrachloroethane	79-34-5	16	3	0.005	3
Tetrachloroethene (PCE) (Tetrachloroethylene)	127-18-4	1,500	NA	0.005	1,500
Toluene	108-88-3	91,000	NA	0.005	91,000
Toxaphene	8001-35-2	3	200	0.2	3
1,2,4-Trichlorobenzene	120-82-1	820	NA	0.005	820
1,1,1-Trichloroethane	71-55-6	NA	NA	0.005	NA
1,1,2-Trichloroethane	79-00-5	440	6	0.005	6
Trichloroethene (TCE) (Trichloroethylene)	79-01-6	69	10	0.005	10
Trichlorofluoromethane	75-69-4	340,000	NA	0.005	340,000
2,4,5-Trichlorophenol	95-95-4	68,000	NA	0.2	68,000
2,4,6-Trichlorophenol	88-06-2	74	960	0.2	74
Vanadium	7440-62-2	1,100	470,000	5	1,100
Vinyl chloride	75-01-4	8	2	0.005	2
Xylenes	1330-20-7	170,000	NA	0.005	170,000
Zinc	7440-66-6	340,000	110,000	6	110,000

NA = Standard not available

* The direct contact standard for arsenic is based on natural background

Table 1
Default Impact to Ground Water Soil Screening Levels for Contaminants (mg/kg)

Contaminant	CAS Number	Health based Ground Water Quality Criteria (µg/L)	Default Impact to GW Health-Based Soil Screening Level (mg/kg)	Soil PQL (mg/kg)	Impact to GW Soil Screening Level (mg/kg)
Acenaphthene	83-32-9	400	110	0.2	110
Acenaphthylene	208-96-8	NA	NA	0.2	NA
Acetone (2-propanone)	67-64-1	6000	19	0.01	19
Acetophenone	98-86-2	700	3	0.2	3
Acrolein	107-02-8	4	0.01	0.5	0.5†
Acrylonitrile	107-13-1	0.06	0.0002	0.5	0.5†
Aldrin	309-00-2	0.002	0.2	0.002	0.2
Aluminum	7429-90-5	200	6000	20	6000
Anthracene	120-12-7	2000	2400	0.2	2400
Antimony	7440-36-0	6	5	6	6†
Arsenic	7440-38-2	0.02	0.01	1	19*
Atrazine	1912-24-9	3	0.05	0.2	0.2†
Barium	7440-39-3	6000	2100	20	2100
Benzaldehyde	100-52-7	NA	NA	0.2	NA
Benzene	71-43-2	0.2	0.001	0.005	0.005†
Benzidine	92-87-5	0.0002	0.000001	0.7	0.7†
Benzo(a)anthracene (1,2-Benzanthracene)	56-55-3	0.05	0.8	0.2	0.8
Benzo(a)pyrene	50-32-8	0.005	0.2	0.2	0.2
Benzo(b)fluoranthene (3,4-benzofluoranthene)	205-99-2	0.05	2	0.2	2
Benzo(ghi)perylene	191-24-2	NA	NA	0.2	NA
Benzo(k)fluoranthene	207-08-9	0.5	25	0.2	25
Beryllium	7440-41-7	1	0.7	0.5	0.7
1,1'-Biphenyl	92-52-4	400	140	0.2	140
Bis(2-chloroethyl)ether	111-44-4	0.03	0.0001	0.2	0.2†
Bis(2-chloroisopropyl)ether	108-60-1	300	5	0.2	5
Bis(2-ethylhexyl)phthalate	117-81-7	2	1200	0.2	1200
Bromodichloromethane (Dichlorobromomethane)	75-27-4	0.6	0.003	0.005	0.005†
Bromoform	75-25-2	4	0.03	0.005	0.03
Bromomethane (Methyl bromide)	74-83-9	10	0.04	0.005	0.04
2-Butanone (Methyl ethyl ketone) (MEK)	78-93-3	300	0.9	0.01	0.9
Butyl benzyl phthalate	85-68-7	100	230	0.2	230
Cadmium	7440-43-9	4	2	0.5	2
Caprolactam	105-60-2	3500	12	0.2	12
Carbazole	86-74-8	NA	NA	0.2	NA
Carbon disulfide	75-15-0	700	6	0.5	6
Carbon tetrachloride	56-23-5	0.4	0.005	0.005	0.005
Chlordane (alpha and gamma)	57-74-9	0.01	0.05	0.002	0.05
Chlorobenzene	108-90-7	50	0.6	0.005	0.6
Chloroethane (Ethyl chloride)	75-00-3	NA	NA	0.005	NA
Chloroform	67-66-3	70	0.4	0.005	0.4
Chloromethane (Methyl chloride)	74-87-3	NA	NA	0.005	NA
2-Chlorophenol (o-Chlorophenol)	95-57-8	40	0.8	0.2	0.8
Chrysene	218-01-9	5	80	0.2	80
Cobalt	7440-48-4	100	90	5	90
Copper	7440-50-8	1300	11000	3	11000
Cyanide	57-12-5	100	20	3	20

Table 1
Default Impact to Ground Water Soil Screening Levels for Contaminants (mg/kg)

Contaminant	CAS Number	Health based Ground Water Quality Criteria (µg/L)	Default Impact to GW Health-Based Soil Screening Level (mg/kg)	Soil PQL (mg/kg)	Impact to GW Soil Screening Level (mg/kg)
4,4'-DDD	72-54-8	0.1	4	0.003	4
4,4'-DDE	72-55-9	0.1	18	0.003	18
4,4'-DDT	50-29-3	0.1	11	0.003	11
Dibenz(a,h)anthracene	53-70-3	0.005	0.8	0.2	0.8
Dibromochloromethane (Chlorodibromomethane)	124-48-1	0.4	0.002	0.005	0.005†
1,2-Dibromo-3-chloropropane	96-12-8	0.02	0.0001	0.005	0.005†
1,2-Dibromoethane (ethylene dibromide)	106-93-4	0.0004	0.000002	0.005	0.005†
1,2-Dichlorobenzene (o-Dichlorobenzene)	95-50-1	600	17	0.005	17
1,3-Dichlorobenzene (m-Dichlorobenzene)	541-73-1	600	19	0.005	19
1,4-Dichlorobenzene (p-Dichlorobenzene)	106-46-7	75	2	0.005	2
3,3'-Dichlorobenzidine	91-94-1	0.08	0.003	0.2	0.2†
Dichlorodifluoromethane	75-71-8	1000	39	0.005	39
1,1-Dichloroethane	75-34-3	50	0.2	0.005	0.2
1,2-Dichloroethane	107-06-2	0.3	0.001	0.005	0.005†
1,1-Dichloroethene (1,1-Dichloroethylene)	75-35-4	1	0.008	0.005	0.008
1,2-Dichloroethene (cis) (c-1,2-Dichloroethylene)	156-59-2	70	0.3	0.005	0.3
1,2-Dichloroethene (trans) (t-1,2-Dichloroethylene)	156-60-5	100	0.6	0.005	0.6
2,4-Dichlorophenol	120-83-2	20	0.2	0.2	0.2
1,2-Dichloropropane	78-87-5	0.5	0.003	0.005	0.005†
1,3-Dichloropropene (cis and trans) (summed)	542-75-6	0.4	0.003	0.005	0.005†
Dieldrin	60-57-1	0.002	0.002	0.003	0.003†
Diethyl phthalate	84-66-2	6000	88	0.2	88
2,4-Dimethylphenol	105-67-9	100	1	0.2	1
Di-n-butyl phthalate	84-74-2	700	950	0.2	760**
4,6-Dinitro-2-methylphenol (4,6-Dinitro-o-cresol)	534-52-1	0.7	0.005	0.3	0.3†
2,4-Dinitrophenol	51-28-5	10	0.03	0.3	0.3†
2,4-Dinitrotoluene	121-14-2	NA	NA	0.2	NA
2,6-Dinitrotoluene	606-20-2	NA	NA	0.2	NA
2,4-Dinitrotoluene/2,6-Dinitrotoluene (mixture)	25321-14-6	0.05	0.0003	0.2	0.2†
Di-n-octyl phthalate	117-84-0	100	330000	0.2	3300**
1,2-Diphenylhydrazine	122-66-7	0.04	0.001	0.7	0.7†
Endosulfan I and Endosulfan II (alpha and beta)	115-29-7	40	4	0.003	4
Endosulfan sulfate	1031-07-8	40	2	0.003	2
Endrin	72-20-8	2	1	0.003	1
Ethyl benzene	100-41-4	700	13	0.005	13
Fluoranthene	206-44-0	300	1300	0.2	1300
Fluorene	86-73-7	300	170	0.2	170
Alpha-HCH (alpha-BHC)	319-84-6	0.006	0.0003	0.002	0.002†
Beta-HCH (beta-BHC)	319-85-7	0.02	0.001	0.002	0.002†
Heptachlor	76-44-8	0.008	0.5	0.002	0.5
Heptachlor epoxide	1024-57-3	0.004	0.01	0.002	0.01
Hexachlorobenzene	118-74-1	0.02	0.04	0.2	0.2†
Hexachloro-1,3-butadiene	87-68-3	0.4	0.9	0.2	0.9
Hexachlorocyclopentadiene	77-47-4	40	320	0.2	320
Hexachloroethane	67-72-1	2	0.1	0.2	0.2†
Indeno(1,2,3-cd)pyrene	193-39-5	0.05	7	0.2	7
Isophorone	78-59-1	40	0.2	0.2	0.2

Table 1
Default Impact to Ground Water Soil Screening Levels for Contaminants (mg/kg)

Contaminant	CAS Number	Health based Ground Water Quality Criteria (µg/L)	Default Impact to GW Health-Based Soil Screening Level (mg/kg)	Soil PQL (mg/kg)	Impact to GW Soil Screening Level (mg/kg)
Lead	7439-92-1	5	90	1	90
Lindane (gamma-HCH) (gamma-BHC)	58-89-9	0.03	0.001	0.002	0.002†
Manganese	7439-96-5	50	65	2	65
Mercury	7439-97-6	2	0.01	0.1	0.1†
Methoxychlor	72-43-5	40	160	0.02	160
Methyl acetate	79-20-9	7000	22	0.005	22
Methylene chloride (Dichloromethane)	75-09-2	3	0.01	0.005	0.01
2-Methylnaphthalene	91-57-6	30	8	0.17	8
2-Methylphenol (o-cresol)	95-48-7	NA	NA	0.2	NA
4-Methylphenol (p-cresol)	106-44-5	NA	NA	0.2	NA
Methyl tert-butyl ether (MTBE)	1634-04-4	70	0.2	0.005	0.2
Naphthalene	91-20-3	300	25	0.2	25
Nickel (Soluble salts)	7440-02-0	100	48	4	48
2-Nitroaniline	88-74-4	NA	NA	0.3	NA
Nitrobenzene	98-95-3	4	0.02	0.2	0.2†
N-Nitrosodimethylamine	62-75-9	0.0007	0.000002	0.7	0.7†
N-Nitrosodi-n-propylamine	621-64-7	0.005	0.00002	0.2	0.2†
N-Nitrosodiphenylamine	86-30-6	7	0.4	0.2	0.4
Pentachlorophenol	87-86-5	0.3	0.06	0.3	0.3†
Phenanthrene	85-01-8	NA	NA	0.2	NA
Phenol	108-95-2	2000	8	0.2	8
Polychlorinated biphenyls (PCBs)	1336-36-3	0.02	0.2	0.03	0.2
Pyrene	129-00-0	200	840	0.2	840
Selenium	7782-49-2	40	11	4	11
Silver	7440-22-4	40	0.3	1	1†
Styrene	100-42-5	100	3	0.005	3
Tertiary butyl alcohol (TBA)	75-65-0	100	0.3	0.1	0.3
1,1,2,2-Tetrachloroethane	79-34-5	1	0.007	0.005	0.007
Tetrachloroethene (PCE) (Tetrachloroethylene)	127-18-4	0.4	0.004	0.005	0.005†
Thallium	7440-28-0	0.5	0.5	3	3†
Toluene	108-88-3	600	7	0.005	7
Toxaphene	8001-35-2	0.03	0.3	0.2	0.3
1,2,4-Trichlorobenzene	120-82-1	9	0.7	0.005	0.7
1,1,1-Trichloroethane	71-55-6	30	0.3	0.005	0.3
1,1,2-Trichloroethane	79-00-5	3	0.02	0.005	0.02
Trichloroethene (TCE) (Trichloroethylene)	79-01-6	1	0.01	0.005	0.01
Trichlorofluoromethane	75-69-4	2000	34	0.005	34
2,4,5-Trichlorophenol	95-95-4	700	68	0.2	68
2,4,6-Trichlorophenol	88-06-2	1	0.04	0.2	0.2†
Vanadium	7440-62-2	NA	NA	5	NA
Vinyl chloride	75-01-4	0.08	0.0005	0.005	0.005†
Xylenes	1330-20-7	1000	19	0.005	19
Zinc	7440-66-6	2000	930	6	930

NA = Standard not available *Health based standard defaults to background **Health based standard defaults to soil saturation limit †standard set at PQL

Appendix B: Laboratory SOPs

SOP Minor Revision Summary

SOP:			
Title -	**POLYCHLORINATED BIPHENYLS (PCBS) BY GAS CHROMATOGRAPHY (SOIL, WATER & OIL) (EPA METHODS 608, 608.3, 8082, & 8082A, SM 6431B)**		
Number -	330343	**Department -**	SVOA
Revision -	17	**Rev. Date -**	3/23/2018

This Standard Operating Procedure has been amended to include changes required during normal business operations. These changes as defined by SOP 010103 (Document Control and Distribution) are routine modifications that will be incorporated into the SOP upon the next scheduled review.

Rev.	Date	Section	Brief Description
a	8/7/18	8.5	Add guidance for Aroclor and Chlordane Identification

Standard Operating Procedure

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TITLE: POLYCHLORINATED BIPHENYLS (PCBS) BY GAS CHROMATOGRAPHY (SOIL, WATER & OIL) (EPA METHODS 608, 608.3, 8082, & 8082A, SM 6431B)

Reviewed by: Blake Judge, Chris Johnson, Steve Miller

Department Manager *QA Department*

1.0 SCOPE AND APPLICATION

NOTE: EPA Methods 608 and 608.3 include the analysis of pesticides. For direction regarding pesticide analysis using these methods, see ESC SOP #330344, *Chlorinated Pesticides by GC*.

STATE NOTE: For samples analyzed in conjunction with the Ohio Voluntary Action Program (VAP) please utilize SOP #330343OH.

1.1 This standard operating procedure describes a gas chromatographic method for the determination of polychlorinated biphenyls (PCBs) as Aroclors. It is used for waste samples, waters, soils, sediments, and other solid samples. Compounds analyzed by this method and their typical reporting limits are found below (subject to change).

Analyte	CAS No./ IUPAC No.:	Soil mg/kg	Water mg/L
Aroclor 1016	12674-11-2	0.017	0.0005
Aroclor 1221	11104-28-2	0.017	0.0005
Aroclor 1232	11141-16-5	0.017	0.0005
Aroclor 1242	53469-21-9	0.017	0.0005
Aroclor 1248	12672-29-6	0.017	0.0005
Aroclor 1254	11097-69-1	0.017	0.0005
Aroclor 1260	11096-82-5	0.017	0.0005
Aroclor 1262*Ŧ	37324-23-5	--	0.0005
Aroclor 1268*	11100-14-4	--	0.0005

* See section 13.3.
Ŧ Not a target analyte in Method 608.3

1.2 Aroclors are multi-component mixtures. When samples contain more than one Aroclor, a higher level of analyst expertise is required to attain acceptable levels of qualitative and quantitative analysis. The same is true of Aroclors that have been subjected to environmental degradation ("weathering") or degradation by treatment technologies.

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Such weathered multi-component mixtures may have significant differences in peak patterns than those of Aroclor standards.

1.3 Quantitation of PCBs as Aroclors is appropriate for many regulatory compliance determinations, but is particularly difficult when the Aroclors have been weathered by long exposure in the environment.

1.4 A Method Detection Limit (MDL) study must be completed at least annually or more frequently if major instrumentation changes occur. MDLs are performed based on ESC SOP #030206. Updated MDL records are filed and stored on ESC's intranet.

1.4.1 Limit of Detection (LOD) and Limit of Quantitation (LOQ) studies are completed at the frequency required by the TNI standard per the procedure identified in the ESC SOP #030206, *Method Detection Limits (MDL), Limits of Detection (LOD) and Limits of Quantitation (LOQ).* Should the procedure be utilized for DOD support; then the frequency of these studies must meet the requirements of the current DOD QSM (see Attachment II).

1.4.2 Lower Limit of Quantitation (LOQ) – For analyses performed per the requirements of Method 8000D, the LLOQ is established at concentrations where both quantitative and qualitative requirements can consistently be met (see Sections 2.8 and 10.16.

1.4.3 When analyzing the PCBs as Aroclors, it is only necessary to establish an MDL for one of the multi-component analytes (e.g., PCB 1254), or the mixture of Aroclors 1016 and 1260 may be used to establish MDLs for all of the Aroclors.

2.0 METHOD SUMMARY AND DEFINITIONS

2.1 A measured volume or weight of sample (approximately 100mL or 1L for liquids, up to 30g for solids) is extracted using the appropriate matrix-specific sample extraction technique.

2.2 Aqueous samples are extracted at neutral pH with methylene chloride using EPA method 3510C (separatory funnel) or other appropriate technique. Reduced volume (RV) extraction using EPA method 3510C that requires a smaller volume (usually 100mL) of field sample is also available for use where applicable. See section 13.4 of this procedure and ESC SOP #330702B. The resulting extracts are exchanged in Hexane for final solvent and concentrated using ESC SOP #330708, Buchi Syncore Concentration System.

2.3 Solid samples are extracted with methylene chloride using EPA methods 3546 (microwave). The extract is exchanged in Hexane for final solvent. Extracts from solid samples may or may not require concentration depending on instrumentation used for analysis and the data quality objectives of the client project. Non-concentrated extracts may utilize a Large Volume Injection (LVI) technique if instrumentation is equipped with proper inlet or if sensitivity at detection is not sufficient.

2.4 Oily matrices are subjected to waste dilution according to EPA method 3580A.

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2.5 Extracts for PCB analysis may be subjected to a sulfuric acid/potassium permanganate cleanup (EPA Method 3665A), silica gel cleanup (EPA Method 3630C), and Sulfur Cleanup (EPA Method 3660B). These cleanup techniques remove many single component organochlorine/organophosphorus pesticides, sulfur and other non-target analytes that can interfere with the identification and quantitation of PCBs; therefore, cleaned extracts for analysis using Method 8082 are not applicable to the analysis of those compounds (see EPA Method 8081).

2.6 Routinely, an internal standard is added to the sample extract then the extract is injected into a gas chromatograph equipped with a capillary column and an electron capture detector; however in cases where there is an obvious interferent co-eluting with the internal standard peak, extracts without internal standard are analyzed and quantitation using external calibration is performed.

2.7 The chromatographic data may be used to determine the nine Aroclors in Sec. 1.1 or total PCBs.

2.8 Lower Limit of Quantitation (LLOQ) – For analyses performed according to the requirements of Method 8000D, the lowest concentration at which the laboratory has demonstrated target analytes can be reliably measured and reported with a certain degree of confidence, which must be greater than or equal to the lowest point in the calibration curve.

2.9 LVI: Large Volume Injection: any injection volume >5ul. Technique is dependent upon type of GC inlet used and sensitivity of detection.

2.10 See the current Quality Assurance Manual for definitions associated with terms found in this document.

3.0 HEALTH AND SAFETY

3.1 The toxicity or carcinogenicity of each reagent used in the laboratory has not been fully established. Each chemical should be regarded as a potential health hazard and exposure to these compounds must be as low as reasonably achievable. A reference file of safety data sheets (SDSs) is made available on ESC's intranet to all personnel. Use hazardous reagents in a fume hood whenever possible and if eye or skin contact occurs, flush with large volumes of water. Always wear safety glasses or a shield for eye protection, protective clothing and observe proper mixing protocols.

3.2 Many of the compounds determined by this methodology have been identified as known or putative carcinogens in man and/or animals. Exposure to these compounds must be reduced to a minimum. Neat standards should be handled in a fume hood. The analyst must use gloves to minimize the possibility of trans-dermal adsorption of these compounds.

3.3 Since the electron capture detector is a non-destructive detector, effluent from the gas chromatograph must be vented through an adsorption trap. Large quantities of the dichloromethane extraction solvent should be handled in the fume hood.

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3.4 Wear safety glasses, gloves, and laboratory coat to protect against physical contact with samples that contain potentially hazardous chemicals.

4.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

4.1 All samples must have been collected using a sampling plan that addresses the considerations of this method.

4.2 The sample containers must be glass or Teflon and have screw caps with Teflon-lined septa. Sample containers must be filled with care to prevent any portion of the collected sample contacting the sampler's gloves, thus causing possible contamination. Samples must not be collected or stored in the presence of exhaust fumes. If the sample contacts the sampler (e.g. if an automatic sampler is used), run organic-free reagent water through the sampler and utilize the rinsate as a field blank.

4.3 If residual chlorine is present, water samples are preserved with 3mL of 10% sodium thiosulfate per gallon and cooled to 4 $\pm$ 2ºC. Water samples are collected in a 1L amber bottle with Teflon lined caps and must be extracted within 365 days of collection and analyzed within 40 days following the extraction. See section 13.5.

4.4 Soils are collected in wide mouth jars with Teflon lined caps and are cooled to 4 $\pm$ 2ºC upon collection. Soils must be extracted within 365 days of collection and analyzed within 40 days following extraction. See section 13.5.

4.5 All analytical glassware must be cleaned according to SOP #030701, *Glassware Cleaning*.

4.6 Samples submitted for analysis that do not meet the requirements contained within this section must be addressed before performing the logging process within the laboratory. In some cases, exceeding the appropriate preservation and storage criteria can cause significant bias in the resulting data. Clients may need to resubmit samples where the conditions during shipment cause uncertainty regarding sample integrity. If samples do not meet the requirements for preservation, sampling, shipment and storage and the client approves the completion of the analytical process, sample results can be qualified and possible bias is narrated per the ESC SOP #030201, *Data Handling and Reporting*.

4.7 Method 608.3 allows the use of hydrogen as a carrier gas in place of helium. If used, the laboratory should take the necessary precautions in dealing with hydrogen, and should limit hydrogen flow at the source to prevent buildup of an explosive mixture of hydrogen in air.

5.0 INTERFERENCES

5.1 Interferences co-extracted from the samples vary considerably from matrix to matrix. While general cleanup techniques are referenced or provided as part of this method, unique samples may require additional cleanup approaches to achieve desired degrees of discrimination and quantitation. Sources of interference in this method can be grouped into three broad categories.

5.1.1 Contaminated solvents, reagents, or sample processing hardware.

5.1.2 Contaminated GC carrier gas, parts, column surfaces, or detector surfaces.

5.1.3 Compounds extracted from the sample matrix to which the detector will respond.

5.2 Interferences by phthalate esters introduced during sample preparation can pose a major problem in PCB determinations.

5.2.1 Common flexible plastics contain varying amounts of phthalate esters that are easily extracted or leached from such materials during laboratory operations. Interferences from phthalate esters can best be minimized by avoiding contact with any plastic materials and checking all solvents and reagents for phthalate contamination.

5.2.2 Exhaustive cleanup of solvents, reagents and glassware may be required to eliminate background phthalate ester contamination.

5.2.3 Phthalate esters can be removed through the use of Method 3665A (sulfuric acid/permanganate cleanup).

5.3 Cross-contamination of clean glassware routinely occurs when plastics are handled during extraction steps, especially when solvent-wetted surfaces are handled. Glassware must be scrupulously cleaned. Clean all glassware as soon as possible after use by rinsing with the last solvent used. Detergent washing with hot water and rinses with tap water and organic-free reagent water follow. Drain the glassware, and dry it in an oven at 130°C for several hours, or rinse with methanol and drain. Store dry glassware in a clean environment.

NOTE: Oven-drying of glassware used for PCB analysis can increase contamination because PCBs are readily volatilized in the oven and spread to other glassware. Therefore, exercise caution and do not dry glassware from samples containing high concentrations of PCBs with glassware that may be used for trace analyses.

5.4 Elemental sulfur (S) is readily extracted from soil samples and may cause chromatographic interferences in the determination of PCBs. Sulfur can be removed using EPA Method 3660B. Other non-target contaminants can be cleaned from extracts using EPA Methods 3665A, 3620C, or 3630C. See the relevant ESC SOPs for more information regarding the use and procedure for these cleanup methods.

5.5 If co-elutions occur in analysis of a sample, a co-elution on one column is acceptable so long as effective separation of the co-eluting compounds can be achieved on the second column.

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TITLE: POLYCHLORINATED BIPHENYLS (PCBS) BY GAS CHROMATOGRAPHY (SOIL, WATER & OIL) (EPA METHODS 608, 608.3, 8082, & 8082A, SM 6431B)

6.0 EQUIPMENT AND SUPPLIES

6.1 Instrumentation (equivalent substitutions may be made)

Instrument name:	SVGC #18	SVGC #28
Use (method #'s):	8082, 608	8082, 608
Model #:	Agilent 6890	Agilent 7890
Column (type, brand, size):	STX–CLPesticides 30m x 0.32mm x 0.5um, STX-CLPesticides II 30m x 0.32mm x 0.25um	STX–CLPesticides 30m x 0.32mm x 0.5um, STX-CLPesticides II 30m x 0.32mm x 0.25um
Detector:	Dual Micro ECD	Dual micro ECD
Software name and version:	EnviroQuant Chemstation G1701DA	EnviroQuant Chemstation G1701EA
Software version:	D.00.01.27	E.02.00
Sample introduction system:	HP 7683 AS	Agilent 7693 AS
Computer name:	SVCOMPD	SVCOMPAT
Computer brand, and model #:	HP Compaq	HP Compaq
Gases used (grade and supplier):	N2 – Zero Grade/He/H_2	N2 – Zero Grade/He/H_2

6.2 Vials 10 - 15mL with Teflon lined screw caps

6.3 Syringes - Hamilton Gastight or equivalent: 1mL, 250µL, 100µL, 10µL

6.4 40mL vials with Teflon lined caps

6.5 9" VWR Disposable Pasteur Pipette, or equivalent

6.6 10mL Pyrex Disposable Pipette, or equivalent

6.7 1.8mL Wheaton ABC Vials with Teflon rubber lined caps or equivalent

6.8 10mL Pyrex Volumetric Flasks - Class "A" or equivalent.

7.0 REAGENTS AND STANDARDS

7.1 All reagents and standards must be recorded in the appropriate preparation log and assigned a unique number. See SOP #030230, *Standards Logger – Tree Operation*. Additional information regarding reagent preparation can be found in the Standards Logger (Tree) digital archive system. All spiking solutions and surrogate standard solutions should be replaced at least every 6 months or sooner if a problem is detected unless otherwise noted.

7.2 Pesticide grade chemicals are used in all tests.

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TITLE: POLYCHLORINATED BIPHENYLS (PCBS) BY GAS CHROMATOGRAPHY (SOIL, WATER & OIL) (EPA METHODS 608, 608.3, 8082, & 8082A, SM 6431B)

NOTE: Store the standard solutions (stock, composite, calibration, internal, and surrogate standards) according to manufacturer's guidance. Routinely, store PCB standard and spiking solutions at <6°C in polytetrafluoroethylene (PTFE)-sealed containers in the dark. When a lot of standards is prepared, it is recommended that aliquots of that lot be stored in individual small vials for protection from degradation and possible contamination.

7.3 Aroclor stocks, working and calibration standards - The laboratory working spike standard is made using 500uL, or 2.5uL for non-concentrated soil and RV of a 200ug/mL Pesticides Surrogate Standard Spiking Solution (Ultra Scientific Cat# ISM-320) and 100uL, or 0.5uL for RV, each of Aroclor 1016 & 1260 at 1000ug/mL. The final volume is 10mL in Hexane and the final concentration is 10ppm and 50ppb for non-concentrated soil and RV. Stock standards for each Aroclor are received at 1.0mg/mL and are diluted as follows for calibration working standards. Equivalent substitutions of purchased standards and calibration standard levels may be made.

- PCB 1016 - AccuStandard Cat# C-2165-H-10x
- PCB 1260 - AccuStandard Cat# C-2605-H-10x
- PCB 1221 - AccuStandard Cat# C-2215-H-10x
- PCB 1232 - AccuStandard Cat# C-2325-H-10x
- PCB 1242 - AccuStandard Cat# C-2425-H-10x
- PCB 1248 - AccuStandard Cat# C-2485-H-10x
- PCB 1254 - AccuStandard Cat# C-2445-H-10x
- PCB 1262 - AccuStandard Cat# C-262S-H-10X
- PCB 1268 - AccuStandard Cat# C-268S-H-10X

Calibration standards are produced using this solution at the concentrations below. Also see section 13.2.

For concentrated Soil and 1L extracted analyses:

Compound	Std1 µg/mL	Std2 µg/mL	Std3 µg/mL	Std4* µg/mL	Std5 µg/mL	Std6 µg/mL
Amount of Intermediate added (uL)	50uL	100uL	250uL	500uL	750uL	1000uL
Final Volume (mL)	1mL	1mL	1mL	1mL	1mL	1mL
Analyte Concentrations						
1016	.05ppm	.10ppm	.25ppm	.50ppm	.75ppm	1.0ppm
1260	.05ppm	.10ppm	.25ppm	.50ppm	.75ppm	1.0ppm
DCB	.05ppm	.10ppm	.25ppm	.50ppm	.75ppm	1.0ppm
TCMX	.05ppm	.10ppm	.25ppm	.50ppm	.75ppm	1.0ppm

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Standard Operating Procedure

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TITLE: **POLYCHLORINATED BIPHENYLS (PCBS) BY GAS CHROMATOGRAPHY (SOIL, WATER & OIL) (EPA METHODS 608, 608.3, 8082, & 8082A, SM 6431B)**

For non-concentrated Soil and RV analyses:

Compound	Std1 µg/mL	Std2 µg/mL	Std3* µg/mL	Std4 µg/mL	Std5 µg/mL	Std6 µg/mL
Amount of Intermediate added (uL)	40uL	80uL	100uL	200uL	400uL	1000uL
Final Volume (mL)	1mL	1mL	1mL	1mL	1mL	1mL
Analyte Concentrations						
1016	2ppb	4ppb	5ppb	10ppb	20ppb	50ppb
1260	2ppb	4ppb	5ppb	10ppb	20ppb	50ppb
DCB	2ppb	4ppb	5ppb	10ppb	20ppb	50ppb
TCMX	2ppb	4ppb	5ppb	10ppb	20ppb	50ppb

- Levels also used for ICV/CCV.

NOTE: A standard containing a mixture of Aroclor 1016 and Aroclor 1260 includes many of the peaks represented in the other five Aroclor mixtures. As a result, a multi-point initial calibration employing a mixture of Aroclors 1016 and 1260 at five concentrations is sufficient to demonstrate the linearity of the detector response without the necessity of performing initial calibrations for each of the nine Aroclors, but six points are routinely run for calibration. In addition, the 1016/1260 mixture is used as a standard to demonstrate that a sample does not contain peaks that represent any one of the Aroclors. This standard is used to determine the concentrations of either Aroclor 1016 or Aroclor 1260, if they are present in a sample. A 0.50ppm or 5ppb for non-concentrated soil and RV, single point calibration is used for all remaining Aroclors other than 1016/1260. These are analyzed following each new initial calibration curve.

METHOD NOTE: For Method 608.3, one of the calibration standards should be at a concentration at or below the method-defined minimum level (ML) specified in the table below, as specified by a regulatory/control authority, or in a permit:

Method 608.3 ML Values

Analyte	ML (ng/L)
PCB-1016	--
PCB-1221	--
PCB-1232	--
PCB-1242	95
PCB-1248	--
PCB-1254	--
PCB-1260	--
PCB-1268	--

Alternatively, the laboratory may establish an ML for each analyte based on the concentration of the lowest calibration standard in a series of standards produced by the laboratory or obtained from a commercial vendor, again, provided that the ML does not exceed the method-defined ML, and provided that the resulting calibration meets the acceptance criteria in based on the RSD, RSE, or R^2.

A separate standard near the MDL may be analyzed as a check on sensitivity, but should not be included in the linearity assessment. The solvent for the standards must match the final solvent for the sample extracts (e.g., isooctane or hexane).

7.3.1 PCB presence and ID: Where PCBs are suspected and do not match the 1016/1260 standards, select the Aroclor that is suspected and run a single calibration point using the calibration standards listed in section 7.3.

7.4 Laboratory Control Sample, Matrix Spike Solution and Second Source Calibration Verification Solution:

Method	Matrix	Supplier/ Concentration*	Dilution	Spike Conc.	Spike Volume
608/8082 PCBs	Water	NSI - 1.0mg/mL each Aroclor 1016 & 1260	Dilute 1.0mL standard to 200mL in Acetone	5µg/mL	100uL of Spike Solution to 1L DI water (LCS) or 1L of sample (MS) or 10uL to 100mL for 3510RV
8082 PCBs	Conc. Soil/ Solid	NSI - 1.0mg/mL each Aroclor 1016 & 1260	Dilute 1.0mL standard to 200mL in Acetone	5µg/mL	1.0mL of Spike Solution to 30g Ottawa sand (LCS) or 30g of sample (MS) also Waste Dil.
608/8082 PCBs	Non-Conc. Soil/ Solid	NSI - 1.0mg/mL each Aroclor 1016 & 1260	Dilute 1.0mL standard to 200mL in Acetone	5µg/mL	100uL of Spike Solution to 1L DI water (LCS) or 1L of sample (MS) or 10uL to 100mL for non-concentrated soil

** see section 13.2*

7.5 Hexane - pesticide grade - VWR EM-HX0298-1 or equivalent

7.6 Concentrated sulfuric acid (H_2S0_4) - VWR VW6840-3 reagent grade or equivalent.

7.7 Stock Internal Standard: 1-Bromo-2-nitrobenzene at 5000 mg/L (Ultra Cat# PPS-351) or equivalent. Dilute the purchased stock standard 0.10mL, or 2uL for non-concentrated soil and RV, to 10mL for the intermediate standard. Add 10uL of the intermediate standard to each 1mL standard, field sample, method blank, and QC (LCS/LCSD/MS/MSD) extract.

7.8 Sodium sulfate, reagent grade, granular anhydrous, rinsed with methylene chloride, baked in a shallow tray at 450°C for 1 hour minimum, cooled in a desiccator, and stored in a pre-cleaned glass bottle with screw cap which prevents moisture from entering.

7.8.1 If, after heating, the sodium sulfate develops a noticeable grayish cast (due to the presence of carbon in the crystal matrix), that batch of reagent is not suitable for use and should be discarded. Extraction with methylene chloride (as opposed to simple rinsing) and baking at a lower temperature may produce sodium sulfate suitable for use.

7.9 Method 608.3 Standard Requirements

7.9.1 Quality Control (QC) Check Sample Concentrate—Prepare one or more mid-level standard mixtures (concentrates) in acetone (or other water miscible solvent). The concentrate is used as the spiking solution with which to prepare the Demonstration of Capabilities (DOC) samples, the Laboratory Control Sample (LCS), and Matrix Spike (MS) and Matrix Spike Duplicate (MSD) samples. If prepared by the laboratory (as opposed the purchasing it from a commercial supplier), the concentrate must be prepared independently from the standards used for calibration, but may be prepared from the same source as the second source standard used for calibration verification.

7.9.2 Calibration Verification Standards— In order to verify the results of the initial calibration standards, prepare one or more mid-level standard mixtures in isooctane or hexane, using standards obtained from a second source (different manufacturer or different certified lot from the calibration standards). These standards will be analyzed to verify the accuracy of the calibration. As with the QC sample concentrate, multiple solutions may be required to address coelutions among all of the analytes.

7.9.3 Internal standard solution—If the internal standard calibration technique is to be used, prepare Pentachloronitrobenzene (PCNB) at a concentration of 10 mg/mL in ethyl acetate. Alternative and multiple internal standards (e.g., tetrachloro-m-xylene, 4,4′-dibromobiphenyl, and/or decachlorobiphenyl) may be used provided that the laboratory performs all QC tests and meets all QC acceptance criteria with the alternative or additional internal standard(s) as an integral part of this method.

7.9.4 Surrogate solution—Prepare a solution containing one or more surrogates at a concentration of 2mg/mL in acetone. Potential surrogates include: dibutyl chlorendate (DBC), tetrachloro-m-xylene (TCMX), 4,4′-dibromobiphenyl, or decachlorobiphenyl. Alternative surrogates and concentrations may be used, provided the laboratory performs all QC tests and meets all QC acceptance criteria with the alternative surrogate(s) as an integral part of this method. If the internal standard calibration technique is used, do not use the internal standard as a surrogate.

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7.9.5 DDT and endrin decomposition (breakdown) solution—Prepare a solution containing endrin at a concentration of 50ng/mL and 4,4'-DDT at a concentration of 100ng/mL, in isooctane or hexane. A 1-mL injection of this standard will contain 50 picograms (pg) of endrin and 100 pg of DDT. The concentration of the solution may be adjusted by the laboratory to accommodate other injection volumes such that the same masses of the two analytes are introduced into the instrument.

8.0 PROCEDURE

8.1 Sample extraction

8.1.1 In general, water samples are extracted at a neutral pH with methylene chloride using a separatory funnel (ESC SOPs #330702 or #330702B). Solid samples are extracted with methylene chloride by microwave (ESC SOP #330707). Oil samples are extracted according to EPA method 3580A (ESC SOP #330754).

8.1.2 Reference materials, field-contaminated samples, or spiked samples are used to verify the applicability of the selected extraction technique to each new sample type. Such samples are spiked with the compounds of interest in order to determine the percent recovery and the limit of detection for that sample type. When other materials are not available and spiked samples are used, they are spiked with the analytes (Aroclors) of interest. When the presence of specific Aroclors is not anticipated, the Aroclor 1016/1260 mixture is an appropriate choice for spiking.

8.2 Extract cleanup: For information on specific cleanup procedures, see SOP #330741, *Sulfur Cleanup,* SOP #330740, *Acid Cleanup,* and SOP #330739, *Silica Gel Cleanup.*

8.3 Current conditions can be found in CyberLab for the GC instrument.

8.4 Initial Calibration: Prepare and inject, minimally, a 5-point calibration standard curve for EPA 8082, 8082A and SM 6431B or a 3-point calibration curve for EPA Method 608 (PCBs). The lowest level of the calibration curve must be at or below the RL. The lowest standard also serves as the MRL verification standard and must be re-analyzed or re-processed, using the new calibration curve, following each new initial calibration, to meet regulatory requirements. The MRL must be processed using the same calibration curve as is being utilized for client samples and must meet the requirements found in section 10.13. The same GC operating conditions used for the initial calibration must also be used for field sample analyses and QC samples.

8.4.1 When PCBs are quantitatively determined as Aroclors, the initial calibration consists of two parts.

8.4.1.1 A standard containing a mixture of Aroclor 1016 and 1260 includes many of the peaks represented in the other five Aroclor mixtures. Thus, such a standard is used to demonstrate the linearity of the detector. In addition, such a mixture is used to demonstrate that a sample does not contain peaks that are represented in any one of the Aroclors. This standard is

also used to determine the concentrations of either Aroclor 1016 or 1260 are present in a sample. Therefore, an initial five-point calibration is performed using the mixture of Aroclors 1016 and 1260 and the response (RF) or calibration factor (CF) for each concentration level is calculated. See section 9.0 for calculations.

8.4.1.2 **Dual Column Confirmation:** Calibration criteria must be met on both columns for positive confirmation of target analytes.

8.4.1.3 Standards of the other five Aroclors are necessary for pattern recognition. These standards are also used to determine a single-point calibration factor for each Aroclor, assuming that the Aroclor 1016/1260 mixture has been used to describe the detector response. The standards for these seven Aroclors must be analyzed prior to the analysis of any samples and can be analyzed before or after the analysis of the 1016/1260 calibration standards.

8.4.1.4 Where only a few Aroclors are of interest for a specific project, the analyst can employ a 5-point initial calibration for Method 8082A (3 points for Method 608) of each of the Aroclors of interest and not use the 1016/1260 mixture or the pattern recognition standards.

STATE NOTE: For Arizona compliance samples, a full calibration curve for Aroclor 1016/1260 is analyzed while all other multi-peak components, including all other Aroclors, toxaphene, and chlordane, are injected at the reporting limit. If any of these compounds are detected in the sample, a five-point calibration of the detected Aroclor is performed with the lowest standard at or below the RL. The samples require dilution if high concentrations of these compounds are present. The area of 3-5 selected peaks is compared to the same peaks in the sample for the determination of concentration.

8.4.2 **Working Calibration Curve:** Inject the calibration standards to generate a working curve. HP Chemstation calculates the calibration factor or response factor for each compound in each standard according to the equations found in section 9.0. . If multi-point calibration is performed for individual Aroclors, use the calibration factors determined from those standards to evaluate linearity.

8.4.3 Initial Calibration Verification (ICV)/Continuing Calibration Verification (CCV): On days that the instrument does not require full calibration, the initial calibration of the analytical system must be verified once for every 12 hour analytical sequence or 20 samples. For calibration verification, the mixture of 1016/1260 is used, unless one of the other 5 Aroclors is the target of interest and the calibration curve has been performed using that Aroclor. The calibration verification process does not require analysis of the other Aroclors that are used for pattern recognition.

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8.4.3.1 The linear calibration or response factors for the (ICV/CCV) is determined using the calculations found in section 9.0 and then the percent difference or drift from the initial calibration curve is determined using the calculations in section 9.0.

8.4.3.2 The ICV/CCV is routinely at the mid-level concentration of the calibration standard; however other concentrations may be used to better meet client or regulatory requirements.

8.4.4 Second Source Calibration Verification (SSCV): The initial calibration curve generated must be verified using a source that is different from the stock solutions used to prepare the calibration curve. This source can be a separate manufacturer or separate lot number from the same manufacturer, if available. Routinely, the second source verification is performed at the mid-range of the calibration curve, but the concentration may be altered to better reflect client/project needs. The calibration factor for the SSCV is calculated using the equation found in section 9.0 and the difference from the initial calibration curve is determined using the equation also found in that section.

8.4.5 Method 608.3 Requirements

Injection of calibration solutions— Inject a constant volume of each calibration solution into the GC column/detector pairs. An alternative volume may be used provided all requirements in this method are met. Beginning with the lowest level mixture and proceeding to the highest level mixture may limit the risk of carryover from one standard to the next, but other sequences may be used. An instrument blank should be analyzed after the highest standard to demonstrate that there is no carry-over within the system for this calibration range.

8.5 Confirmations and Qualitative Identification. The identification of PCBs as Aroclors is based on agreement between the retention times of peaks in the sample chromatogram with the retention time windows established through the analysis of standards of the target analytes. Analyst judgment and experience also weigh heavily in the positive identification of potential Aroclors. Tentative identification of an analyte occurs when a peak from a sample extract falls within the established retention time window for a specific target analyte. Each tentative identification must be confirmed using a second GC column of dissimilar stationary phase (as in the dual-column analysis), based on a clearly identifiable Aroclor pattern, or using another technique such as GC/MS.

8.5.1 The results of a single column/single injection analysis MUST be confirmed on a second, dissimilar GC column. In order to be used for confirmation, retention time windows must be established for the second GC column.

8.5.1.1 Method 608.3 Requirements

8.5.1.1.1 Report the lower result from the two columns for each analyte in each sample or QC standard at or above the ML to 3 significant figures.

8.5.1.1.2 Results for each analyte in MS/MSD samples should be reported from the same GC column as used to report the results for that analyte in the unspiked sample. If the MS/MSD recoveries and RPDs calculated in this manner do not meet applicable acceptance criteria, the analyst may use the results from the other GC column to determine if the MS/MSD results meet the acceptance criteria. If such a situation occurs, the results for the sample should be recalculated using the same GC column data as used for the MS/MSD samples, and reported with appropriate annotations that alert the data user of the issue.

8.5.1.1.3 In general, if the %D of the two results is less than 50% (e.g., a factor of 2), then the pesticide is present. This %D is generous and allows for the pesticide that has the largest measurement error.

8.5.2 Known Contaminants - When samples are analyzed from a source known to contain specific Aroclors, the results from a single-column analysis are confirmed on the basis of a clearly recognizable Aroclor pattern. This approach cannot be used for samples from unknown or unfamiliar sources or for samples that appear to contain mixtures of Aroclors. In order to employ this approach, the analyst must document:

- The peaks that were evaluated when comparing the sample chromatogram and the Aroclor standard.
- The absence of major peaks representing any other Aroclor.
- The source-specific information indicating that Aroclors are anticipated in the sample (e.g., historical data, client knowledge, etc.).

8.5.3 Quantitation of PCBs as Aroclors. The quantitation of PCB as Aroclors is accomplished by comparison of the peak pattern in the sample chromatogram to that of the most similar peak pattern from the Aroclor standard(s). A choice must be made as to which Aroclor pattern is most similar to that of the extract and whether the pattern in the standard is truly representative of the PCBs in the sample.

STATE NOTE: Once the correct Aroclor has been identified for Arizona compliance samples, a full calibration curve is prepared and analyzed followed by the samples of interest along with the appropriate QC samples.

STATE NOTE: Arizona compliance samples require that one Aroclor (1016/1260) has a full calibration curve and all other multi-peak components (i.e., Aroclors, toxaphene, and chlordane) must be injected at the laboratory reporting limit.

8.5.3.1 Use the chromatograms from the individual Aroclor standards (not the 1016/1260 mixtures) to determine the pattern of peaks for Aroclors 1221, 1232, 1242, 1248, and 1254 (1262 & 1268 by request). The patterns for Aroclors 1016 and 1260 are evident from the mixed calibration

standards; however, an individual 1016 standard may be injected to help determine slight differences between 1016 and 1242.

8.5.3.1.1 Once the pattern of the Aroclor present in the field samples has been identified, compare the responses of the 3-5 major peaks in the single-point calibration standard for the appropriate Aroclor with the peaks observed in the sample extract. The amount of Aroclor is calculated using the individual calibration factor for each of the characteristic peaks chosen and the calibration model (linear or non-linear) established from the multi-point calibration of the 1016/1260 mixture. A final analyte concentration is determined by calculating a concentration from each of the characteristic peaks and averaging those concentrations to determine the reportable concentration of that Aroclor in each field sample.

8.5.4 Three to five peaks are used for Aroclor identification and quantitation. Five peaks are preferred; however as few as three can be used where there is obvious interference. The peaks must be characteristic of the Aroclor in question. Choose peaks in the Aroclor standards that are at least 25% of the height of the largest Aroclor peak. For each Aroclor, the set of 3 to 5 peaks must include at least one peak that is unique to that Aroclor. Use 5 peaks for the Aroclor 1016/1260 mixture, none of which are found in both of these Aroclors.

8.5.5 When determining PCBs as Aroclors by the internal or external standard technique, calculate the response factor (RF) or calibration factor (CF) for each characteristic Aroclor peak in each of the initial calibration standards. Five sets of response/calibration factors will be generated for the Aroclor 1016/1260 mixture, each set consisting of the response/calibration factors for each of the peaks chosen for this mixture. The single standard for each of the other Aroclors will generate 5 response/calibration factors, one for each selected peak. See section 9.0 for the equations to calculate the response or calibration factors for the calibration curve and for the calculation of the concentration of Aroclors in field samples.

8.5.5.1 Peak height measurements are recommended over peak area only when overlapping peaks can cause errors in area integration.

8.5.5.2 If the peak response is less than 2.5 times the baseline noise level, the validity of the quantitative result may be questionable. The analyst can consult with the source of the sample to determine whether further concentration of the sample is warranted.

8.5.5.3 If compound identification or quantitation is precluded due to interference (e.g., broad, rounded peaks or ill-defined baselines are present) cleanup of the extract or replacement of the capillary column or detector is warranted. Re-analyze the sample on another instrument to determine if

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the problem results from analytical hardware or the sample matrix. Refer to the ESC procedures to be followed if extract cleanup is required.

8.6 Weathering of PCBs in the environment and changes resulting from waste treatment processes may alter the PCBs to the point that the pattern of a specific Aroclor is no longer recognizable. Samples containing more than one Aroclor present similar problems. Identification and determination of PCBs in these circumstances rely heavily on the experience and discretion of the analyst. Alternative quantitative procedures for said circumstances such as described in section 8.6.1, are not routinely employed by ESC analytical staff but available per method.

8.6.1 If results in terms of Aroclors are required, then the quantitation as Aroclors can be performed by measuring the total area of the PCB pattern and quantitating on the basis of the Aroclor standard that is most similar to the sample. Any peaks that are not identifiable as PCBs on the basis of retention times are subtracted from the total area. If quantitation is performed in this manner, the problems are fully described for the data user and the specific procedures employed by the analyst are thoroughly documented.

8.7 Acceptance criteria for all calibration standards and QC (Method Blank/internal standards/LCS/LCSD/MS/MSD) are contained in section 10.0. Corrective actions for outliers are contained in section 11.0.

9.0 DATA ANALYSIS AND CALCULATIONS

9.1 Internal Calibration Equations (Response Factors):

$$RF = \frac{[A_s][C_{is}]}{[A_{is}][C_s]}$$

where:
A_s = Peak area (or height) of the analyte or surrogate.
A_{is} = Peak area (or height) of the internal standard.
C_s = Concentration of the analyte or surrogate, in µg/L.
C_{is} = Concentration of the internal standard, in µg/L.

- Percent Relative Standard Deviation (%RSD)

$$\overline{RF} = \frac{\sum_{i=1}^{n} RF_i}{n} \qquad SD = \sqrt{\frac{\sum_{i=1}^{n} (RF_i - \overline{RF})^2}{n-1}} \qquad RSD = \frac{SD}{\overline{RF}} x100\%$$

where:
RSD = Relative standard deviation.
RF = Mean of 5 initial RFs for a compound.
SD = Standard deviation of average RFs for a compound.

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- Concentration of an analyte in an extract using RF (on column):

$$X_s = \frac{(Conc._{IStd})(Area_{Analyte})}{(Average\ RF_{analyte})(Area_{IStd})}$$

where:
X_s = Calculated raw concentration of analyte (in ppb)

- Quantitation Report Multiplier"

$$M_a = \frac{(V_t)(D)}{(V_s)} \quad or \quad M_s = \frac{(V_t)(D)}{(W_s)}$$

where:
M_a = Quantitation Report Multiplier for Aqueous Samples
M_s = Quantitation Report Multiplier for Solid Samples
V_t = Total volume of concentrated extract (in mL)
D = Dilution factor. If no dilution, D=1. Always dimensionless
V_s = Volume of aqueous sample extracted (in mL)
W_s = Weight sample extracted (in grams)

- Sample concentration by volume (ug/L) for aqueous samples:

$$Concentration\ in\ \frac{mg}{L} = (X_s)(M_a)$$

- Sample concentration by weight (ug/kg) for solid samples and non-aqueous liquids:

$$Concentration\ in\ \frac{mg}{kg} = \frac{(X_s)(M_s)}{(\%S)}$$

where:
%S = Percent solids expressed as a decimal

9.2 Percent Error (%Error)

$$\%Error = \frac{x_i - x'_i}{x_i} * 100$$

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where:
x'_i = Measured amount of analyte at the calibration level *i*, in mass or concentration units
x_i = True amount of analyte at calibration level *i*, in mass or concentration units

9.3 Relative Standard Error (%RSE) – As an alternative to using the average response factor when using Method 608.3, the quality of the calibration may be evaluated using the Relative Standard Error (RSE). The acceptance criterion for the RSE is the same as the acceptance criterion for Relative Standard Deviation (RSD), in the method. RSE is calculated as:

$$\%RSE = 100 \times \frac{\sum_{i=1}^{n}\left[\frac{x'_i - x_i}{x_i}\right]^2}{(n-p)}$$

where:
x'i = Calculated concentration at level i
xi = Actual concentration of the calibration level i
n = number of calibration points
p = Number of terms in the fitting equation (average = 1; linear = 2; quadratic = 3)

9.4 See the current Quality Assurance Manual for equations associated with common calculations.

10.0 QUALITY CONTROL AND METHOD PERFORMANCE

10.1 All analysts must meet the qualifications specified in SOP #030205, *Technical Training and Personnel Qualifications* before approval to perform this method. Analysts must complete an initial demonstration of proficiency before being approved to perform this method. Continuing proficiency must be demonstrated using proficiency testing, laboratory control sample analysis and/or MDL studies. Method performance is assessed per analyst. Updated method performance records are filed and stored in a central location within the department.

10.1.1 Method 608.3 Demonstration of Capability (DOC) Requirements

10.1.1.1 For the DOC, a QC check sample concentrate containing each analyte of interest is prepared in a water miscible solvent using the solution in Section 7.9.1.

10.1.1.2 Prepare four QC check samples by adding an appropriate volume of the concentrate and of the surrogate(s) to each of four 1–L aliquots of reagent water. Swirl or stir to mix.

10.1.1.3 Extract and analyze the well-mixed QC check samples.

10.1.1.4 Calculate the average percent recovery ($\bar{X}$) and the standard deviation (s) of the percent recovery for each analyte using the four results.

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Standard Operating Procedure

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TITLE: POLYCHLORINATED BIPHENYLS (PCBS) BY GAS CHROMATOGRAPHY (SOIL, WATER & OIL) (EPA METHODS 608, 608.3, 8082, & 8082A, SM 6431B)

10.1.1.5 For each analyte, compare s and $\bar{X}$ with the following acceptance criteria for precision and recovery. For analytes that are not listed, QC acceptance criteria must be developed by the laboratory.

Analyte	Limit for s (% SD)	Range for $\bar{X}$ (%)
PCB-1016	24	61 – 103
PCB-1221	50	44 – 150
PCB-1232	32	28 – 197
PCB-1242	26	50 – 139
PCB-1248	32	58 – 140
PCB-1254	34	44 – 130
PCB-1260	28	37 – 130

If s and $\bar{X}$ for all analytes of interest meet the acceptance criteria, system performance is acceptable and analysis of blanks and samples can begin. If any individual s exceeds the precision limit or any individual $\bar{X}$ falls outside the range for recovery, system performance is unacceptable for that analyte.

10.1.1.6 When one or more of the analytes tested fail at least one of the acceptance criteria, repeat the test for only the analytes that failed. If results for these analytes pass, system performance is acceptable and analysis of samples and blanks may proceed. If one or more of the analytes again fail, system performance is unacceptable for the analytes that failed the acceptance criteria. Correct the problem and repeat the test.

10.2 Use the designated Run log to record batch order and standards/reagents used during analysis. See SOP #030201, *Data Handling and Reporting*.

10.3 Batches:

Batches are defined as sets of 1 - 20 samples. Batch analysis must include the following: 1 method blank, 1 Initial Calibration Verification (ICV), 1 Laboratory Control Sample/Laboratory Control Sample Duplicate pair (LCS/LCSD), 1 Matrix Spike/Spike Duplicate (MS/MSD) pair, Exceptions are made for waste dilution samples where the minimum batch QC must include a method blank. An LCS/LCSD pair may be extracted but is not required per waste dilution SOP. All batch information must be maintained in the preparation documentation assigned to the department.

10.4 Initial Calibration – If the percent relative standard deviation (% RSD) of the calibration factors for each analyte is <20% for EPA 8082 and 8082A and <10% for EPA method 608, the average calibration factor can be used for quantitation. If the %RSD exceeds the method defined acceptance criteria, a calibration curve using linear regression can be employed. The linear regression calibration curve must have a correlation factor of 0.990

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(USACE requires 0.995) or greater using equal or inverse weighting. The origin may not be used as a point in the calibration curve and the curve must not be forced through zero. The method blank is also not included as a point in the calibration curve for this method.

10.4.1 Method 608.3 Requirements

10.4.1.1 Internal Standard Calibration – If the RSD is less than 15%, linearity through the origin can be assumed and the average RF can be used for calculations. Alternatively, the results can be used to prepare a calibration curve of response ratios, As/Ais, vs. concentration ratios, Cs/Cis, for the analyte. A minimum of six concentration levels is required for a nonlinear (e.g., quadratic) regression. If used, the regression must be weighted inversely proportional to concentration, and the coefficient of determination of the weighted regression must be greater than 0.920. Alternatively, the relative standard error (Reference 10) may be used as an acceptance criterion. As with the RSD, the RSE must be less than 15%. If an RSE less than 15% cannot be achieved for a quadratic regression, system performance is unacceptable and the system must be adjusted and re-calibrated.

10.5 Method Blank – A method blank must be extracted and analyzed with each set of samples. The method blank must be carried through the same procedure as the samples and must not contain target analytes above the method detection limit.

10.6 Initial Calibration Verification (ICV)/Continuing Calibration Verification (CCV) – On days when a full calibration is not needed, an ICV must be analyzed once per 12hr analytical sequence prior to the analysis of any QC or field samples.

- The CF/RF must be within 15% of the initial calibration.

10.6.1 For Aroclor analyses, the routine CCV standard is a mixture of Aroclor 1016 and Aroclor 1260. The calibration verification process does not *require* analysis of the other Aroclor standards used for pattern recognition; however, if one of the other Aroclors is the analyte of interest and the component used for the initial calibration, the CCV will be a mid-level standard of the Aroclor of interest.

10.6.2 Method 608.3 Requirements

10.6.2.1 The working calibration curve, CF, or RF must be verified immediately after calibration and at the beginning and end of each 24-hour shift by the analysis of a midlevel calibration standard. The calibration verification standard(s) must be obtained from a second manufacturer or a manufacturer's batch prepared independently from the batch used for calibration. Alternatively, calibration verification may be performed after a set number of injections (e.g., every 20 injections), to include injection of extracts of field samples, QC samples, instrument blanks, etc. (i.e., it is based on the number of injections performed, not sample extracts). The time for the injections may not exceed 24 hours.

Standard Operating Procedure

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TITLE: POLYCHLORINATED BIPHENYLS (PCBS) BY GAS CHROMATOGRAPHY (SOIL, WATER & OIL) (EPA METHODS 608, 608.3, 8082, & 8082A, SM 6431B)

NOTE: The 24-hour shift begins after analysis of the combined QC standard (calibration verification) and ends 24 hours later. The ending calibration verification standard is run immediately after the last sample run during the 24-hour shift, so the beginning and ending calibration verifications are outside of the 24-hour shift. If calibration verification is based on the number of injections instead of time, then the ending verification standard for one group of injections may be used as the beginning verification for the next group of injections.

10.7 Second Source Calibration Verification (SSCV) – A second source calibration verification standard (SSCV) is analyzed after each calibration and must meet criteria of ± 20% of the expected concentration for each analyte.

10.8 Laboratory Control Sample (LCS)/Laboratory Control Sample Duplicate (LCSD) – must be extracted with each batch of samples.

- The LCS/LCSD must be within the acceptance criteria listed in Section 10.8.1. Section 10.8.1 represents QC acceptance criteria calculated from historical ESC values for the method. The acceptance criteria are more stringent than those of methods 608.

10.8.1 Current QC Acceptance Criteria are available in the LIMS.

STATE NOTE: For all 608 samples analyzed from South Carolina, the LCS/LCSD RPD must be <20% and recoveries must be within and the following limits in a water matrix:

Parameter	Recovery Limits
Aroclor 1016	70 – 114%
Aroclor 1260	70 – 127%

STATE NOTE: For South Carolina, marginal exceedances do not apply. All outliers in QC require corrective action when possible and the data must be flagged when necessary.

10.8.2 Method 608.3 Requirements

10.8.2.1 Prepare the LCS by adding QC check sample concentrate to reagent water. Include all analytes of interest in the LCS. The volume of reagent water must be the same as the nominal volume used for the sample, the DOC, the blank, and the MS/MSD.

10.8.2.2 Analyze the LCS prior to analysis of samples in the extraction batch.

10.8.2.3 For each analyte, compare the percent recovery (P) with its corresponding QC acceptance criterion in the following table:

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Analyte	Range for P (%)
PCB-1016	50 - 140
PCB-1221	15 - 178
PCB-1232	10 - 215
PCB-1242	39 - 150
PCB-1248	38 - 158
PCB-1254	29 - 140
PCB-1260	8 - 140

For analytes of interest not listed in the table, use the QC acceptance criteria developed for the MS/MSD or limits based on laboratory control charts. If the recoveries for all analytes of interest fall within the designated ranges, analysis of blanks and field samples may proceed.

10.9 Matrix Spike (MS)/Matrix Spike Duplicate (MSD) – must be analyzed with each batch of samples.

- Method 608 states that matrix spikes must be done at a rate of 10%.
- The spike and spike duplicate must meet the criteria listed in Section 10.8.1. Section 10.8.1 represents QC acceptance criteria calculated from historical ESC values for the method.

STATE NOTE: For all samples analyzed from South Carolina, the MS/MSD recoveries must be within the most stringent limits comparing in-house derived recovery limits and those given in Table 3 of Method 608. The following are the current limits:

Parameter	Recovery Limits
Aroclor 1016	70 – 114%
Aroclor 1260	46 – 126%

10.9.1 Method 608.3 Requirements

10.9.1.1 The laboratory must, on an ongoing basis, spike at least 5% of the samples in duplicate from each discharge being monitored to assess accuracy (recovery and precision). If direction cannot be obtained from the data user, the laboratory must spike at least one sample in duplicate per extraction batch of up to 20 samples. Spiked sample results should be reported only to the data user whose sample was spiked, or as requested or required by a regulatory/control authority, or in a permit.

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10.9.1.2 If, as in compliance monitoring, the concentration of a specific analyte will be checked against a regulatory concentration limit, the concentration of the spike should be at that limit; otherwise, the concentration of the spike should be one to five times higher than the background concentration, at or near the midpoint of the calibration range, or at the concentration in the LCS whichever concentration would be larger. When no information is available, the midpoint of the calibration may be used.

10.9.1.3 Compare the percent recoveries (P1 and P2) and the RPD for each analyte in the MS/MSD aliquots with the corresponding QC acceptance criteria for recovery (P) and RPD in the following table:

Analyte	Range for P (%)	Maximum MS/MSD RPD (%)
PCB-1016	50 - 140	36
PCB-1221	15 - 178	48
PCB-1232	10 - 215	25
PCB-1242	39 - 150	29
PCB-1248	38 - 158	35
PCB-1254	29 - 140	45
PCB-1260	8 - 140	38

If any individual P falls outside the designated range for recovery in either aliquot, or the RPD limit is exceeded, the result for the analyte in the unspiked sample is suspect and may not be reported or used for permitting or regulatory compliance.

For analytes not listed in the table, QC acceptance criteria must be developed by the laboratory.

10.9.1.4 After analysis of a minimum of 20 MS/MSD samples for each target analyte and surrogate, and if the laboratory chooses to develop and apply optional in-house QC limits, the laboratory should calculate and apply the optional in-house QC limits for recovery and RPD of future MS/MSD samples. The in-house QC limits must be updated at least every two years and reestablished after any major change in the analytical instrumentation or process. At least 80% of the analytes tested in the MS/ MSD must have in-house QC acceptance criteria that are tighter than those in the table presented in Section 10.9.1.3 and the remaining analytes (those not included in the 80%) must meet the acceptance criteria in the able.

If an in-house QC limit for the RPD is greater than the limit in the table, then the limit in the table must be used. Similarly, if an in-house lower

limit for recovery is below the lower limit in the table, then the lower limit in the table must be used, and if an in-house upper limit for recovery is above the upper limit in the table, then the upper limit in the table must be used.

10.10 Confirmation - Any sample that shows a detectable concentration of any compound above the method detection limit must be confirmed on a second column or by GC/MS, except as noted in section 8.5.2. The result from the primary column and the confirmation column must agree within 40% RPD and acceptable calibration criteria must be met on both columns.

10.11 Surrogate – Calculate the surrogate recovery on all samples, method blanks, and spikes. Determine if the recovery is within the QC Acceptance criteria in section 10.8.1.

10.12 Internal Standards (internal calibration model) – For Method 8082, the internal standard area counts must be monitored for all CCVs. ISTDs must recover within 50-150% of the average of the most recent calibration. For Method 608.3, the ISTD should be verified within 50-200% of the mid-level ICAL standard.

The internal standard responses and retention times in the check calibration 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 the last calibration verification, the chromatographic system must be inspected for malfunctions and corrections must be made, as required.

Internal standards must be monitored for each sample. ISTDs in samples must meet the 50-150% of the average of the most recent calibration. . For Method 608.3, the ISTD should be verified within 50-200% of the daily verification standard.

10.13 MRL – The reporting limit verification when analyzed must recover within ±50% of the target concentration for the standard.

STATE NOTE: For all samples analyzed from Minnesota, the reporting limit must be verified at least monthly, with each new initial calibration, or when there has been significant change to the instrument (column replacement, cleaning source, etc.) whichever is more frequent. The reporting limit verification can be performed by either re-injecting the low standard or by re-processing the low standard that was analyzed in the calibration curve. The reporting limit verification (MRL) must recovery within ±40% of the expected concentration. If this criterion is not met, the MRL may be re-analyzed once, instrument maintenance can be performed, a higher concentration standard can be injected, or a new calibration curve must be generated. If a higher concentration standard is utilized, the reporting limit must be raised to the higher level verified.

10.14 Any sample analyte responses that are beyond the linear range of the calibration curve must be diluted and re-analyzed.

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10.15 Manual Integration – All manual integrations must comply with the requirements found in ESC SOP #030215, *Manual Integration Procedure*. Before and after integrations must be available for review by the secondary data reviewer.

10.16 Second Source Calibration Verification (SSCV) - A second source calibration verification standard (SSCV) is analyzed after each calibration and must meet criteria of ±20% of the expected concentration for each analyte for 8082. Method 608.3 utilizes CCV limits for evaluation.

10.17 For sample analyzed per the requirements of Method 8000D, the LLOQ (see Section 1.8.2) must be verified at least annually, and whenever significant changes are made to the preparation and/or analytical procedure, to demonstrate quantitation capability at lower analyte concentration levels

10.17.1 The LLOQ verification (to be performed after the initial calibration) is prepared by spiking a clean control material with the analyte(s) of interest at 0.5-2 times the LLOQ concentration level(s).

10.17.2 The LLOQ check is carried through the same preparation and analytical procedures as environmental samples and other QC samples.

10.17.3 It is recommended to analyze the LLOQ verification on every instrument where data is reported; however, at a minimum, the lab must rotate the verification among similar analytical instruments such that all are included within 3 years.

10.17.4 Recovery of target analytes in the LLOQ verification must be within established in-house limits or within other such project-specific acceptance limits to demonstrate acceptable method performance at the LLOQ. Until the laboratory has sufficient data to determine acceptance limits, the LCS criteria ± 20% (i.e., lower limit minus 20% and upper limit plus 20%) may be used for the LLOQ acceptance criteria.

10.18 For corrective actions, see section 11.0.

11.0 DATA VALIDATION AND CORRECTIVE ACTION

11.1 All data must undergo a primary review by the analyst. The analyst must check the performance of the initial calibration, mid-point check standard, and continuing calibrations to ensure that they meet the criteria of the method. The analyst must review any sample that has quantifiable compounds and make sure that they have been confirmed. The analyst must also verify that reported results are derived from quantitation between the RL and the highest standard of the initial calibration curve. All calculations must be checked (any dilutions, %solids, etc.). Data must be checked for the presence or absence of appropriate flags. Comments must be noted when data is flagged.

11.2 All data must undergo a second analyst review. The analyst checking the data must check the performance of the initial calibration, mid-point check standard, and continuing calibrations to ensure that they meet the criteria of the method.

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11.2.1 The analyst must review any sample that has quantifiable compounds and make sure that they have been confirmed.

11.2.2 All calculations must be checked.

11.2.3 All surrogate recoveries must be checked to ensure that they are within QC acceptance criteria or that corrective action has occurred.

11.2.4 Method blanks must be free of all interfering peaks.

11.2.5 Quality control criteria must be checked for the LCS, LCSD, MS, and MSD.

11.2.6 Data must be checked to determine the need for appropriate flags. Comments are noted when results are flagged.

11.2.7 The reviewer must verify all reported results are derived from analytical results that are above the reporting limit and below the highest standard of the initial calibration curve.

11.2.8 Reported sample hits must include an overlay of the identified analyte with the sample for the second analyst review.

11.2.9 All manual integrations must be verified through checking the before/after shot of the sample and/or QC.

11.2.10 All multipliers/dilutions must be verified on the quant report and must agree with the information provided on the injection log.

11.2.11 Retention times of the samples must be compared to that of the calibration standard.

11.2.12 Verify any linear regression by reviewing the calibration curve printout.

11.2.13 See SOP #030201, *Data Handling and Reporting*.

11.3 Initial Calibration – Corrective actions for failures in the initial calibration curve include: instrument maintenance and re-preparing the calibration standards.

Method 8000D: To determine calibration function acceptability, refit the initial calibration data back to the calibration model and calculate %Error (see Section 9.1). Percent error between the calculated and expected amounts of an analyte must be ≤30% for all standards. For some data uses, ≤50% may be acceptable for the lowest calibration point.

11.4 SSCV – If the acceptance criterion is not met, a new calibration curve or new SSCV must be prepared and analyzed, depending on the source of the discrepancy. An SSCV must pass the acceptance criteria prior to the analysis of field samples. If SSCV show a high bias, samples with concentrations below the RL may be reported. Any sample that contains a target analyte at a value above the RL must be reanalyzed with acceptable bracketing CCVs.

11.5 ICV/CCV – When the initial or continuing calibration verification is out of the acceptance criteria and analysis of a second consecutive (immediate) calibration verification fails to produce results within acceptance criteria, corrective actions shall be performed. The laboratory shall demonstrate acceptable performance after the final round of corrective action with two consecutive calibration verifications or a new initial instrument calibration shall be performed.

11.6 Method Blank – If the method blank shows any detectable amount greater than the RL, the laboratory performance is assumed to be out of control and the problem must be corrected. Corrective actions include: re-analysis once. If the failure persists, re-extract the entire batch of samples, if submitted sample volume permits, or, if acceptable to the client, the data may be qualified.

General guidelines for qualifying sample results with regard to method blank quality are as follows:

- If the method blank concentration is less than the MDL and sample results are greater than the RL, then no qualification is required.
- No qualification is necessary when an analyte is detected in the method blank but not in the associated samples.
- If the concentration in a sample is more than ten times the concentration in the method blank, then no qualification is required.
- If the method blank concentration is greater than the MDL but less than the RL and sample results are greater than the MDL, then qualify associated sample results to indicate that analyte was detected in the method blank.
- If the method blank concentration is greater than the RL, further corrective action and qualification is required. An analyst should consult their supervisor for further instruction.

Method 8000D: When samples that are extracted together are analyzed on separate instruments or in separate analytical shifts, the method blank associated with those samples (e.g., extracted with the samples) must be analyzed on at least one of those instruments. A solvent blank must be analyzed on all other instruments on which the set of samples was analyzed to demonstrate the instrument is not contributing contaminants to the samples. At least one method blank or instrument blank must be analyzed on every instrument after calibration standard(s) and prior to the analysis of any samples.

When sample extracts are subjected to cleanup procedures, the associated method blank must also be subjected to the same cleanup procedures.

Results of the method blank should be less than the LLOQ for the analyte or less than the level of acceptable blank contamination specified in the approved QAPP or other appropriate systematic planning document. Blanks are generally considered to be acceptable if target analyte concentrations are less than one-half the LLOQ or are less than project-specific requirements.

When new reagents or chemicals are received, the lab should monitor the blanks associated with samples for any signs of contamination. It is not necessary to test every

new batch of reagents or chemicals prior to sample preparation if the source shows no prior problems. However, if reagents are changed during a preparation batch, separate blanks need to be prepared for each set of reagents.

11.7 MS/MSD – If the spike and spike duplicate do not meet the criteria listed in section 10.8.1, or current ESC quality control acceptance criteria, the sample must be flagged as possible matrix interference.

11.7.1 Spike failure that result in the use of a "J" flag followed by the appropriate number, which further explains the failure concerning high or low bias

11.7.2 **Method 8000D:** If, as in compliance monitoring, the concentration of a specific analyte in the sample is being checked against a regulatory concentration limit or action level, the spike should be at or below the limit, or 1 - 5 times the background concentration (if historical data are available), whichever concentration is higher. If historical data are not available, a background sample of the same matrix from the site may be submitted for matrix spiking purposes to ensure that high concentrations of target analytes and/or interferences will not prevent calculation of recoveries. If the background sample concentration is very low or non-detect, a spike of greater than 5 times the background concentration is still acceptable. To assess data precision with duplicate analyses, it is preferable to use a low concentration field sample to prepare a MS/MSD for organic analyses. This spiking procedure will be performed when project-specific instructions are received from the client.

If the concentration of a specific analyte in a sample is not being checked against a limit specific to that analyte, then the analyst may spike the matrix spike or MS/MSD sample(s) at the same concentration as the reference sample at 20 times the estimated LLOQ in the matrix of interest, or at a concentration near the middle of the calibration range. It is suggested that a background sample of the same matrix from the site be submitted as a sample for matrix spiking purposes. NOTE: Preparing the spiking solution from the same source as the calibration standards helps minimize additional variability due to differences between sources. Typically, spiking concentrations are near the middle of the calibration range.

To develop precision and bias data for the spiked compounds, the analyst has two choices: analyze the original sample, and an MS/MSD pair; or analyze the original sample, a duplicate sample, and one spiked sample. If samples are not expected to contain the target analytes of concern, then the laboratory may use a MS/MSD pair. If samples are expected to contain the target analytes of concern, then the laboratory may use one matrix spike and a duplicate analysis of an unspiked field sample as an alternative to the MS/MSD pair.

The laboratory should use 70 - 130% as interim acceptance criteria for recoveries of spiked analytes, until in-house LCS limits are developed. Where in-house limits have been developed for matrix spike percent recoveries, the LCS

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results should be similar to or tighter than those limits, as the LCS is prepared in a clean matrix.

11.8 LCS/LCSD - If the LCS/LCSD does not perform within the ranges listed in Attachment II, or current ESC quality control acceptance criteria, the laboratory performance is assumed to be out of control and the problem must be corrected. Corrective action can include re-analysis, if instrument malfunction is suspected, or re-preparation and re-analysis of the entire batch, if the failure is suspected as either extraction or sample related.

11.9 Confirmation - If the relative percent difference of the results exceeds 40% and one result is significantly higher (e.g., >40%), check the chromatograms to see if an obviously overlapping peak is causing an erroneously high result. If no overlapping peaks are noted, examine the baseline parameters established by the instrument data system (or operator) during peak integration. If re-integration is necessary, ESC manual integration procedures must be followed and documented by printing a before and after shot of the chromatograms. When confirmation is not within the 40% criteria (or 50% for Method 608.3), unless otherwise specified in an approved project plan, the higher result should be reported, as this is a conservative approach relative to protection of the environment, unless obvious additive contamination present does not represent target analytes based on the experience of the analyst.

11.10 Surrogates - If the recovery is not within the quality control acceptance criteria stated in section 10.8.1, confirm that there are no errors in the calculations, surrogate solutions and standards. Check the instrument performance. Examine the chromatograms for interfering peaks and integrated areas. Re-calculate the data and/or re-analyze the extract if any of the above checks reveal a problem. Re-extract and re-analyze the sample if none of the above is determined to be the problem.

11.10.1 If a field sample exhibits poor surrogate recovery due to obvious matrix interferents, then qualify the sample with "J1" high or "J2" low to show that the surrogate quality control acceptance criteria were not met. Samples with unacceptable recoveries are re-extracted if there is sufficient field sample volume remaining.

11.10.2 If low surrogate recoveries are found throughout the analytical batch, including the QC samples, then the run must be re-extracted and re-analyzed, if sufficient volume was submitted by the client.

11.11 Internal Standards - If any internal standard response is beyond the acceptable recovery in the ICV/CCV, corrective action is required. Corrective action can take to form of checking the original calculations to ensure accuracy, re-analysis of the CCV to verify initial results, instrument maintenance (i.e. column clipping or changing, inlet liner cleaning/replacement, etc.) or re-calibration.

If the retention time for any internal standard changes by more than 30 seconds from the last calibration verification, the chromatographic system must be inspected for malfunctions and corrections must be made, as required. When corrections are made,

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re-analysis of the CCV or a complete re-calibration is necessary, depending on the impact of the correction on the analytical system.

Internal standards in the field samples must be monitored. If ISTD recovery does not meet the acceptance criteria, correction action is required. Possible corrective actions include: re-analysis, if instrument malfunction is suspected, or re-preparation and re-analysis, if the failure is suspected as either extraction or sample related. If the sample has an obvious matrix interferent and the internal standard recovery is greater than 150%, the sample can be diluted (if acceptable reporting limits can be achieved) to minimize the interference or the sample must be re-extracted and re-analyzed. If interference is not obviously the problem with the ISTD recovery, the sample must be re-analyzed undiluted to confirm the original failure.

11.12 MRL – If the MRL does not meet the acceptance criteria, the RLV may be re-analyzed once, instrument maintenance can be performed, a higher concentration standard can be injected, or a new calibration curve must be generated. If a higher concentration standard is utilized, the reporting limit for the field samples must be elevated to the higher level verified. High bias of MRL does not impact samples with target analyte concentrations lower than the reporting limit.

11.13 Instrument maintenance is performed as needed to optimize instrument performance and improve chromatography. Commonly performed maintenance includes changing of the injection port liner and clipping the column at the injection port end to eliminate active sites. A new calibration curve must be analyzed following any major maintenance performed on the analytical system if most recent calibration does not confirm with method limits.

11.14 Data that does not meet acceptable QC criteria may be acceptable for use in certain circumstances.

11.14.1 If a method blank contains an amount of target analyte, but all samples are non-detected, the data may be reported with a “B3” flag. If a method blank contains an amount of target analyte, but the samples contain analyte at a level that is 10 times the level present in the method blanks, the data may be reported with a “B” flag.

11.14.2 If the MS/MSD fails acceptance criteria in an initial analysis and again upon re-analysis, the data is released with an appropriate qualifier as the failure is accepted as matrix related.

11.14.3 If a calibration verification standard is above the acceptable QC criteria and all samples being bracketed are below the reporting limit, the data is acceptable based on a high calibration bias with undetectable levels in the field samples. Any positive samples require re-analysis.

11.14.4 If the surrogate exhibits high recovery in the field samples and the target analytes in the field samples are below the reporting limit, the data may be released with a J1 qualifier indicating the high bias. If the QC samples (LCS, LCSD, MS, MSD) exhibit a high bias in the surrogate and the field samples are below the reporting limit for the target analyte, the data may be released with a J1 qualifier.

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11.14.5 If the target analyte spiked in the quality control samples (LCS, LCSD, MS, MSD) exhibits high recovery and the target analytes in the field samples are below the reporting limit, the data may be released with a J4 or L1 qualifier indicating the high bias.

11.14.6 If the target analyte spiked into the QC pair (LCS/LCSD, MS/MSD) exhibit acceptable recoveries, but high calculated RPD values for precision, and the target analytes in the field sample are flagged with a J3 for the precision beyond acceptable quality control limits.

11.14.7 Sample results can be qualified and possible bias is narrated per the ESC SOP #030201, *Data Handling and Reporting*.

11.14.7.1 For samples analyzed per the requirements of Method 8000D, reported concentrations of target analytes between the MDL and the LLOQ must be qualified as estimated.

12.0 POLLUTION PREVENTION AND WASTE MANAGEMENT

12.1 The EPA requires that laboratory waste management practice to be conducted consistent with all applicable federal and state laws and regulations. Excess reagents, samples and method process wastes must be characterized and disposed of in an acceptable manner. See *ESC Waste Management Plan.*

12.2 See SOP #030302, Environmental Sustainability & *Pollution Prevention*.

13.0 METHOD MODIFICATIONS/CLARIFICATIONS

13.1 Modifications to this method are noted in the body of the text as notes. Compliance analyses performed in conjunction with specific state and/or method requirements must be performed as noted.

13.2 Adjustments to the concentrations of standards/spiking solutions, standards providers, and quality control are subject to change to better meet client/project/regulatory needs or to improve laboratory method performance.

13.3 Additional Aroclors (i.e. Aroclor 1262 and 1268) are quantitated using this procedure than those specifically listed in EPA Method 8082 and/or 8082A

13.4 The reduced volume of field sample used in this procedure is performed in accordance with section 7.1 of the published EPA 3510C method. The reduction in volume extracted along with either sufficient sensitivity of detection and/or large volume injection technique (>5uL injected) on the GC allows for acceptable detection limits in line with those obtained using a 1L extraction. Complete method validation is performed for this process prior to utilizing the reduced volume extraction. This validation is maintained by the Regulatory Affairs Department and is regularly verified using LCS/LCSD, MDL studies and DOCs.

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13.5 Due to the laboratory information management systems (LIMS) requirements and in conjunction with the EPA Methods Update Rule, Table II (5/18/12), a sample holding time has been set for 365 days from collection to extraction.

13.6 Method 608.3 allowed method modifications:

13.6.1 If the underlying chemistry and determinative technique in a modified method are essentially the same as an approved Part 136 method, then the modified method is an equivalent and acceptable alternative to the approved method provided the requirements of this section are met.

13.6.2 Those who develop or use a modification to an approved (Part 136) method must document that the performance of the modified method, in the matrix to which the modified method will be applied, is equivalent to the performance of the approved method. If such a demonstration cannot be made and documented, then the modified method is not an acceptable alternative to the approved method.

13.6.3 Supporting documentation must, if applicable, include the routine initial demonstration of capability and ongoing QC including determination of precision and accuracy, detection limits, and matrix spike recoveries.

13.6.3.1 Initial demonstration of capability typically includes analysis of four replicates of a mid-level standard and a method detection limit study.

13.6.3.2 Ongoing quality control typically includes method blanks, mid-level laboratory control samples, and matrix spikes (QC is as specified in the method).

13.6.3.3 The method is considered equivalent if the quality control requirements in the reference method are achieved.

13.6.3.3.1 Where the laboratory is using a vendor-supplied method, it is the QC criteria in the reference method, not the vendor's method, that must be met to show equivalency.

13.6.3.3.2 Where a sample preparation step is required (i.e., digestion, distillation), QC tests are to be run using standards treated in the same way as the samples.

13.6.3.4 The method user's Standard Operating Procedure (SOP) must clearly document the modifications made to the reference method.

13.6.4 If the method user is uncertain whether a method modification is allowed, the Regional ATP Coordinator or Director should be contacted for approval prior to implementing the modification

13.6.5 The method user should also complete necessary performance checks to verify that acceptable performance is achieved with the method modification prior to analyses of compliance samples.

13.6.6 The modified method must meet or exceed performance of the approved method(s) for the analyte(s) of interest, as documented by meeting the initial and ongoing quality control requirements in the method.

13.6.7 The permittee must notify their permitting authority of the intent to use a modified method. Such notification should be of the form ‘‘Method xxx has been modified within the flexibility allowed in 40 CFR 136.6.’’ The permittee may indicate the specific paragraph of § 136.6 allowing the method modification. Specific details of the modification need not be provided, but must be documented in the Standard Operating Procedure (SOP) and maintained by the analytical laboratory that performs the analysis.

14.0 REFERENCES

14.1 *Polychlorinated Biphenyls (PCBs) by Gas Chromatography*, SW-846 Method 8082, Revision 0, December 1996.

14.2 *Polychlorinated Biphenyls (PCBs) by Gas Chromatography*, SW-846 Method 8082A, Revision 1, February 2007.

14.3 *The Determination of Polychlorinated Biphenyls in Transformer Fluid and Waste Oils*, EPA 600/4-81-045, Sept. 1982.

14.4 *Determinative Chromatographic Separations*, SW-846 Method 8000B, Revision 2, December 1996.

14.5 Determinative Chromatographic Separations, SW-846 Method 8000C, Revision 3, March 2003.

14.6 *Determinative Chromatographic Separations*, SW846 Method 8000D, Revision 4, July 2014.

14.7 *Polychlorinated Biphenyls (PCBs) by Liquid-Liquid Extraction Gas Chromatographic Method*, SM 6431B.

14.8 *Organochlorine Pesticides and PCBs*, EPA Method 608, 40CFR Part 136, Appendix A

14.9 *Organochlorine Pesticides and PCBs by GC/HSD*, EPA Method 608.3, Federal Register, Volume 82, Number 165, August 28, 2017.

14.10 EPA Method 608 ATP 3M0222, Federal Register, Volume 60, Number 148, August 2, 1995.

14.11 40 Code of Federal Regulations §136.6(b)(4)(j).

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TITLE: **POLYCHLORINATED BIPHENYLS (PCBS) BY GAS CHROMATOGRAPHY (SOIL, WATER & OIL) (EPA METHODS 608, 608.3, 8082, & 8082A, SM 6431B)**

Attachment I: Revision History

Current Version:

Version	Date	Description of Revisions
17	3/23/2018	Technical and quality review and update. Added Method 608.3 criteria. Revised Title and Sections 1.0, 1.1, 2.5, 7.3, 8.2, 8.4.3, 9.4, 10.8.1, 11.9, 11.14.7.1, 13.1, and 13.4. Added Sections 1.4.3, 4.7, 5.5, 7.8, 7.8.1, 7.9 and all subsections, 8.4.5, 8.5.4.4 and all subsections, 9.3, 10.1.1 an d all subsections, 10.4.1, 10.4.1.1, 10.6.2 and all subsections, 10.8.2 and all subsections, 10.9.1 and all subsections, 10.12, 10.16, 13.6 and all subsections, 14.9, 14.10, 14.11, and re-numbered as necessary.

Superseded Versions:

This document supersedes the following:

Version	Date	Description of Revisions
0	2/11/00	Origination
1	8/21/00	
2	10/16/01	
3	7/9/03	
4	12/17/04	
5	2/23/09	Technical and Quality Review and update. Included state notes, included criteria for dual column analysis, clarified ICV/CCV use and criteria, included correlation coefficient and linear regression calculations, revised sections 12.0 & 13.0.
6	3/25/11	Technical and Quality Review and update. Revised sections 1.1, 2.0, 4.3, 4.4, 6.1, 7.1, 7.3, 7.4, 7.7, 8.1, 8.3, 8.4, 8.5.3.1, 8.5.5, 9.0, 10.0, 11.0, and 12.1; Added state notes in sections 1.0, 4.5, and 13.2
7	9/21/11	Technical and Quality Review and update. Revised sections 2.2, 8.5.1, 9.6, 10.10, 11.10, 11.11, and 11.14; Added state notes in sections 1.0, 8.0, 11.6, and 11.14; Added sections 8.7, 9.7, 10.16, 11.14.4 through 11.14.6 and 13.3
8	2/17/12	Technical and Quality Review and update. Revised sections 2.1, 2.2, 6.1, 7.3, 7.7, 8.1.1, and 10.8.1; Added state notes in sections 1.0 and 10.8.1; Added sections 1.4.1, 2.29, 2.30, and 13.4.
9	4/24/12	Technical and Quality Review and update. Revised sections 7.3, 7.4, 7.7, 8.7, 10.8.1, and 11.5; Added sections 4.6 and 11.14.7. Ohio VAP approved 4/24/12.
10	1/6/14	Technical and Quality Review and update. Revised sections 2.1, 2.3, 2.28, 4.3, 4.4, 7.1, 7.3, 7.4, 7.7, 8.1.1, 8.3, 8.4, 8.4.3, 10.3, 10.4, 10.6, 10.8.1, 10.12, 10.13, 11.4, 11.9, 11.12, 11.13 11.14.2, and 11.14.5; Added state notes in sections 1.0 and 11.14.5 and added sections 2.31, 13.5 and 14.8.

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Version	Date	Description of Revisions
11	11/3/2015	Technical and quality review and update. Header and signature bar reformatting. Revised Sections 1.4.1, 10.5, 10.8.1, 11.6, and 13.4. Added Attachment II.
12	8/16/2016	Technical and quality review and update. Revised header and Sections 1.0, 1.4.1, 2.8, 4.6, 7.1, 8.3, 8.4.2, 8.4.3, 8.6, 10.3, 10.6, 11.5, 11.13, 11.14.7, 12.2, and Attachment II Table 2. Deleted Sections 2.9 through 2.31, 8.3.1, and 8.3.2, 9.1 through 9.10.
13	10/24/2016	Technical and quality review and update to comply with SC DHEC SOP requirements (see correspondence dated 6/24/16). Revised Sections 1.0, 11.3, 11.6, 14.1, 14.4, 14.5, 14.7, and 14.8. Added Sections 1.4.2, 2.8, 9.1, 10.16 and all subsections, 11.7.2, 11.14.7.1, 14.2, and 14.6.
14	6/19/2017	Technical and quality review and update. Revised Sections 1.4, 3.1, 9.1, 9.2, 9.3, 10.8, and 10.9.
15	7/10/2017	Technical and quality review and update. Revised Sections 2.9, 2.10, 9.1, 13.4
16	11/29/2017	Update in response to A2LA audit finding CAR2872. Revised Attachment II Table 5.

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Attachment II: DoD Requirements

1.0 Equipment/Instrument Maintenance

Instrument maintenance must be performed routinely to optimize instrument performance and improve chromatography. Commonly performed maintenance includes cleaning/repairing detector, column clipping/replacement, injector port cleaning/changing liner, etc. A new calibration curve must be analyzed following any major maintenance performed on the analytical system.

2.0 Computer Hardware and Software

Software name and version: HP Chemstation G1701DA or equivalent

3.0 Troubleshooting

Table 1. GC Troubleshooting Guide

Problem	Cause	Treatment
No Peaks	Syringe clogged	Clean or replace syringe
	Detector/Software/Computer failure	Check cables. Restart computer.
	Column Leaks	Use new ferrules.
	Broken Column	If at ends, clip column. If in the middle or multiple sites, replace column.
Peaks too Small	Split too high	Reduce split
	Column connection leaks	Check column installation. Search for leaks. Replace ferrules.
	Injector temperature too low	Check temperature program. Increase injector temperature.
	Dirty ECD	Clean ECD.
Retention Times Change	Gas flow too low or too high	Replace septum. Check gas regulator.
	Oven temperature unstable	Check temperature program. Check temperature with external thermometer.
	Column blocked	Compare flow at column entrance to outlet. Replace column.
Constantly Rising Baseline	Leak at column entrance or injection septum.	Check column installation; search for leaks; replace ferrules.
	Injector contaminated.	Make a run at lower injector temperature; if the baseline improves, replace liner, use low bleed or high temperature septa.
	Column contaminated.	Cut two turns from column entrance; rinse column with solvent (only chemically bonded phases); otherwise replace column or use guard column.
	Detector contaminated.	Clean detector.
	Increase of temperature too fast.	Decrease temperature gradient and end temperature.

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Table 1. GC Troubleshooting Guide

Problem	Cause	Treatment
	Poor gas quality.	Use gas grades recommended for GC; for longer supply lines from gas source to GC use gas purification cartridges directly connected to the GC.
Increasing Baseline at High Temperatures	Decomposition of the stationary phase.	Check for leaks; matrix check for compatibility with the column.
	Column contaminated.	Cut two turns from column entrance; rinse column with solvent (only chemically bonded phases); otherwise replace column or use guard column.
	Increase of temperature too fast / end temperature too high.	Decrease temperature gradient and end temperature.
	Column not properly conditioned.	Condition column according to manufacturers' instructions (while column is not connected to the detector).
	Detector contaminated	Clean detector according to manufacturers' instructions.
	Poor gas quality.	Use gas grades recommended for GC; for longer supply lines from gas source to GC use gas purification cartridges directly connected to the GC.
Plateaus at Certain Temperatures	Steps in temperature program too drastic.	Avoid very short and strong heating periods.
Fronting	Column overload.	Decrease injection volume; dilute sample.
	Sample vaporizes too slowly, not evenly or condenses.	Increase injector temperature (consider max. temperature limits of the column).
	Analytes coelute.	Change temperature program or use column with different selectivity.
	Sample decomposes.	Check temperature program, oven temperature (external thermometer); if analytes are not temperature-stable, reduce injector temperature; replace liner.
	Column absorbs or decomposes analytes.	Check capillary ends; check intact deactivation using the test mixture; for poor results shorten both column ends by about 10 cm; or replace column; if column test does not show any defects: a) use a column with thicker film b) use phase with better deactivation c) use column with special selectivity.

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Table 1. GC Troubleshooting Guide

Problem	Cause	Treatment
Tailing	Sample vaporizes too slowly, not evenly or condenses.	Increase injector temperature (consider max. temperature limits of the column).
	System leaks.	Check column installation; search for leaks; replace ferrules.
	Analytes coelute.	Change temperature program or use column with different selectivity.
	Sample decomposes.	Check temperature program, oven temperature (external thermometer); if analytes are not temperature-stable, reduce injector temperature; replace liner by a deactivated one.
	Column absorbs or decomposes analytes.	Check capillary ends; check intact deactivation using the test mixture; for poor results shorten both column ends by about 10 cm; or replace column; if column test does not show any defects: a) use a column with thicker film b) use phase with better deactivation c) use column with special selectivity.
	Split rate too low.	Increase split rate.
	Column overload.	Decrease injection volume; dilute sample.
Split Peaks	Solvent and column not compatible.	Change solvent or use guard column.
	Solvent mixtures with large differences in boiling point and polarity.	Use just one solvent.
	Sample decomposes.	Check temperature program, oven temperature (external thermometer); if analytes are not temperature-stable, reduce injector temperature; replace liner by a deactivated one.
	Analytes coelute.	Modify temperature program or use longer column; possibly change column polarity.
	Detector overload.	Inject less; control make-up flow.

4.0 Other Requirements

4.1 All hardcopy laboratory notebooks must be reviewed by the Supervisor, or their designee, on a monthly basis.

4.2 If not self-explanatory (e.g., a typo or transposed number), corrections to technical and quality records shall also include a justification for the change.

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4.3 A person performing a manual integration must sign and date each manually integrated chromatogram and record the rationale for performing manual integration. Electronic signatures are acceptable.

4.4 The results of calibration and verification of support equipment must be within the specifications required of the application for which this equipment is used or the equipment must be removed from service until repaired. Calibration and verification records, including those of established correction factors, must be maintained. In the absence of method-specific requirements, the minimum requirements are as follows:

Table 2. Support Equipment Checks

Performance Check	Frequency	Acceptance Criteria
Balance calibration check [Using two standard weights that bracket the expected mass]	Daily prior to use	Top-loading balance: ±2% or ±0.02g, whichever is greater Analytical balance: ±0.1% or ±0.5 mg, whichever is greater
Verification of standard mass [Using weights traceable to the International System of Units (SI) through a NMI	Every 5 years	Certificate of Calibration from ISO/IEC 17025 accredited calibration laboratory
Monitoring of refrigerator/freezer temperatures	Daily (i.e. 7 days per week) [use MIN/MAX thermometers or data loggers equipped with notification of out of control event capabilities if personnel not available to record daily]	Refrigerators: 0˚C to 6˚C Freezers: ≤-10˚C
Thermometer verification check [Using a thermometer traceable to the SI through an NMI] [Performed at two temperatures that bracket the target temperature(s). Assume linearity between the two bracketing temperatures.] [If only a single temperature is used, at the temperature of use]	Liquid in glass: Before first use and annually Electronic: Before first use and quarterly	Apply correction factors or replace thermometer
Volumetric labware	Class B: By lot before first use Class A and B: Upon evidence of deterioration	Bias: Mean within ±2% of nominal volume Precision: RSD ≤1% of nominal volume (based on 10 replicate measurements)
Non-volumetric labware [Applicable only when used for measuring initial sample volume and final extract/ digestates volume]	By lot before first use or upon evidence of deterioration	Bias: Mean within ±3% of nominal volume Precision: RSD ≤3% of nominal volume (based on 10 replicate measurements)

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Table 2. Support Equipment Checks

Performance Check	Frequency	Acceptance Criteria
Mechanical volumetric pipette	Quarterly	Bias: Mean within ±2% of nominal volume Precision: RSD ≤1% of nominal volume (based on minimum of 3 replicate measurements) [Note: for variable volume pipettes, the nominal volume is the volume of use]
Glass microliter syringe	Upon receipt and upon evidence of deterioration	General Certificate of Bias & Precision upon receipt Replace if deterioration is evident
Drying oven temperature check	Daily prior to and after use	Within ±5% of set temperature
Water purification system	Daily prior to use	See method blank criteria given in Section 4.20 of this addendum

4.5 The expiration date of the prepared standard shall not exceed the expiration date of the primary standard. All containers must bear a preparation date.

4.6 To avoid preparing non-representative samples, the laboratory shall not "target" within a relatively small mass range (e.g., 1.00 ± 0.01g) because such targeting will produce non-representative subsamples if the sample has high heterogeneity. The laboratory shall not manipulate the sample material so the sample aliquot weighs exactly 1.00g ± 0.01g, as an example.

4.7 In the absence of project-specific requirements, the minimum standard data qualifiers to be used are:

U Analyte was not detected and is reported as less than the LOD or as defined by the customer. The LOD has been adjusted for any dilution or concentration of the sample.

J The reported result is an estimated value (e.g., matrix interference was observed or the analyte was detected at a concentration outside the quantitation range).

B Blank contamination. The recorded result is associated with a contaminated blank.

N Non-target analyte. The analyte is a tentatively identified compound using mass spectrometry or any non-customer requested compounds that are tentatively identified.

Q One or more quality control criteria failed (e.g., LCS recovery, surrogate spike recovery, or CCV recovery).

Additional data qualifiers may be used, or different letters or symbols to denote the qualifiers listed above, as long as they are appropriately defined and their use is

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consistent with project-specific requirements (e.g., QSM 5.0, the contract, and project-planning documents).

4.8 If the time of the sample collection is not provided, assume the most conservative time of day. For the purpose of batch processing, the start and stop dates and times of the batch preparation shall be recorded.

4.9 Each preparation method listed on the scope of accreditation must have quarterly LOD/LOQ verifications. However, not all possible combinations of preparation and cleanup techniques are required to have LOD/LOQ verifications. If LOD/LOQ verifications are not performed on all combinations, the laboratory must base the LOD/LOQ verifications on the worst case basis (preparation method with all applicable cleanup steps).

4.10 After each MDL determination, the laboratory must establish the LOD by spiking a quality system matrix at a concentration of at least 2 times but no greater than four times the MDL. This spike concentration establishes the LOD and the concentration at which the LOD shall be verified. It is specific to each suite of analyte, matrix, and method (including sample preparation). The following requirements apply to the initial LOD establishment and to the LOD verifications:

- The apparent signal to noise (S/N) ratio at the LOD must be at least three and the results must meet all method requirements for analyte identification (e.g., ion abundance, second column confirmation, or pattern recognition). For data systems that do not provide a measure of noise, the signal produced by the verification sample must produce a result that is at least three standard deviations greater than the mean method blank concentration. This is initially estimated based on a minimum of four method blank analyses and later established with a minimum of 20 method blank results.
- If the LOD verification fails, then the laboratory must repeat the MDL determination and LOD verification or perform and pass two consecutive LOD verifications at a higher spike concentration and set the LOD at the higher concentration.
- The laboratory shall maintain documentation for all MDL determinations and LOD verifications.
- The DL and LOD must be reported for all analyte-matrix-methods suites, unless it is not applicable to the test or specifically excluded by project requirements.

4.11 The LOD shall be verified quarterly. In situations where methods are setup and used on an infrequent basis, the laboratory may choose to perform LOD verifications on a one per batch basis. All verification data will be in compliance, reported, and available for review.

4.12 For DoD, at a minimum, the LOQ shall be verified quarterly. In situations where methods are setup and used on an infrequent basis, the laboratory may choose to perform LOQ verifications on a one per batch basis.

4.13 All initial instrument calibrations must be verified with a standard obtained from a second manufacturer prior to analyzing any samples. The use of a standard from a second lot obtained from the same manufacturer (independently prepared from different source

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materials) is acceptable for use as a second source standard. The concentration of the second source standard shall be at or near the midpoint of the calibration range. The acceptance criteria for the initial calibration verification must be at least as stringent as those for the continuing calibration verification.

4.14 Exclusion of calibration points without documented scientifically valid technical justification is not permitted.

4.15 The concentration of the CCV standard shall be greater than the low calibration standard and less than or equal to the midpoint of the calibration range.

4.16 All CCVs analyzed must be evaluated and reported. If a CCV fails, reanalysis or corrective actions must be taken.

- If a CCV fails, the laboratory can immediately analyze two additional consecutive CCVs (immediately is defined as starting a consecutive pair within one hour; no samples can be run between the failed CCV and the two additional CCVs). This approach allows for spurious failures of analytes to be reported without reanalysis of samples. Any corrective actions that change the dynamics of the system (e.g., clip column, clean injection port, run blanks) requires that all samples since the last acceptable CCV be reanalyzed.
- Both of these CCVs must meet acceptance criteria in order for the samples to be reported without reanalysis.
- If either of these two CCVs fail or if the laboratory cannot immediately analyze two CCVs, the associated samples cannot be reported and must be reanalyzed.
- Corrective action(s) and recalibration must occur if the above scenario fails. All affected samples since the last acceptable CCV must be reanalyzed.
- Flagging of data for a failed CCV is only appropriate when the affected samples cannot be reanalyzed. The laboratory must notify the client prior to reporting data associated with a failed CCV.

4.17 The results of all MS/MSDs must be evaluated using the same acceptance criteria used for the DoD LCS limits (see Addendum Tables 3 and 4) or project limits, if specified. If the specific analyte(s) are not available in the Addendum Tables 3 and 4, the laboratory shall use their LCS in-house limits (see the LIMS) as a means of evaluating MS/MSDs. The MS and MSD must be spiked with all reported analytes.

4.19 Surrogate spike results shall be compared with DoD LCS limits (see Addendum Tables 3 and 4) or acceptance criteria specified by the client. If these criteria are not available, the laboratory shall compare the results with its in-house statistically established LCS criteria (see the LIMS).

4.20 The method blank shall be considered to be contaminated if:

- The concentration of any target analyte (chemical of concern) in the blank exceeds 1/2 the LOQ and is greater than 1/10th the amount measured in any associated sample, or 1/0th the regulatory limit, whichever is greater;

- The concentration of any common laboratory contaminant in the blank exceeds the LOQ;
- If a method blank is contaminated as described above, then the laboratory shall reprocess affected samples in a subsequent preparation batch, except when sample results are below the LOD. If insufficient sample volume remains for reprocessing, the results shall be reported with appropriate data qualifiers.

4.21 Sporadic Marginal Exceedances are not allowed for target analytes (chemicals of concern as identified by a project) without project-specific approval. Target analytes are considered those few analytes that are critical for the success of a project (such as risk drivers) where sporadic marginal exceedances cannot be allowed. Laboratories should consult with clients whenever long lists of analytes are requested for analysis to determine if marginal exceedances will not be allowed.

4.22 DoD considers the same analyte exceeding the LCS control limit two (2) out of three (3) consecutive LCS to be indicative of non-random behavior, which requires corrective action and reanalysis of the LCS.

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Table 3. LCS Control Limits – Method 8082 Solid Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
12674-11-2	Aroclor 1016	6847	90.1	14.5	47	134
11097-69-1	Aroclor 1254	406	101.2	11.4	67	135
11096-82-5	Aroclor 1260	7975	96.6	14.4	53	140
877-09-8	Tetrachloro-m-xylene	2379	86.7	14.4	44	130

Table 4. LCS Control Limits – Method 8082 Water Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
12674-11-2	Aroclor 1016	3356	87.1	13.8	46	129
11097-69-1	Aroclor 1254	184	80.1	15.4	34	127
11096-82-5	Aroclor 1260	3538	89.4	14.8	45	134

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Table 5. Quality Control Requirements – Organic Analysis by Gas Chromatography

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Breakdown check (Endrin/DDT 8081 only)	Before sample analysis and at the beginning of each 12-hour shift.	Degradation of DDT and Endrin must each be ≤15%.	Correct problem, then repeat breakdown checks.	Flagging is not appropriate.	No samples shall be run until degradation of DDT and Endrin is each ≤15%.
Initial Calibration (ICAL) for all analytes (including surrogates)	At instrument set-up and after ICV or CCV failure, prior to sample analysis.	ICAL must meet one of the three options below: **Option 1:** RSD for each analyte ≤ 20%; **Option 2:** linear least squares regression for each analyte: r2 ≥ 0.99; **Option 3:** non-linear least squares regression (quadratic) for each analyte: r2 ≥ 0.99.	Correct problem then repeat ICAL.	Flagging is not appropriate.	Minimum 5 levels for linear and 6 levels for quadratic. Quantitation for multicomponent analytes such as chlordane, toxaphene, and Aroclors must be performed using a 5-point calibration. Results may not be quantitated using a single point. No samples shall be analyzed until ICAL has passed.
Retention Time window position establishment	Once per ICAL and at the beginning of the analytical sequence.	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the initial CCV is used.	NA	NA	Calculated for each analyte and surrogate.

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Table 5. Quality Control Requirements – Organic Analysis by Gas Chromatography

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Retention Time (RT) window width	At method set-up and after major maintenance (e.g., column change).	RT width is ± 3 times standard deviation for each analyte RT from the 72-hour study or 0.03 minutes, whichever is greater.	NA	NA	Calculated for each analyte and surrogate. Only applicable if internal standard calibration is not used.
Initial Calibration Verification (ICV)	Once after each ICAL, analysis of a second source standard prior to sample analysis.	All reported analytes within established RT windows. All reported analytes within ± 20% of true value.	Correct problem, rerun ICV. If that fails, repeat ICAL.	Flagging is not appropriate.	No samples shall be analyzed until calibration has been verified with a second source.

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Table 5. Quality Control Requirements – Organic Analysis by Gas Chromatography

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Continuing Calibration Verification (CCV)	Before sample analysis, after every 10 field samples, and at the end of the analysis sequence with the exception of CCVs for Pesticides multi-component analytes (i.e., Toxaphene, Chlordane, and Aroclors other than 1016 and 1260), which are only required before sample analysis.	All reported analytes and surrogates within established RT windows. All reported analytes and surrogates within ± 20% of true value.	Immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails or if two consecutive CCVs cannot be run, perform corrective action(s) and repeat CCV and all associated samples since the last successful CCV. Alternately, recalibrate if necessary; then reanalyze all associated samples since the last acceptable CCV.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification.	Results may not be reported without a valid CCV. Flagging is only appropriate in cases where the samples cannot be reanalyzed.

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Table 5. Quality Control Requirements – Organic Analysis by Gas Chromatography

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Internal Standards (IS)	If employed, every field sample, standard, and QC sample.	Retention time within ± 0.06 RRT UNITS from retention time of the midpoint standard in the ICAL; Internal standard signal (area or height) within -50% to +100% of ICAL midpoint standard. On days when ICAL is not performed, the daily initial CCV can be used.	Inspect GC for malfunctions and correct problem. Reanalysis of samples analyzed while system was malfunctioning is mandatory.	If corrective action fails in field samples, data must be qualified and explained in the Case Narrative. Apply Q-flag to analytes associated with the non-compliant IS. Flagging is not appropriate for failed standards.	NA.
Method Blank (MB)	One per preparatory batch.	No analytes detected >1/2 LOQ or > 1/10 the amount measured in any sample or 1/10 the regulatory limit, whichever is greater.	Correct problem. If required, reprep and reanalyze MB and all samples processed with the contaminated blank.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch.	Results may not be reported without a valid method blank. Flagging is only appropriate in cases where the samples cannot be reanalyzed.

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Table 5. Quality Control Requirements – Organic Analysis by Gas Chromatography

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Laboratory Control Sample (LCS)	One per preparatory batch.	A laboratory must use Table 3 and 4 limits for batch control if project limits are not specified. If the analyte(s) are not listed, use in-house LCS limits (see the LIMS) if project limits are not specified.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Results may not be reported without a valid LCS. Flagging is only appropriate in cases where the samples cannot be reanalyzed.
Matrix Spike (MS)	One per preparatory batch.	A laboratory must use Table 3 and 4 limits for batch control if project limits are not specified. If the analyte(s) are not listed, use in-house LCS limits (see the LIMS) if project limits are not specified.	Examine the project-specific requirements. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met and explain in the case narrative.	For matrix evaluation only. If MS results are outside the limits, the data shall be evaluated to determine the source(s) of difference (i.e., matrix effect or analytical error).

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TITLE: **POLYCHLORINATED BIPHENYLS (PCBS) BY GAS CHROMATOGRAPHY (SOIL, WATER & OIL) (EPA METHODS 608, 8082, & 8082A, SM 6431B)**

Table 5. Quality Control Requirements – Organic Analysis by Gas Chromatography

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Matrix Spike Duplicate (MSD) or Matrix Duplicate (MD)	One per preparatory batch.	A laboratory must use Table 3 and 4 limits for batch control if project limits are not specified. If the analyte(s) are not listed, use in-house LCS limits (see the LIMS) if project limits are not specified. RPD ≤ 30% (between MS and MSD or sample and MD).	Examine the project-specific requirements. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met and explain in the case narrative.	The data shall be evaluated to determine the source of difference. For Sample/MD: RPD criteria only apply to analytes whose concentration in the sample is greater than or equal to the LOQ.

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Standard Operating Procedure

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Table 5. Quality Control Requirements – Organic Analysis by Gas Chromatography

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Surrogate Spike	All field and QC samples.	QC acceptance criteria specified by the project, if available; otherwise use Table 3 and 4 limits or in-house LCS limits (See the LIMS) if analyte(s) are not listed.	Correct problem, then reprep and reanalyze all failed samples for all surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary, but the client must be notified prior to reporting data, and the failures must be discussed in the Case Narrative.	Apply Q-flag to all associated analytes if acceptance criteria are not met and explain in the case narrative.	Alternative surrogates are recommended when there is obvious chromatographic interference.
Confirmation of positive results (second column)	All positive results must be confirmed (except for single column methods such as TPH by Method 8015 where confirmation is not an option or requirement).	Calibration and QC criteria for second column are the same as for initial or primary column analysis. Results between primary and secondary column RPD ≤ 40%.	NA	Apply J-flag if RPD >40%. Discuss in the case narrative.	Use project-specific reporting requirements if available; otherwise, use method requirements if available; otherwise report the result from the primary column.

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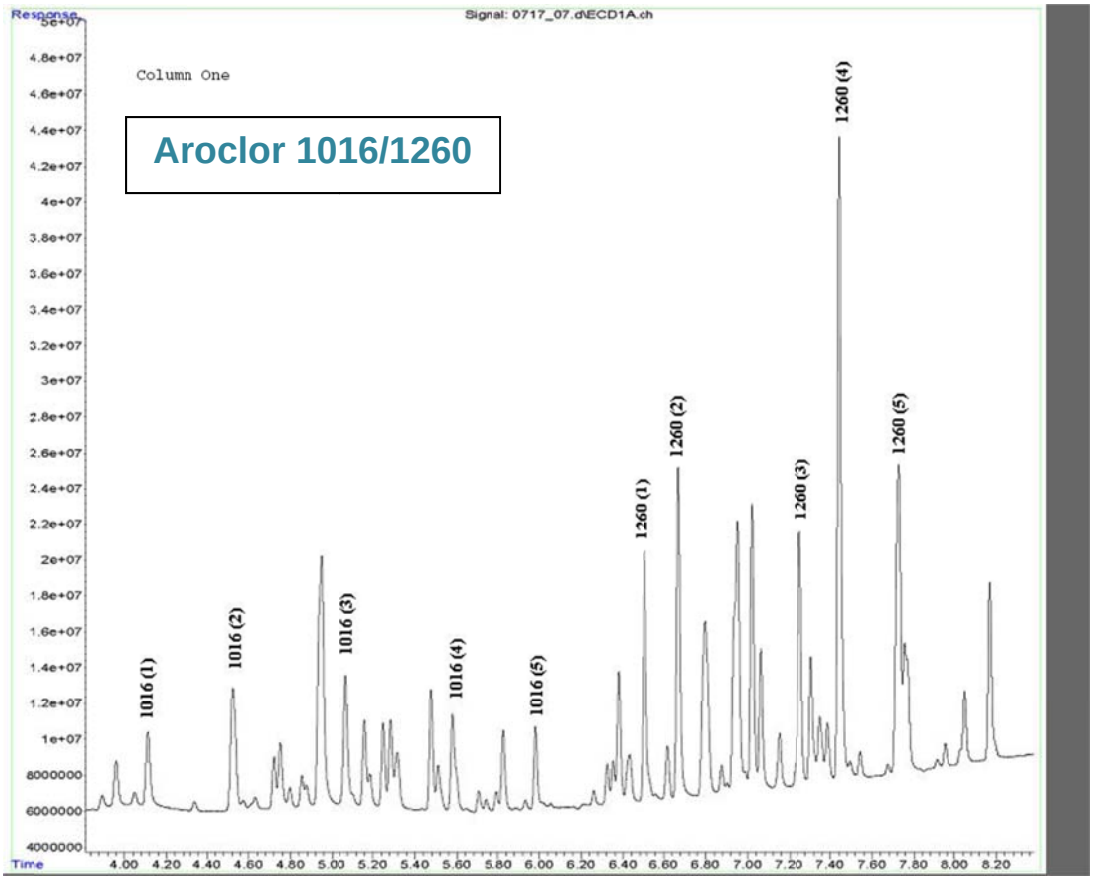
Environmental Science Corporation
SOP MINOR REVISION FORM

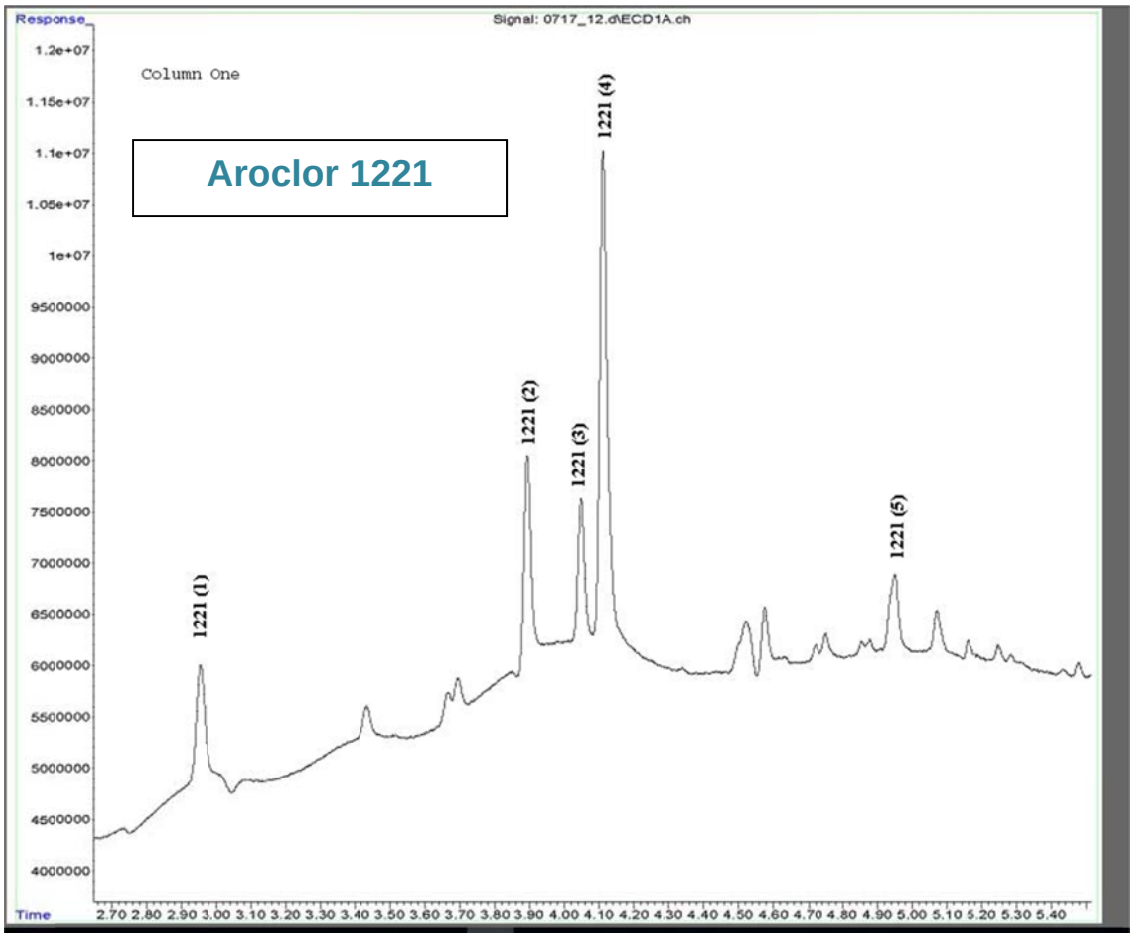
SOP/DOC# 330343 Current revision date & number: 03/23/18 R17

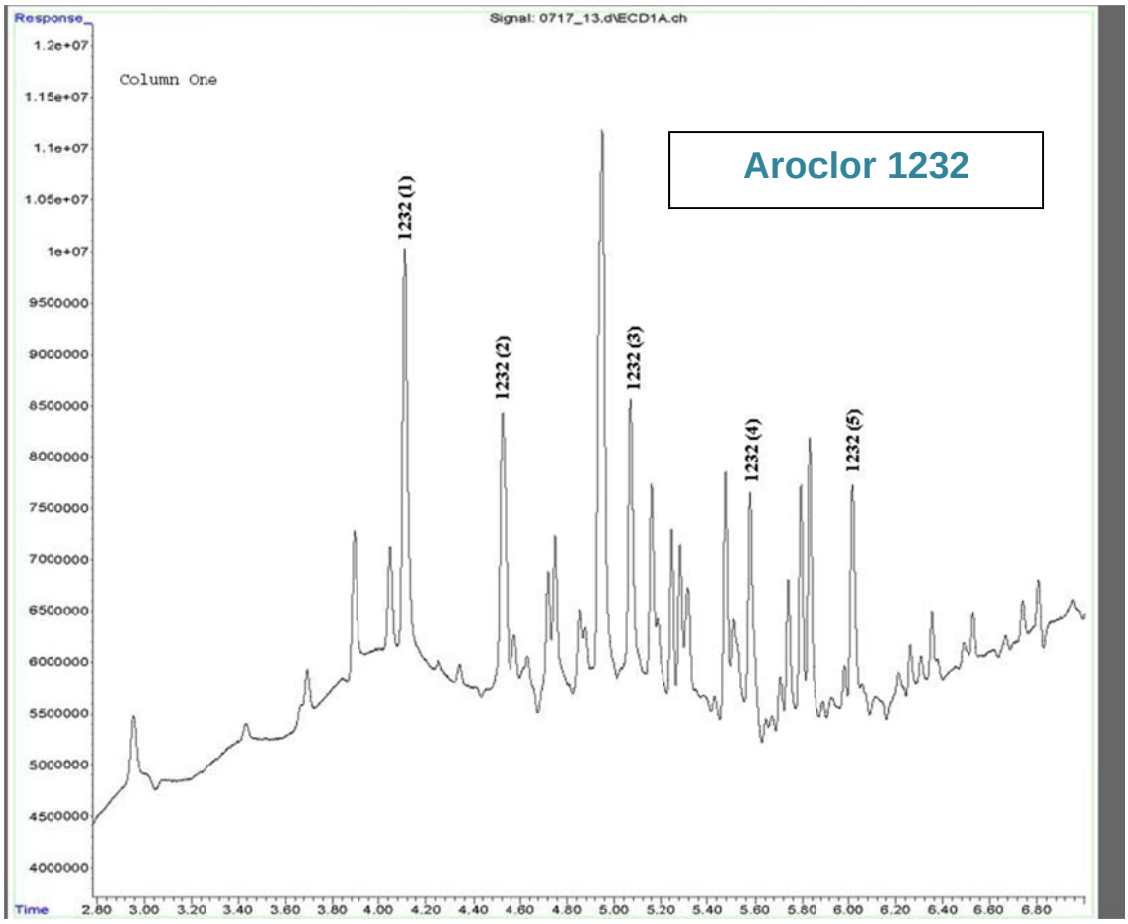
Procedure/Method : POLYCHLORINATED BIPHENYLS (PCBS) BY GAS CHROMATOGRAPHY (SOIL, WATER & OIL) (EPA METHODS 608, 608.3, 8082, & 8082A, SM 6431B)

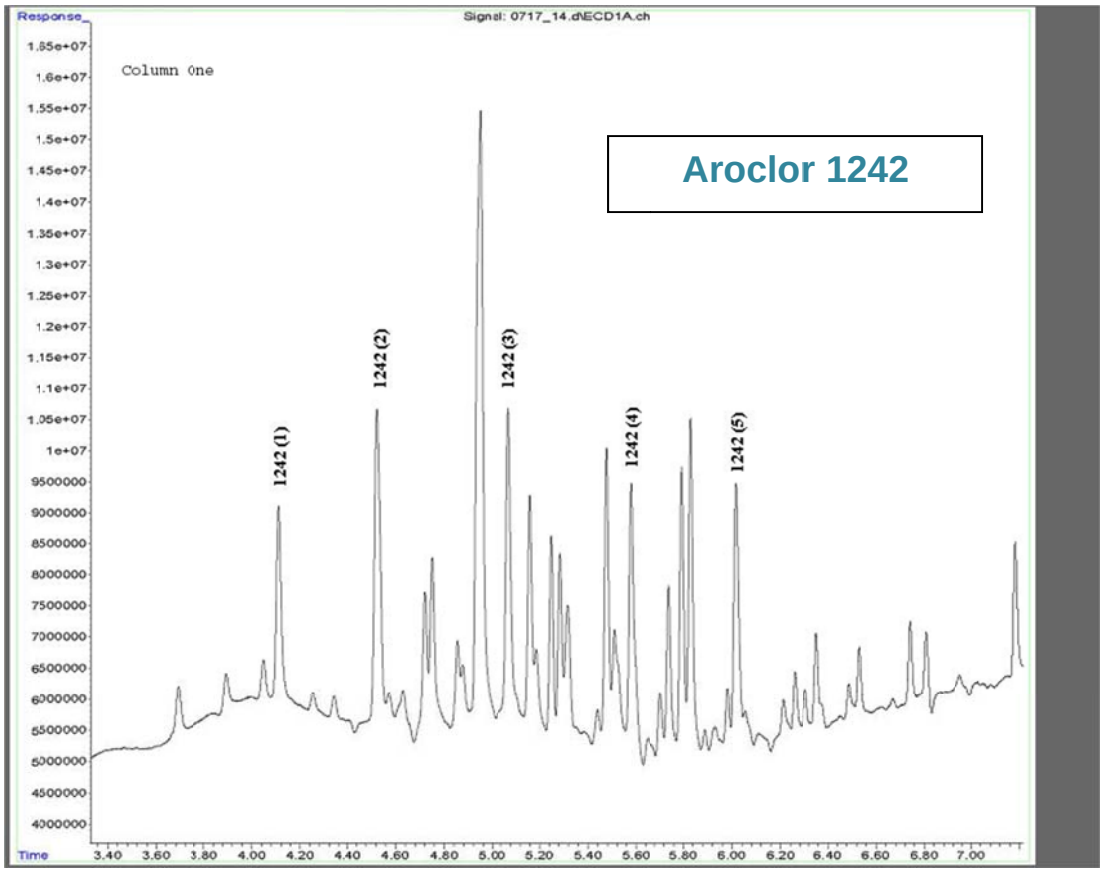
Date	Requested By	Section	Revision	Reason*	Approvals	
					Supervisor	QA
08/07/18	Steve Miller	8.5	Add the following to Section 8.5: "In order to better facilitate consistency and reduce differences between different analysts, see below guidelines and Chromatograms of different Aroclors patterns as references and tools for the process of identification and quantitation of PCBs and multicomponent pesticides, Chlordane and Toxaphene. Aroclor 1016 has the same characteristic first three peak pattern as 1248, but the first peak is much more visible in 1016 when compared to 1242. Aroclor 1016 also does not contain the heavier components of either 1242 or 1248. When deciding between Aroclor 1242 and Aroclor 1248 look for the following characteristics. First, evaluate the ratios of the first three peaks in. both Aroclors. In Aroclor 1242 the peak heights for the first three peaks double from peak to peak. In Aroclor 1248 the peak heights triple from peak to peak. When comparing Aroclors 1254 and 1260, 1254 elutes earlier than 1260. Therefore, if both Aroclors are present, the front part of 1254 will be present ahead of 1260. See chromatograms for labeled peak references. In addition to the aforementioned guidelines chromatograms of each Arclor with the most abundant 5 peaks labeled with in each Aroclor, are now a part of the SOP for a visual reference. Shared peaks identified to be used as guides in determining which Aroclor they belong in cases where more than one multicomponent is detected in the same sample."	CAR3151	Shakir Wani	

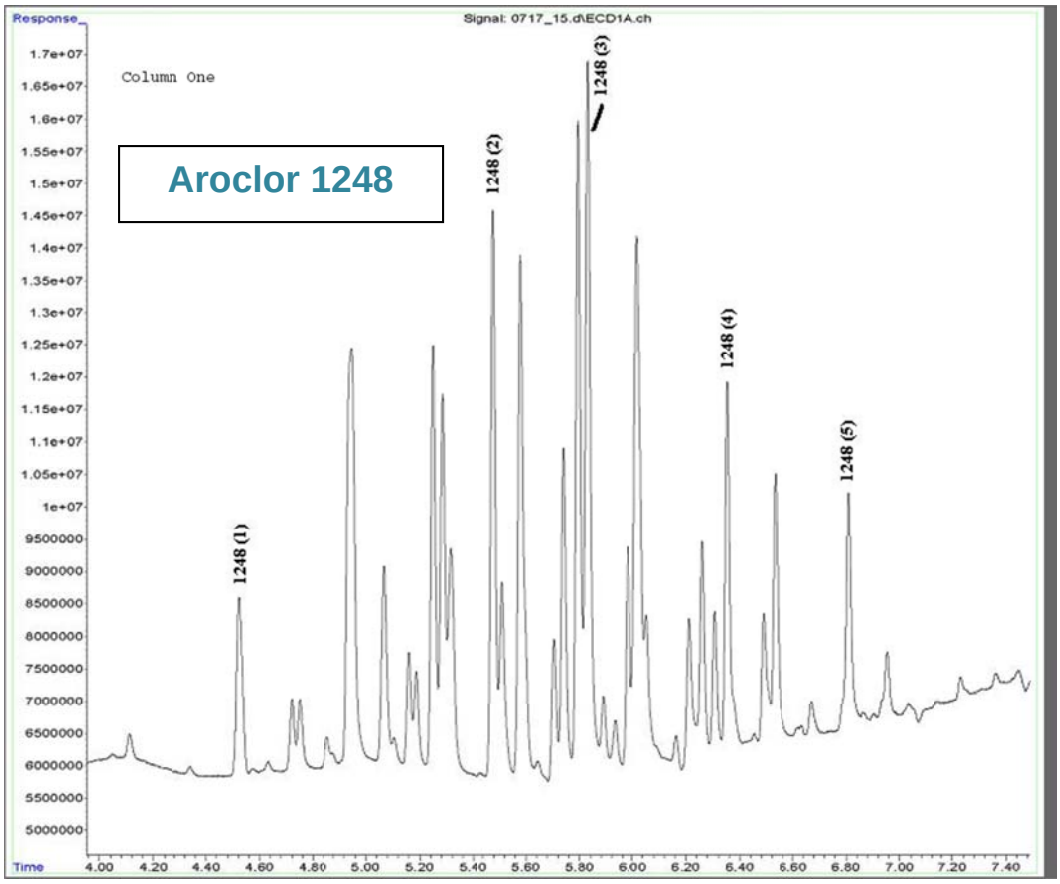
*Comments: See attached chromatograms to be added to the SOP for a visual comparing PCB patterns for identifications.

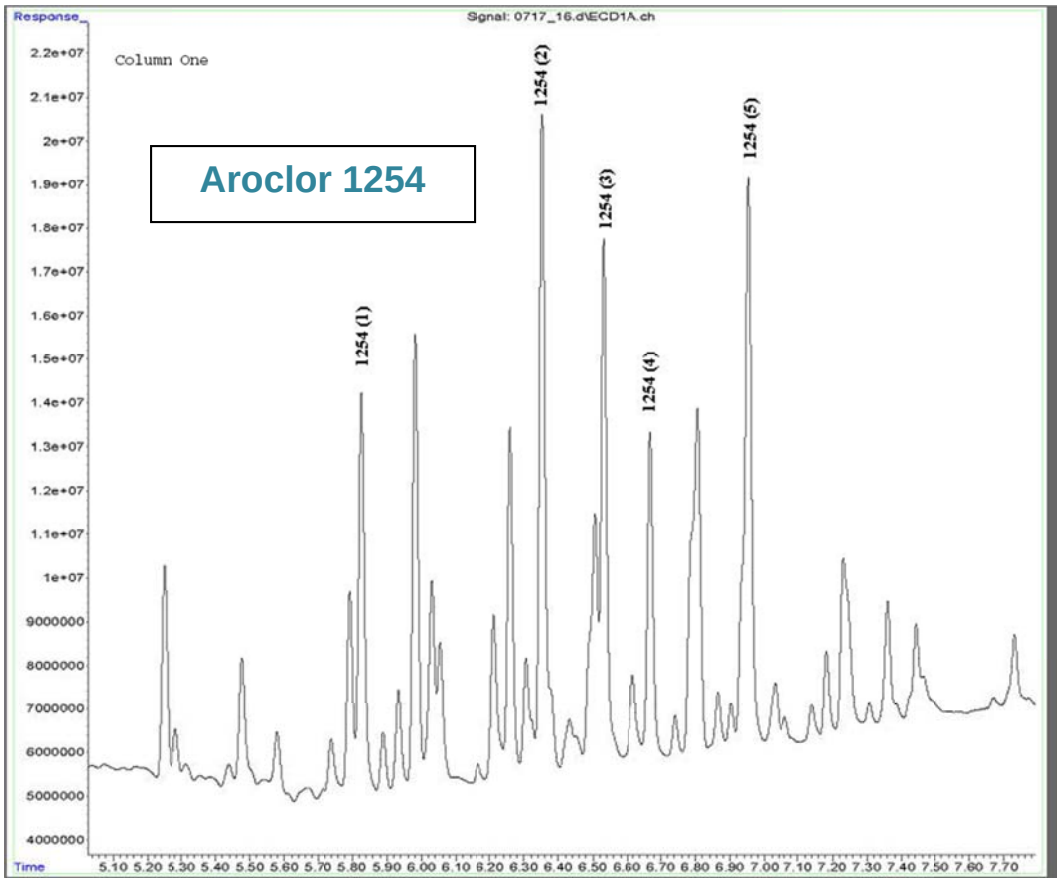

Response
Signal: 0717_07.d\ECD1A.ch
Column One
Aroclor 1016/1260
1016 (1)
1016 (2)
1016 (3)
1016 (4)
1016 (5)
1260 (1)
1260 (2)
1260 (3)
1260 (4)
1260 (5)
Time


Response
Signal: 0717_12.d\ECD1A.ch
Column One
Aroclor 1221
1221 (1)
1221 (2)
1221 (3)
1221 (4)
1221 (5)
Time


Response
Signal: 0717_13.dECD1A.ch
Column One
Aroclor 1232
1232 (1)
1232 (2)
1232 (3)
1232 (4)
1232 (5)
Time


Response
Signal: 0717_14.dECD1A.ch
Column One
Aroclor 1242
1242 (1)
1242 (2)
1242 (3)
1242 (4)
1242 (5)
Time


Signal: 0717_15.d\ECD1A.ch
Response
Column One
Aroclor 1248
1248 (1)
1248 (2)
1248 (3)
1248 (4)
1248 (5)
Time


Signal: 0717_16.d\ECD1A.ch
Response
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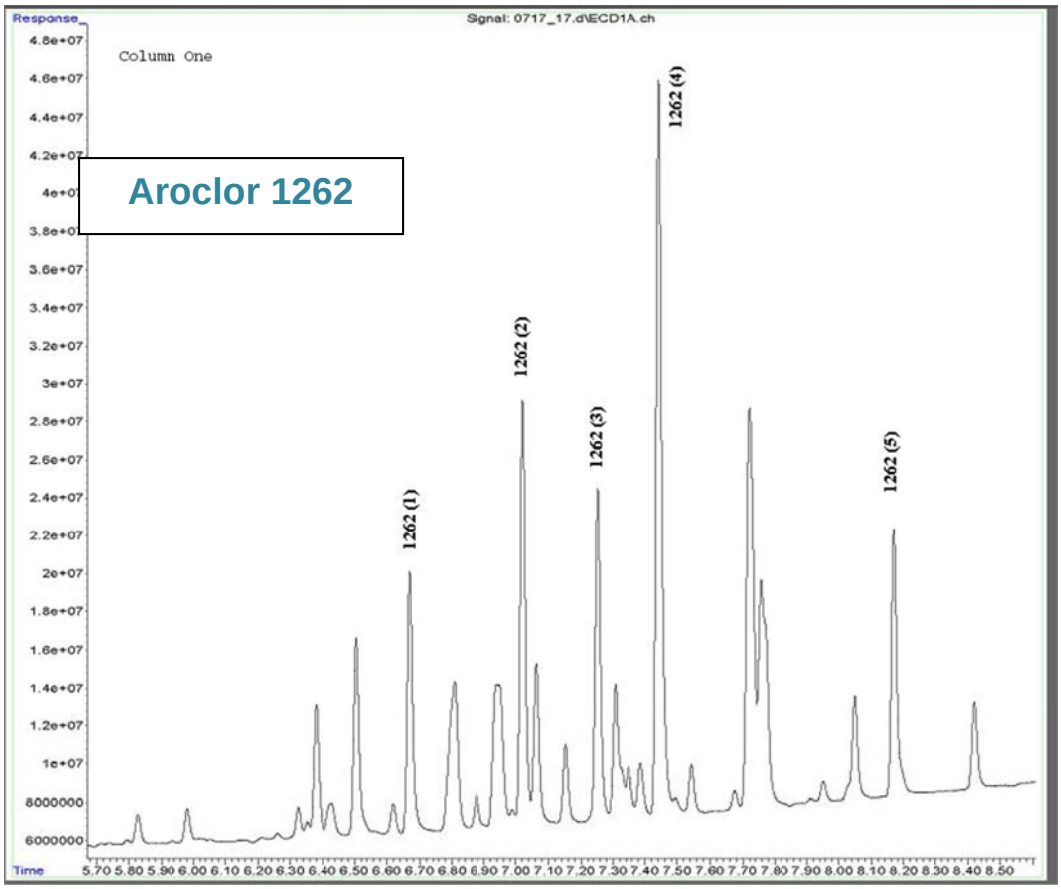
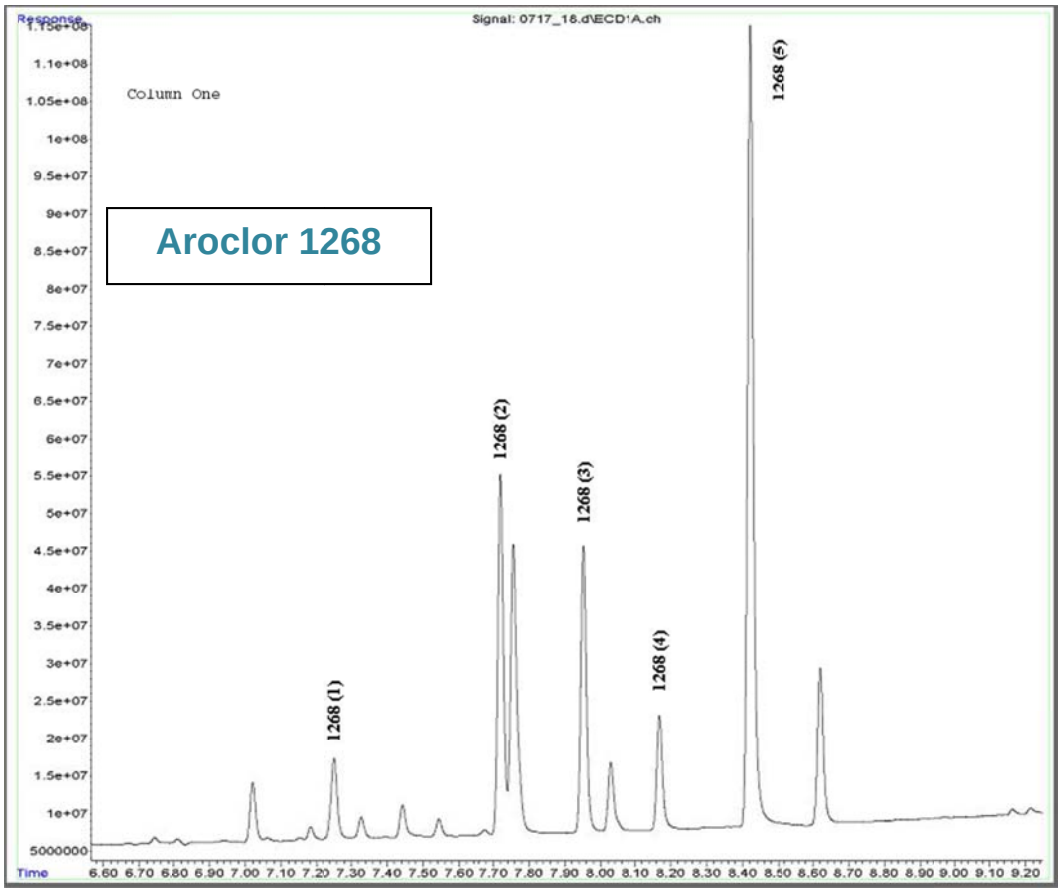
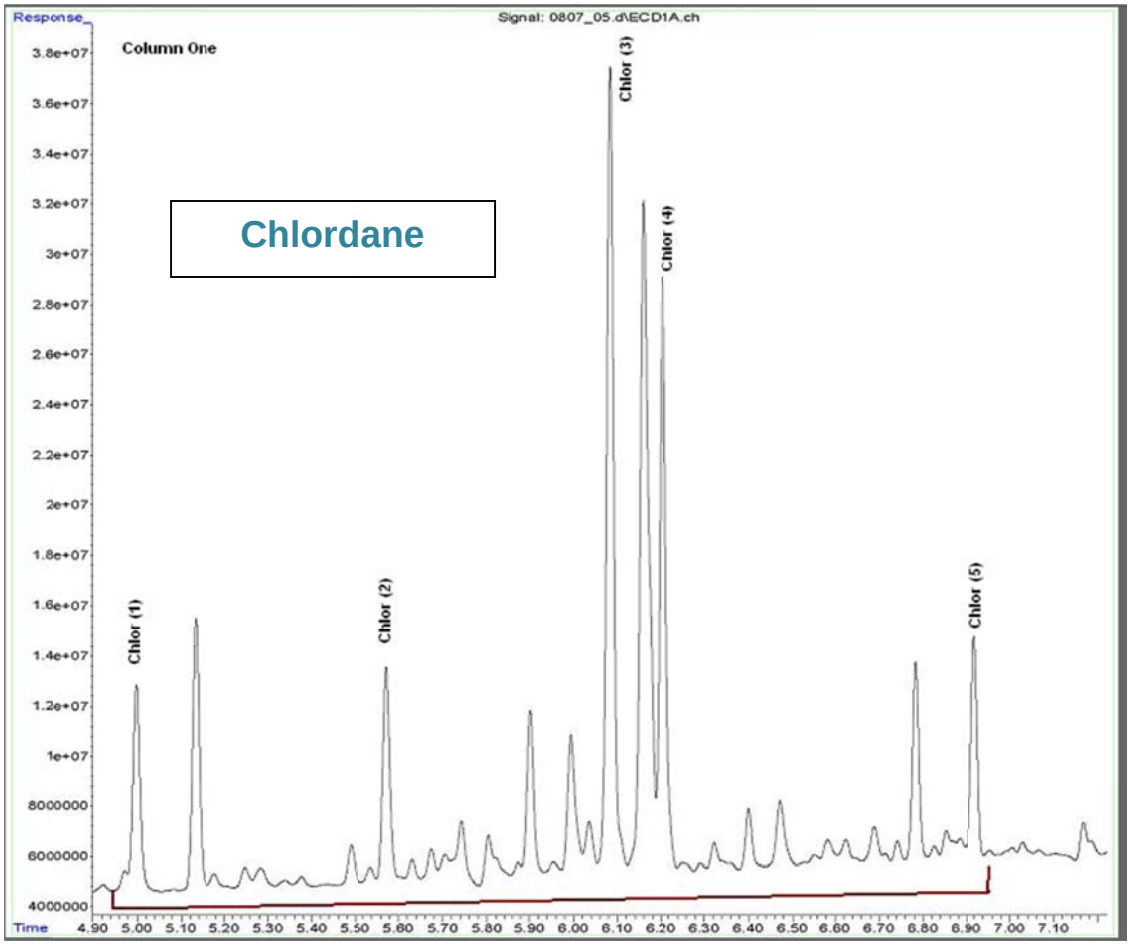
1254 (1)
1254 (2)
1254 (3)
1254 (4)
1254 (5)
Time


Signal: 0717_17.d\ECD1A.ch
Response
Column One
Aroclor 1262
1262 (1)
1262 (2)
1262 (3)
1262 (4)
1262 (5)
Time


Signal: 0717_16.d\ECD1A.ch
Response
Column One
Aroclor 1268
1268 (1)
1268 (2)
1268 (3)
1268 (4)
1268 (5)
Time


Response_
Signal: 0807_05.d\ECD1A.ch
Column One
Chlordane
Chlor (1)
Chlor (2)
Chlor (3)
Chlor (4)
Chlor (5)
3.8e+07
3.6e+07
3.4e+07
3.2e+07
3e+07
2.8e+07
2.6e+07
2.4e+07
2.2e+07
2e+07
1.8e+07
1.6e+07
1.4e+07
1.2e+07
1e+07
8000000
6000000
4000000
Time
4.90 5.00 5.10 5.20 5.30 5.40 5.50 5.60 5.70 5.80 5.90 6.00 6.10 6.20 6.30 6.40 6.50 6.60 6.70 6.80 6.90 7.00 7.10

Standard Operating Procedure

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TITLE: PESTICIDES BY GAS CHROMATOGRAPHY (EPA METHODS 608, 608.3, 8081A, 8081B, SM 6630C)

Reviewed by: Chris Johnson, Blake Judge, Shakir Wani, Steve Miller

Department Manager *QA Department*

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1.0 SCOPE AND APPLICATION

STATE NOTE: For samples analyzed in conjunction with the Ohio Voluntary Action Program (VAP) please utilize SOP #330344OH.

NOTE: EPA Methods 608 and 608.3 include the analysis of Polychlorinated Biphenyls (PCBs). For direction regarding PCB analysis using these methods, see SOP #330343.

1.1 This standard operating procedure represents the following:

- Is designed to determine the amount of certain chlorine-containing pesticides per unit weight or volume in matrices such as waste samples, waters, soils and sludge.
- Capillary columns are employed with electron capture detectors (ECD). Additional procedures can be used for further clarifying highly-contaminated matrices.
- The compounds that are determined by this method are listed in the Table 1.1 with their reporting limits. Actual detection limits vary with the different matrices.

TABLE 1.1 Method Compounds and Reporting Limits (*See section 13.2.*)

COMPOUND	Pace National		Method 608.3	
	RL (Water mg/L)	RL (Soil mg/kg)	MDL (ng/L)	ML (ng/L)
alpha-BHC	0.0005	0.02	3	9
Aldrin	0.0005	0.02	4	12
beta-BHC	0.0005	0.02	6	18
Chlordane∓	0.005	0.20		
delta-BHC	0.0005	0.02	9	27
Dieldrin	0.0005	0.02	2	6
Endosulfan I	0.0005	0.02	14	42
Endosulfan II	0.0005	0.02	4	12
Endosulfan sulfate	0.0005	0.02	66	198
Endrin	0.0005	0.02	6	18
Endrin Aldehyde	0.0005	0.02	23	70
Endrin Ketone∓	0.0005	0.02		
Heptachlor	0.0005	0.02	3	9

Standard Operating Procedure

TITLE: **PESTICIDES BY GAS CHROMATOGRAPHY (EPA METHODS 608, 608.3, 8081A, 8081B, SM 6630C)**

COMPOUND	Pace National		Method 608.3	
	RL (Water mg/L)	RL (Soil mg/kg)	MDL (ng/L)	ML (ng/L)
Heptachlor Epoxide	0.0005	0.02	83	249
Lindane (gamma-BHC)	0.0005	0.02	4	12
Methoxychlor₸	0.0005	0.02		
p'p'DDD	0.0005	0.02	11	33
p'p'DDE	0.0005	0.02	4	12
p'p'DDT	0.0005	0.02	12	36
Toxaphene₸	0.01	0.37		
Chlorpyrifos (Dursban)**₸	0.1	20.0		
Alpha Chlordane	0.5	20.0	14	42
Gamma Chlordane	0.5	20.0	14	42
Method 608.3 – Additional Analytes				
Acephate				
Alachlor				
Atrazine				
Benfluralin (Benefin)				
Bromacil				
Bromoxynil octanoate				
Butachlor				
Captafol				
Captan				
Carbophenothion (Trithion)				
Chlorobenzilate				
Chloroneb (Terraneb)				
Chloropropylate (Acaralate)				
Chlorothalonil				
Cyanazine				
DCPA (Dacthal)				
2,4′-DDD				
2,4′-DDE				
2,4′-DDT				
Diallate (Avadex)				
1,2-Dibromo-3-chloropropane (DBCP)				
Dichlone				
Dichloran				
Dicofol				
Endrin ketone				
Ethalfluralin (Sonalan)				
Etridiazole				
Fenarimol (Rubigan)				
Hexachlorobenzene				

Standard Operating Procedure

TITLE: **PESTICIDES BY GAS CHROMATOGRAPHY (EPA METHODS 608, 608.3, 8081A, 8081B, SM 6630C)**

COMPOUND	Pace National		Method 608.3	
	RL (Water mg/L)	RL (Soil mg/kg)	MDL (ng/L)	ML (ng/L)
Hexachlorocyclopentadiene				
Isodrin				
Isopropalin (Paarlan)				
Kepone				
Methoxychlor				
Metolachlor				
Metribuzin				
Mirex				
Nitrofen (TOK)				
cis-Nonachlor				
trans-Nonachlor				
Norfluorazon				
Octachlorostyrene				
Oxychlordane				
PCNB (Pentachloronitrobenzene)				
Pendamethalin (Prowl)				
cis-Permethrin				
trans-Permethrin				
Perthane (Ethylan)				
Propachlor				
Propanil				
Propazine				
Quintozene				
Simazine				
Strobane				
Technazene				
Technical Chlordane				
Terbacil				
Terbuthylazine				
Toxaphene			240	720
Trifluralin				

** *Chlorpyrifos (Dursban, CAS number 2921-88-2) can also be analyzed and reported by this method for special projects, if requested.*

Ŧ *Not listed as a primary target analyte in Method 608.3.*

1.2 A Method Detection Limits (MDL) study must be completed at least annually or more frequently if major instrumentation changes occur. MDLs are performed based on SOP #030206. Updated MDL records are filed and stored on Pace National's intranet.

1.2.1 Limit of Detection (LOD) and Limit of Quantitation (LOQ) studies are completed at the frequency required by the TNI standard per the procedure identified in the SOP #030206, *Method Detection Limits (MDL), Limits of Detection (LOD) and Limits of Quantitation (LOQ).* Should the procedure be utilized for DOD support; then the frequency of these studies must meet the requirements of the current DOD QSM (see Attachment II).

1.2.2 Lower Limit of Quantitation (LOQ) – For analyses performed per the requirements of Method 8000D, the LLOQ is established at concentrations where both quantitative and qualitative requirements can consistently be met (see Sections 2.2 and 10.19).

2.0 METHOD SUMMARY AND DEFINITIONS

2.1 A measured volume or weight of sample is extracted using the appropriate extraction technique. Liquid samples are extracted at neutral pH with methylene chloride using a separatory funnel (SOP #330702) per EPA method 3510C. Reduced volume (RV) extraction using EPA method 3510C that requires a smaller volume (usually 100mL) of field sample is also available for use where applicable. EPA method 3511 that requires a smaller volume (usually 40mL) of field sample is also available for use where applicable. See section 13.3 of this procedure and SOP #330702B. Solid samples are extracted with hexane-methylene chloride using microwave (SOP #330707), where permitted. The extract is brought to a final volume of 30mL with hexane without concentration. Routinely, an internal standard is added to the sample extract then the extract is injected into a gas chromatograph equipped with a capillary column with an electron capture detector (ECD). In these cases, internal calibration is performed; however in cases where there is an obvious interferent co-eluting with the internal standard peak, extracts without internal standard are analyzed and quantitation using external calibration is performed.

METHOD NOTE: Samples may also be extracted using a disk-based solid-phase extraction (SPE) procedure which was approved by the U.S. EPA as an Alternate Test Procedure (ATP) for waste water analyses in 1995 (see Section 14.10).

2.2 Lower Limit of Quantitation (LLOQ) – For analyses performed according to the requirements of Method 8000D, the lowest concentration at which the laboratory has demonstrated target analytes can be reliably measured and reported with a certain degree of confidence, which must be greater than or equal to the lowest point in the calibration curve.

2.3 LVI: Large Volume Injection: any injection volume >5ul. Technique is dependent upon type of GC inlet used and sensitivity of detection.

2.4 See the current Quality Assurance Manual for definitions associated with terms found in this document.

3.0 HEALTH AND SAFETY

3.1 The toxicity or carcinogenicity of each reagent used in the laboratory has not been fully established. Each chemical should be regarded as a potential health hazard and exposure to these compounds must be as low as reasonably achievable. A reference file of safety data sheets (SDSs) is made available on Pace National's intranet to all personnel. Use hazardous reagents in a fume hood whenever possible and if eye or skin contact occurs, flush with large volumes of water. Always wear safety glasses or a shield for eye protection, protective clothing and observe proper mixing protocols.

3.2 Many of the compounds determined by this methodology have been identified as known or putative carcinogens in man and/or animals. Exposure to these compounds must be reduced to a minimum. Neat standards should be handled in a fume hood.

- The analyst must use gloves to minimize the possibility of trans-dermal adsorption of these compounds.

3.3 Since the electron capture detector is a non-destructive detector, effluent from the gas chromatograph must be vented through an adsorption trap. Large quantities of the dichloromethane extraction solvent should be handled in the fume hood. The laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. This file is made available to all personnel involved in the chemical analysis.

4.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

4.1 All samples must have been collected using a sampling plan that addresses the considerations of this method.

4.2 Preservation & Holding Time

- If residual chlorine is present, water samples are preserved with 3mL/1000mL sample of 10% sodium thiosulfate per gallon and cooled to 4 $\pm$ 2ºC.
- The holding time for water samples begins at collection and ends with extraction that must be completed within 7 days. Extract holding time begins with extraction and ends with analysis that must be completed within 40 days.
- Soils and sludge are cooled to 4 $\pm$ 2ºC upon collection.
- The holding time for soil samples begins at collection and ends with extraction that must be completed within 14 days. Extract holding time begins with extraction and ends with analysis that must be completed within 40 days.

4.3 Container

- Water samples are collected in a 1 Liter amber bottle with Teflon lined caps for traditional EPA 3510C extractions or in a 100mL amber bottle with Teflon lined caps for 3510RV extraction.
- Soils are collected in wide-mouth jars with Teflon lined caps.

4.4 Additional requirements for sample extraction are detailed in SOP numbers 330702, 330702B, 330705, 330706, 330707, and 330743.

4.5 Samples submitted for analysis that do not meet the requirements contained within this section must be addressed before performing the logging process within the laboratory. In some cases, exceeding the appropriate preservation and storage criteria can cause significant bias in the resulting data. Clients may need to resubmit samples where the conditions during shipment cause uncertainty regarding sample integrity. If samples do not meet the requirements for preservation, sampling, shipment and storage and the client approves the completion of the analytical process, sample results can be qualified and possible bias is narrated per the SOP #030201, *Data Handling and Reporting*.

4.6 Method 608.3 allows the use of hydrogen as a carrier gas in place of helium. If used. the laboratory should take the necessary precautions in dealing with hydrogen, and should limit hydrogen flow at the source to prevent buildup of an explosive mixture of hydrogen in air.

4.7 Method 608.3 requires that when Aldrin is to be determined and residual chlorine is present in the sample, 80mg/L of sodium thiosulfate must be added, but not to excess.

5.0 INTERFERENCES

5.1 Interferences can be caused by the following:

- Contaminated solvents or reagents
- Sample processing hardware or glassware
- Contaminated carrier gas
- GC parts, column surfaces or detectors
- Co-eluting compounds

5.2 Cleanup procedures are used to remove some of the interferences from sample matrix or interferences from sample matrix or interferences introduced during sample processing (phthalate esters). Cleanup procedures should not be performed on extracts that contain internal standards, as the effects of cleanup processes on these analytes are not fully known.

5.3 Glassware:

- Glassware must be scrupulously cleaned.
- Clean all glassware by detergent washing with hot water and rinsing with tap water and organic-free reagent water.
- Drain the glassware and rinse with acetone and hexane.
- Store dry glassware in a clean environment. See SOP #030701, *Glassware Cleaning.*

5.4 Sulfur:

- The presence of sulfur results in broadening of the peaks on the GC chromatogram.

- Sulfur can be removed by using copper cleanup. See SOP #330741, *Sulfur Cleanup*.

5.5 Polar contaminants, phenols and unidentified co-extracts may be eliminated using silica gel cleanup. See SOP #330739.

5.6 If co-elutions occur in analysis of a sample, a co-elution on one column is acceptable so long as effective separation of the co-eluting compounds can be achieved on the second column.

6.0 EQUIPMENT AND SUPPLIES

6.1 Instrumentation *(or equivalents):*

Instrument name:	SVGC #24, #29
Use (method #'s):	608, 8081, 8082, SM 6630C
Model #:	HP 6890/7890 or equivalent
Column (type, brand, size):	Two of the following (or equivalent): STX–CLPesticides 30m x 0.32mm x 0.5um, STX-CLPesticides II 30m x 0.32mm x 0.25um
Detector:	Dual micro ECD
Software name and version:	Enviro Quant Chemstation G1701BA or equivalent
Software version:	D.01.00/E.02.00 or equivalent
Sample introduction system:	Agilent 7683/7693 AS or equivalent
Computer	HP Vectra or equivalent
Gases used (grade and supplier):	He, H_2 & N_2 – 4.8
Syringes used (brand, size, type):	Hamilton 250uL, 100uL, 10uL or equivalent

6.2 Class A Volumetric flasks, 10mL and 25mL, for preparation of standards.

6.3 9" VWR Disposable Pasteur pipette or equivalent

6.4 10mL Pyrex disposable pipette or equivalent

6.5 1.8mL Wheaton ABC vials with rubber, Teflon lined cap or equivalent.

7.0 REAGENTS AND STANDARDS

7.1 All reagents and standards must be recorded in the appropriate preparation log and assigned a unique number. See SOP #030230, *Standards Logger – Tree Operation*. Additional information regarding reagent preparation can be found in the Standards Logger (Tree) digital archive system. All spiking solutions and surrogate standard solutions should be replaced at least every 6 months or sooner if a problem is detected unless otherwise noted.

7.2 TCL Pesticide mix (Restek) 10ug/mL, CAT # 563209 or equivalent

7.3 TCL Pesticide mix - (Restek) 200ug/L, CAT# 570337 or equivalent

7.4 Chlordane - 1000ug/mL (Restek), CAT 32021or equivalent

7.5 Toxaphene - 1000ug/mL (Restek) CAT # 32005or equivalent

7.6 Surrogate standards - 200ug/mL TCMX and Decachlorobiphenyl Ultra Scientific (Cat#ISM-320) or equivalent.

7.7 Degradation Check Solution – ULTRA Scientific Cat# ISM-450 or equivalent

7.8 SSCV Pest Extraction Spike – 2.0ug/mL – NSI Cat # Q3425 or equivalent

Dilute as follows:

Technique	Method	Matrix	Extracted Sample Amount (g or mL)	Amount Added to Sample (mL)	Final Solvent Volume (mL)
Microwave	3546	Soil	15	0.5	30
Sep Funnel	3510RV	Water	100	.05	5
Sep Funnel	3510C	Water	1000	0.10	10

7.9 Organic free reagent water – Prepared in the extraction lab by processing the laboratory DI water through a carbon filtration system.

7.10 Hexane VWR Cat# BJGC217-4 or equivalent – pesticide grade

7.11 LCS/Matrix Spike Solution - NSI Cat #Q3425 or equivalent. The concentration is 2.0 µg/mL.

- Water - Measure 100uL of the LCS/MS solution and add to 1 liter of sample or laboratory reagent water for traditional 3510C extraction or 50uL into 100mL for 3510RV. The final concentration is 1.0ug/mL for 100ml and 0.2ug/ml for 1000ml. Soil - 0.5mL to 15g of sample (concentrated to 30mL for microwave extraction). The final concentration is 66.7ug/Kg

7.12 Stock Internal standard: 1-Bromo-2-nitrobenzene (5000 mg/L). Ultra Scientific Cat# PPS-351 or equivalent. Dilute stock standard 1-1000. Add 10uL to each 1mL of standards, field samples, method blank, and QC (LCS/LCSD/MS/MSD) extract.

7.13 Working Standards: The lowest level of the calibration curve must be at or below the RL Surrogates are included in the working standards at the same concentration as the target analytes. Dilute the certified stock solution in section 7.2 to a final volume of 1mL in hexane as follows to prepare the working calibration standards:

- For RV and non-concentrated soil analysis from 50ppb intermediate:

Standard Concentration (ppb)	Intermediate Stock Used (uL) in 1mL
.4	2
1.0	5
5.0	25
10.0	50
20.0*	100
50.0	250
100	500
200	1000

* Levels also used for ICV/CCV.

METHOD NOTE: For Method 608.3, one of the calibration standards should be at a concentration at or below the method-defined minimum level (ML) specified in Table 1.1, as specified by a regulatory/control authority, or in a permit:

Alternatively, the laboratory may establish an ML for each analyte based on the concentration of the lowest calibration standard in a series of standards produced by the laboratory or obtained from a commercial vendor, again, provided that the ML does not exceed the method-defined ML, and provided that the resulting calibration meets the acceptance criteria in based on the RSD, RSE, or R^2.

A separate standard near the MDL may be analyzed as a check on sensitivity, but should not be included in the linearity assessment. The solvent for the standards must match the final solvent for the sample extracts (e.g., isooctane or hexane).

7.14 Sodium sulfate, reagent grade, granular anhydrous, rinsed with methylene chloride, baked in a shallow tray at 450°C for 1 hour minimum, cooled in a desiccator, and stored in a pre-cleaned glass bottle with screw cap which prevents moisture from entering.

7.14.1 If, after heating, the sodium sulfate develops a noticeable grayish cast (due to the presence of carbon in the crystal matrix), that batch of reagent is not suitable for use and should be discarded. Extraction with methylene chloride (as opposed to simple rinsing) and baking at a lower temperature may produce sodium sulfate suitable for use.

7.15 Method 608.3 Standard Requirements

7.15.1 Quality Control (QC) Check Sample Concentrate—Prepare one or more mid-level standard mixtures (concentrates) in acetone (or other water miscible solvent). The concentrate is used as the spiking solution with which to prepare the Demonstration of Capabilities (DOC) samples, the Laboratory Control

Sample (LCS), and Matrix Spike (MS) and Matrix Spike Duplicate (MSD) samples. If prepared by the laboratory (as opposed the purchasing it from a commercial supplier), the concentrate must be prepared independently from the standards used for calibration, but may be prepared from the same source as the second source standard used for calibration verification.

7.15.2 Calibration Verification Standards— In order to verify the results of the initial calibration standards, prepare one or more mid-level standard mixtures in isooctane or hexane, using standards obtained from a second source (different manufacturer or different certified lot from the calibration standards). These standards will be analyzed to verify the accuracy of the calibration. As with the QC sample concentrate, multiple solutions may be required to address coelutions among all of the analytes.

7.15.3 Internal standard solution—If the internal standard calibration technique is to be used, prepare Pentachloronitrobenzene (PCNB) at a concentration of 10 mg/mL in ethyl acetate. Alternative and multiple internal standards (e.g., tetrachloro-m-xylene, 4,4′-dibromobiphenyl, and/or decachlorobiphenyl) may be used provided that the laboratory performs all QC tests and meets all QC acceptance criteria with the alternative or additional internal standard(s) as an integral part of this method.

7.15.4 Surrogate solution—Prepare a solution containing one or more surrogates at a concentration of 2mg/mL in acetone. Potential surrogates include: dibutyl chlorendate (DBC), tetrachloro-m-xylene (TCMX), 4,4′-dibromobiphenyl, or decachlorobiphenyl. Alternative surrogates and concentrations may be used, provided the laboratory performs all QC tests and meets all QC acceptance criteria with the alternative surrogate(s) as an integral part of this method. If the internal standard calibration technique is used, do not use the internal standard as a surrogate.

7.15.5 DDT and endrin decomposition (breakdown) solution—Prepare a solution containing endrin at a concentration of 50ng/mL and 4,4'-DDT at a concentration of 100ng/mL, in isooctane or hexane. A 1-mL injection of this standard will contain 50 picograms (pg) of endrin and 100 pg of DDT. The concentration of the solution may be adjusted by the laboratory to accommodate other injection volumes such that the same masses of the two analytes are introduced into the instrument.

8.0 PROCEDURE

8.1 See instrument maintenance logs or Cyberlab for specific details to acquisition method

8.2 **Initial Calibration** – Due to the calibration verification and breakdown requirements for this method, the injection liner must be changed daily prior to calibration and/or verification. All other maintenance will be recorded in the specified instrument maintenance log.

8.2.1 **DDT and Endrin Degradation –** For calculations, see section 9.1

- DDT and Endrin are easily degraded in the injection port.
- Breakdown occurs when the injection liner is contaminated with high boiling residue.
- Check for degradation by injecting up to 50uL of a solution containing 10/20ug/L of Endrin/DDT
- Acceptance criteria for this injection are found in section 10.9 with corrective actions for failures in section 11.8.

8.2.1.1 Method 608.3 requires that if DDT, Endrin, or their breakdown products are to be determined, then the degradation test must be performed prior to calibration verification. DDT decomposes to DDE and DDD. Endrin decomposes to Endrin aldehyde and Endrin ketone.

8.2.2 **Initial Calibration Curve**

- Prepare five or more concentrations of each single component pesticide, multicomponent pesticide, and surrogate (TCMX and DCBP) in 1mL of hexane as noted in section 7.13. A minimum of 5 standards for each analyte are required for EPA Method 8081 and 608.3. A minimum of 3 standards for each analyte are required for EPA Method 608.
- All target analytes are included in the calibration curve.
- Calibration standards must be replaced if comparison to a secondary check standard reveals a problem.
- Inject the calibration standards to generate a working curve. HP Chemstation calculates the calibration factor or response factor for each compound in each standard according to the equations found in section 9.2 & 9.3.
- Average Calibration/Response Factor is calculated for each target analyte by averaging each of the individual calibration factors. See equations in section 9.2 & 9.3 and method performance requirements in section 10.4.
- Linear Regression Option: A calibration curve can be used instead of average CF/RF for quantitation when the percent relative standard deviation %RSD exceeds acceptance criteria. See equations in sections 9.4 & 9.5.
- Method 608.3 requires that one of the calibration standards be at or below the ML (see Table 1.1).

When the appropriate number of calibration standards is used, all points must be considered in the average response factor calculation or linear regression calculation. The deletion of the highest point is acceptable when necessary, with the analyst noting that the high end of the calibration has been lowered. The deletion of the lowest calibration point is acceptable, when necessary, provided that the analyst notes the deletion on the injection log and raises the reporting

limit, if necessary, for that compound. It is also necessary to print the calibration curve showing linearity and acceptable correlation coefficient.

8.2.3 **Dual Column Confirmation:** Calibration criteria must be met on both columns for positive confirmation of target analytes.

8.2.4 **Manual Integrations:** Manual integrations are performed, when needed, according to the SOP #030215, *Manual Integrations*.

8.2.5 Method 608.3 Requirements

Injection of calibration solutions— Inject a constant volume of each calibration solution into the GC column/detector pairs. An alternative volume may be used provided all requirements in this method are met. Beginning with the lowest level mixture and proceeding to the highest level mixture may limit the risk of carryover from one standard to the next, but other sequences may be used. An instrument blank should be analyzed after the highest standard to demonstrate that there is no carry-over within the system for this calibration range.

8.3 **Priming the Column:** The GC column may be primed (or deactivated) prior to calibration/degradation check by injecting a pesticide standard approximately 20 times the midpoint if the column has not been used for a day or more.

8.4 **Multicomponent Standard Check:** Each working day a mid-level ICV of Chlordane & Toxaphene is injected before analysis of samples at 200ug/L to verify calibration. If the ICV does not pass for these multicomponent targets, then the analytes in field samples are not reportable until a new calibration curve is analyzed.

STATE NOTE: For Arizona compliance samples multi-peak components, including Toxaphene, and Chlordane, are injected at the reporting level. If any of these compounds are detected in the sample, a five-point calibration is performed, with the lowest standard at or below the RL. The sample is diluted if high concentrations of these compounds are present. The area of 5 selected peaks is compared to the same peaks in the sample for quantitation for Chlordane.

STATE NOTE: For all samples analyzed from Minnesota, the reporting limit must be verified at least monthly, with each new initial calibration, or when there has been significant change to the instrument (column replacement, cleaning source, etc.) whichever is more frequent. The reporting limit verification can be performed by either re-injecting the low standard or by re-processing the low standard that was analyzed in the calibration curve. The reporting limit verification (RLV) must recovery within ±40% of the expected concentration. If this criterion is not met, the RLV may be re-analyzed once, instrument maintenance can be performed, a higher concentration standard can be injected, or a new calibration curve must be generated. If a higher concentration standard is utilized, the reporting limit must be raised to the higher level verified.

8.5 **Quantitation and Chromatogram Review:**

Sample Analysis: Sample extracts, method blank and corresponding (LCS/LCSD/MS/MSD), in 1.8mL vials for soil, 16ml for 1L water extractions, or 8mL for RV waters, are retrieved from the extraction lab.

- The sample ID's must be checked, by the analyst, and must match the samples listed in the Prep Data program.
- The analyst must sign the extraction log as verification of receipt and correctness. A secondary signature is by another trained extractor denotes review of the Standards used
- The method blank, LCS/LCSD, MS/MSD and samples are loaded into the autosampler. All dilution, volume, and weight information are carefully recorded as part of the injection log entry.
- Appropriate multipliers are assigned based on the sample extraction information. Sample information on the quant report must match the information on the injection log.
- The samples are injected via autosampler into the instrument and the corresponding quantitation report and chromatograph are generated.

Identification: Tentative identification of an analyte occurs when a peak from a sample extract falls within the absolute retention time window.

- Each tentative identification must be confirmed using either a second GC column of dissimilar stationary phase or using another technique such as GC/MS.
- Results are routinely confirmed using a second GC column of dissimilar stationary phase followed by the use of a second detector.
- The analyst must check the agreement between the quantitative results on both columns/detectors once the identification has been confirmed.
- Detectable amounts on either column require the analyst to review the same compound on the corresponding column.
- If the compound is below the reporting limit on the corresponding column, the analyst must review the integration and verify that the compound is or is not valid.
- Detectable amounts between the MDL and RL require appropriate review and integration for verification.
- If chromatographic problems are evident, clean-up procedures must be considered. The silica Gel clean-up technique is usually appropriate for typical interferences.

Method 608.3 Identification:

- In order to identify a single component analyte from analysis of a sample, blank, or other QC sample, the peak representing the analyte must fall within its respective retention time windows on both column/detector systems.
- The relative agreement between the numerical results from the two GC columns may be used to support the identification of the target analyte by providing evidence that coeluting interferences are not present at the retention time of the

target analyte. Calculate the percent difference (%D) between the results for the analyte from both columns. In general, if the %D of the two results is less than 50% (e.g., a factor of 2), then the pesticide is present. Note: Laboratories may employ metrics less than 50% for this comparison, including those specified in other analytical methods for these pesticides (e.g., CLP or SW–846).

- Report the lower result from the two columns for each analyte in each sample or QC standard at or above the ML to 3 significant figures.
- Report a result for each analyte in each sample or QC standard below the ML(see Table 1.1) as ‘‘<ML,’’ where ‘‘ML’’ is the concentration of the analyte at the ML (e.g., if the ML is 10 mg/L, then report the result as <10 mg/L), or as required by the regulatory authority or permit.
- Report a result for each analyte in a blank at or above the MDL to 2 significant figures. Report a result for each analyte found in a blank below the MDL as ‘‘<MDL,’’ where MDL is the concentration of the analyte at the MDL, or as required by the regulatory/control authority or permit.

8.6 **Chlordane and Toxaphene**

- ICV is run with every batch at 100ppb

Detection of Multi-Peak Compounds:

- When toxaphene, and/or chlordane are detected in field samples, a full calibration curve as noted in section 8.2.3 is utilized for quantitation. If a full calibration is not verified on the day of detection of these compounds in field samples, then the daily ICV and any CCVs must pass method continuing calibration criteria for these analytes to be able to report these targets.
- When reporting toxaphene or chlordane, the results from the total area is used unless background interference is present. Where there is interference, the five major peaks for chlordane are used over the total area, to calculate the final result.
- Pace National maintains current records of pattern recognition for all multi component compounds in the semi-volatile department.

STATE NOTE: Arizona compliance samples require that one multi-peak component target has a full calibration curve and all other multi-peak components (i.e., toxaphene, Aroclors, and chlordane) must be injected at the laboratory reporting level for DW samples.

8.7 **Midpoint Check Standard – Initial/Continuing Calibration Verification (ICV/CCV)**

- An initial calibration verification standard (ICV) must be analyzed to verify continuing acceptability of the most recent calibration curve on days that a full initial calibration curve is not required.
- For internal standard technique, a calibration check standard (CCV) must be analyzed once every 12hrs and/or prior to QC or 20 client sample batches.
- Acceptance criteria for the ICV/CCV can be found in section 10.7.

- All CCVs must be checked against set retention time windows.
- If any CCV falls outside retention time windows, the GC system is out of control.
- Determine the cause of the problem and correct it.
- If the problem cannot be corrected, a new initial calibration must be performed.

STATE NOTE: For Arizona compliance samples and other states a complete calibration curve for each single-component pesticide is analyzed and quantitated before the analysis of samples.

8.7.1 Method 608.3 requires that the calibration curve be verified at the beginning and end of each 24-hour shift by the analysis of a mid-level calibration standard. The calibration verification standard(s) must be obtained from a second source.

8.8 Second Source Calibration Verification (SSCV) - The initial calibration curve generated must be verified using a source that is different from the stock solutions used to prepare the calibration curve. This source can be a separate manufacturer or separate lot number from the same manufacturer, if available. Routinely, the second source verification is performed at the mid-range of the calibration curve, but the concentration may be altered to better reflect client/project needs. The calibration factor for the SSCV is calculated using the equation found in section 9.0 and the difference from the initial calibration curve is determined using the equation also found in that section.

9.0 DATA ANALYSIS AND CALCULATIONS

9.1 DDT Breakdown:

$$\%\ \text{Breakdown for DDT} = \frac{\text{Total DDT Degradatio n peak area(DDD + DDE)}}{\text{Total Peak Areas (DDT + DDD + DDE)}}$$

Endrin Breakdown:

$$\%\ \text{Breakdown for Endrin} = \frac{\text{Total Endrin Degradatio n peak area(Endri n Aldehyde + Endrin ketone)}}{\text{Total Peak Areas Endrin + Endrin Aldehyde + Endrin ketone)}}$$

9.2 The compounds detected are quantitated as follows (except for multi-component compounds):

$$\text{water mg/L} = \frac{\text{Area of Analyte}}{\text{Average CF}} \text{ X } \frac{\text{mL of extract}}{\text{mL of sample}} \text{ X Dilution Factor}$$

$$\text{soil mg/kg} = \frac{\text{Area of Analyte}}{\text{Average CF}} \text{ X } \frac{\text{mL of extract}}{\text{grams of sample}} \text{ X Dilution Factor}$$

9.3 Multi-component compounds:

$$\text{soil mg/kg} = \frac{\text{Total Peak Area}}{\text{Average CF}} \text{ X } \frac{\text{mL of extract}}{\text{grams of sample}} \text{ X Dilution Factor}$$

$$\text{water mg/L} = \frac{\text{Total Peak Area}}{\text{Average CF}} \text{ X } \frac{\text{mL of extract}}{\text{mL of sample}} \text{ X Dilution Factor}$$

9.3.1 Total Peak Area:

NOTE: The "Total Peak Area" may be replaced by the "Total of selected major peaks" when the background interference is high, see 9.6.2.

9.3.2 Selected Individual Peaks

$$\text{Sample Concentration} = \left(\frac{\text{Sum of Selected Peaks}}{\text{\# of Peaks Selected}} \right)$$

9.4 Internal Calibration Equations (Response Factors):

$$RF = \frac{[A_s][C_{is}]}{[A_{is}][C_s]}$$

where:
A_s = Peak area (or height) of the analyte or surrogate.
A_{is} = Peak area (or height) of the internal standard.
C_s = Concentration of the analyte or surrogate, in µg/L.
C_{is} = Concentration of the internal standard, in µg/L.

- Percent Relative Standard Deviation (%RSD)

$$\overline{RF} = \frac{\sum_{i=1}^{n} RF_i}{n} \qquad SD = \sqrt{\frac{\sum_{i=1}^{n} (RF_i - \overline{RF})^2}{n-1}} \qquad RSD = \frac{SD}{\overline{RF}} x100\%$$

where:
RSD = Relative standard deviation.
RF = Mean of 5 initial RFs for a compound.
SD = Standard deviation of average RFs for a compound.

- Concentration of an analyte in an extract using RF (on column):

$$X_s = \frac{(Conc._{IStd})(Area_{Analyte})}{(Average\ RF_{analyte})(Area_{IStd})}$$

where:
X_s = Calculated raw concentration of analyte (in ppb)

- Quantitation Report Multiplier"

$$M_a = \frac{(V_t)(D)}{(V_s)} \quad or \quad M_s = \frac{(V_t)(D)}{(W_s)}$$

where:
M_a = Quantitation Report Multiplier for Aqueous Samples
M_s = Quantitation Report Multiplier for Solid Samples
V_t = Total volume of concentrated extract (in mL)
D = Dilution factor. If no dilution, D=1. Always dimensionless
V_s = Volume of aqueous sample extracted (in mL)
W_s = Weight sample extracted (in grams)

- Sample concentration by volume (ug/L) for aqueous samples:

$$Concentration\ in\ \frac{\mu g}{L} = X_s * M_a$$

- Sample concentration by weight (ug/kg) for solid samples and non-aqueous liquids:

$$Concentration\ in\ \frac{\mu g}{kg} = \frac{(X_s)(M_s)}{(\%S)}$$

where:
%S = Percent solids expressed as a decimal

9.5 Percent Error (%Error)

$$\%Error = \frac{x_i - x'_i}{x_i} * 100$$

where:
x'_i = Measured amount of analyte at the calibration level *i*, in mass or concentration units
xi = *True amount of analyte at calibration level i, in mass or concentration units*

9.6 Relative Standard Error (%RSE) – As an alternative to using the average response factor when using Method 608.3, the quality of the calibration may be evaluated using the Relative Standard Error (RSE). The acceptance criterion for the RSE is the same as the acceptance criterion for Relative Standard Deviation (RSD), in the method. RSE is calculated as:

$$\%RSE = 100 \times \frac{\sum_{i=1}^{n}\left[\frac{x'_i - x_i}{x_i}\right]^2}{(n-p)}$$

where:
x'i = Calculated concentration at level i
xi = Actual concentration of the calibration level i
n = number of calibration points
p = Number of terms in the fitting equation (average = 1; linear = 2; quadratic = 3)

9.7 See the current Quality Assurance Manual for other equations associated with common calculations.

10.0 QUALITY CONTROL AND METHOD PERFORMANCE

10.1 All analysts must meet the qualifications specified in SOP #030205, *Technical Training and Personnel Qualifications* before approval to perform this method. Analysts must complete an initial demonstration of proficiency before being approved to perform this method. Continuing proficiency must be demonstrated using proficiency testing, laboratory control sample analysis and/or MDL studies. Method performance is assessed per analyst. Updated method performance records are filed and stored in a central location within the department.

10.1.1 Method 608.3 Demonstration of Capability (DOC) Requirements

10.1.1.1 For the DOC, a QC check sample concentrate containing each analyte of interest is prepared in a water miscible solvent using the solution in Section 7.15.1.

10.1.1.2 Prepare four QC check samples by adding an appropriate volume of the concentrate and of the surrogate(s) to each of four 1–L aliquots of reagent water. Swirl or stir to mix.

10.1.1.3 Extract and analyze the well-mixed QC check samples.

10.1.1.4 Calculate the average percent recovery ($\bar{X}$) and the standard deviation (s) of the percent recovery for each analyte using the four results.

10.1.1.5 For each analyte, compare s and $\bar{X}$ with the following acceptance criteria for precision and recovery. For analytes that are not listed, QC acceptance criteria must be developed by the laboratory.

Analyte	Limit for s (% SD)	Range for $\bar{X}$ (%)
Aldrin	25	54-130
Alpha-BHC	28	49-130
Beta-BHC	38	39-130
Delta-BHC	43	51-130
Gamma-BHC	29	43-130
Alpha-Chlordane	24	55-130
Gamma-Chlordane	24	55-130
4,4'-DDD	32	48-130
4,4'-DDE	30	54-130
4,4'-DDT	39	46-137
Dieldrin	42	58-130
Endosulfan I	25	57-141
Endosulfan II	63	22-171
Endosulfan sulfate	32	38-132
Endrin	42	51-130
Heptachlor	28	43-130
Heptachlor epoxide	22	57-132
Toxaphene	30	56-130

If s and $\bar{X}$ for all analytes of interest meet the acceptance criteria, system performance is acceptable and analysis of blanks and samples can begin. If any individual s exceeds the precision limit or any individual $\bar{X}$ falls outside the range for recovery, system performance is unacceptable for that analyte.

10.1.1.6 When one or more of the analytes tested fail at least one of the acceptance criteria, repeat the test for only the analytes that failed. If results for these analytes pass, system performance is acceptable and analysis of samples and blanks may proceed. If one or more of the analytes again fail, system performance is unacceptable for the analytes that failed the acceptance criteria. Correct the problem and repeat the test.

10.2 Use the designated Run log to record batch order and standards/reagents used during analysis. See SOP #030201, *Data Handling and Reporting*.

10.3 Batches:

Batches are defined as sets of 1 - 20 samples. Batch analysis must include the following: 1 method blank, 1 Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD), 1 Initial Calibration Verification (ICV), 1 Matrix Spike/Spike Duplicate (MS/MSD), 1 Continuing Calibration Verification (CCV) before client samples/every 12hrs/prior to every 20 samples, Method 608 requires a matrix spike at

the rate of 10%. All batch information must be maintained in the preparation documentation assigned to the department.

10.4 Initial Calibration – If the percent relative standard deviation (% RSD) of the calibration factors for each analyte is ≤20% for EPA 8081A/8081B/SM6630C and ≤10% for EPA method 608, the average calibration factor can be used for quantitation. If the %RSD exceeds the method defined acceptance criteria, a calibration curve using linear regression can be employed. The linear regression calibration curve must have a correlation factor of 0.990 (USACE requires 0.995) or greater using equal or inverse weighting. The origin may not be used as a point in the calibration curve and the curve must not be forced through zero.

10.4.1 Method 608.3 Requirements

10.4.1.1 External Standard Calibration

10.4.1.1.1 For multi-component analytes, choose a series of characteristic peaks for each analyte (3 to 5 for each Aroclor) and calculate individual calibration factors for each peak.

10.4.1.1.2 If the RSD is less than 20%, linearity through the origin can be assumed and the average CF can be used for calculations. Alternatively, the results can be used to fit a linear or quadratic regression of response. If used, the regression must be weighted inversely proportional to concentration. The coefficient of determination (R^2) of the weighted regression must be greater than 0.920. Alternatively, the relative standard error may be used as an acceptance criterion. As with the RSD, the RSE must be less than 20%. If an RSE less than 20% cannot be achieved for a quadratic regression, system performance is unacceptable and the system must be adjusted and re-calibrated.

10.4.1.2 Internal Standard Calibration

10.4.1.2.1 If the RSD is less than 15%, linearity through the origin can be assumed and the average RF can be used for calculations. Alternatively, the results can be used to prepare a calibration curve of response ratios, As/Ais, vs. concentration ratios, Cs/Cis, for the analyte. A minimum of six concentration levels is required for a nonlinear (e.g., quadratic) regression. If used, the regression must be weighted inversely proportional to concentration, and the coefficient of determination of the weighted regression must be greater than 0.920. Alternatively, the relative standard error (Reference 10) may be used as an

acceptance criterion. As with the RSD, the RSE must be less than 15%. If an RSE less than 15% cannot be achieved for a quadratic regression, system performance is unacceptable and the system must be adjusted and re-calibrated.

10.5 Method Blank - A method blank must be extracted and analyzed with each set of samples. The method blank must be carried through the same procedure as the samples and must not contain target analytes above the method detection limit.

10.6 Matrix Spike (MS) And Matrix Spike Duplicate (MSD) - must be extracted and analyzed with each batch of samples when sufficient sample volume is provided by the client

- Method 608 states that matrix spikes must be done at a rate of 10%.
- The spike and spike duplicate must meet current acceptance criteria. Attachment II represents QC acceptance criteria calculated from historical values for the method. The acceptance criteria are tighter than that of the 608 and 6630C methods.

STATE NOTE: For all samples analyzed from South Carolina, the MS/MSD recoveries must be within the most stringent limits comparing in-house derived recovery limits and those given in Table 3 of Method 608. The following are the current limits:

Parameter	Pace National Recovery Limits	Maximum MS/MSD %RPD
alpha-BHC	43 – 104%	36
Aldrin	42 – 113%	35
beta-BHC	35 – 120%	44
delta-BHC	32 – 113%	52
Dieldrin	45 – 109%	49
Endosulfan I	45 – 117%	28
Endosulfan II	40 – 125%	53
Endosulfan sulfate	37 – 126%	38
Endrin	36 – 135%	48
Endrin aldehyde	31 – 98%	
Endrin ketone	26 – 129%	
Heptachlor	34 – 111%	43
Heptachlor epoxide	44 – 107%	26
Lindane (gamma-BHC)	43 – 105%	39
Methoxychlor	10 – 147%	
p,p-DDD	47 – 117%	39
p,p-DDE	43 – 107%	35
p,p-DDT	25 – 136%	42
alpha-Chlordane	39 – 109%	35
gamma-Chlordane	27 – 131%	35
Toxaphene		41

10.6.1 Method 608.3 Requirements

10.6.1.1 The laboratory must, on an ongoing basis, spike at least 5% of the samples in duplicate from each discharge being monitored to assess accuracy (recovery and precision). If direction cannot be obtained from the data user, the laboratory must spike at least one sample in duplicate per extraction batch of up to 20 samples. Spiked sample results should be reported only to the data user whose sample was spiked, or as requested or required by a regulatory/control authority, or in a permit.

10.6.1.2 If, as in compliance monitoring, the concentration of a specific analyte will be checked against a regulatory concentration limit, the concentration of the spike should be at that limit; otherwise, the concentration of the spike should be one to five times higher than the background concentration, at or near the midpoint of the calibration range, or at the concentration in the LCS whichever concentration would be larger. When no information is available, the midpoint of the calibration may be used.

10.6.1.3 Compare the percent recoveries (P1 and P2) and the RPD for each analyte in the MS/MSD aliquots with the corresponding QC acceptance criteria for recovery (P) and RPD in the tables in Sections 10.6 and 10.7 of this SOP.

If any individual P falls outside the designated range for recovery in either aliquot, or the RPD limit is exceeded, the result for the analyte in the unspiked sample is suspect and may not be reported or used for permitting or regulatory compliance.

For analytes not listed in the table, QC acceptance criteria must be developed by the laboratory.

10.6.1.4 After analysis of a minimum of 20 MS/MSD samples for each target analyte and surrogate, and if the laboratory chooses to develop and apply optional in-house QC limits, the laboratory should calculate and apply the optional in-house QC limits for recovery and RPD of future MS/MSD samples. The in-house QC limits must be updated at least every two years and reestablished after any major change in the analytical instrumentation or process. At least 80% of the analytes tested in the MS/ MSD must have in-house QC acceptance criteria that are tighter than those in the table presented in Section 10.7 and the remaining analytes (those not included in the 80%) must meet the acceptance criteria in the able.

If an in-house QC limit for the RPD is greater than the limit in the table, then the limit in the table must be used. Similarly, if an in-house lower limit for recovery is below the lower limit in the table, then the lower

limit in the table must be used, and if an in-house upper limit for recovery is above the upper limit in the table, then the upper limit in the table must be used.

10.7 Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD) - must be extracted and analyzed with each batch of samples.

- The control must be within current acceptance criteria.

STATE NOTE: For all 8081 samples analyzed from South Carolina, the LCS/LCSD RPD must be <20% and recoveries must be within and the following limits in a water matrix:

Parameter	Pace National Recovery Limits	Method 608.3 Range for P
alpha-BHC	70 – 130%	37-140
Aldrin	70 – 122%	42-140
beta-BHC	70 – 130%	17-147
delta-BHC	70 – 130%	19-140
Dieldrin	70 – 130%	36-146
Endosulfan I	70 – 130%	45-153
Endosulfan II	70 – 130%	D-202
Endosulfan sulfate	70 – 130%	26-144
Endrin	70 – 130%	30-147
Endrin aldehyde	70 – 130%	
Endrin ketone	70 – 130%	
Heptachlor	70 – 111%	34-140
Heptachlor epoxide	70 – 130%	37-142
Lindane (gamma-BHC)	70 – 127%	32-140
Methoxychlor	70 – 130%	
p,p-DDD	70 – 130%	31-141
p,p-DDE	70 – 130%	30-145
p,p-DDT	70 – 130%	25-160
alpha-Chlordane	70 – 130%	45-140
gamma-Chlordane	70 – 130%	45-140
Toxaphene		41-140

10.7.1 Method 608.3 Requirements

10.7.1.1 Prepare the LCS by adding QC check sample concentrate to reagent water. Include all analytes of interest in the LCS. The volume of reagent water must be the same as the nominal volume used for the sample, the DOC, the blank, and the MS/MSD.

10.7.1.2 Analyze the LCS prior to analysis of samples in the extraction batch.

10.7.1.3 For each analyte, compare the percent recovery (P) with its corresponding QC acceptance criterion in the table in Section 10.7.

For analytes of interest not listed in the table, use the QC acceptance criteria developed for the MS/MSD or limits based on laboratory control charts. If the recoveries for all analytes of interest fall within the designated ranges, analysis of blanks and field samples may proceed.

10.8 Initial/Calibration Check Standard (ICV/CCV) - On days when a full calibration is not needed, an ICV/CCV must be analyzed prior to the analysis of any Method Blank, QC (LCS/LCSD/MS/MSD) and field samples, every 12 hours, and prior to every 20 samples. There is not an ending standard required for internal standard technique.

- The CF/RF must be within 15% of the initial calibration.

10.8.1 Method 608.3 Requirements

10.8.1.1 The working calibration curve, CF, or RF must be verified immediately after calibration and at the beginning and end of each 24-hour shift by the analysis of a midlevel calibration standard. The calibration verification standard(s) must be obtained from a second manufacturer or a manufacturer's batch prepared independently from the batch used for calibration. Alternatively, calibration verification may be performed after a set number of injections (e.g., every 20 injections), to include injection of extracts of field samples, QC samples, instrument blanks, etc. (i.e., it is based on the number of injections performed, not sample extracts). The time for the injections may not exceed 24 hours.

NOTE: The 24-hour shift begins after analysis of the combined QC standard (calibration verification) and ends 24 hours later. The ending calibration verification standard is run immediately after the last sample run during the 24-hour shift, so the beginning and ending calibration verifications are outside of the 24-hour shift. If calibration verification is based on the number of injections instead of time, then the ending verification standard for one group of injections may be used as the beginning verification for the next group of injections.

10.9 Endrin and DDT breakdown - must be determined before analysis begins and at the beginning of each 12 hour shift. The breakdown must not be greater than 15% for either compound. For Method 608.3, the percent breakdown must be less than 20%.

10.10 Confirmation - Any sample that shows a detectable concentration of any compound above the method detection limit must be confirmed on a second column or by GC/MS. The result from the primary column and the confirmation column should agree within 40% RPD. This also applies to results between MDL and RL.

For Method 608.3, if the %D of the two results is less than 50% (e.g., a factor of 2), then the pesticide is present. Note: Laboratories may employ metrics less than 50% for this comparison, including those specified in other analytical methods for these pesticides (e.g., CLP or SW–846).

10.11 Surrogate Recovery - Calculate the surrogate recovery on all samples, method blanks, and spikes (MS/MSD/LCS/LCSD). Determine if the recovery is within the acceptance criteria.

10.12 Internal Standards (internal calibration model) – For method 8081: The internal standard area counts must be monitored for all ICVs/CCVs. ISTDs must recover within 50-150% of the average of all calibration points. For Method 608.3, the ISTD should be verified within 50-200% of the mid-level ICAL standard.

The internal standard responses and retention times in the check calibration 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 the last calibration verification, the chromatographic system must be inspected for malfunctions and corrections must be made, as required.

Internal standards must be monitored for each sample. For Method 8081; ISTDs in samples must meet the ±50% criteria when compared to the average ISTDs of the current calibration. For Method 608.3, the ISTD should be verified within 50-200% of the daily verification standard.

10.13 Reporting Limit Verification - The reporting limit verification standard is injected as needed and must recover within ±50%, except as noted. This standard may also be referred to as the MRL on the instrument

STATE NOTE: For all samples analyzed from Minnesota, the reporting limit must be verified at least monthly, with each new initial calibration, or when there has been significant change to the instrument (column replacement, cleaning source, etc.) whichever is more frequent. The reporting limit verification can be performed by either re-injecting the low standard or by re-processing the low standard that was analyzed in the calibration curve. The reporting limit verification (RLV) must recovery within ±40% of the expected concentration. If this criterion is not met, the RLV may be re-analyzed once, instrument maintenance can be performed, a higher concentration standard can be injected, or a new calibration curve must be generated. If a higher concentration standard is utilized, the reporting limit must be raised to the higher level verified.

10.14 QC Acceptance Criteria – See the LIMS (criteria subject to change based on historical data)

10.15 Any sample analyte responses that are beyond the linear range of the calibration curve must be diluted and re-analyzed.

10.16 Manual Integration – All manual integrations must comply with the requirements found in SOP #030215, *Manual Integration Procedure*. Before and after integrations must be available for review by the secondary data reviewer.

10.17 Analyte Retention Time – Establish retention time windows for each compound in the calibration mix. To determine the retention time window, make three injections of a

standard containing the compounds of interest over a 72 hour period. The retention time window shall be defined as plus or minus 3 standard deviations of the absolute retention time for each standard. The typical estimated retention times are set at +/- 0.05 minutes. For multi-component standards such as PCB's, the analyst should use pattern recognition because of retention time shifts. Retention time windows should be recalculated whenever a new column is installed or major instrument maintenance is performed.

Routine maintenance requires analysts to assess retention time windows daily. The calibration standard is used to set the retention time window for the analytical batch. Default windows of ±0.05 minutes are set for each compound in the calibration standard. Where compounds closely elute, the analyst must determine if the default values are appropriate. For multi-component standards such as Chlordane and Toxaphene, the analyst uses pattern recognition due to possible retention time shifts. When internal standard calibration is used, the retention times of the internal standards and the area responses of the internal standards must be checked for each analysis. Retention time shifts of >30 sec from the retention of the most recent calibration standard and/or changes in the internal standard area of more than 50-150% are cause for concern and must be investigated.

10.18 Second Source Calibration Verification (SSCV) - A second source calibration verification standard (SSCV) is analyzed after each calibration and must meet criteria of ±20% of the expected concentration for each analyte for 8081. Method 608.3 utilizes CCV limits for evaluation.

10.19 For sample analyzed per the requirements of Method 8000D, the LLOQ (see Section 1.8.2) must be verified at least annually, and whenever significant changes are made to the preparation and/or analytical procedure, to demonstrate quantitation capability at lower analyte concentration levels

10.19.1 The LLOQ verification (to be performed after the initial calibration) is prepared by spiking a clean control material with the analyte(s) of interest at 0.5-2 times the LLOQ concentration level(s).

10.19.2 The LLOQ check is carried through the same preparation and analytical procedures as environmental samples and other QC samples.

10.19.3 It is recommended to analyze the LLOQ verification on every instrument where data is reported; however, at a minimum, the lab must rotate the verification among similar analytical instruments such that all are included within 3 years.

10.19.4 Recovery of target analytes in the LLOQ verification must be within established in-house limits or within other such project-specific acceptance limits to demonstrate acceptable method performance at the LLOQ. Until the laboratory has sufficient data to determine acceptance limits, the LCS criteria ± 20% (i.e., lower limit minus 20% and upper limit plus 20%) may be used for the LLOQ acceptance criteria.

10.20 For corrective actions, see section 11.0.

11.0 DATA VALIDATION AND CORRECTIVE ACTION

11.1 All data must undergo a primary review by the analyst. The analyst must check the performance of the initial calibration, mid-point check standard, and continuing calibrations to ensure that they meet the criteria of the method. The analyst must review any sample that has quantifiable compounds and make sure that they have been confirmed. The analyst must also verify that reported results are derived from quantitation between the RL and the highest standard of the initial calibration curve. All calculations must be checked (any dilutions, %solids, etc.). Data must be checked for the presence or absence of appropriate flags. Comments must be noted when data is flagged.

11.2 All data must undergo a second analyst review. The analyst checking the data must check the performance of the initial calibration, mid-point check standard, and continuing calibrations to ensure that they meet the criteria of the method.

11.2.1 The analyst should must review any sample that has quantifiable compounds and make sure that they have been confirmed.

11.2.2 All calculations must be checked.

11.2.3 All surrogate recoveries must be checked to ensure that they are within QC acceptance criteria or that corrective action has occurred.

11.2.4 Blanks must be free of all interfering peaks.

11.2.5 Quality control criteria must be checked for the LCS, LCSD, MS, and MSD.

11.2.6 Data must be checked to determine the need for appropriate flags. Comments are noted when results are flagged.

11.2.7 The reviewer must verify all reported results are derived from analytical results that are above the reporting limit and below the highest standard of the initial calibration curve.

11.2.8 All manual integrations must be available for review per SOP #030215, *Manual Integration Procedure*.

11.2.9 All multipliers/dilutions must be verified on the quant report and must agree with the information provided on the injection log.

11.2.10 Retention times of the samples must be compared to that of the calibration standard. Random spot checking of 10% of the data should be sufficient.

11.2.11 Verify linear regression by reviewing the calibration curve printout.

11.2.12 See SOP #030201, *Data Handling and Reporting* and SOP #030227, *Data Review*.

11.3 Initial Calibration – If the calibration curve fit does not meet method requirements when using %RSD, then linear regression can be used when the minimum correlation coefficient is achieved. The deletion of the highest point is acceptable when necessary, with the analyst noting that the high end of the calibration has been lowered. The deletion of the lowest calibration point is acceptable, when necessary, provided that the analyst notes the deletion on the injection log and raises the reporting limit, if necessary, for that compound. The method blank is also not included as a point in the calibration curve for this method. If none of the mentioned factors produce an acceptable calibration curve, then the entire calibration curve must be re-analyzed. Instrument maintenance (cleaning/repairing detector, column clipping/replacement, injector port cleaning/changing liner, etc.) may be required prior to calibration standard reanalysis.

Method 8000D: To determine calibration function acceptability, refit the initial calibration data back to the calibration model and calculate %Error (see Section 9.4). Percent error between the calculated and expected amounts of an analyte must be ≤30% for all standards. For some data uses, ≤50% may be acceptable for the lowest calibration point.

11..4 Method Blank - If the method blank shows any detectable amount greater than the RL, the laboratory performance is assumed to be out of control and the problem must be corrected. Corrective actions include: re-analysis once or re-pour fresh extract if available.

General guidelines for qualifying sample results with regard to method blank quality are as follows:

- If the method blank concentration is less than the MDL and sample results are greater than the RL, then no qualification is required.
- No qualification is necessary when an analyte is detected in the method blank but not in the associated samples.
- If the concentration in a sample is more than ten times the concentration in the method blank, then no qualification is required.
- If the method blank concentration is greater than the MDL but less than the RL and sample results are greater than the MDL, then qualify associated sample results to indicate that analyte was detected in the method blank.
- If the method blank concentration is greater than the RL, further corrective action and qualification is required. An analyst should consult their supervisor for further instruction.

Method 8000D: When samples that are extracted together are analyzed on separate instruments or in separate analytical shifts, the method blank associated with those samples (e.g., extracted with the samples) must be analyzed on at least one of those instruments. A solvent blank must be analyzed on all other instruments on which the set of samples was analyzed to demonstrate the instrument is not contributing contaminants to the samples. At least one method blank or instrument blank must be analyzed on every instrument after calibration standard(s) and prior to the analysis of any samples.

When sample extracts are subjected to cleanup procedures, the associated method blank must also be subjected to the same cleanup procedures.

Results of the method blank should be less than the LLOQ for the analyte or less than the level of acceptable blank contamination specified in the approved QAPP or other appropriate systematic planning document. Blanks are generally considered to be acceptable if target analyte concentrations are less than one-half the LLOQ or are less than project-specific requirements.

When new reagents or chemicals are received, the lab should monitor the blanks associated with samples for any signs of contamination. It is not necessary to test every new batch of reagents or chemicals prior to sample preparation if the source shows no prior problems. However, if reagents are changed during a preparation batch, separate blanks need to be prepared for each set of reagents.

11.5 Matrix Spike (MS) And Matrix Spike Duplicate (MSD) - If the spike and spike duplicate do not meet current acceptance criteria, the sample must be flagged as possible matrix interference.

11.5.1 Spike failure that result in the use of a "J" flag followed by the appropriate number, which further explains the failure concerning high or low bias

11.5.2 Method 8000D: If, as in compliance monitoring, the concentration of a specific analyte in the sample is being checked against a regulatory concentration limit or action level, the spike should be at or below the limit, or 1 - 5 times the background concentration (if historical data are available), whichever concentration is higher. If historical data are not available, a background sample of the same matrix from the site may be submitted for matrix spiking purposes to ensure that high concentrations of target analytes and/or interferences will not prevent calculation of recoveries. If the background sample concentration is very low or non-detect, a spike of greater than 5 times the background concentration is still acceptable. To assess data precision with duplicate analyses, it is preferable to use a low concentration field sample to prepare a MS/MSD for organic analyses. This spiking procedure will be performed when project-specific instructions are received from the client.

If the concentration of a specific analyte in a sample is not being checked against a limit specific to that analyte, then the analyst may spike the matrix spike or MS/MSD sample(s) at the same concentration as the reference sample at 20 times the estimated LLOQ in the matrix of interest, or at a concentration near the middle of the calibration range. It is suggested that a background sample of the same matrix from the site be submitted as a sample for matrix spiking purposes. NOTE: Preparing the spiking solution from the same source as the calibration standards helps minimize additional variability due to differences between sources. Typically, spiking concentrations are near the middle of the calibration range.

To develop precision and bias data for the spiked compounds, the analyst has two choices: analyze the original sample, and an MS/MSD pair; or analyze the original sample, a duplicate sample, and one spiked sample. If samples are not expected to contain the target analytes of concern, then the laboratory may use a MS/MSD pair. If samples are expected to contain the target analytes of concern, then the laboratory may use one matrix spike and a duplicate analysis of an unspiked field sample as an alternative to the MS/MSD pair.

The laboratory should use 70 - 130% as interim acceptance criteria for recoveries of spiked analytes, until in-house LCS limits are developed. Where in-house limits have been developed for matrix spike percent recoveries, the LCS results should be similar to or tighter than those limits, as the LCS is prepared in a clean matrix.

11.6 Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD) - If the control does not perform within current acceptance criteria, the laboratory performance is assumed to be out of control and the problem must be corrected. Corrective action can include re-analysis, if instrument malfunction is suspected, or re-preparation and re-analysis of the entire batch, if the failure is suspected as either extraction or sample related.

STATE NOTE: For all 8081 samples analyzed from South Carolina, the LCS/LCSD recovery must be evaluated within the limits given in Section 10.7 for both soil and water matrices with an RPD of <20%.

11.7 Initial/Calibration Check Standard (ICV/CCV) - When the initial or continuing calibration verification is out of the acceptance criteria and analysis of a second consecutive (immediate) calibration verification fails to produce results within acceptance criteria, corrective actions shall be performed. The laboratory shall demonstrate acceptable performance after the final round of corrective action with two consecutive calibration verifications or a new initial instrument calibration shall be performed.

11.8 Endrin and DDT breakdown - Any breakdown check that exceeds the acceptance criteria (section 10.9) must be followed by corrective action. The breakdown check can be re-injected once. If the failure persists, additional corrective actions include: instrument maintenance, injection port cleaning/deactivation, and column clipping. A passing breakdown must be achieved prior to the analysis of any field samples and every 12hrs.

11.9 Confirmation - If the relative percent difference of the results exceeds 40% and one result is significantly higher (e.g., >40%), check the chromatograms to see if an obviously overlapping peak is causing an erroneously high result. If no overlapping peaks are noted, examine the baseline parameters established by the instrument data system (or operator) during peak integration. If re-integration is necessary, manual integration procedures must be followed and documented by printing a before and after shot of the chromatograms. When confirmation is not within the 40% criteria (50% for Method 608.3), analyst judgment weighs heavily in the interpretation of the data and the appropriate action. A conservative approach is the preferred course of action to protect the environment and public health and unless obvious interferent is present, the higher

result is reported. Both columns must be calibrated and both columns must meet acceptance criteria. For a particular sample, if criteria are met on only one column and target analytes are not detected, then data may be reported; otherwise, the sample must be re-analyzed or qualified.

11.10 Surrogates - If the recovery is not within current acceptance criteria, confirm that there are no errors in the calculations, surrogate solutions and standards. Check the instrument performance. Examine the chromatograms for interfering peaks and integrated areas. Re-calculate the data and/or re-analyze the extract if any of the above checks reveal a problem. Re-extract and re-analyze the sample if none of the above is a problem or flag the data "J1" (surrogate high) or “J2” (surrogate low).

11.11 Internal Standards - If any internal standard response is beyond the acceptable recovery in the ICV/CCV, corrective action is required. Corrective action can take to form of checking the original calculations to ensure accuracy, re-analysis of the CCV to verify initial results, instrument maintenance (i.e. column clipping or changing, inlet liner cleaning/replacement, etc.) or re-calibration.

If the retention time for any internal standard changes by more than 30 seconds from the last calibration verification, the chromatographic system must be inspected for malfunctions and corrections must be made, as required. When corrections are made, re-analysis of the CCV or a complete re-calibration is necessary, depending on the impact of the correction on the analytical system.

Internal standards in the field samples must be monitored. If ISTD recovery does not meet the acceptance criteria, correction action is required. Possible corrective actions include: if instrument malfunction is suspected, or re-preparation and re-analysis, if the failure is suspected as either extraction or sample related. If the sample has an obvious matrix interferent and the internal standard recovery is greater than 150%, the sample can be diluted (if acceptable reporting limits can be achieved) to minimize the interference or the sample must be re-extracted and re-analyzed using an external calibration model.

11.12 Holding Time - If the samples are out of holding time, the data can be flagged with a "Q/T8" to show that the sample has exceeded the holding time. If this happens, the Technical Service Representative (TSR) must be notified of the situation so that the client can be contacted. It may be necessary to obtain a new sample from the client. See section 4.5 for additional information.

11.13 Marginal Exceedances - The laboratory control sample, laboratory control sample duplicate, matrix spike and matrix spike duplicate recoveries must be evaluated against the acceptance criteria listed in this procedure. The LCS/LCSD and MS/MSD are spiked with the same list of compounds for which the instrument is calibrated. Due to the large number of compounds analyzed using these methods, it is statistically likely that accuracy and precision failures will occur.

LCS or LCSD samples that do not pass the acceptable QC acceptance criteria must be re-analyzed. LCS/LCSD failures must meet the marginal exceedance criteria below.

Allowable marginal exceedance outliers are based on the number of compounds being analyzed and must be random events.

Upper and lower marginal exceedance (ME) limits are established by ± 4 times the standard deviation of historical accuracy data.

Number of allowable marginal exceedances:

90+ analytes, 5 analytes allowed in the ME limit
71 – 90 analytes, 4 analytes allowed in the ME limit.
51 – 70 analytes, 3 analytes allowed in the ME limit.
31 – 50 analytes, 2 analytes allowed in the ME limit.
11 – 30 analytes, 1 analyte allowed in the ME limit.
< 11 analytes, no analyte allowed in the ME limit.

11.14 SSCV – If the acceptance criteria are not met, a new calibration curve or new SSCV must be prepared and analyzed, depending on the source of the discrepancy. An SSCV must pass the acceptance criteria prior to the analysis of field samples.

11.15 Data that does not meet acceptable QC criteria may be acceptable for use in certain circumstances.

11.15.1 If a method blank contains an amount of target analyte, but all samples are non-detected, the data may be reported with a “B3” flag. If a method blank contains an amount of target analyte, but the samples contain analyte at a level that is 10 times the level present in the method blanks, the data may be reported with a “B” flag.

11.15.2 If the MS/MSD fails in an initial analysis and again upon re-analysis, the data is released with an appropriate qualifier as the failure is accepted as matrix related.

11.15.3 If a calibration verification standard is above the acceptable QC criteria and all samples being reported are below the reporting limit, the data is acceptable based on a high calibration bias with undetectable levels in the field samples. Any positive samples require re-analysis.

11.15.4 If the surrogate exhibits high recovery in the field samples and the target analytes in the field samples are below the reporting limit, the data may be released with a J1 qualifier indicating the high bias. If the QC samples (LCS, LCSD, MS, MSD) exhibit a high bias in the surrogate and the field samples are below the reporting limit for the target analyte, the data may be released with a J1 qualifier. Any failure of target analyte quantitation above 200% is suspect and should be re-extracted for confirmation if matrix impact is not apparent, or sufficient amount of sample and holding time remains.

11.15.5 If the target analyte spiked in the quality control samples (LCS, LCSD, MS, MSD) exhibits high recovery and the target analytes in the field samples are below the reporting limit, the data may be released with a J4 qualifier indicating the high bias.

11.15.6 If the target analyte spiked into the QC pair (LCS/LCSD, MS/MSD) exhibit acceptable recoveries, but high calculated RPD values for precision, the target analytes in the field sample are flagged with a J3 for the precision beyond acceptable quality control limits.

11.15.7 Sample results can be qualified and possible bias is narrated per the SOP #030201, *Data Handling*.

11.15.7.1 For samples analyzed per the requirements of Method 8000D, reported concentrations of target analytes between the MDL and the LLOQ must be qualified as estimated.

12.0 POLLUTION PREVENTION AND WASTE MANAGEMENT

12.1 The EPA requires that laboratory waste management practice to be conducted consistent with all applicable federal and state laws and regulations. Excess reagents, samples and method process wastes must be characterized and disposed of in an acceptable manner. See *Waste Management Plan*.

12.2 See SOP #030302, Environmental Sustainability & *Pollution Prevention*.

13.0 METHOD MODIFICATIONS/CLARIFICATIONS

13.1 Modifications to this method are noted in the body of the text as notes. Compliance analyses performed in conjunction with specific state and/or method requirements must be performed as noted.

13.2 Adjustments to the concentrations of standards/spiking solutions, standards providers, and quality control are subject to change to better meet client/project/regulatory needs or to improve laboratory method performance.

13.3 The reduction of the size of the field sample used in this procedure is performed in accordance with section 7.1 of the published EPA 3510C method. The reduction in volume extracted along with either sufficient sensitivity of detection and/or large volume injection technique (>5uL) on the GC allows for acceptable detection limits in line with those obtained using a 1L extraction. Complete method validation is performed for each method prior to utilizing the reduced volume extraction. This validation is maintained by the Regulatory Affairs Department and is regularly verified using LCS/LCSD, MDL studies and DOCs.

STATE NOTE: Pace National is not currently certified to perform the reduced volume extraction method using EPA 3510C in conjunction with South Carolina samples.

13.4 Method 608.3 allowed method modifications:

13.4.1 If the underlying chemistry and determinative technique in a modified method are essentially the same as an approved Part 136 method, then the modified method is an equivalent and acceptable alternative to the approved method provided the requirements of this section are met.

13.4.2 Those who develop or use a modification to an approved (Part 136) method must document that the performance of the modified method, in the matrix to which the modified method will be applied, is equivalent to the performance of the approved method. If such a demonstration cannot be made and documented, then the modified method is not an acceptable alternative to the approved method.

13.4.3 Supporting documentation must, if applicable, include the routine initial demonstration of capability and ongoing QC including determination of precision and accuracy, detection limits, and matrix spike recoveries.

13.4.3.1 Initial demonstration of capability typically includes analysis of four replicates of a mid-level standard and a method detection limit study.

13.4.3.2 Ongoing quality control typically includes method blanks, mid-level laboratory control samples, and matrix spikes (QC is as specified in the method).

13.4.3.3 The method is considered equivalent if the quality control requirements in the reference method are achieved.

13.4.3.3.1 Where the laboratory is using a vendor-supplied method, it is the QC criteria in the reference method, not the vendor's method, that must be met to show equivalency.

13.4.3.3.2 Where a sample preparation step is required (i.e., digestion, distillation), QC tests are to be run using standards treated in the same way as the samples.

13.4.3.4 The method user's Standard Operating Procedure (SOP) must clearly document the modifications made to the reference method.

13.4.4 If the method user is uncertain whether a method modification is allowed, the Regional ATP Coordinator or Director should be contacted for approval prior to implementing the modification

13.4.5 The method user should also complete necessary performance checks to verify that acceptable performance is achieved with the method modification prior to analyses of compliance samples.

13.4.6 The modified method must meet or exceed performance of the approved method(s) for the analyte(s) of interest, as documented by meeting the initial and ongoing quality control requirements in the method.

13.4.7 The permittee must notify their permitting authority of the intent to use a modified method. Such notification should be of the form "Method xxx has been modified within the flexibility allowed in 40 CFR 136.6." The permittee may indicate the specific paragraph of § 136.6 allowing the method modification. Specific details of the modification need not be provided, but must be documented in the

Standard Operating Procedure (SOP) and maintained by the analytical laboratory that performs the analysis.

14.0 REFERENCES

14.1 *Organochlorine Pesticides by Gas Chromatography*, SW-846 Method 8081A, Revision 1, December 1996.

14.2 *Organochlorine Pesticides by Gas Chromatography*, SW-846 Method 8081B, Revision 2, February 2007.

14.3 *Determinative Chromatographic Separations*, SW-846 Method 8000B, Revision 2, December 1996.

14.4 *Determinative Chromatographic Separations*, SW-846 Method 8000C, Revision 3, March 2003.

14.5 *Determinative Chromatographic Separations*, SW-846 Method 8000D, Revision 4, July 2014.

14.6 *Organochlorine Pesticides and PCBs*, EPA Method 608, 40 CFR Part 136, Appendix A.

14.7 *Organochlorine Pesticides by Liquid-Liquid Extraction Gas Chromatographic Method II*, SM 6630C, 20th edition.

14.8 *Organochlorine Pesticides by Liquid-Liquid Extraction Gas Chromatographic Method II*, SM 6630C, 2000.

14.9 *Organochlorine Pesticides by Liquid-Liquid Extraction Gas Chromatographic Method II*, SM 6630C, 2007.

14.10 *Organochlorine Pesticides and PCBs by GC/HSD*, EPA Method 608.3, Federal Register, Volume 82, Number 165, August 28, 2017.

14.11 EPA Method 608 ATP 3M0222, Federal Register, Volume 60, Number 148, August 2, 1995.

14.12 40 Code of Federal Regulations §136.6(b)(4)(j).

Standard Operating Procedure

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TITLE: **PESTICIDES BY GAS CHROMATOGRAPHY (EPA METHODS 608, 608.3, 8081A, 8081B, SM 6630C)**

Attachment I: Revision History

Current Version:

Version	Date	Description of Revisions
21	7/17/2018	Technical and quality review and update. Replaced logo and watermark. Added Method 608.3 requirements. Revised Sections 1.0, 1.1, 1.2, 1.2.1, 2.1, 3.1, 4.4, 5.3, 5.4, 5.5, 7.13, 8.2.2, 8.5, 8.6, 8.7, 9.6, 10.6, 10.7, 10.9, 10.10, 10.12, 10.16, 10.17, 10.18, 11.2.12, 11.5, 11.6, 11.9, 11.10, 11.12, 11.13, 11.15.1, 11.15.7, 12.1, and 13.1. Added Sections 4.6, 4.7, 5.6, 7.14, 7.15, 8.2.1.1, 8.2.5, 8.7.1, 9.7, 10.1.1, 10.4.1, 10.6.1, 10.7.1, 10.8.1, 13.4, 14.10, 14.11, and 14.12.

Superseded Versions:

This document supersedes the following:

Version	Date	Description of Revisions
0	8/23/94	Origination
1	7/12/95	
2	2/1/99	
3	2/11/00	
4	8/21/00	
5	10/16/01	
6	9/19/03	
7	12/14/04	
8	2/7/05	
9	2/17/09	Technical and Quality Review and update. Update to include internal standard use. Inclusion of sections 8.2.7, 9.3, State notes; corrective actions in sections 11.3 & 11.5. Ohio VAP approved 2/17/09.
10	7/28/11	Technical and Quality Review and update. Revised sections 1.1, 2.1 through 2.3, 5.2, 6.1, 7.1, 7.4, 7.5, 7.7, 7.9 through 7.11, 8.4, 8.6, 8.8, 9.4, 9.7 through 9.9, 11.8, and Attachment II; Added sections 2.20 through 2.23, 10.12, 10.14, 10.15, 11.12, 12.1, 13.2, and state notes following sections 8.4, 10.12, 10.13, 11.12.
11	2/22/12	Technical and Quality Review and update. Revised sections 2.1, 4.3, 4.4, 6.1, 7.8, 7.11, 7.12, 7.13, 8.1, 8.2, 8.4, 8.6, 8.7, and 14.6; Added sections 1.2.1, 2.25, 2.26, and 13.3.
12	6/12/12	Technical and Quality Review and update. Revised sections 1.1, 1.2, 2.1, 7.12, 7.13, 8.2, 8.5, 8.6, 8.8, 9.4, 9.7, 9.8, 9.9, 10.4, 10.7, 10.10, 11.1, 11.2, 11.3, 11.5, 11.9, and 11.12; Added sections 4.5, 8.9, 9.10, 10.12, 10.14 through 10.17 and 11.14 through 11.15.

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TITLE: PESTICIDES BY GAS CHROMATOGRAPHY (EPA METHODS 608, 608.3, 8081A, 8081B, SM 6630C)

Version	Date	Description of Revisions
13	12/19/13	Technical and Quality Review and update. Revised Attachment II and sections 6.1, 7.1, 7.8, 7.13, 8.1, 8.2.3, 8.4, 8.7, 10.3, 10.4, 10.5, 10.7, 10.11, 10.12, 10.16, and 11.15.4; Added state note in section 1.0 and sections 14.7 and 14.8.
14	12/8/14	Technical and Quality Review and update. Revised Attachment II and sections 2.1, 7.8, 7.11 7.13, and 8.8. Removed Section 8.5
15	11/3/2015	Technical and quality review and update. Header and signature block reformatting. Revised Sections 1.2.1, 7.11, 7.12, 7.13, 8.2, 8.2.1, 8.4, 8.5, 8.6, 8.7, 10.3, 10.5, 10.5, 10.6, 10.7, 10.8, 10.11, 10.13, 10.14, 10.17, 11.2.8, 11.4, 11.5, 11.6, 11.10, 11.12, 10.15.2, 10.15.3, 10.15.4, 13.3, and Attachment II. Removed Section 8.5 and 11.2.8.
16	8/16/2016	Technical and quality review and update. Revised header and Sections 1.0, 1.2.1, 2.2, 4.5, 7.1, 8.1, 8.6, 10.7, 11.7, 11.13, 11.14, 12.2, and Attachment II Table 2. Deleted Sections 2.3 through 2.26, 9.2 through 9.4, 9.8, and 9.9.
17	10/24/16	Technical and quality review and update to satisfy the requirements of SC DHEC (see correspondence dated 6/24/16). Revised Sections 10.14, 11.2.7, 11.3, 11.4, 14.1, 14.3, 14.6, and 14.7. Added Sections 1.2.2, 2.2, 9.4, 10.19 and all subsections, 11.5.2, 11.15.7.1, 14.4, 14.5, 14.8, and 14.9. Deleted Sections 14.5 and 14.6.
18	6/19/2017	Technical and quality review and update. Revised Sections 1.2, 3.1, 7.13, 9.4, 9.5, 9.6, 10.6, and 10.7.
19	7/10/2017	Technical and quality review and update. Revised Sections 2.1, 2.3, 2.4, 9.4, 13.3
20	11/29/2017	Update in response to A2LA audit finding CAR2872. Revised Sections 8.7, 10.3, 10.8, 11.9, and Attachment II Table 5.

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Attachment II: DOD Requirements

1.0 Equipment/Instrument Maintenance

Instrument maintenance must be performed routinely to optimize instrument performance and improve chromatography. Commonly performed maintenance includes cleaning/repairing detector, column clipping/replacement, injector port cleaning/changing liner, etc. A new calibration curve must be analyzed following any major maintenance performed on the analytical system.

2.0 Computer Hardware and Software

Software name and version: HP Chemstation G1701BA Version C.00.00 or equivalent

3.0 Troubleshooting

Table 1. GC Troubleshooting Guide

Problem	Cause	Treatment
No Peaks	Syringe clogged	Clean or replace syringe
	Detector/Software/Computer failure	Check cables. Restart computer.
	Column Leaks	Use new ferrules.
	Broken Column	If at ends, clip column. If in the middle or multiple sites, replace column.
Peaks too Small	Split too high	Reduce split
	Column connection leaks	Check column installation. Search for leaks. Replace ferrules.
	Injector temperature too low	Check temperature program. Increase injector temperature.
	Dirty ECD	Clean ECD.
Retention Times Change	Gas flow too low or too high	Replace septum. Check gas regulator.
	Oven temperature unstable	Check temperature program. Check temperature with external thermometer.
	Column blocked	Compare flow at column entrance to outlet. Replace column.
Constantly Rising Baseline	Leak at column entrance or injection septum.	Check column installation; search for leaks; replace ferrules.
	Injector contaminated.	Make a run at lower injector temperature; if the baseline improves, replace liner, use low bleed or high temperature septa.
	Column contaminated.	Cut two turns from column entrance; rinse column with solvent (only chemically bonded phases); otherwise replace column or use guard column.
	Detector contaminated.	Clean detector.
	Increase of temperature too fast.	Decrease temperature gradient and end temperature.

Table 1. GC Troubleshooting Guide

Problem	Cause	Treatment
	Poor gas quality.	Use gas grades recommended for GC; for longer supply lines from gas source to GC use gas purification cartridges directly connected to the GC.
Increasing Baseline at High Temperatures	Decomposition of the stationary phase.	Check for leaks; matrix check for compatibility with the column.
	Column contaminated.	Cut two turns from column entrance; rinse column with solvent (only chemically bonded phases); otherwise replace column or use guard column.
	Increase of temperature too fast / end temperature too high.	Decrease temperature gradient and end temperature.
	Column not properly conditioned.	Condition column according to manufacturers' instructions (while column is not connected to the detector).
	Detector contaminated	Clean detector according to manufacturers' instructions.
	Poor gas quality.	Use gas grades recommended for GC; for longer supply lines from gas source to GC use gas purification cartridges directly connected to the GC.
Plateaus at Certain Temperatures	Steps in temperature program too drastic.	Avoid very short and strong heating periods.
Fronting	Column overload.	Decrease injection volume; dilute sample.
	Sample vaporizes too slowly, not evenly or condenses.	Increase injector temperature (consider max. temperature limits of the column).
	Analytes coelute.	Change temperature program or use column with different selectivity.
	Sample decomposes.	Check temperature program, oven temperature (external thermometer); if analytes are not temperature-stable, reduce injector temperature; replace liner.
	Column absorbs or decomposes analytes.	Check capillary ends; check intact deactivation using the test mixture; for poor results shorten both column ends by about 10 cm; or replace column; if column test does not show any defects: a) use a column with thicker film b) use phase with better deactivation c) use column with special selectivity.

Table 1. GC Troubleshooting Guide

Problem	Cause	Treatment
Tailing	Sample vaporizes too slowly, not evenly or condenses.	Increase injector temperature (consider max. temperature limits of the column).
	System leaks.	Check column installation; search for leaks; replace ferrules.
	Analytes coelute.	Change temperature program or use column with different selectivity.
	Sample decomposes.	Check temperature program, oven temperature (external thermometer); if analytes are not temperature-stable, reduce injector temperature; replace liner by a deactivated one.
	Column absorbs or decomposes analytes.	Check capillary ends; check intact deactivation using the test mixture; for poor results shorten both column ends by about 10 cm; or replace column; if column test does not show any defects: a) use a column with thicker film b) use phase with better deactivation c) use column with special selectivity.
	Split rate too low.	Increase split rate.
	Column overload.	Decrease injection volume; dilute sample.
Split Peaks	Solvent and column not compatible.	Change solvent or use guard column.
	Solvent mixtures with large differences in boiling point and polarity.	Use just one solvent.
	Sample decomposes.	Check temperature program, oven temperature (external thermometer); if analytes are not temperature-stable, reduce injector temperature; replace liner by a deactivated one.
	Analytes coelute.	Modify temperature program or use longer column; possibly change column polarity.
	Detector overload.	Inject less; control make-up flow.

4.0 Other Requirements

4.1 All hardcopy laboratory notebooks must be reviewed by the Supervisor, or their designee, on a monthly basis.

4.2 If not self-explanatory (e.g., a typo or transposed number), corrections to technical and quality records shall also include a justification for the change.

4.3 A person performing a manual integration must sign and date each manually integrated chromatogram and record the rationale for performing manual integration. Electronic signatures are acceptable.

4.4 The results of calibration and verification of support equipment must be within the specifications required of the application for which this equipment is used or the equipment must be removed from service until repaired. Calibration and verification records, including those of established correction factors, must be maintained. In the absence of method-specific requirements, the minimum requirements are as follows:

Table 2. Support Equipment Checks

Performance Check	Frequency	Acceptance Criteria
Balance calibration check [Using two standard weights that bracket the expected mass]	Daily prior to use	Top-loading balance: ±2% or ±0.02g, whichever is greater Analytical balance: ±0.1% or ±0.5 mg, whichever is greater
Verification of standard mass [Using weights traceable to the International System of Units (SI) through a NMI	Every 5 years	Certificate of Calibration from ISO/IEC 17025 accredited calibration laboratory
Monitoring of refrigerator/freezer temperatures	Daily (i.e. 7 days per week) [use MIN/MAX thermometers or data loggers equipped with notification of out of control event capabilities if personnel not available to record daily]	Refrigerators: 0˚C to 6˚C Freezers: ≤-10˚C
Thermometer verification check [Using a thermometer traceable to the SI through an NMI] [Performed at two temperatures that bracket the target temperature(s). Assume linearity between the two bracketing temperatures.] [If only a single temperature is used, at the temperature of use]	Liquid in glass: Before first use and annually Electronic: Before first use and quarterly	Apply correction factors or replace thermometer
Volumetric labware	Class B: By lot before first use Class A and B: Upon evidence of deterioration	Bias: Mean within ±2% of nominal volume Precision: RSD ≤1% of nominal volume (based on 10 replicate measurements)
Non-volumetric labware [Applicable only when used for measuring initial sample volume and final extract/ digestates volume]	By lot before first use or upon evidence of deterioration	Bias: Mean within ±3% of nominal volume Precision: RSD ≤3% of nominal volume (based on 10 replicate measurements)

Table 2. Support Equipment Checks		
Performance Check	**Frequency**	**Acceptance Criteria**
Mechanical volumetric pipette	Quarterly	Bias: Mean within ±2% of nominal volume Precision: RSD ≤1% of nominal volume (based on minimum of 3 replicate measurements) [Note: for variable volume pipettes, the nominal volume is the volume of use]
Glass microliter syringe	Upon receipt and upon evidence of deterioration	General Certificate of Bias & Precision upon receipt Replace if deterioration is evident
Drying oven temperature check	Daily prior to and after use	Within ±5% of set temperature
Water purification system	Daily prior to use	See method blank criteria given in Section 4.20 of this addendum

4.5 The expiration date of the prepared standard shall not exceed the expiration date of the primary standard. All containers must bear a preparation date.

4.6 To avoid preparing non-representative samples, the laboratory shall not "target" within a relatively small mass range (e.g., 1.00 ± 0.01g) because such targeting will produce non-representative subsamples if the sample has high heterogeneity. The laboratory shall not manipulate the sample material so the sample aliquot weighs exactly 1.00g ± 0.01g, as an example.

4.7 In the absence of project-specific requirements, the minimum standard data qualifiers to be used are:

U Analyte was not detected and is reported as less than the LOD or as defined by the customer. The LOD has been adjusted for any dilution or concentration of the sample.

J The reported result is an estimated value (e.g., matrix interference was observed or the analyte was detected at a concentration outside the quantitation range).

B Blank contamination. The recorded result is associated with a contaminated blank.

N Non-target analyte. The analyte is a tentatively identified compound using mass spectrometry or any non-customer requested compounds that are tentatively identified.

Q One or more quality control criteria failed (e.g., LCS recovery, surrogate spike recovery, or CCV recovery).

Additional data qualifiers may be used, or different letters or symbols to denote the qualifiers listed above, as long as they are appropriately defined and their use is consistent with project-specific requirements (e.g., QSM 5.0, the contract, and project-planning documents).

4.8 If the time of the sample collection is not provided, assume the most conservative time of day. For the purpose of batch processing, the start and stop dates and times of the batch preparation shall be recorded.

4.9 Each preparation method listed on the scope of accreditation must have quarterly LOD/LOQ verifications. However, not all possible combinations of preparation and cleanup techniques are required to have LOD/LOQ verifications. If LOD/LOQ verifications are not performed on all combinations, the laboratory must base the LOD/LOQ verifications on the worst case basis (preparation method with all applicable cleanup steps).

4.10 After each MDL determination, the laboratory must establish the LOD by spiking a quality system matrix at a concentration of at least 2 times but no greater than four times the MDL. This spike concentration establishes the LOD and the concentration at which the LOD shall be verified. It is specific to each suite of analyte, matrix, and method (including sample preparation). The following requirements apply to the initial LOD establishment and to the LOD verifications:

- The apparent signal to noise (S/N) ratio at the LOD must be at least three and the results must meet all method requirements for analyte identification (e.g., ion abundance, second column confirmation, or pattern recognition). For data systems that do not provide a measure of noise, the signal produced by the verification sample must produce a result that is at least three standard deviations greater than the mean method blank concentration. This is initially estimated based on a minimum of four method blank analyses and later established with a minimum of 20 method blank results.
- If the LOD verification fails, then the laboratory must repeat the MDL determination and LOD verification or perform and pass two consecutive LOD verifications at a higher spike concentration and set the LOD at the higher concentration.
- The laboratory shall maintain documentation for all MDL determinations and LOD verifications.
- The DL and LOD must be reported for all analyte-matrix-methods suites, unless it is not applicable to the test or specifically excluded by project requirements.

4.11 The LOD shall be verified quarterly. In situations where methods are setup and used on an infrequent basis, the laboratory may choose to perform LOD verifications on a one per batch basis. All verification data will be in compliance, reported, and available for review.

4.12 For DoD, at a minimum, the LOQ shall be verified quarterly. In situations where methods are setup and used on an infrequent basis, the laboratory may choose to perform LOQ verifications on a one per batch basis.

4.13 All initial instrument calibrations must be verified with a standard obtained from a second manufacturer prior to analyzing any samples. The use of a standard from a second lot obtained from the same manufacturer (independently prepared from different source materials) is acceptable for use as a second source standard. The concentration of the second source standard shall be at or near the midpoint of the calibration range. The acceptance criteria for the initial calibration verification must be at least as stringent as those for the continuing calibration verification.

4.14 Exclusion of calibration points without documented scientifically valid technical justification is not permitted.

4.15 The concentration of the CCV standard shall be greater than the low calibration standard and less than or equal to the midpoint of the calibration range.

4.16 All CCVs analyzed must be evaluated and reported. If a CCV fails, reanalysis or corrective actions must be taken.

- If a CCV fails, the laboratory can immediately analyze two additional consecutive CCVs (immediately is defined as starting a consecutive pair within one hour; no samples can be run between the failed CCV and the two additional CCVs). This approach allows for spurious failures of analytes to be reported without reanalysis of samples. Any corrective actions that change the dynamics of the system (e.g., clip column, clean injection port, run blanks) requires that all samples since the last acceptable CCV be reanalyzed.
- Both of these CCVs must meet acceptance criteria in order for the samples to be reported without reanalysis.
- If either of these two CCVs fail or if the laboratory cannot immediately analyze two CCVs, the associated samples cannot be reported and must be reanalyzed.
- Corrective action(s) and recalibration must occur if the above scenario fails. All affected samples since the last acceptable CCV must be reanalyzed.
- Flagging of data for a failed CCV is only appropriate when the affected samples cannot be reanalyzed. The laboratory must notify the client prior to reporting data associated with a failed CCV.

4.17 The results of all MS/MSDs must be evaluated using the same acceptance criteria used for the DoD LCS limits (see Addendum Tables 3 and 4) or project limits, if specified. If the specific analyte(s) are not available in the Addendum Tables 3 and 4, the laboratory shall use their LCS in-house limits (see the LIMS) as a means of evaluating MS/MSDs. The MS and MSD must be spiked with all reported analytes.

4.19 Surrogate spike results shall be compared with DoD LCS limits (see Addendum Tables 3 and 4) or acceptance criteria specified by the client. If these criteria are not available, the laboratory shall compare the results with its in-house statistically established LCS criteria (see the LIMS).

4.20 The method blank shall be considered to be contaminated if:

- The concentration of any target analyte (chemical of concern) in the blank exceeds 1/2 the LOQ and is greater than 1/10th the amount measured in any associated sample, or 1/0th the regulatory limit, whichever is greater;
- The concentration of any common laboratory contaminant in the blank exceeds the LOQ;
- If a method blank is contaminated as described above, then the laboratory shall reprocess affected samples in a subsequent preparation batch, except when sample results are below the LOD. If insufficient sample volume remains for reprocessing, the results shall be reported with appropriate data qualifiers.

4.21 Sporadic Marginal Exceedances are not allowed for target analytes (chemicals of concern as identified by a project) without project-specific approval. Target analytes are considered those few analytes that are critical for the success of a project (such as risk drivers) where sporadic marginal exceedances cannot be allowed. Laboratories should consult with clients whenever long lists of analytes are requested for analysis to determine if marginal exceedances will not be allowed.

4.22 DoD considers the same analyte exceeding the LCS control limit two (2) out of three (3) consecutive LCS to be indicative of non-random behavior, which requires corrective action and reanalysis of the LCS.

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Table 3. LCS Control Limits – Method 8081 Solid Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
789-02-6	2,4'-DDT	110	100.1	11.9	64	136
53-19-0	2,4-DDD	111	102.8	9.2	75	130
3424-82-6	2,4-DDE	111	102.2	9.5	74	131
72-54-8	4,4'-DDD	2995	97.7	13.9	56	139
72-55-9	4,4'-DDE	2938	95.3	13	56	134
50-29-3	4,4'-DDT	2470	95.8	15.1	50	141
309-00-2	Aldrin	2985	90.5	15.2	45	136
319-84-6	alpha-BHC	3021	90.9	15.3	45	137
5103-71-9	alpha-Chlordane	2681	93.7	13.2	54	133
319-85-7	beta-BHC	2989	93.1	14.3	50	136
57-74-9	Chlordane	229	95.7	17.7	43	149
319-86-8	delta-BHC	2943	93.3	15.3	47	139
60-57-1	Dieldrin	2987	95.7	13.4	56	136
959-98-8	Endosulfan I	984	92.2	13.2	53	132
33213-65-9	Endosulfan II	2913	93.1	13.5	53	134
1031-07-8	Endosulfan sulfate	2954	95.9	13.5	55	136
72-20-8	Endrin	3076	98.1	13.9	57	140
7421-93-4	Endrin Aldehyde	3004	86	17	35	137
53494-70-5	Endrin Ketone	2953	95.5	13.5	55	136
58-89-9	gamma-BHC [Lindane]	3153	92.1	14.4	49	135
5103-74-2	gamma-Chlordane	2749	94.3	13.7	53	135
76-44-8	Heptachlor	3144	91.6	14.9	47	136
1024-57-3	Heptachlor Epoxide	3093	93.9	13.9	52	136
118-74-1	Hexachlorobenzene	319	91.6	11.4	57	126
72-43-5	Methoxychlor	3021	97.6	15.2	52	143
2385-85-5	Mirex	303	96.4	10.6	65	128
877-09-8	Tetrachloro-m-xylene	1482	85.3	14.6	42	129
8001-35-2	Toxaphene	532	86.7	17.9	33	141

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Table 4. LCS Control Limits – Method 8081 Water Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
72-54-8	4,4'-DDD	3112	99.6	14.4	56	143
72-55-9	4,4'-DDE	3062	96	12.9	57	135
50-29-3	4,4'-DDT	2681	97	15.3	51	143
309-00-2	Aldrin	3021	89.5	14.7	45	134
319-84-6	alpha-BHC	3070	95.8	13.9	54	138
5103-71-9	alpha-Chlordane	2736	94.3	11.6	60	129
319-85-7	beta-BHC	3068	96.3	13.3	56	136
57-74-9	Chlordane	150	101.2	13	62	140
319-86-8	delta-BHC	3035	97.2	15	52	142
60-57-1	Dieldrin	3078	98	12.6	60	136
959-98-8	Endosulfan I	968	93.8	10.7	62	126
33213-65-9	Endosulfan II	3047	93.4	13.7	52	135
1031-07-8	Endosulfan sulfate	3013	97.2	11.9	62	133
72-20-8	Endrin	3635	98.7	13	60	138
7421-93-4	Endrin aldehyde	3018	91.1	13.5	51	132
53494-70-5	Endrin Ketone	2908	95.9	12.6	58	134
58-89-9	gamma-BHC [Lindane]	3693	96.4	12.5	59	134
5103-74-2	gamma-Chlordane	3008	95.8	13.2	56	136
76-44-8	Heptachlor	3597	91.9	12.8	54	130
1024-57-3	Heptachlor Epoxide	3574	96.9	12.1	61	133
118-74-1	Hexachlorobenzene	134	82.1	18.1	27.8	136.5
72-43-5	Methoxychlor	3569	99	15.2	54	145
2385-85-5	Mirex	340	88.8	12.6	51	127
877-09-8	Tetrachloro-m-xylene	1510	84.1	13.3	44	124
8001-35-2	Toxaphene	421	83.9	16.8	33	134

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Table 5. Quality Control Requirements – Organic Analysis by Gas Chromatography

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Breakdown check (Endrin/DDT)	Before sample analysis and at the beginning of each 12-hour shift.	Degradation of DDT and Endrin must each be ≤15%.	Correct problem, then repeat breakdown checks.	Flagging is not appropriate.	No samples shall be run until degradation of DDT and Endrin is each ≤15%.
Initial Calibration (ICAL) for all analytes (including surrogates)	At instrument set-up and after ICV or CCV failure, prior to sample analysis.	ICAL must meet one of the three options below: **Option 1:** RSD for each analyte ≤ 20%; **Option 2:** linear least squares regression for each analyte: r2 ≥ 0.99; **Option 3:** non-linear least squares regression (quadratic) for each analyte: r2 ≥ 0.99.	Correct problem then repeat ICAL.	Flagging is not appropriate.	Minimum 5 levels for linear and 6 levels for quadratic. Quantitation for multicomponent analytes such as chlordane, toxaphene, and Aroclors must be performed using a 5-point calibration. Results may not be quantitated using a single point. No samples shall be analyzed until ICAL has passed.
Retention Time window position establishment	Once per ICAL and at the beginning of the analytical sequence.	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the initial CCV is used.	NA	NA	Calculated for each analyte and surrogate.

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Table 5. Quality Control Requirements – Organic Analysis by Gas Chromatography

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Retention Time (RT) window width	At method set-up and after major maintenance (e.g., column change).	RT width is ± 3 times standard deviation for each analyte RT from the 72-hour study or 0.03 minutes, whichever is greater.	NA	NA	Calculated for each analyte and surrogate. Only applicable if internal standard calibration is not used.
Initial Calibration Verification (ICV)	Once after each ICAL, analysis of a second source standard prior to sample analysis.	All reported analytes within established RT windows. All reported analytes within ± 20% of true value.	Correct problem, rerun ICV. If that fails, repeat ICAL.	Flagging is not appropriate.	No samples shall be analyzed until calibration has been verified with a second source.

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Table 5. Quality Control Requirements – Organic Analysis by Gas Chromatography

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Continuing Calibration Verification (CCV)	Before sample analysis, after every 10 field samples, and at the end of the analysis sequence with the exception of CCVs for Pesticides multi-component analytes (i.e., Toxaphene, Chlordane and Aroclors other than 1016 and 1260), which are only required before sample analysis.	All reported analytes and surrogates within established RT windows. All reported analytes and surrogates within ± 20% of true value.	Immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails or if two consecutive CCVs cannot be run, perform corrective action(s) and repeat CCV and all associated samples since the last Successful CCV. Alternately, recalibrate if necessary; then reanalyze all associated samples since the last acceptable CCV.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification.	Results may not be reported without a valid CCV. Flagging is only appropriate in cases where the samples cannot be reanalyzed.

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Table 5. Quality Control Requirements – Organic Analysis by Gas Chromatography

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Internal Standards (IS)	If employed, every field sample, standard, and QC sample.	Retention time within ± 0.06 RRT UNITS from retention time of the midpoint standard in the ICAL; Internal standard signal (area or height) within -50% to +100% of ICAL midpoint standard. On days when ICAL is not performed, the daily initial CCV can be used.	Inspect GC for malfunctions and correct problem. Reanalysis of samples analyzed while system was malfunctioning is mandatory.	If corrective action fails in field samples, data must be qualified and explained in the Case Narrative. Apply Q-flag to analytes associated with the non-compliant IS. Flagging is not appropriate for failed standards.	NA.
Method Blank (MB)	One per preparatory batch.	No analytes detected >1/2 LOQ or > 1/10 the amount measured in any sample or 1/10 the regulatory limit, whichever is greater.	Correct problem. If required, reprep and reanalyze MB and all samples processed with the contaminated blank.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch.	Results may not be reported without a valid method blank. Flagging is only appropriate in cases where the samples cannot be reanalyzed.

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Table 5. Quality Control Requirements – Organic Analysis by Gas Chromatography

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Laboratory Control Sample (LCS)	One per preparatory batch.	A laboratory must use Table 3 and 4 limits for batch control if project limits are not specified. If the analyte(s) are not listed, use in-house LCS limits (see the LIMS) if project limits are not specified.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Results may not be reported without a valid LCS. Flagging is only appropriate in cases where the samples cannot be reanalyzed.
Matrix Spike (MS)	One per preparatory batch.	A laboratory must use Table 3 and 4 limits for batch control if project limits are not specified. If the analyte(s) are not listed, use in-house LCS limits (see the LIMS) if project limits are not specified.	Examine the project-specific requirements. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met and explain in the case narrative.	For matrix evaluation only. If MS results are outside the limits, the data shall be evaluated to determine the source(s) of difference (i.e., matrix effect or analytical error).

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TITLE: PESTICIDES BY GAS CHROMATOGRAPHY (EPA METHODS 608, 8081A, 8081B, SM 6630C)

Table 5. Quality Control Requirements – Organic Analysis by Gas Chromatography

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Matrix Spike Duplicate (MSD) or Matrix Duplicate (MD)	One per preparatory batch.	A laboratory must use Table 3 and 4 limits for batch control if project limits are not specified. If the analyte(s) are not listed, use in-house LCS limits (see the LIMS) if project limits are not specified. RPD ≤ 30% (between MS and MSD or sample and MD).	Examine the project-specific requirements. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met and explain in the case narrative.	The data shall be evaluated to determine the source of difference. For Sample/MD: RPD criteria only apply to analytes whose concentration in the sample is greater than or equal to the LOQ.
Surrogate Spike	All field and QC samples.	QC acceptance criteria specified by the project, if available; otherwise use Table 3 and 4 limits or in-house LCS limits (see the LIMS) if analyte(s) are not listed.	Correct problem, then reprep and reanalyze all failed samples for all surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary, but the client must be notified prior to reporting data, and the failures must be discussed in the Case Narrative.	Apply Q-flag to all associated analytes if acceptance criteria are not met and explain in the case narrative.	Alternative surrogates are recommended when there is obvious chromatographic interference.

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TITLE: PESTICIDES BY GAS CHROMATOGRAPHY (EPA METHODS 608, 8081A, 8081B, SM 6630C)

Table 5. Quality Control Requirements – Organic Analysis by Gas Chromatography

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Confirmation of positive results (second column)	All results > the DL must be confirmed (except for single column methods such as TPH by Method 8015 where confirmation is not an option or requirement).	Calibration and QC criteria for second column are the same as for initial or primary column analysis. Results between primary and secondary column RPD ≤ 40%.	NA	Apply J-flag if RPD >40%. Discuss in the case narrative.	Use project-specific reporting requirements if available; otherwise, use method requirements if available; otherwise, report the result from the primary column.

SOP Minor Revision Summary

SOP:			
Title -	SEMIVOLATILE ORGANICS BY GC/MS (EPA METHODS 8270C, 8270D, 625, 625.1 AND SM 6410B), INCLUDING PROVISIONS FOR ANALYSIS IN SIM MODE		
Number -	330345	**Department -**	SVOA
Revision -	26	**Rev. Date -**	3/22/18

This Standard Operating Procedure has been amended to include changes required during normal business operations. These changes as defined by SOP 010103 (Document Control and Distribution) are routine modifications that will be incorporated into the SOP upon the next scheduled review.

Rev.	Date	Section	Brief Description
a	6/4/18	8.1.2	Added details about the use of peak detection thresholds
		7.15.1	Added details about spike verification

Standard Operating Procedure

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TITLE: SEMIVOLATILE ORGANICS BY GC/MS (EPA METHODS 8270C, 8270D, 625, 625.1 AND SM 6410B), INCLUDING PROVISIONS FOR ANALYSIS IN SIM MODE

Reviewed by: Chris Johnson, Steve Miller

Organics Director *QA Department*

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1.0 SCOPE AND APPLICATION

STATE NOTE: For samples analyzed in conjunction with the Ohio Voluntary Action Program (VAP) please utilize SOP #330345OH.

1.1 This method is used to determine the concentration of semi-volatile organic compounds in extracts prepared from many types of solid waste matrices, soils, and water samples. The lists of compounds that are routinely determined by this method are listed in Attachment II. This table represents a default list to be used in the absence of a project-specific list, which would take precedence. See section 13.4.

1.2 This method is used to quantitate most neutral, acidic and/or basic organic compounds that are soluble in methylene chloride and capable of being eluted, without derivatization, from a gas chromatographic fused-silica column coated with a slightly polar methyl silicone phase. Such compounds include polynuclear aromatic hydrocarbons, chlorinated hydrocarbons and pesticides, phthalate esters, organophosphate esters, nitrosamines, haloethers, aldehydes, ethers, ketones, anilines, pyridines, quinolines, aromatic nitro compounds, and phenols, including nitrophenols.

1.3 In general, this method is not appropriate for the quantitation of multi-component analytes (i.e. Toxaphene, Chlordane, Aroclors, etc.) because of the limited sensitivity for those analytes; however when those analytes are identified using another analytical technique, this procedure is appropriate for confirmation pending sufficient analyte concentration is present in the extract.

1.4 Detection limits, sensitivity and optimum ranges of organic compounds vary with sample matrices, extraction technique, detector parameters, and model of GC/MS.

1.5 Qualifier ions are method specified and can be found in Attachment IV.

1.6 Use of this method is restricted to analysts who are knowledgeable in the interpretation of Mass Spectrometry and use of GC/MS systems.

1.7 The use of selected ion monitoring (SIM) is acceptable for applications requiring limits below the normal range of electron impact mass spectrometry. However, SIM may provide a lesser degree of confidence in the compound identification unless multiple ions are monitored for each compound.

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1.8 An MDL study must be completed at least annually or more frequently if major instrumentation changes occur. Method Detection Limits (MDLs) are performed based on ESC SOP #030206. Updated MDL records are filed and stored on ESC's intranet.

1.8.1 Limit of Detection (LOD) and Limit of Quantitation (LOQ) studies are completed at the frequency required by the TNI standard per the procedure identified in the ESC SOP #030206, *Method Detection Limits (MDL), Limits of Detection (LOD) and Limits of Quantitation (LOQ).* Should the procedure be utilized for DOD support; then the frequency of these studies must meet the requirements of the current DOD QSM (see Attachment IX).

1.8.2 Lower Limit of Quantitation (LOQ) – For analyses performed per the requirements of Method 8000D, the LLOQ is established at concentrations where both quantitative and qualitative requirements can consistently be met (see Sections 2.10 and 10.4).

2.0 METHOD SUMMARY AND DEFINITIONS

2.1 Field samples are prepared for analysis by gas chromatography/mass spectrometry (GC/MS) using the appropriate sample extraction technique. See ESC SOPs 330702/330702A/330702B/330705/330707/330708/330709/330754 for extraction and extract concentration methods. A measured volume or weight of sample is extracted using the appropriate extraction technique. Liquid samples are extracted at neutral pH with methylene chloride using a separatory funnel (SOP #330702) per EPA method 3510C. Reduced volume (RV) extraction using EPA method 3510C that requires a smaller volume (usually 100mL) of field sample is also available for use where applicable. Large volume injection (LVI) extraction using EPA method 3511 that requires a smaller volume (usually 40mL) of field sample is also available for use where applicable. See section 13.5 of this procedure and ESC SOP #330702B. Soil analysis using the same technology can also be performed with extraction as noted in ESC SOP #330707 and no concentration performed on the extract. This process is termed throughout this SOP as non-concentrated soil. Solid samples can also be extracted traditionally using methylene chloride-acetone (1:1) and a sonication process (SOP #330705) or with methylene chloride using the microwave process (SOP #330707), where permitted. These extracts are denoted in this procedure using the terminology "concentrated soil" extracts.

2.2 The semi-volatile compounds are introduced into the GC/MS by directly injecting a volume of the sample extract into a gas chromatograph oven (GC) equipped with a narrow-bore fused-silica capillary column. The oven, containing the capillary column, is temperature and pressure programmed to separate the analytes by molecular composition. The capillary column transfers the eluting analytes to the detector (MS) connected to a computer that then collects and stores the information for each injection.

2.3 Identification of target analytes is accomplished by comparing the mass spectra of each peak with the reference spectra of authentic standards.

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2.4 Quantitation of the analytes of interest is accomplished by comparing the response of a major (quantitation) ion, present in the target analyte, relative to an internal standard in each extract, in conjunction with the response factor generated from a calibration curve.

2.5 Proper quantitation ions for each compound must be selected so that no interferences are present from adjoining (or co-eluting) analytes with common ions. Proper GC conditions must be used to resolve compounds with similar mass spectra. Background subtraction of mass spectra may be necessary when matrix interference is present.

2.6 Qualitative - The identification of compounds based on retention time and comparison of the sample mass spectra, after background correction, with characteristic ions in the reference mass spectra. The reference mass spectra must be generated by the laboratory using the same analytical conditions used for the analysis of field samples. The characteristic ions from the reference mass spectra 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 spectra.

2.7 Quantitative – Following qualitative identification, the quantitation of the identified compound is based on the integrated abundance of the primary characteristic ion from the Extracted Ion Current Profile (EICP).

2.8 Relative Retention Time (RRT) – The process of normalizing the response (peak area) of the target compound to the response of the internal standard.

2.9 Isotope dilution calibration - Isotope dilution calibration is essentially a special case of internal standard calibration. In isotope dilution, the internal standards are stable isotopically-labeled analogs of the target analytes *and* they are added to the sample prior to any sample handling steps, including sample extraction. Because the spiked compounds differ from the target compounds only in the presence of the stable isotopes, the physical and chemical behavior of each labeled compound is virtually the same as its unlabeled "native" analog. Thus, any losses of the target compound that may occur during any of the sample preparation, extraction, cleanup, or determinative steps will be mirrored by a similar loss of the labeled standard.

2.10 Lower Limit of Quantitation (LLOQ) – For analyses performed according to the requirements of Method 8000D, the lowest concentration at which the laboratory has demonstrated target analytes can be reliably measured and reported with a certain degree of confidence, which must be greater than or equal to the lowest point in the calibration curve.

2.11 Large Volume Injection (LVI): any injection volume >5ul. Technique is dependent upon type of GC inlet used and sensitivity of detection.

2.12 Minimum Level (ML): A term used in Method 625.1 which refers to either the sample concentration equivalent to the lowest calibration point in a method or a multiple of the MDL, whichever is higher. Minimum levels may be obtained in several ways: They may be published in a method; they may be based on the lowest acceptable calibration point used by a laboratory; or they may be calculated by multiplying the MDL in a method, or the MDL determined by a laboratory, by a factor of 3. For the purposes of NPDES

compliance monitoring, EPA considers the following terms to be synonymous: ''quantitation limit,'' ''reporting limit,'' and ''minimum level.''

2.13 See the current Quality Assurance Manual for other definitions associated with terms found in this document.

3.0 HEALTH AND SAFETY

3.1 The toxicity or carcinogenicity of each reagent used in the laboratory has not been fully established. Each chemical must be regarded as a potential health hazard and exposure to these compounds must be as low as reasonably achievable. A reference file of safety data sheets (SDSs) is made available on ESC's intranet to all personnel. Use hazardous reagents in a fume hood whenever possible and if eye or skin contact occurs, flush with large volumes of water. Always wear safety glasses or a shield for eye protection, protective clothing and observe proper mixing protocols.

3.2 **CAUTION:** Be careful when diluting and mixing acids. ALWAYS pour acid into water when mixing. Gently heat acid mixtures (NEVER HEAT RAPIDLY), to prevent splatter from extremely exothermic reactions typical of acid-water mixtures, etc.

3.3 Prior to performing this procedure, the analyst should be familiar with the proper use of corrosive liquid spill kits and contaminant procedures.

3.4 Much of the instrumentation used in this procedure has heated zones that can cause severe burns. Always unplug all instruments before doing any maintenance that involves electrical parts.

4.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

4.1 All samples must have been collected using a sampling plan that addresses the considerations of this method.

4.2 Requirements for sample extraction are detailed in SOP numbers 330702, 330702A, 330702B, 330705, 330707, 330708, 330709, and 330754.

4.3 The sample holding time for solid samples is 14 days to extraction and, for aqueous samples, the holding time is 7 days. Holding time begins when (date and time) the samples are collected and ends either 14 or 7 days following sampling, at the time sampled.

4.4 The holding time for each extract is 40 days from sample preparation to analysis.

4.5 The container for aqueous samples and liquid sludge being extracted using the traditional 1L EPA 3510 method are 1L amber glass bottles. For the reduced volume extraction process using the EPA 3510 method, 100mL amber glass bottles are utilized. The containers for aqueous samples being extracted using EPA Method 3511 are 40mL amber glass bottles. Add 0.008% $Na_2S_2O_3$ per liter, if residual chlorine is expected or present.

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4.6 Collect solid sample materials in 4 oz. jars or larger, depending on the weight and density of the sampled materials.

4.7 All samples and extracts must be shipped and stored at <6°C.

4.8 Samples submitted for analysis that do not meet the requirements contained within this section must be addressed before performing the logging process within the laboratory. In some cases, exceeding the appropriate preservation and storage criteria can cause significant bias in the resulting data. Clients may need to resubmit samples where the conditions during shipment cause uncertainty regarding sample integrity. If samples do not meet the requirements for preservation, sampling, shipment and storage and the client approves the completion of the analytical process, sample results can be qualified and possible bias is narrated per the ESC SOP #030201, *Data Handling and Reporting*.

5.0 INTERFERENCES

5.1 Raw GC/MS data from all method blanks, samples, and spikes is evaluated for interferences. Determine if the source of interference is in the preparation and/or cleanup of samples and take corrective action to eliminate the problem.

5.2 Contamination by carryover can occur whenever high-concentration and low-concentration samples are sequentially analyzed. To reduce carryover, the sample syringe is rinsed between sample injections. Whenever an unusually concentrated sample is encountered, it should be followed by analysis of solvent to check for cross-contamination. Clean/replace injector liner or clip column, check with solvent blanks, and repeat samples if necessary.

5.3 Choice of quantitative ions and qualifier ions: Some compounds may co-elute, so the selection of quantitation ions and qualifier ions must be made carefully so these ions are specific to each of the compounds that co-elute. Qualifier ions that are most commonly used are listed in Attachment IV and are recommended from the published 8270 methods. There is no method stated ions for the following: Pyridine, 1-Methylnaphthalene, Biphenyl, Carbazole. Aniline and Bis (2-Chloroethyl)ether quantitation ions may vary due to chromatographic conditions causing co-elution of the shared primary ion. Targets have strongly-responding, analyte-specific secondary ions suitable for quantitative use. Refer to Attachment IV for ESC ions.

5.4 Problematic Compounds:

5.4.1 Benzidine may be subject to oxidative losses during solvent concentration and exhibits poor chromatographic behavior.

5.4.2 Hexachlorocyclopentadiene is subject to thermal decomposition in the GC inlet, as well as photochemical decomposition.

5.4.3 N-nitrosodimethylamine may be difficult to separate from the solvent using the chromatographic conditions listed in this method.

5.4.4 N-nitrosodiphenylamine decomposes in the GC inlet and can't be separated from diphenylamine.

5.4.5 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 when there is high boiling material contamination of the GC system.

5.4.6 Pyridine may perform poorly at the GC injection port temperatures listed in this method. The amount of degradation may be reduced by lowering the injection port temperature. Modification of the injection port temperature may adversely affect the performance of other target analytes.

5.4.7 Benzenethiol, or thiophenol, can be found in refinery wastes at caustic pH values. Benzenethiol is unstable in water/soils of neutral or acidic pH values. Benzenethiol rapidly degrades in organic solvents used to prepare the instrument calibration standards. Benzenethiol is part of Appendix VIII and the 1985 Skinner List, but was never included in Appendix IX to 40 CFR 264, due to its instability in the environment

6.0 EQUIPMENT AND SUPPLIES

6.1 Gas chromatograph/mass spectrometer system.

6.1.1 Gas chromatograph (HP 6890/7890 or equivalent)- An analytical system complete with a temperature- programmable gas chromatograph suitable for split-less injection and all required accessories, including, auto sampler, syringes, analytical columns, and gases. The capillary column is directly coupled with the source.

6.1.2 Column 1 - 30m x 0.25mm ID with a 0.25µm film thickness silicon-coated fused silica capillary column (Phenomonex ZB-5MS or equivalent).

6.1.3 Column 2 – J&W 30m x 0.25mm x 0.5um film DB5MS or an equivalent is used. Ultrapure (99.999%) Helium gas is used for a mobile phase.

6.1.4 Syringes: Agilent (or equivalent) syringes sizes 10µL, 25µL, 50µL, 100µL and 1.0mL.

6.2 Mass spectrometer (HP-5973/5975 or equivalent) capable of scanning from 35 to 550 amu every 1 second, using 70 volts (nominal) electron energy in the electron impact ionization mode. The mass spectrum for decafluorotriphenylphosphine (DFTPP) must meet the applicable criteria in method 8270C, 8270D or 525 when 50ng of DFTPP GC/MS tuning standard is injected.

6.3 GC/MS interface - The interface is capillary-direct into the mass spectrometer source.

6.4 Data system (HP Chemstation with Enviroquant) - A computer system is interfaced to the mass spectrometer. The system allows the continuous acquisition and storage of 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

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number. This type of plot is defined as Extracted Ion Current Profile (EICP). The most recent version of the EPA/NIST Mass Spectral Library is also available

6.5 Volumetric flasks, Class A - Appropriate sizes with ground-glass stoppers.

6.6 Balance - Analytical, capable of weighing 0.0001g

7.0 REAGENTS AND STANDARDS

7.1 All reagents and standards must be recorded in the appropriate preparation log and assigned a unique number. See SOP #030230, *Standard Logger – Tree Operation*. Additional information regarding reagent preparation can be found in the Standards Logger (Tree) digital archive system. All spiking solutions and surrogate standard solutions should be replaced at least every 6 months or sooner if a problem is detected unless otherwise noted.

7.2 Reagent grade inorganic chemicals are 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 ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

7.3 Organic-free reagent water - all references to water in this method refer to organic-free reagent water (ASTM II or equivalent).

7.4 Burdick & Jackson Omni Solv Dichloromethane Dx0831-1 (or equivalent).

7.5 Stock standard solutions - Standard solutions are purchased as certified solutions. Commercially–prepared stock standards are used at concentrations that are certified by the manufacturer or by an independent source.

7.5.1 Restek, Custom 8270 Mix – 56321, or equivalent, at 200ppm

7.5.2 NSI, 8270 TCL Project Mix – Q4296, or equivalent, at 1000ppm

7.5.3 AccuStandard, Composite Mix #3 – Z-014E-R3, or equivalent, at 2000ppm

7.5.4 Restek, Benzoic Acid Mix – 31879, or equivalent, at 2000ppm

7.5.5 Restek, Benzidine Mix #2 – 31852, or equivalent, at 1000ppm

7.5.6 AccuStandard, 2-Nitrodiphenylamine – S-4829A, or equivalent, at 200ppm

7.5.7 B/N Surrogate Mix – C-376M-39, or equivalent, at 2000ppm

7.5.8 Organic Acid Surrogate Mix – C-131M-24, or equivalent, 4000ppm

7.5.9 Second Source: Restek, 8270 MegaMix – 31850, or equivalent, at 1000ppm

7.5.10 Benzenethiol Std: GCS011266-01-SS, or equivalent, at 1000ppm

7.5.11 Indene Std: GCS011267-03, or equivalent, at 1000ppm

7.5.12 Quinoline Std: GCS011268-01-SS, or equivalent, at 1000ppm

7.5.13 Dibenz(a,h)acridine Std: GCS011269-05-SS, or equivalent, at 1000ppm

7.5.14 N-Nitrosodimethylamine (NDMA) STD: Restek, 521 Surr Std – 33910, or equivalent, at 1000ppm

7.5.15 Transfer the stock standard solutions into bottles with PTFE-lined screw caps. Store, protected from light, at –10°C or less or as recommended by the standard manufacturer. Stock standards should be checked frequently for signs of degradation or evaporation, especially just prior to preparing calibration standards from them. Stock standards are assigned a 6 month expiration date from the day that a sealed ampoule is opened. Standards are discarded if signs of degradation are apparent when compared to a second source standard.

7.5.16 1,4-Dioxane ISTD: Restek; 1,4-Dioxane-d_8; #30614 2000ppm in methanol.

7.5.17 1,4-Dioxane ICAL: Restek; 1,4-Dioxane #31853 2000ppm in methylene chloride.

7.5.18 1,4-Dioxane SSCV/LCS: Restek; 1,4-Dioxane; #30287 2000ppm in methanol.

7.6 For PAHs by SIM, use a custom mix purchased from Ultra Scientific (Cat#: CUS-9356) with all required PAH targets. Each target compound is at concentration of 200ppm. Other concentrations may be acceptable with dilutions as appropriate for yielding the appropriate concentrations in the secondary source. The secondary source is also a custom mix from Ultra Scientific (Cat#: CUS-9345) at 200ppm.

7.7 For NDMA by EPA 8270C/D SIM, use the 8270 Mega Mix (sec. 7.5.1) and the SSCV (section 7.5.9) or equivalent.

7.8 For the Missouri Department of Natural Resources-specified Diesel Range Organics (DROMO) by GC/MS, use a custom mix purchased from Ultra Scientific (Cat#: CUS-8255), or equivalent, which is a neat solution of diesel and an Ultra Scientific custom mix (Cat#: CUS-8254) for the gasoline components at neat. Alternatively, calibration standards can be prepared using the TX TPH Calibration Mix from Restek (Cat#: 31483) at 10,000ppm each. The secondary source is an NSI, Diesel Range Organic Spike (Cat#: Q4394) at 2500ppm each.

7.9 Internal standards solutions- the internal standards are naphthalene-d8, acenaphthene-d10, phenanthrene-d10, chrysene-d12, perylene-d12 and 1-4 dichlorobenzene-d4. Purchase from NSI (Cat # Q-6343-O) as certified stock solution at 800µg/mL. Alternative internal standard concentrations may be used for LVI work. Internal standard intermediates at 16µg/mL and 4µg/mL are prepared for spiking, RV/LVI 8270PAHand RV/LVI 8270SIM analyses, respectively.

7.9.1 For all concentrated soil, 1000mL concentrated water, and 8270 full run water reduced volume extracts, use the 800µg/mL internal standard solution. Each sample extract undergoing analysis is spiked with 10µL of internal standard

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intermediate solution, resulting in a concentration of 8µg/mL of each internal standard.

7.9.2 For non-concentrated soil, reduced volume water and 3511 water analyses, including PAH and DROMO, use the 16µg/mL ISTD intermediate. For non-concentrated soil, reduced volume and EPA 3511 water extracts being analyzed by the SIM process, use the 4µg/mL ISTD intermediate. Each sample extract undergoing analysis is spiked with 10µL of the appropriate internal standard intermediate solution, resulting in a concentration of 160µg/L and 40µg/L, respectively, for each internal standard.

7.10 Preparation of Intermediate Standard

Stock Mix	Section ID:	Amount Added (mL)	Concentration of Stock in ppm	Concentration in Intermediate (ppm)
Restek - Custom Mix with Surrogates	7.5.1	--	200	--
NSI - 8270 TCL Project Mix	7.5.2	2.0	1000	200
AccuStandard - Composite Mix #3	7.5.3	1.0	2000	200
Restek - Benzoic Acid Mix	7.5.4	1.0	2000	200
Restek - Benzidine Mix #2	7.5.5	1.0	2000	200
AccuStandard - 2-Nitrodiphenylamine	7.5.6	2.0	1000	200

Using a volumetric syringe, measure each of the solutions listed in Section 7.9 and place into a 10mL volumetric flask. The final concentration will be 200µg/mL of each component. Use this solution or the certified custom mix purchased from Restek in section 7.5.1 to prepare the working standards in the tables in section 7.10.

7.10.1 For 1L extractions or concentrated soil extracts using SIM**,** prepare a 5µg/mL intermediate by diluting the 10µg/mL PAH mix described in section 7.6.

7.10.2 For EPA Method 3511 extracts for 8270 analyses, PAH reduced volume, and non-concentrated soil, a 2µg/mL intermediate is prepared directly by diluting 100µL of the 200µg/mL stock to a final volume of 10mL using volumetric glassware.

7.10.3 For SIM analyses using reduced volume or EPA 3511 water extracts or non-concentrated soil extracts, a 200ug/L intermediate is prepared directly by diluting 10µL from the 200µg/mL stock to a final volume of 10mL using volumetric glassware.

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7.10.4 For DROMO analyses using extraction method 3511 for water samples or non-concentrated soil, prepare a 200ug/mL intermediate in 10mL of methylene chloride by adding 40uL of each Gasoline and Diesel at 50,000ug/mL.

7.11 Preparation of Working Standards

Standards must be stored at 4 ± 2°C. The expiration date of any working standard will be 6 months unless the manufacturer's stock expires prior to that date or if the standard starts showing signs of degradation. See section 7.11.1 through 7.11.6 for preparation instructions. Concentrations of standards used are subject to change depending on instrument condition, client needs and sample preparation method of the variety of analysis being performed. A minimum of five calibration levels is required for Method 8270C and 8270D, while a minimum of 3 calibration levels is required for Method 625.

7.11.1 8270C/D Calibration standards for concentrated soil and 1L concentrated water extractions: A minimum of five calibration standards is prepared at different concentrations. At least one of the calibration standards must correspond to a sample concentration at or below the laboratory's reporting limit (RL). The remaining standards correspond to the working range of the GC/MS system. Each standard contains each analyte for detection. Working standards are made directly from the intermediate stock standard described in section 7.10 give solutions at concentrations of 0.2µg/mL up to 50µg/mL. Surrogates are included at the same concentrations. Internal standards are spiked at a constant concentration per extraction method for quantitation purposes.

SVOC mix (200ppm) µL	ISTD mix uL	Final volume	Final conc. ppm	Level
1	10	1.0mL	0.2	1
5	10	1.0mL	1	2
10	10	1.0mL	2	3
25	10	1.0mL	5	4
50	10	1.0mL	10	5
75	10	1.0mL	15	6
100	10	1.0mL	20	7
150	10	1.0mL	30	8
200	10	1.0mL	40	9
250	10	1.0mL	50	10

A minimum of 5 points are used to construct the calibration curve.

7.11.2 Calibration standards for 8270C/D reduced volume and EPA 3511 (soil and water) extracted samples: A minimum of five calibration standards is prepared at different concentrations. At least one of the calibration standards must correspond to a sample concentration at or below the laboratory-reporting limit (RL). The remaining standards correspond to the working range of the GC/MS system. Each standard contains each analyte for detection. Working standards are made directly from the intermediates described in section 7.9 to give solutions at concentrations of 0.01µg/mL up to 1µg/mL. Surrogates are included

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at the same concentrations. Internal standards are spiked at a constant of 160µg/L for quantitation purposes.

SVOC mix (2ppm) µL	ISTD mix uL	Final volume	Final conc. ppb	Level
5	10	1.0mL	10	1
25	10	1.0mL	50	2
50	10	1.0mL	100	3
100	10	1.0mL	200	4
200	10	1.0mL	400	5
300	10	1.0mL	600	6
400	10	1.0mL	800	7
500	10	1.0mL	1000	8

7.11.3 For SIM analyses concentrated soil and 1L water extractions**,** calibration standards are diluted from the intermediate standard solution (section 7.9.1) to give a calibration at the following concentrations: 20, 50, 100, 500, 1000, 2000, 4000, 10,000µg/L. A minimum of five calibration standards is prepared at different concentrations. At least one of the calibration standards must correspond to a sample concentration at or below the laboratory-reporting limit (RL). The calibration levels may change based on the working range of the GC/MS system. Surrogates are included at the same concentrations. The internal standards are at a constant 8µg/mL.

SIM Standard Concentration (ug/L)	Amount Added (uL) 5µg/mL Int.	Final Volume (mL)
20	2.0	1.0
50	5.0	1.0
100	10.0	1.0
500	50.0	1.0
1000	100.0	1.0
2000	200.0	1.0
4000	400.0	1.0
10000	1000.0	1.0

7.11.4 For SIM analyses using reduced volume, non-concentrated soil, or EPA 3511 extracts**,** calibration standards are diluted from the intermediate standard solution (section 7.9.3) to give a calibration at the following concentrations: 1, 5, 10, 20, 40, 80, 200µg/L. A minimum of five calibration standards is prepared at different concentrations. At least one of the calibration standards must correspond to a sample concentration at or below the laboratory-reporting limit (RL). The calibration levels may change based on the working range of the GC/MS system. Surrogates are included at the same concentrations. The internal standards are at a constant 40µg/L.

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SIM RV 3511 Standard Concentration (ug/L)	Amount Added (uL) 200µg/L Int.	Final Volume (mL)
1	5	1.0
5	25	1.0
10	50	1.0
20	100	1.0
40	200	1.0
80	400	1.0
200	1000	1.0

7.11.5 For Missouri DRO analysis by 3511 and non-concentrated soil, prepare the working calibration curve as reflected in the following table.

DROMO mix (200ppb) µL	Final Volume	Final conc. (ppb)
25	1.0 mL	5
50	1.0 mL	10
100	1.0 mL	20
200	1.0 mL	40
400	1.0 mL	80
600	1.0 mL	120
800	1.0 mL	160

7.12 DFTPP Standard Prep for 50ppm Solution – 50µL of 1000 ppm DFTPP (AccuStandard M-625-TS-20X) + 950µL of Methylene Chloride (final volume of 1mL).

7.13 DFTPP Standard Prep for 25ppm Solution – 25µL of 1000 ppm DFTPP (AccuStandard M-625-TS-20X) + 950µL of Methylene Chloride (final volume of 1mL).

7.14 DFTPP Standard Prep for 2ppm Solution – 2µL of 1000 ppm DFTPP (AccuStandard M-625-TS-20X) + 950µL of Methylene Chloride (final volume of 1mL).

7.15 Surrogates and Spike Solutions – Preparation techniques are detailed in SOP numbers 330702, 330702A, 330702B, 330705, 330707, 330708, 330709, and 330754.

7.16 See section 13.4 for additional information regarding standards and spiking solutions.

8.0 PROCEDURE

STATE NOTE: For samples analyzed in conjunction with the Ohio VAP program, the criteria found and itemized in this procedure for EPA method 8270C must be utilized. Alternative GCMS tuning criteria from that specified in EPA 8270C is acceptable as permitted in Section 7 of the published method.

8.1 GC Conditions: The GC conditions are listed in each instrument maintenance log and are updated as necessary.

8.1.1 Due to the tuning and calibration requirements outlined in this method, a liner change is necessary prior to beginning an analytical sequence. Any additional maintenance performed on the instrumentation will be documented as performed

in the specific instrument maintenance log. (i.e., column clip/change, septa change, inlet cleaning, detector cleaning/maintenance, etc.)

8.2 Mass Spectrometer Tuning Criteria: The GC/MS is hardware-tuned using a 50ng (or less) injection of DFTPP. Analyses must not begin until the tuning criteria are met. It is recommended that each initial tune verification utilize the "Autofind" function and be set up to look at three scans (the apex & ±1 scan) and average the three scans then perform background subtraction. Background subtraction is required prior to the start of the peak but no more than 20 scans prior. Background correction cannot include any parts of the target peak. The scans must be averaged and background corrected. Average scans 0.1 minute before to 0.1 minute after the target peak including 2 scans and the peak apex. The mass spectrometer must be tuned every 12 hours if samples, standards, etc. are to be analyzed for Methods 8270C, 8270D, and 625.1 or every 24 hours for Method 625. ESC uses 8270D evaluation criteria per method allowances.

TABLE 8.2
Method 8270D
DFTPP Key Ions And Ion Abundance Criteria[a, b]

Mass	Ion Abundance Criteria
51	10-80% of mass 198
68	<2% of mass 69
70	<2% of mass 69
127	10-80% of mass 198
197	<2% of mass 198
198	Base peak, or >50% of mass 442
199	5-9% of mass 198
275	10-60% of mass 198
365	>1% of mass 198
441	Present, but <24% of mass 442
442	Base peak, or >50% of mass 198
443	15-24% of mass 442

(a) Data taken from Table 3 in SW-846 Method 8270D.
(b) Alternate tuning criteria may be used (e.g., CLP, Method 525, or manufacturers' instructions), providing that method performance is not adversely affected.

METHOD NOTE: Per Method 625.1 requirements, the 12-hour shift begins after the DFTPP and DDT/endrin tests (if DDT and endrin are to be determined), and after analysis of the calibration verification standard. The 12-hour shift ends 12 hours later. The DFTPP, DDT/endrin, and calibration verification tests are outside of the 12-hour shift.

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STATE NOTE: All South Carolina samples require a tune every 12 hours, regardless of which method is being utilized.

The GC/MS tuning standard solution must also be used to assess GC column performance and injection port inertness. Degradation of DDT to DDE and DDD is used to assess breakdown occurring in the injection port. The calculation for the determination of the breakdown occurring is found in section 9.1 and must include both DDD and DDE. Breakdown must not exceed 20%. Benzidine and pentachlorophenol are used to assess tailing occurring within the analytical system and both analytes should be present at their normal responses with no obvious peak tailing. To determine the tailing factor for benzidine and pentachlorophenol, use the calculation found in section 9.2. For EPA Methods 625 and 8270C, benzidine must have a tailing ratio of <3 and pentachlorophenol must have a tailing ratio of <5. For EPA Method 8270D and 625.1, benzidine and pentachlorophenol must have a tailing ratio of <2. The Missouri diesel method does not require tailing or degradation checks prior to or during analysis.

8.3 The use of selected ion monitoring (SIM) is acceptable for applications requiring quantitation limits below the normal range of electron impact mass spectrometry. However, SIM may provide a lesser degree of confidence in the compound identification since less mass spectral information is available. Using the primary ion for quantitation and the secondary ions for confirmation set up the collection groups based on their retention times. The selected ions are nominal ions and most compounds have small mass defect, usually less than 0.2 amu, in their spectra. These mass defects should be used in the acquisition table. The dwell time may be automatically calculated by the laboratory's GC/MS software or manually calculated using the following formula. The total scan time should be less than 1,000 msec and produce at least 5 to 10 scans per chromatographic peak. The start and stop times for the SIM groups are determined from the full scan analysis using the formula below: Additional guidance for performing SIM analyses, in particular for PAHs and phenol target analyte compounds, can be found in the most recent CLP semivolatile organic methods statement of work (SOW). See the SIM sections from the following CLP SOW for further details: EPA CLP Organics SOW. (Reference 14)

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TITLE: SEMIVOLATILE ORGANICS BY GC/MS (EPA METHODS 8270C, 8270D, 625, 625.1 AND SM 6410B), INCLUDING PROVISIONS FOR ANALYSIS IN SIM MODE

SIM Groups for PAHs and including pentachlorophenol and hexachlorobenzene

SIM Group	1	2	3	4	5	6	7	8
RT start	Solvent delay	Before 2-Methyl naphthalene	Before Acenaph-thalene	Before Fluorene	Before Fluor-anthene	Before Benzo (a)-anthracene	Before Benzo (b)-fluoranthene	Before Dibenz (a,h-)anthracene
Ions	82, 128, 129, 136, 137	127, 141, 142, 162, 171, 172	139, 151, 152, 153, 154, 162, 164, 168	94, 165, 166, 176, 178, 179, 188, 264, 266, 268, 282, 284, 286	200, 202, 203, 244, 245	226, 228, 229, 240, 241	252, 253, 260, 264	138, 139, 276, 277, 278, 279
Dwell	40	35	25	30	40	50	75	50

8.4 Calibration

8.4.1 **Initial Calibration**

EPA Method 8270C: The working standards prepared in section 7.10 are injected and average response factors are calculated. The calibration curve is typically constructed of six to nine standards, however, this may change depending on instrument conditions and/or client needs (see Section 13.4). See section 8.3.2 for information regarding use and deletion of calibration points.

The calibration check compounds (CCCs) listed in Section 8.3.1a must have an average percent relative standard deviation (%RSD) of less than or equal to 30%. Any target analyte that has a %RSD >15% for the RF must be calculated by linear or quadratic regression instead of RF. If the RSD of any target analyte is $\leq$15%, the average response factor may be used for quantitation. When any compound does not meet the calibration criteria for RF, the analyst MUST use linear regression or quadratic curve fit. The calibration curve cannot be forced through zero and does not include a method blank. It must also meet a correlation coefficient of 0.990 or better. Analyses being generated for USACE projects must meet a correlation coefficient of 0.995 or better. If a quadratic curve fit is used, a minimum of 6 calibration standards must be utilized to obtain a working calibration curve.

The system performance check compounds (SPCCs) in Table 8.3.1b must have an average RF of $\geq$0.05. When these criteria are met, samples can be analyzed.

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TITLE: **SEMIVOLATILE ORGANICS BY GC/MS (EPA METHODS 8270C, 8270D, 625, 625.1 AND SM 6410B), INCLUDING PROVISIONS FOR ANALYSIS IN SIM MODE**

Table 8.3.1a: Calibration Check Compounds (CCC)

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	

Table 8.3.1b: System Performance Check Compounds (SPCC)

Compound	*Minimum Average Response Factor*
n-Nitroso-di-n-propylamine	>0.05
Hexachlorocyclopentadiene	>0.05
2,4-Dinitrophenol	>0.05
4-Nitrophenol	>0.05

EPA Method 8270D: The working standards prepared in section 7.10 are injected and average response factors are calculated. The calibration curve is typically constructed of six to nine standards, however, this may change depending on instrument conditions and/or client needs (see section 13.4). At least five standards are required for Response Factor and linear regression calibration. If a quadratic curve fit is used, a minimum of 6 calibration standards must be utilized to obtain a working calibration curve. See section 8.3.2 for information regarding use and deletion of calibration points.

Target analytes must have an average RSD of ≤20%. Any target analyte that has a %RSD >20% for the RF must be calculated by linear or quadratic regression instead of RF. If the RSD of any target analyte is ≤20%, the average response factor may be used for quantitation. When any compound does not meet the calibration criteria for RF, the analyst MUST use linear regression or, if permitted, quadratic curve fit. The calibration curve cannot be forced through zero. It must also meet a correlation coefficient of 0.990 or better. Analyses being generated for USACE projects must meet a correlation coefficient of 0.995 or better.

In addition to the minimum %RSD criteria, it is recommended that a minimum response factor for the most common target analytes be demonstrated for each individual calibration level to ensure that these compounds are performing as expected. See Table 8.3.1c. Meeting the minimum response factor criteria for the lowest calibration standard is critical in establishing and demonstrating the desired sensitivity.

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TITLE: **SEMIVOLATILE ORGANICS BY GC/MS (EPA METHODS 8270C, 8270D, 625, 625.1 AND SM 6410B), INCLUDING PROVISIONS FOR ANALYSIS IN SIM MODE**

Table 8.3.1c: Recommended Minimum Response Factors for Each Calibration Level (Initial and Continuing Calibration)

Compound	*Minimum Response Factor*	*Compound*	*Minimum Response Factor*
Benaldehyde	0.010	4-Nitrophenol	0.010
Phenol	0.800	Dibenzofuran	0.800
Bis(2-chloroethyl)ether	0.700	2,4-Dinitrotoluene	0.200
2-Chlorophenol	0.800	Diethyl phthalate	0.010
2-Methylphenol	0.700	1,2,4,5-Tetrachlorobenzene	0.010
2,2-Oxybis-(1-chloropropane)	0.010	4-Chlorophenyl-phenyl ether	0.400
Acetophenone	0.010	Fluorene	0.900
4-Methylphenol	0.600	4-Nitroaniline	0.010
n-Nitroso-di-n-propylamine	0.500	4,6-Dinitro-2-methylphenol	0.010
Hexachloroethane	0.300	4-Bromophenyl-phenyl ether	0.100
Nitrobenzene	0.200	n-Nitrosodiphenylamine	0.010
Isophorone	0.400	Hexachlorobenzene	0.100
2-Nitrophenol	0.100	Atrazine	0.010
2,4-Dimethylphenol	0.200	Pentachlorophenol	0.050
Bis(2-chloroethoxy)methane	0.300	Phenanthrene	0.700
2,4-Dichlorophenol	0.200	Anthracene	0.700
Naphthalene	0.700	Carbazole	0.010
4-Chloroaniline	0.010	Di-n-butyl phthalate	0.010
Hexachlorobutadiene	0.010	Fluoranthene	0.600
Caprolactam	0.010	Pyrene	0.600
4-Chloro-3-methylphenol	0.200	Butyl Benzyl phthalate	0.010
2-Methylnaphthalene	0.400	3,3-Dichlorobenzidine	0.010
Hexachlorocyclopentadiene	0.050	Benzo(a)anthracene	0.800
2,4,6-Trichlorophenol	0.200	Chrysene	0.700
2,4,5-Trichlorophenol	0.200	Bis (2-ethylhexyl)phthalate	0.010
1,1-Biphenyl	0.010	Di-n-octyl phthalate	0.010
2-Chloronaphthalene	0.800	Benzo(b)fluoranthene	0.700
2-Nitroaniline	0.010	Benzo(k)fluoranthene	0.700
Dimethyl phthalate	0.010	Benzo(a)pyrene	0.700
2,6-Dinitrotoluene	0.200	Indeno(1,23-c,d)pyrene	0.500
Acenaphthylene	0.900	Dibenz(a,h)anthracene	0.400
3-Nitroaniline	0.010	Benzo(g,h,i)perylene	0.500
Acenaphthene	0.900	2,3,4,6-Tetrachlorophenol	0.010
2,4-Dinitrophenol	0.010		

EPA 8270C GC/MS SIM: When analyzing samples using SW-846 8270C SIM, all target compounds must be treated as CCCs and must have an average RSD of ≤30%.

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EPA 8270D GC/MS SIM: If analyzing samples by EPA 8270D SIM, follow the initial calibration criteria for the specified referenced method as found in section 8.3.1 (EPA Method 8270D).

EPA Method 625: The working standards prepared in section 7.10 are injected and average response factors are calculated. A minimum of 3 points calibration is required for method 625. The %RSD is calculated for the standards analyzed and must be $\leq$35% for all compounds in order to assume linearity.

EPA Method 625.1: One of the calibration standards should be at a concentration at or below the minimum level (ML) specified in Attachment VII or as specified by a regulatory/control authority or in a permit. The ML value may be rounded to a whole number that is more convenient for preparing the standard, but must not exceed the ML in Attachment VII for those analytes which list ML values. Alternatively, the laboratory may establish a laboratory ML for each analyte based on the concentration in a nominal whole-volume sample that is equivalent to the concentration of the lowest calibration standard in a series of standards produced in the laboratory or obtained from a commercial vendor. The laboratory's ML must not exceed the ML in Attachment VII, and the resulting calibration must meet all applicable acceptance criteria in Section 10, based on the RSD, RSE, or r^2. The concentrations of the other calibration standards should correspond to the expected range of concentrations found in real samples or should define the working range of the GC/MS system for full-scan and/ or SIM operation, as appropriate. A minimum of six concentration levels is required for a second order, non-linear (i.e., quadratic) calibration.

Calculate the mean (average) and relative standard deviation (RSD) of the responses factors. If the RSD is less than 35%, the RF can be assumed to be invariant and the average RF can be used for calculations. Alternatively, the results can be used to fit a linear or quadratic regression of response ratios, As/Ais, vs. concentration ratios Cs/Cis. If used, the regression must be weighted inversely proportional to concentration. The coefficient of determination (r^2) of the weighted regression must be greater than 0.920 (this value roughly corresponds to the RSD limit of 35%). Alternatively, the relative standard error (RSE) may be used as an acceptance criterion. As with the RSD, the RSE must be less than 35%. If an RSE less than 35% cannot be achieved for a quadratic regression, system performance is unacceptable and the system must be adjusted and re-calibrated.

All Published Methods: Reference spectra must be updated upon analysis of each new calibration curve.

Linear Regression Weighting: As an alternative to calculating mean response factors and applying the RSD test, use the GC/MS data system software or other available software to generate a linear or second order regression calibration curve, by plotting A/A(is) vs. Q(x) using the equations found in section 9.4. Either equal weighting factors or 1/x regressions may be used.

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STATE NOTE: For all Minnesota sample analyses, the RL level standard is re-injected and quantitated against the newly updated calibration curve or the applicable standards are reprocessed (re-quantitated) using the completed calibration curve and is evaluated for the ±40% deviation criterion with the exception of the listed poor performers in this procedure.

STATE NOTE: For all Wisconsin sample analyses, analysts must evaluate the %RSD of calibrations to ensure that they do not have unacceptable curvature. The %RSD limit criteria, as found in the specific methods listed above, applies to calibrations using average RF calibrations. For linear and quadratic curve fits, a limit of 40% RSD is used for normal target analytes and 50% RSD is utilized for known poor performing compounds.

STATE NOTE: When analyzing samples in conjunction with the Ohio VAP or South Carolina DHEC programs, the calibration model must be RSD or linear. Quadratic curve modeling is not permitted unless historical performance of analytes exhibited a nonlinear response (i.e., Benzoic Acid and problematic phenols). Quadratic models cannot be used to extend the calibration range or bypass instrument maintenance.

8.4.2 CALIBRATION POINTS – Usage and Deletion

When the appropriate number of calibration standards is used, all points must be considered in the average response factor calculation or linear regression calculation. The deletion of the highest point is acceptable when necessary, with the analyst noting that the high end of the calibration has been lowered. The deletion of the lowest calibration point is acceptable, when necessary, provided that the analyst notes the deletion on the injection log and raises the reporting limit, if necessary, for that compound.

8.4.3 **EPA Method 8270D:** LINEAR REGRESSION USE – The method of linear regression calibration has the potential for a significant bias to the lower portion of the calibration model. This bias is not normally seen in relative percent difference methods. When utilizing linear regression fits, a minimum quantitation check on the viability of the lowest calibration point should be performed by re-fitting the response from the lowest concentration standard back into the completed calibration curve. It is not necessary to re-analyze a low concentration standard, but using the analytical system software, the low standard can be re-quantitated as if it were a field sample. The recalculated concentrations of the analytes utilizing the linear regression curve fit must be within ±30% of the true standard concentration.

STATE NOTE: For the analysis of South Carolina samples, all target analytes, including Hexachlorophene, is required to utilize linear regression. Quadratic curve fit is not allowed. To achieve this,

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the calibration curve may be modified by the removal of the lowest two levels and will utilize calibration levels of 60, 80, 100, 120, and 140 for quantitation of this analyte in South Carolina samples. The reporting limit (RL) for South Carolina will routinely be 100ppb for water samples.

8.4.4 Quadratic Regression: Quadratic regression may be used for the following compounds: Pentachlorophenol, 4-Nitrophenol, 2,3,4,6-Tetrachlorophenol, 4,6-Dinitro-2-methylphenol, 2,4-Dinitrophenol. Plots must have a minimum of 6 points and a correlation coefficient of 0.995 or better.

STATE NOTE: Quadratic curve modeling is not permitted for samples originating in South Carolina or for samples reported for the Ohio VAP unless historical performance of analytes exhibited a nonlinear response (e.g., Benzoic Acid).

8.4.5 Second Source Calibration Verification – the initial calibration for each target analyte must be checked with a standard from a source that is different from those used for initial calibration.

8.4.6 **Daily Tuning and Continuing Calibration**

As with the initial calibration, the system must be tuned with 50ng of DFTPP or less to meet the acceptance criteria found in section 8.1. Following successful tuning, the midpoint level standard (CCV) is analyzed. Calibration verification for each method, as listed below, must be met prior to the analysis of field samples and every 12 hours for 8270C/D and every 24 hours for EPA 625 (see the method note in Section 8.2 for Method 625.1 requirements).

EPA Method 8270C: The percent difference of the CCCs (see Table 8.3.1a & b) in the mid-level standard must be $\leq$20% and the SPCCs must have an RF $\geq$0.05. The retention time of the internal standards must be within $\pm$30 seconds from the mid-point standard level of the last initial calibration curve and the area response must be within –50% to +100%. Once these criteria are met, samples can be analyzed.

EPA Method 625: The calculated recovery for any parameter in the method from the mid-level standard must not vary by more than $\pm$20% drift from the initial calibration curve.

EPA Method 625.1: The RF or calibration curve must be verified immediately after calibration and at the beginning of each 12-hour shift, by analysis of a standard at or near the concentration of the mid-point calibration standard. The standard(s) must be obtained from a second manufacturer or a manufacturer's batch prepared independently from the batch used for calibration. Include the surrogates in this solution. It is necessary to verify calibration for the analytes of interest only.

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Compare the recoveries for the analytes of interest against the acceptance criteria for recovery (Q) in Attachment VII and the recoveries for surrogates against the acceptance criteria in Attachment VIII. If recovery of the analytes of interest and surrogates meet acceptance criteria, system performance is acceptable and analysis of samples may continue. If any individual recovery is outside its limit, system performance is unacceptable for that analyte.

EPA Methods 8270C and 625 (analyzed concurrently): The CCV must be evaluated for CCC and SPCCs as per EPA Method 8270C requirements. All non-CCC and other target analytes must meet the criteria established in Method 625 for all analytes (±20%). For analytes not contained in the Method 625 analyte list, the analyst evaluates the CCV and the experience of the analyst weighs heavily in determining the usability of the data.

STATE NOTE: For all Wisconsin sample analyses, non-CCC compounds for 8270C requires a ±50% criteria for the CCV.

EPA 8270C GC/MS SIM: When analyzing samples using SW-846 EPA 8270C SIM, all compounds in the CCV must be treated as CCCs and must meet the minimum requirements of ≤20% difference.

EPA 8270D GC/MS SIM: If analyzing samples by EPA 8270D SIM, follow the initial calibration criteria for the specified referenced method as found in section 8.3.6 (EPA Method 8270D below).

EPA Method 8270D: Each of the most common target analytes in the CCV must meet the minimum response factors in Table 8.3.1c. When using the average RF, the percent difference for each target compound in the CCV must be ≤20%. When using regression fit calibration, the percent drift of the CCV must be ≤20%. The retention time of the internal standards must be within ±30 seconds from the mid-point standard level of the last initial calibration curve and the area response must be within –50% to +100%.

8.4.7 For corrective action regarding tuning and calibration, see sections 11.1 and 11.2.

8.5 Method Blank Analysis – A method blank should be analyzed prior to any field sample analysis to verify that the analytical system is free from contaminants. If the method blank indicates that contamination may be present in the analytical system, it may be necessary to analyze a solvent blank to demonstrate the source of the contamination is not carryover from standards or lingering field sample artifacts.

8.6 GC/MS analysis of field samples and preparation QC.

8.6.1 It is highly recommended that the extracts be screened on a GC/FID or GC/PID using the same type of capillary column used in the GC/MS system. This will minimize contamination of the GC/MS system from unexpectedly high concentrations of organic compounds.

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8.6.2 Allow the extracts to warm to room temperature. Just prior to analysis, add 10µL of the internal standard solution to the 1mL concentrated extract or 5µL of the internal standard solution to the 0.5mL extract obtained from sample preparation.

8.6.3 If the response for any quantitation ion exceeds highest level of the initial calibration range, the extract must be diluted and re-analyzed. Additional internal standard must be added to the diluted extract to maintain the same concentration as in the calibration standards (0.04, 0.16 or 8ng/uL, unless a more sensitive GC/MS system is being used). For example, if performing a 1:10 dilution on a concentrated extract, take 100uL of the extract and dilute to a volume of 1mL with the appropriate solvent. Add 9uL of the appropriate internal standard solution to the diluted extract and inject on the analytical system. It can be assumed that 1uL of internal standard was contained in the 100uL extract used for the initial dilution.

8.6.4 Internal standard area counts and retention times must be monitored in all samples, spikes and method blanks to monitor system performance, check for drifting, ensure effective autosampler performance, etc. If the area of the Extracted Ion Current Profile (EICP) changes by a factor of 2 (-50% to +100%) from the areas in the daily CCV, corrective action is required. The RRT of the internal standard in the extract must be within ± 0.06RRT units of the RRT of the daily CCV.

STATE NOTE: With each new calibration curve, a reporting limit verification (RLV) standard must be analyzed for samples analyzed from Minnesota. This standard consists of either re-injecting the low calibration standard(s) or re-processing the low standard(s) utilized in the construction of the calibration curve. The RLV must recover within ±40% of the expected concentration. See section 11.10 for additional information.

8.7 Qualitative Identification

8.7.1 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 the laboratory 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. Retention time windows for internal standards and target compounds integrations are updated with each calibration curve and after any instrument maintenance occurs that causes a shift that may affect ChemStation integrations.

8.7.1.1 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 a 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.

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8.7.1.2 The RRT of the sample component is within ± 0.06RRT units of the RRT of the standard component.

8.7.1.3 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%). Analyst experience is vital in this determination when interferences are present.

8.7.1.4 Structural isomers that produce very similar mass spectra should be identified as individual isomers if they have sufficiently different GC retention times. Sufficient GC resolution is achieved if the height of the valley between the two isomers is <50% of the average of the two peak heights (for Method 8270D) and <25% of the sum of the two peak heights (for Methods 8270C & 625). Otherwise, structural isomers are identified as isomeric pairs.

8.7.1.5 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.

8.7.1.6 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 can be met, but each analyte spectrum will contain extraneous ions contributed by the co-eluting compound.

8.7.1.7 Absolute retention times are used for compound identification in all GC methods that do *not* employ internal standard calibration. Retention time windows are established to compensate for minor shifts in absolute retention times as a result of sample loadings and normal chromatographic variability. The width of the retention time window should be carefully established to minimize the occurrence of both false positive and false negative results. Tight retention time windows may result in false negatives and/or may cause unnecessary reanalysis of samples when surrogates or spiked compounds are erroneously not identified. Overly wide retention time windows may result in false positive results that may not be confirmed.

8.7.1.7.1 Before establishing retention time windows, make sure that the chromatographic system is operating reliably and that the system conditions are optimized for the target analytes and surrogates in the sample matrix to be analyzed. Make three injections of all

standard mixtures 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.

8.7.1.7.2 Record the retention time (in minutes) for each single component analyte and surrogate to three decimal places. Calculate the mean and standard deviation of the three absolute retention times for each single component analyte and surrogate. For multi-component analytes, choose three to five major peaks (see the determinative methods for more details) and calculate the mean and standard deviation of those peaks.

8.7.1.7.3 If the standard deviation of the retention times for a target compound is 0.000 (i.e., no difference between the absolute retention times), then either collect data from additional injections of standards or use a default standard deviation of 0.01 minutes.

8.7.1.7.4 The width of the retention time window for each analyte, surrogate, and major constituent in multi-component analytes is defined as ± 3 times the standard deviation of the mean absolute retention time established during the 72-hour period or 0.03 minutes, whichever is greater.

8.7.1.7.5 Establish the center of the retention time 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.

8.7.1.7.6 Calculate absolute retention time windows 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 or if a GC column has been shortened during maintenance.

8.8 TICs – Tentatively Identified Compounds

Periodically, clients may request the tentative identification of compounds present in the field sample that are not normal target compounds and are not normally calibrated. This identification is limited to the compounds in the current NBS (National Bureau of Standards) mass spectral library employed by ESC.

Library Search Identification – For samples containing components not associated with the calibration standards, a library search may be made for the purpose of a tentative identification. Data system library searches must not use normalization routines that would misrepresent the library or unknown spectra when making comparisons. For example, the RCRA permit or waste delisting requirements may require the reporting of

non-target analytes. The analyst may only assign tentative identifications after visual comparison of sample spectra with the nearest library searches.

Guidelines for tentative identification are:

- Relative intensities of major ions in the reference spectrum (ions >10% of the most abundant ion) should be present in the sample spectrum.
- The relative intensities of the major ions should agree within ±20%. (EXAMPLE: For an ion with an abundance of 50% in the standard spectrum, the corresponding sample ion abundance must be between 30% and 70%).
- 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 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.

Routinely, ESC employs a minimum Q value of 80 for tentative identifications and a minimum concentration of 10ppb. Peaks below a Q value of 80 but above 10ppb are reported as “Unknown”. Any identified peaks below 10ppb are removed as these could result from baseline noise or other interferences, not necessarily attributable to the field sample or reliably quantifiable using GCMS technology. Additionally, any peaks that are attributable to instrument contamination (I.e., siloxanes) are also removed.

8.9 Quantitative analysis

8.9.1 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.

8.9.1.1 It is recommended to use the integrations produced by the software if the integration is correct because the software will produce more consistent integrations of peaks in chromatograms. Manual integrations may be necessary in some cases and must be performed in conjunction with ESC SOP #030215, *Manual Integration*.

DOD samples must include a reason for each integration performed on the manual integration documentation.

8.9.2 If the RSD of a compound's response factor meets method requirements, then the concentration in the extract may be determined using the average response factor (average RF) from initial calibration data.

8.9.3 Where applicable, the concentration of any tentatively identified compounds in the sample should be estimated. The same formula as is used to calculate target analyte concentrations is used with the following modifications: The areas A_x and

A_{is} must be from the total ion chromatograms and the RF for the compound is assumed at 1. See section 9.7 for calculation.

8.9.4 The resulting concentration must be reported indicating that the value is an estimate. Use the nearest internal standard free of interferences for estimated concentration calculations.

8.9.5 Quantitation of multi-component compounds (e.g., Toxaphene, Aroclors, etc.) is beyond the scope of Method 8270. Normally, quantitation is performed using a GC/ECD, by Methods 8081or 8082. However, Method 8270 may be used to confirm the identification of these compounds, when the concentrations are at least 10ng/µL in the concentrated sample extract.

8.9.6 **Peak Resolution:** Structural isomers that produce very similar spectra must be quantitated as individual isomers if they have sufficiently different GC retention times. Sufficient GC resolution is achieved if the height of the valley between the two isomers is <50% of the average of the two peak heights (for Method 8270D) and <25% of the sum of the two peak heights (for Methods 8270C & 625). Otherwise, structural isomers should be identified as isomeric pairs.

STATE NOTE: Minnesota MPCA requires that peak resolution of all co-eluters, analyzed using Method 8270C, must be resolved as close to 75% as possible, but not <70%. Resolution must be adequate at lower levels and not worsen as concentration increases.

8.9.7 Indeno(1,2,3-cd)pyrene and dibenz(a,h)anthracene share a similar structure and physical properties. Under routine analytical production conditions it is very difficult to achieve resolved chromatographic separation. The mass-spectra of these compounds exhibit base peaks separated by 2 AMUs (276 and 278 respectively) and these unique ions are used for quantitation of the respective compounds as defined by Method 8270. It has been found that the major base ion, 276, for indeno(1,2,3-cd)pyrene includes a significant contribution from dibenz(a,h)anthracene when the targets are present together at equal concentrations; however, indeno(1,2,3-cd)pyrene presence *does not* contribute significant ion 278 abundance to dibenz(a,h)anthracene quantitation at equal concentrations. For these reasons when dibenz(a,h)anthracene is found to be present at similar or lesser concentrations than indeno(l,2,3-cd)pyrene, the results are normalized by the calibration conditions and considered to be non-impacted. Alternatively, when dibenz(a,h)anthracene is found to be present at relatively greater concentrations than indeno(l ,2,3-cd)pyrene, the indeno(1,2,3-cd)pyrene results are considered to be elevated and may be confirmed by a secondary acquisition and analysis utilizing a technique for chromatographic separation of the targets. Concentrations shall be considered similar up to a factor of two.

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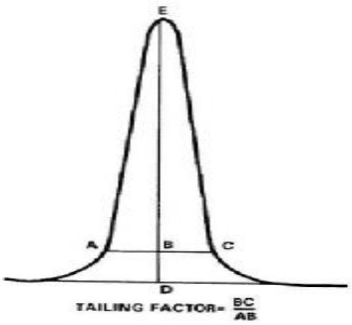
9.0 DATA ANALYSIS AND CALCULATIONS

9.1 GC/MS Tune: DDT Breakdown Determination during Tuning:

$$\%\ \text{breakdown of DDT} = \frac{\text{sum of degradation peak areas (DDD + DDE)}}{\text{sum of all peak areas (DDT + DDE + DDD)}} \times 100$$

9.2 GC/MS Tune: Benzidine and Pentachlorophenol Tailing Factor

$$\text{TailingFactor} = \frac{BC}{AB}$$



where: BC is the width of the back ½ of the peak at 10% of the peak height
AB is the width of the front ½ of the peak at 10% of the peak height.

9.3 Internal Calibration Equations (Response Factors):

$$RF = \frac{[A_s][C_{is}]}{[A_{is}][C_s]}$$

where:
A_s = Peak area (or height) of the analyte or surrogate.
A_{is} = Peak area (or height) of the internal standard.
C_s = Concentration of the analyte or surrogate, in µg/L.
C_{is} = Concentration of the internal standard, in µg/L.

- Percent Relative Standard Deviation (%RSD)

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Standard Operating Procedure

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TITLE: **SEMIVOLATILE ORGANICS BY GC/MS (EPA METHODS 8270C, 8270D, 625, 625.1 AND SM 6410B), INCLUDING PROVISIONS FOR ANALYSIS IN SIM MODE**

$$\overline{RF} = \frac{\sum_{i=1}^{n} RF_i}{n} \qquad SD = \sqrt{\frac{\sum_{i=1}^{n} (RF_i - \overline{RF})^2}{n-1}} \qquad RSD = \frac{SD}{\overline{RF}} x100\%$$

where:
RSD = Relative standard deviation.
RF = Mean of 5 initial RFs for a compound.
SD = Standard deviation of average RFs for a compound.

- Concentration of an analyte in an extract using RF (on column):

$$X_s = \frac{(Conc._{IStd})(Area_{Analyte})}{(Average\ RF_{analyte})(Area_{IStd})}$$

where:
X_s = Calculated raw concentration of analyte (in ppb)

- Quantitation Report Multiplier"

$$M_a = \frac{(V_t)(D)}{(V_s)} \quad or \quad M_s = \frac{(V_t)(D)}{(W_s)}$$

where:
M_a = Quantitation Report Multiplier for Aqueous Samples
M_s = Quantitation Report Multiplier for Solid Samples
V_t = Total volume of concentrated extract (in mL)
D = Dilution factor. If no dilution, D=1. Always dimensionless
V_s = Volume of aqueous sample extracted (in mL)
W_s = Weight sample extracted (in grams)

- Sample concentration by volume (ug/L) for aqueous samples:

$$Concentration\ in\ \frac{mg}{L} = (X_s)(M_a)$$

- Sample concentration by weight (ug/kg) for solid samples and non-aqueous liquids:

$$Concentration\ in\ \frac{mg}{kg} = \frac{(X_s)(M_s)}{(\%S)}$$

where:
%S = Percent solids expressed as a decimal

9.4 Relative Retention Time (RRT):

$$RRT = \frac{RT\ of\ Target\ Analyte}{RT\ of\ Internal\ Standard}$$

9.5 Percent Error (%Error)

$$\%Error = \frac{x_i - x'_i}{x_i} * 100$$

where:
x'_i = Measured amount of analyte at the calibration level *i*, in mass or concentration units
x_i = True amount of analyte at calibration level *i*, in mass or concentration units

9.6 Relative Standard Error (%RSE) – As an alternative to using the average response factor when using Method 625.1, the quality of the calibration may be evaluated using the Relative Standard Error (RSE). The acceptance criterion for the RSE is the same as the acceptance criterion for Relative Standard Deviation (RSD), in the method. RSE is calculated as:

$$\%RSE = 100 \times \frac{\sum_{i=1}^{n} \left[\frac{x'_i - x_i}{x_i}\right]^2}{(n-p)}$$

where:
x'i = Calculated concentration at level i
xi = Actual concentration of the calibration level i
n = Number of calibration points
p = Number of terms in the fitting equation (average = 1; linear = 2; quadratic = 3)

9.7 See the current Quality Assurance Manual for other equations associated with common calculations.

10.0 QUALITY CONTROL AND METHOD PERFORMANCE

10.1 All analysts must meet the qualifications specified in SOP #030205, *Technical Training and Personnel Qualifications* before approval to perform this method. Analysts must complete an initial demonstration of proficiency before being approved to perform this method. Continuing proficiency must be demonstrated using proficiency testing, laboratory control sample analysis and/or MDL studies. Method performance is assessed per analyst. Updated method performance records are filed and stored in a central location within the department.

10.1.1 Method 625.1 Demonstration of Capability (DOC) Requirements

10.1.1.1 For the DOC, a QC check sample (LCS) concentrate containing each analyte of interest is prepared in a water miscible solvent. The QC check sample concentrate must be prepared independently from those used for calibration, but may be from the same source as the second-source standard used for calibration verification. The concentrate should produce concentrations of the analytes of interest in water at the midpoint of the calibration range, and may be at the same concentration as the LCS.

10.1.1.2 Prepare four QC check samples by adding an appropriate volume of the concentrate and of the surrogate(s) to each of four aliquots of reagent water and mix well. The volume of reagent water must be the same as the volume that will be used for the sample, blank, and MS/MSD.

10.1.1.3 Extract and analyze the four LCSs samples.

10.1.1.4 Calculate the average percent recovery ($\bar{X}$) and the standard deviation (s) of the percent recovery for each analyte using the four results.

10.1.1.5 For each analyte, compare s and $\bar{X}$ with the acceptance criteria for precision and recovery presented in Attachment VII. For analytes that are not listed, QC acceptance criteria must be developed by the laboratory.

If s and $\bar{X}$ for all analytes of interest meet the acceptance criteria, system performance is acceptable and analysis of blanks and samples can begin. If any individual s exceeds the precision limit or any individual $\bar{X}$ falls outside the range for recovery, system performance is unacceptable for that analyte.

10.1.1.6 When one or more of the analytes tested fail at least one of the acceptance criteria, repeat the test for only the analytes that failed. If results for these analytes pass, system performance is acceptable and analysis of samples and blanks may proceed. If one or more of the analytes again fail, system performance is unacceptable for the analytes that failed the acceptance criteria. Correct the problem and repeat the test.

10.2 Use the designated Run log to record batch order and standards/reagents used during analysis. See SOP #030201, *Data Handling and Reporting*.

10.3 Batches:

Batches are defined as sets of 1 - 20 samples. Batch analysis must include the following: 1 method blank, 1 Laboratory Control Sample (LCS), 1 Laboratory Control Sample Duplicate (LCSD), 1 Matrix Spike/Spike Duplicate (MS/MSD) (if client has supplied

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sufficient sample volume). All batch information must be maintained in the preparation documentation assigned to the department.

10.4 For sample analyzed per the requirements of Method 8000D, the LLOQ (see Section 1.8.2) must be verified at least annually, and whenever significant changes are made to the preparation and/or analytical procedure, to demonstrate quantitation capability at lower analyte concentration levels

10.4.1 The LLOQ verification (to be performed after the initial calibration) is prepared by spiking a clean control material with the analyte(s) of interest at 0.5-2 times the LLOQ concentration level(s).

10.4.2 The LLOQ check is carried through the same preparation and analytical procedures as environmental samples and other QC samples.

10.4.3 It is recommended to analyze the LLOQ verification on every instrument where data is reported; however, at a minimum, the lab must rotate the verification among similar analytical instruments such that all are included within 3 years.

10.4.4 Recovery of target analytes in the LLOQ verification must be within established in-house limits or within other such project-specific acceptance limits to demonstrate acceptable method performance at the LLOQ. Until the laboratory has sufficient data to determine acceptance limits, the LCS criteria ± 20% (i.e., lower limit minus 20% and upper limit plus 20%) may be used for the LLOQ acceptance criteria.

10.5 Method 625.1 Requirements

10.5.1 At the beginning of each 12-hour shift during which standards or extracts will be analyzed, perform the tests in this section to verify system performance. If an extract is concentrated for greater sensitivity (e.g., by SIM), all tests must be performed at levels consistent with the reduced extract volume.

10.5.2 Inject the DFTPP standard and verify that the criteria are met.

10.5.2.1 Analysis of DFTPP, the DDT/Endrin decomposition test (if used), the LCS, and the blank are outside of the 12-hour analysis shift. The total time for DFTPP, DDT/ Endrin, the LCS, the blank, and the 12-hour shift must not exceed 15 hours.

10.5.3 The resolution should be verified on the mid-point concentration of the initial calibration as well as the laboratory designated continuing calibration verification level if closely eluting isomers are to be reported (e.g., benzo(b)fluoranthene and benzo(k)fluoranthene). Sufficient gas chromatographic resolution is achieved if the height of the valley between two isomer peaks is less than 50% of the average of the two peak heights.

10.5.4 Verify calibration.

10.5.5 Verify tailing factor specifications.

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10.5.6 Analyze the extract of the LCS at the beginning of analyses of samples in the extraction batch. The LCS must meet the following requirements in section 8.4, and the blank must meet the following requirements before sample extracts may be analyzed.

10.5.6.1 Compare the percent recovery (PS) for each analyte with its corresponding QC acceptance criterion in Attachment VII. For analytes of interest not listed in Attachment VII, use the QC acceptance criteria developed for the LCS, or limits based on laboratory control charts. If the recoveries for all analytes of interest fall within their respective QC acceptance criteria, analysis of blanks and field samples may proceed

10.5.7 Analyze the extract of the blank at the beginning of analyses of samples in the extraction batch. The blank must meet the requirements in section 8.5 before sample extracts may be analyzed.

10.5.7.1 Analyze the blank immediately after analysis of the LCS and prior to analysis of the MS/MSD and samples to demonstrate freedom from contamination.

10.5.7.2 If an analyte of interest is found in the blank at a concentration greater than the MDL for the analyte, at a concentration greater than one-third the regulatory compliance limit, or at a concentration greater than one-tenth the concentration in a sample in the extraction batch, whichever is greater, analysis of samples must be halted, and the problem corrected. If the contamination is traceable to the extraction batch, samples affected by the blank must be re-extracted and the extracts re-analyzed. If, however, continued re-testing results in repeated blank contamination, the laboratory must document and report the failures (e.g., as qualifiers on results), unless the failures are not required to be reported as determined by the regulatory/control authority. Results associated with blank contamination for an analyte regulated in a discharge cannot be used to demonstrate regulatory compliance.

10.5.8 If DDT and/or endrin are to be determined, the breakdown test must be performed prior to calibration verification. The QC acceptance criteria must be met before analyzing samples for DDE and/ or Endrin. DDT decomposes to DDE and DDD. Endrin decomposes to endrin aldehyde and endrin ketone.

10.5.8.1 Both the % breakdown of DDT and of Endrin must be less than 20%, otherwise the system is not performing acceptably for DDT and endrin.

10.5.9 The data user should identify the sample and the analytes of interest to be spiked and provide sufficient sample volume to perform MS/MSD analyses. The laboratory must, on an ongoing basis, spike at least 5% of the samples in duplicate from each discharge being monitored to assess accuracy (recovery and precision). If direction cannot be obtained from the data user, the laboratory

must spike at least one sample in duplicate per extraction batch of up to 20 samples with the analytes in Table 1. Spiked sample results should be reported only to the data user whose sample was spiked, or as requested or required by a regulatory/control authority, or in a permit.

10.5.9.1 If, as in compliance monitoring, the concentration of a specific analyte will be checked against a regulatory concentration limit, the concentration of the spike should be at that limit; otherwise, the concentration of the spike should be one to five times higher than the background concentration (determined below), at or near the midpoint of the calibration range, or at the concentration in the LCS whichever concentration would be larger.

10.5.9.2 Analyze one sample aliquot to determine the background concentration (B) of the each analyte of interest. If necessary, prepare a new check sample concentrate (section 8.2.1) appropriate for the background concentration. Spike and analyze two additional sample aliquots, and determine the concentration after spiking (A1 and A2) of each analyte. Calculate the percent recoveries (P1 and P2) as 100(A1 - B)/T and 100 (A2 - B)/T, where T is the known true value of the spike. Also calculate the relative percent difference (RPD) between the concentrations.

10.5.9.3 Compare the percent recoveries (P1 and P2) and the RPD for each analyte in the MS/MSD aliquots with the corresponding QC acceptance criteria in Attachment VII. The laboratory may develop and apply QC acceptance criteria more restrictive than the criteria in Attachment VII, if desired.

10.6 For acceptance criteria for calibration standards, QC samples and field samples and corrective actions, see section 11.0.

11.0 DATA VALIDATION AND CORRECTIVE ACTION

11.1 A successful DFTPP tune must be achieved prior to initial calibration or daily calibration verification. If a tune does not meet the acceptance criteria in section 8.2, then re-inject the tuning solution. If the failure persists, instrument maintenance or detector adjustment is required. The instrument is equipped with detector adjustments in routines called “Autotunes” that can make minor adjustments to m/z ratios and detector setting and can align the analytical system to return the system to peak performance. If after performing the Autotune routine, the injected tuning standard still fails, the system may require injector and/or detector cleaning, column cutting or replacement, injection liner cleaning or replacement, or other maintenance as specified by the manufacturer.Following successful tuning of the DFTPP solution, the DDT degradation and Benzidine/Pentachlorophenol tailing must be assessed. If either fail to meet the required acceptance criteria, instrument maintenance is required. The DDT degradation is most likely an inlet or column condition and corrective action entails clipping 6-12” from the injector end of the column, changing the injection port liner, possibly changing the gold

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inlet seal and re-injecting the tuning solution. The tailing issue is most likely caused by the same type of inlet issues and the same corrective action steps should occur when the tailing criteria is not met. Tailing may also be caused by incorrect column positioning in the inlet and the correct position of the column should be verified prior to performing more involved corrective action processes.

A successful instrument tune, including degradation and tailing acceptability, must be achieved prior to the analysis of calibration standards and sample extracts.

Method 625.1: The DFTPP spectrum may be evaluated by summing the intensities of the m/z's across the GC peak, subtracting the background at each m/z in a region of the chromatogram within 20 scans of but not including any part of, the DFTPP peak. The DFTPP spectrum may also be evaluated by fitting a Gaussian to each m/z and using the intensity at the maximum for each Gaussian or by integrating the area at each m/z and using the integrated areas. Other means may be used for evaluation of the DFTPP spectrum so long as the spectrum is not distorted to meet the criteria in Table 8.2d of this SOP.

The tailing factor for benzidine and pentachlorophenol must be <2; otherwise, adjust instrument conditions and either replace the column or break off a short section of the front end of the column, and repeat the test. Once the scan conditions are established, they must be used for analyses of all standards, blanks, and samples.

11.2 Initial or Continuing Calibration:

Method 8270C, SM 6410B & Methods 625 and 625.1: If the calibration curve or daily calibration verification fails to meet the applicable method verification criteria for RSD, the analyst MUST use linear regression or quadratic curve fit. Quadratic models cannot be used to extend the calibration range or bypass instrument maintenance. If the method criteria are still not met when using the alternate curve fits, samples may not be quantitated using the calibration curve and a new calibration curve must be analyzed. Instrument maintenance and/or new standard preparation may also be required prior to the analysis of the new calibration curve. Following maintenance, the new calibration curve can be generated. The system may require injector and/or detector cleaning, column cutting or replacement, injection liner cleaning or replacement, or other maintenance as specified by the manufacturer. Additional actions that can be taken to address failures in calibration are included in section 8.3.

Method 8270D: Due to the large number of compounds that may be analyzed by this method, some compounds in the initial and/or daily calibration verification will fail to meet the initial and continuing calibration acceptance criteria. For these instances, failing compounds may not be critical to specific project needs and therefore may be utilized as qualified data or estimated values for screening purposes. If more than 10% of the compounds in the initial or continuing calibration exceed the 20% RSD limit and/or do not meet the minimum correlation coefficient (0.990) for alternate curve fits, then the chromatographic system is considered too reactive for analysis. Instrument maintenance must be performed and the calibration process must be repeated. The system may require injector and/or detector cleaning, column cutting or replacement, injection liner cleaning or replacement, or other maintenance as specified by

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the manufacturer. Additional actions that can be taken to address failures in calibration are included in section 8.3.

TNI: If the ICV or CCV results obtained are outside the established acceptance criteria and analysis of a second consecutive (immediate) calibration verification fails to produce results within acceptance criteria, corrective actions shall be performed. The laboratory shall demonstrate acceptable performance after the final round of corrective action with two consecutive calibration verifications, or a new initial instrument calibration shall be performed.

Method 8000D: To determine calibration function acceptability, refit the initial calibration data back to the calibration model and calculate %Error (see Section 9.5). Percent error between the calculated and expected amounts of an analyte must be ≤30% for all standards. For some data uses, ≤50% may be acceptable for the lowest calibration point.

Method 625.1: The RF or calibration curve must be verified immediately after calibration and at the beginning of each 12-hour shift, by analysis of a standard at or near the concentration of the mid-point calibration standard. The standard(s) must be obtained from a second manufacturer or a manufacturer's batch prepared independently from the batch used for calibration.

When one or more analytes fail acceptance criteria, analyze a second aliquot of the calibration verification standard and compare ONLY those analytes that failed the first test with their respective acceptance criteria. If these analytes now pass, system performance is acceptable and analysis of samples may continue. A repeat failure of any analyte that failed the first test, however, will confirm a general problem with the measurement system. If this occurs, repair the system and repeat the test, or prepare a fresh calibration standard and repeat the test. If calibration cannot be verified after maintenance or injection of the fresh calibration standard, re-calibrate the instrument.

11.3 The method blank must be extracted and analyzed with each set of samples at a frequency of at least 5% and must be free of the analytes of interest at the method detection limit. If the method blank contains target analytes at a detectable concentration, it may be necessary to analyze a solvent blank to demonstrate the source of the contamination is not carryover from standards or lingering field sample artifacts. Following verification that the analytical system is free from interferences, the method blank can be re-analyzed once. A passing method blank must be analyzed before any samples are analyzed; otherwise corrective action is required. Corrective action can take the form of checking the original calculations to ensure accuracy or instrument maintenance (i.e. column clipping or changing, inlet liner cleaning/replacement, etc.) or re-calibration. The surrogate recoveries in the method blank must meet the established control criteria (see the LIMS). If not, the recovery demonstrates an analytical system that is in an out-of-control mode and the batch must be re-extracted/re-analysis unless directed otherwise by the client.

General guidelines for qualifying sample results with regard to method blank quality are as follows:

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- If the method blank concentration is less than the MDL and sample results are greater than the RL, then no qualification is required.
- No qualification is necessary when an analyte is detected in the method blank but not in the associated samples.
- If the concentration in a sample is more than ten times the concentration in the method blank, then no qualification is required.
- If the method blank concentration is greater than the MDL but less than the RL and sample results are greater than the MDL, then qualify associated sample results to indicate that analyte was detected in the method blank.
- If the method blank concentration is greater than the RL, further corrective action and qualification is required. An analyst should consult their supervisor for further instruction.

Method 8000D: When samples that are extracted together are analyzed on separate instruments or in separate analytical shifts, the method blank associated with those samples (e.g., extracted with the samples) must be analyzed on at least one of those instruments. A solvent blank must be analyzed on all other instruments on which the set of samples was analyzed to demonstrate the instrument is not contributing contaminants to the samples. At least one method blank or instrument blank must be analyzed on every instrument after calibration standard(s) and prior to the analysis of any samples.

When sample extracts are subjected to cleanup procedures, the associated method blank must also be subjected to the same cleanup procedures.

Results of the method blank should be less than the LLOQ for the analyte or less than the level of acceptable blank contamination specified in the approved QAPP or other appropriate systematic planning document. Blanks are generally considered to be acceptable if target analyte concentrations are less than one-half the LLOQ or are less than project-specific requirements.

When new reagents or chemicals are received, the lab should monitor the blanks associated with samples for any signs of contamination. It is not necessary to test every new batch of reagents or chemicals prior to sample preparation if the source shows no prior problems. However, if reagents are changed during a preparation batch, separate blanks need to be prepared for each set of reagents.

Method 625.1: If an analyte of interest is found in the blank at a concentration greater than the MDL for the analyte, at a concentration greater than one-third the regulatory compliance limit, or at a concentration greater than one-tenth the concentration in a sample in the extraction batch, whichever is greater, analysis of samples must be halted, and the problem corrected. If the contamination is traceable to the extraction batch, samples affected by the blank must be re-extracted and the extracts re-analyzed. If, however, continued re-testing results in repeated blank contamination, the laboratory must document and report the failures (e.g., as qualifiers on results), unless the failures are not required to be reported as determined by the regulatory/control authority. Results associated with blank contamination for an analyte regulated in a discharge cannot be used to demonstrate regulatory compliance. QC failures do not relieve a discharger or permittee of reporting timely results.

11.4 Second Source Calibration Verification

Method 8270D: The value determined from the second source calibration verification (SSCV) should be within ±30% drift of the expected concentration. Alternative recovery limits may be appropriate based on analyte performance and project specific requirements. Quantitative analysis cannot proceed for analytes that fail the SSCV, except for screening purposes only.

Method 8270C/625/SM6410B: The value determined from the second source calibration verification (SSCV) must be ≤50% drift for non-CCC compounds; ≤20% drift for CCC compounds and meet the minimum response factor criteria for SPCC compounds as in the initial calibration construction. Historical performance weighs heavily in the acceptability of those analytes that are known to perform poorly. Corrective action can take the form of checking the original calculations to ensure accuracy, re-analysis of the SSCV to verify initial results, instrument maintenance (i.e. column clipping or changing, inlet liner cleaning/replacement, etc.) or re-calibration.

STATE NOTE: If the samples are analyzed in conjunction with South Carolina DHEC, alternate recovery limits can only be used if they are more stringent than method criteria.

Method 625.1: The RF or calibration curve must be verified immediately after calibration and at the beginning of each 12-hour shift, by analysis of a standard at or near the concentration of the mid-point calibration standard. The standard(s) must be obtained from a second manufacturer or a manufacturer's batch prepared independently from the batch used for calibration. Traceability must be to a national standard, when available. Include the surrogates in this solution. It is necessary to verify calibration for the analytes of interest only.

When one or more analytes fail acceptance criteria, analyze a second aliquot of the calibration verification standard and compare ONLY those analytes that failed the first test with their respective acceptance criteria. If these analytes now pass, system performance is acceptable and analysis of samples may continue. A repeat failure of any analyte that failed the first test, however, will confirm a general problem with the measurement system. If this occurs, repair the system and repeat the test, or prepare a fresh calibration standard and repeat the test. If calibration cannot be verified after maintenance or injection of the fresh calibration standard, re-calibrate the instrument.

11.5 Surrogates: If the surrogate recoveries in the samples do not fall within the appropriate acceptance criteria presented in the LIMS, ensure that there were no errors in calculations, internal standard, or instrument performance. If the recovery of any one surrogate is critically low (<10%) or critically high (>200%), then the sample must be re-extracted unless otherwise directed by the client or a clear, documented matrix interference is exhibited. If two of three acid and two of three base/neutral surrogates are within acceptance criteria, then the sample may be reported. If re-extraction is required and there is no more sample available or it has exceeded holding times, the data must be flagged with a "J1" (surrogate high) or a "J2" (surrogate low). See SOP #030201, *Data Handling and Reporting*, for more information on qualifying out of control data.

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STATE NOTE: If the sample is from North Carolina, two of the three acid and two of the three base/neutral surrogates must pass. If two of the three acid or base/neutral surrogates fail, the sample must be re-extracted. For all other samples, one of the three surrogates must pass from both the acid and base/neutral sides. If any surrogates have less than a 10% or greater than 200% recovery, and matrix interferences are not confirmed as the cause of the failure, the sample must be re-extracted.

STATE NOTE: If field samples are analyzed in conjunction with the Ohio VAP program, surrogate outliers in batch QC samples, including the method blank, LCS/LCSD, MS/MSD require re-extraction of the entire batch, if sufficient volume has been submitted by the client and an obvious matrix interferent is not present.

STATE NOTE: If the sample is analyzed in conjunction with the Ohio VAP, corrective action for failing QC (i.e. method blank, surrogate, MS/MSD, LCS/LCSD, ISTD, etc.) must be performed prior to flagging data, if sufficient sample volume was submitted by the client. Corrective action can include re-analysis, if instrument malfunction is suspected, or re-preparation and re-analysis, if the failure is suspected as either extraction or sample related.

Method 625.1: The laboratory must evaluate surrogate recovery data in each sample against its in-house surrogate recovery limits. The laboratory may use 60–140% as interim acceptance criteria for recoveries for surrogates not listed in Attachment VIII. At least 80% of the surrogates must meet the 60–140% interim criteria until in-house limits are developed. Alternatively, surrogate recovery limits may be developed from laboratory control charts, but such limits must be at least as restrictive as those in Attachment VIII. Spike the surrogates into all samples, blanks, LCSs, and MS/MSDs. Compare surrogate recoveries against the QC acceptance criteria in Attachment VIII and/or those developed in-house. If any recovery fails its criteria, attempt to find and correct the cause of the failure.

The large number of analytes tested in performance tests in this method present a substantial probability that one or more will fail acceptance criteria when many analytes are tested simultaneously, and a retest is allowed if this situation should occur. If, however, continued re-testing results in further repeated failures, the laboratory must document and report the failures (e.g., as qualifiers on results), unless the failures are not required to be reported as determined by the regulatory/control authority. Results associated with a QC failure for an analyte regulated in a discharge cannot be used to demonstrate regulatory compliance. QC failures do not relieve a discharger or permittee of reporting timely results.

11.6 Internal Standard: The internal standard area counts must be monitored for all ICVs. ISTDs must recover within –50% to +100% of the area counts from the internal standard area counts of the midpoint standard of the most recent initial calibration sequence. If any internal standard response is beyond the acceptable recovery, corrective action is required. Corrective action can take the form of checking the original calculations to

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ensure accuracy, re-analysis of the ICV to verify initial results, instrument maintenance (i.e. column clipping or changing, inlet liner cleaning/replacement, etc.) or re-calibration.

The internal standard responses and retention times in the check calibration 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 the last calibration verification, the chromatographic system must be inspected for malfunctions and corrections must be made, as required. When corrections are made, re-analysis of the CCV or a complete re-calibration is necessary, depending on the impact of the correction on the analytical system.

Internal standards must be monitored for each sample. ISTDs in samples must meet the –50% to +100% criteria when compared to the ISTDs in the daily CCV or mid-level of the calibration curve, on 12h shifts when full calibration is performed. Possible corrective actions include: re-analysis, if instrument malfunction is suspected, or re-preparation and re-analysis, if the failure is suspected as either extraction or sample related. If the sample has an obvious matrix interferent and the internal standard recovery is greater than +100%, the sample can be diluted (if acceptable reporting limits can be achieved) to minimize the interference or the sample must be re-extracted and re-analyzed to confirm the original results. ISTD failures <50% of daily ICV may be reported if all corresponding analytes are BDL as the high quantitation bias created by the reduced internal standard recovery has not adversely impacted the reported analyte results.

Method 625.1: The responses (GC peak heights or areas) of the internal standards in the calibration verification must be within 50% to 200% (1/2 to 2x) of their respective responses in the mid-point calibration standard. If they are not, repeat the calibration verification test or perform and document system repair. Subsequent to repair, repeat the calibration verification. If the responses are still not within 50% to 200%, re-calibrate the instrument and repeat the calibration verification test.

The responses (GC peak heights or areas) of each internal standard in each sample, blank, and MS/MSD must be within 50% to 200% (1/2 to 2x) of its respective response in the LCS for the extraction batch. If, as a group, all internal standards are not within this range, perform and document system repair, repeat the calibration verification, and re-analyze the affected samples. If a single internal standard is not within the 50% to 200% range, use an alternate internal standard for quantitation of the analyte referenced to the affected internal standard. It may be necessary to use the data system to calculate a new response factor from calibration data for the alternate internal standard/analyte pair. If an internal standard fails the 50–200% criteria and no analytes are detected in the sample, ignore the failure or report it if required by the regulatory/control authority.

11.7 LCS/LCSD and MS/MSD: The laboratory control sample, laboratory control sample duplicate, matrix spike and matrix spike duplicate recoveries must be evaluated against the acceptance criteria given in the LIMS. The LCS/LCSD and MS/MSD are spiked with the same list of compounds for which the instrument is calibrated. Due to the large number of compounds analyzed using these methods, it is statistically likely that accuracy and precision failures will occur.

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LCS or LCSD samples that do not pass the acceptable QC criteria must be re-analyzed. LCS/LCSD failures must meet the marginal exceedance criteria below. The normal compound list for 8270/625 typically contains 90 analytes; therefore only 5 analytes can be considered as marginally exceeding the acceptance criteria. If more than 5 failures occur or if the failures demonstrate a pattern that is causing the outliers, the entire sample batch with associated QC must be re-extracted and re-analyzed. Marginal exceedances must be random events.

Upper and lower marginal exceedance (ME) limits are established by +/- four times the standard deviation of historical accuracy data and the number of marginal exceedances allowed is based on the number of analytes spiked in the LCS.

Number of allowable marginal exceedances:

90 analytes, 5 analytes allowed in the ME limit
71 – 90 analytes, 4 analytes allowed in the ME limit.
51 – 70 analytes, 3 analytes allowed in the ME limit.
31 – 50 analytes, 2 analytes allowed in the ME limit.
11 – 30 analytes, 1 analyte allowed in the ME limit.
< 11 analytes, no analyte allowed in the ME limit.

If the MS/MSD fails to meet recovery limits listed in the LIMS, the data on the unspiked field sample for that compound must be flagged with a “J5” (high recovery) or a “J6” (low recovery). If the MS/MSD fail to pass precision limits (%RSD), the data on the unspiked field sample for that compound must be flagged with a “J3” qualifier.

Method 8000D: If, as in compliance monitoring, the concentration of a specific analyte in the sample is being checked against a regulatory concentration limit or action level, the spike should be at or below the limit, or 1 - 5 times the background concentration (if historical data are available), whichever concentration is higher. If historical data are not available, a background sample of the same matrix from the site may be submitted for matrix spiking purposes to ensure that high concentrations of target analytes and/or interferences will not prevent calculation of recoveries. If the background sample concentration is very low or non-detect, a spike of greater than 5 times the background concentration is still acceptable. To assess data precision with duplicate analyses, it is preferable to use a low concentration field sample to prepare a MS/MSD for organic analyses. This spiking procedure will be performed when project-specific instructions are received from the client.

If the concentration of a specific analyte in a sample is not being checked against a limit specific to that analyte, then the analyst may spike the matrix spike or MS/MSD sample(s) at the same concentration as the reference sample at 20 times the estimated LLOQ in the matrix of interest, or at a concentration near the middle of the calibration range. It is suggested that a background sample of the same matrix from the site be submitted as a sample for matrix spiking purposes. NOTE: Preparing the spiking solution from the same source as the calibration standards helps minimize additional variability due to differences between sources. Typically, spiking concentrations are near the middle of the calibration range.

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To develop precision and bias data for the spiked compounds, the analyst has two choices: analyze the original sample, and an MS/MSD pair; or analyze the original sample, a duplicate sample, and one spiked sample. If samples are not expected to contain the target analytes of concern, then the laboratory may use a MS/MSD pair. If samples are expected to contain the target analytes of concern, then the laboratory may use one matrix spike and a duplicate analysis of an unspiked field sample as an alternative to the MS/MSD pair.

The laboratory should use 70 - 130% as interim acceptance criteria for recoveries of spiked analytes, until in-house LCS limits are developed. Where in-house limits have been developed for matrix spike percent recoveries, the LCS results should be similar to or tighter than those limits, as the LCS is prepared in a clean matrix.

STATE NOTE: For South Carolina or Ohio VAP samples, marginal exceedances do not apply. All outliers in QC require corrective action when possible and the data must be flagged when necessary.

STATE NOTE: For all samples from South Carolina, the LCS/LCSD recovery must be evaluated within 70-130% and the MS/MSD recoveries must be within in-house derived recovery limits; however, if the limits given in Method 625 Table 6 are more stringent, then those limits must be used. The following are the current limits:

Parameter	LCS/LCSD	MS/MSD
1,2,4-TRICHLOROBENZENE	70 - 130%	44 – 104%
2,4,6-TRICHLOROPHENOL	70 - 130%	37 - 132%
2,4-DICHLOROPHENOL	70 - 130%	39 - 117%
2,4-DIMETHYLPHENOL	70 - 119%	32 - 119%
2,4-DINITROPHENOL	70 - 130%	10 - 141%
2,4-DINITROTOLUENE	70 - 130%	45.4 - 139%
2,6-DINITROTOLUENE	70 - 130%	50 - 134%
2-CHLORONAPHTHALENE	70 - 118%	60 - 118%
2-CHLOROPHENOL	70 - 130%	23 - 111%
2-NITROPHENOL	70 - 130%	29 - 135%
3,3-DICHLOROBENZIDINE	70 - 130%	10 - 143%
4,6-DINITRO-2-METHYLPHENOL	70 - 130%	10 - 143%
4-BROMOPHENYL-PHENYLETHER	70 - 127%	53 - 127%
4-CHLORO-3-METHYLPHENOL	70 - 130%	38.4 - 123%
4-CHLOROPHENYL-PHENYLETHER	70 - 130%	49.8 -127%
4-NITROPHENOL	70 - 130%	10 - 52.8%
ACENAPHTHENE	70 - 130%	47 - 141%
ACENAPHTHYLENE	70 - 130%	40 - 132%
ANTHRACENE	70 - 130%	44.5 - 130%
BENZO(A)ANTHRACENE	70 - 130%	46.4 - 130%
BENZO(A)PYRENE	70 - 130%	34.6 - 129%
BENZO(B)FLUORANTHENE	70 - 130%	36.3 - 137%
BENZO(G,H,I)PERYLENE	70 - 130%	10 - 140%
BENZO(K)FLUORANTHENE	70 - 130%	30.3 - 136%
BENZYLBUTYL PHTHALATE	70 - 130%	44.8 - 152%

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Parameter	LCS/LCSD	MS/MSD
BIS(2-CHLORETHOXY)METHANE	70 - 130%	39.2 - 128%
BIS(2-CHLOROETHYL)ETHER	70 - 130%	14.8 - 131%
BIS(2-CHLOROISOPROPYL)ETHER	70 - 130%	36 - 117%
BIS(2-ETHYLHEXYL)PHTHALATE	70 - 130%	12.6 - 153%
CHRYSENE	70 - 130%	40 - 133%
DIBENZ(A,H)ANTHRACENE	70 - 130%	10 - 143%
DIETHYL PHTHALATE	70 - 114%	50.4 - 114%
DIMETHYL PHTHALATE	70 - 112%	9.1 - 112%
DI-N-BUTYL PHTHALATE	70 - 118%	53.3 - 118%
DI-N-OCTYL PHTHALATE	70 - 130%	13.3 - 146%
FLUORANTHENE	70 - 130%	42.9 - 137%
FLUORENE	70 - 121%	59 - 121%
HEXACHLORO-1,3-BUTADIENE	70 - 116%	28.9 - 116%
HEXACHLOROBENZENE	70 - 130%	47 - 121%
HEXACHLOROCYCLOPENTADIENE	70 - 130%	10 - 128%
HEXACHLOROETHANE	70 - 113%	40 - 109%
INDENO(1,2,3-CD)PYRENE	70 - 130%	10 - 141%
ISOPHORONE	70 - 130%	31.9 - 118%
NAPHTHALENE	70 - 130%	29 - 115%
NITROBENZENE	70 - 130%	35 - 118%
N-NITROSODI-N-PROPYLAMINE	70 - 130%	35.4 - 129%
PENTACHLOROPHENOL	70 - 130%	14 - 128%
PHENANTHRENE	70 - 130%	54 - 120%
PHENOL	70 - 112%	10 - 55.7%
PYRENE	70 - 115%	52 - 115%

Method 625.1: For LCS analyses, repeat the test only for those analytes that failed to meet the acceptance criteria (PS). If these analytes now pass, system performance is acceptable and analysis of blanks and samples may proceed. Repeated failure, however, will confirm a general problem with the measurement system. If this occurs, repeat the test using a fresh LCS or an LCS prepared with a fresh QC check sample concentrate, or perform and document system repair. Subsequent to analysis of the LCS prepared with a fresh sample concentrate, or to system repair, repeat the LCS test. If failure of the LCS indicates a systemic problem with samples in the batch, re-extract and re-analyze the samples in the batch.

The large number of analytes tested in performance tests in this method present a substantial probability that one or more will fail acceptance criteria when many analytes are tested simultaneously, and a retest is allowed if this situation should occur. If, however, continued re-testing results in further repeated failures, the laboratory must document and report the failures (e.g., as qualifiers on results), unless the failures are not required to be reported as determined by the regulatory/control authority. Results associated with a QC failure for an analyte regulated in a discharge cannot be used to demonstrate regulatory compliance. QC failures do not relieve a discharger or permittee of reporting timely results.

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NOTE: To maintain the validity of the test and re-test, system maintenance and/or adjustment is not permitted between the pair of tests.

For MS/MSD analyses, compare the percent recoveries (P1 and P2) and the RPD for each analyte in the MS/MSD aliquots with the corresponding QC acceptance criteria in Attachment VII. A laboratory may develop and apply QC acceptance criteria more restrictive than the criteria in Attachment VII, if desired.

If any individual P falls outside the designated range for recovery in either aliquot, or the RPD limit is exceeded, the result for the analyte in the unspiked sample is suspect. The large number of analytes tested in performance tests in this method present a substantial probability that one or more will fail acceptance criteria when many analytes are tested simultaneously, and a retest is allowed if this situation should occur. If, however, continued re-testing results in further repeated failures, the laboratory must document and report the failures (e.g., as qualifiers on results), unless the failures are not required to be reported as determined by the regulatory/control authority. Results associated with a QC failure for an analyte regulated in a discharge cannot be used to demonstrate regulatory compliance. QC failures do not relieve a discharger or permittee of reporting timely results.

11.8 Calibration Range: For any compound found in a sample at a level above the highest standard, the extract must be diluted and re-analyzed to allow quantitation within the range of instrument calibration. Whenever an extract dilution is made, the appropriate amount of internal standard must be added to bring the ISTD concentrations back to the concentrations consistent with the calibration standards.

STATE NOTE: For all samples analyzed from Minnesota, the reporting limit must be verified at least monthly, with each new initial calibration, or when there has been significant change to the instrument (column replacement, cleaning source, etc.) whichever is more frequent. The reporting limit verification can be performed by either re-injecting the low standard or by re-processing the low standard that was analyzed in the calibration curve. The reporting limit verification (RLV) must recovery within ±40% of the expected concentration. If this criterion is not met, the RLV may be re-analyzed once, instrument maintenance can be performed, a higher concentration standard can be injected, or a new calibration curve must be generated. If a higher concentration standard is utilized, the reporting limit must be raised to the higher level verified.

11.9 All data must undergo a primary review by the analyst. The analyst must check the performance of the initial calibration, check standard, and continuing calibrations to ensure that they meet the criteria of the method. The analyst must review any sample that has quantifiable compounds and make sure that they have been confirmed, if necessary. The analyst must also verify that reported results are derived from quantitation between the RL and the highest standard of the initial calibration curve. All calculations must be checked (any dilutions, %solids, etc.). Data must be checked for the presence or absence of appropriate flags. Comments must be noted when data is flagged.

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11.10 All data must undergo a second analyst review. The analyst checking the data must check the performance of the initial calibration, mid-point check standard, and continuing calibrations to ensure that they meet the criteria of the method.

11.10.1 The analyst should must review any sample that has quantifiable compounds and make sure that they have been confirmed.

11.10.2 All calculations must be checked.

11.10.3 All surrogate recoveries must be checked to ensure that they are within QC acceptance criteria or that corrective action has occurred.

11.10.4 Blanks must be free of all interfering peaks.

11.10.5 Quality control criteria must be checked for the LCS, LCSD, MS, and MSD.

11.10.6 Data must be checked to determine the need for appropriate flags. Comments are noted when results are flagged.

11.10.7 The reviewer must verify all reported results are derived from analytical results that are either above the reporting limit/MDL, as applicable, and below the highest standard of the initial calibration curve.

11.10.8 All manual integrations must be verified through checking the before/after shot of the sample, method blank, and/or QC (LCS/LCSD/MS/MSD).

11.10.9 All multipliers/dilutions must be verified on the quant report and must agree with the information provided on the injection log.

11.10.10 Retention times of the samples must be compared to that of the calibration standard. Random spot checking of 10% of the data should be sufficient.

11.10.11 Verify linear regression by reviewing the calibration curve printout.

11.10.12 See SOP #030201, *Data Handling and Reporting* and SOP #030227*, Data Review*.

11.11 Data that does not meet acceptable QC criteria may be acceptable for use in certain circumstances.

11.11.1 If a method blank contains an amount of target analyte, but all samples are non-detected, the data may be reported with a “B3” flag. If a method blank contains an amount of target analyte, but the samples contain analyte at a level that is 10 times the level present in the method blanks, the data may be reported with a “B” flag.

STATE NOTE: The Ohio VAP program or South Carolina DHEC does not accept data released using the 10X criteria for method blank contamination as noted in section 11.11.1.

11.11.3 If a calibration verification standard is above the acceptable QC criteria and all samples being bracketed are below the reporting limit, the data is acceptable based

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on a high calibration bias with undetectable levels in the field samples. Any positive samples require re-analysis. If MDL reporting is required by the client, reported samples must calculate <MDL to be considered not impacted by the high bias.

11.11.4 If the surrogate exhibits high recovery in the field samples and the target analytes in the field samples are below the reporting limit, the data may be released with a J1 qualifier indicating the high bias. If the QC samples (LCS, LCSD, MS, MSD) exhibit a high bias in the surrogate and the field samples are below the reporting limit for the target analyte, the data may be released with a J1 qualifier.

11.11.5 If the target analyte spiked in the quality control samples (LCS, LCSD, MS, MSD) exhibits high recovery and the target analytes in the field samples are below the reporting limit, the data may be released with a J4 qualifier indicating the high bias.

11.11.6 If the target analyte spiked into the QC pair (LCS/LCSD, MS/MSD) exhibit acceptable recoveries, but high calculated RPD values for precision, target analytes in the field sample are flagged with a J3 for the precision beyond acceptable quality control limits.

11.11.7 Sample results can be qualified and possible bias is narrated per the ESC SOP #030201, *Data Handling and Reporting*.

11.11.7.1 For samples analyzed per the requirements of Method 8000D, reported concentrations of target analytes between the MDL and the LLOQ must be qualified as estimated.

12.0 POLLUTION PREVENTION AND WASTE MANAGEMENT

12.1 The EPA requires that laboratory waste management practice to be conducted consistent with all applicable federal and state laws and regulations. Excess reagents, samples and method process wastes must be characterized and disposed of in an acceptable manner. See *ESC Waste Management Plan.*

12.2 See SOP #030302, *Environmental Sustainability & Pollution Prevention*.

13.0 METHOD MODIFICATIONS/CLARIFICATIONS

13.1 The **Missouri Department of Natural Resources requires** that **DRO** be analyzed by GC/MS. Tuning and frequency requirements are the same as 8270C, omitting DDT, pentachlorophenol, and benzidine assessments. Extract samples the same as 8270PAH using the appropriate extraction method. Only base/neutral surrogates are needed. GC/MS mass range should be 35-550amu. Prepare a five-point calibration curve with 1:1 unleaded gasoline and #2 diesel fuel at 10,000 µg/mL each in methylene chloride. Calibration standards range from 200 to 10,000ug/mL for concentrated soil or 1L water extractions and calibration levels for EPA 3511 extracted water samples and non-concentrated Soil range from 5-200ppm from a 200ppm intermediate. Retention time windows are set using C_{10}, C_{21}, and C_{35}. For DRO, set RT 0.1 minutes after C_{10} to 0.1 minutes after C_{21}. For ORO, set RT 0.1 minutes after C_{21} to 0.1 minutes after C_{35}. Verify RT windows daily (24 hours) by running component standard. Quantitate using baseline-

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to baseline, not valley–to-valley. The total ion chromatogram must be used to quantitate. DRO is quantitated using external standard method. The response factor determined for DRO (C_{10}-C_{21}) **must** be used for C_{21}-C_{35}. Subtract area for any internal standard and surrogates. %RSD <20. Run a CCV every 12 hours near mid-point of calibration, %D <20. Run a method blank, LCS and MS/MSD every extraction batch. May re-process files to quantitate PAH analytes, if needed. Quantitation of DRO must be performed using the external standard process.

13.2 EPA method 625 employs the use of 2 separate packed GC columns for base/neutral and acidic analyte separations. Modern capillary column technology employs a single column that provides sufficient separatory abilities for use in this analytical process as is demonstrated in EPA method 8270C.

13.3 Modifications to this method are noted in the body of the text as state notes. Compliance analyses performed in conjunction with specific state requirements must be performed as noted within the specific state(s) note listed.

13.4 Adjustments to the concentrations of standards/spiking solutions, standards providers, and quality control samples are subject to change to better meet client/project/regulatory needs or to improve laboratory method performance.

13.5 The reduction of the size of the field sample used in this procedure is performed in accordance with section 7.1 of the published EPA 3510C/625method. The reduction in volume extracted along with increased sensitivity at detection and/or analysis of the resulting extract using large volume injection (>5uL) on each GCMS allows for low detection limits typical of those obtained using a 1L extraction. Complete method validation is performed for each method prior to utilizing the reduced volume extraction. This validation is maintained by the Regulatory Affairs Department and is regularly verified using LCS/LCSD, MDL studies and DOCs.

13.6 **Low level NDMA and 1,4-Dioxane by SIM scan/isotope dilution.** Tuning and frequency requirements are the same as 8270C. Extract samples the same as 8270BNA using the appropriate extraction method. 250ng of N-nitrosodimethylamine-d6 or 1,4Dioxane-d_8 is added to each sample per every 0.5mL of final extract volume prior to extraction resulting in a true value of 500ppb in extract. Only base/neutral surrogates monitoring is necessary. GC/MS is set to scan for masses 42, 43, 46, 48, 54, 74, 80, 82, 115, 128, 150 and 152 for NDMA-d_6 or masses 57, 58, 62, 64, and 88 for 1,4-Dioxane-d_8 in SIM mode. Calibrate at least 5 points using 8270BNA mega mix or 1,4-Dioxane ICAL standard. 500ng of N-nitrosodimethylamine-d_6 is added per every 1mL of calibration standard to each level of the calibration resulting in a true value of 500ppb Calibration standards range from 5ppb to 10,000ppb for 3510RV extracted water samples. Quantitate using Chemstation auto-integration software unless a significant discrepancy is noted in which case manually adjust integrations to best represent the calibration. Select ion monitoring should be used for acquisition and quantitation. NDMA and 1,4-Dioxane are quantitated using the isotope dilution method as described in 8000C. The %RSD determined for NDMA RFs **must** be <15% in order to use the average of response factors for quantitation, otherwise linear regression is to be used. Run a DFTPP tune and CCV every 12 hours near mid-point of calibration, %Diff must be <20%

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for the calibration to be deemed in control and sample analysis to proceed. Run a method blank, LCS and LCSD with every extraction batch. MS/MSDs will be processed with batches when requested by the client as matrix spiking and duplication does not yield reliable precision data when analyzed by the isotope dilution method. Quantitation of low level NDMA and 1,4-Dioxane should be performed using the isotope dilution process.

14.0 REFERENCES

14.1 *Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)*, SW846 Method 8270C, Revision 3, December 1996.

14.2 *Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)*, SW846 Method 8270D, Revision 4, February 2007.

14.3 *Determinative Chromatographic Separations*, SW846 Method 8000B, Revision 2, December 1996.

14.4 *Determinative Chromatographic Separations*, SW846 Method 8000C, Revision 3, March 2003.

14.5 *Determinative Chromatographic Separations*, SW846 Method 8000D, Revision 4, July 2014.

14.6 *Base/Neutrals and Acids*, 40 CFR Part 136, Appendix A, EPA Method 625, October 1991.

14.7 *Extractable Base/Neutrals and Acids*, Standard Methods for the Examination of Water and Wastewater, Method 6410B-2000.

14.8 *Extractable Base/Neutrals and Acids*, Standard Methods for the Examination of Water and Wastewater, Method 6410B-1997 (20th Ed).

14.9 *Base/Neutrals and Acids by GC/MS*, EPA Method 625.1, Federal Register, Volume 82, Number 165, August 28, 2017.

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Attachment I: Revision History

Current Version:

Version	Date	Description of Revisions
26	3/22/2018	Technical and quality review and update. Added 625.1 requirements. Revised SOP Title and Sections 1.8.1, 2.11, 8.2, 8.4.1, 8.4.6, 9.7, 10.6, 11.1, 11.2, 11.3, 11.4, 11.5, 11.6, and 11.7. Added Sections 2.12, 9.6, 10.1.1 and all subsections, 10.5 and all subsections, 14.9, Attachment VII, and Attachment VIII.

Superseded Versions:

This document supersedes the following:

Version	Date	Description of Revisions
0	4/27/95	Origination
1	7/13/95	
2	8/22/96	
3	8/20/99	
4	4/18/00	
5	8/21/00	
6	12/20/00	
7	9/3/01	
8	7/30/02	
9	7/9/03	
10	3/25/04	
11	8/7/06	Technical and Quality Review and update.
12	2/11/09	Addition of 8270D requirements; Addition of State Notes; Update of standards information; Technical and Quality Review and update. Ohio VAP approval 2/11/09.
13	11/23/10	Technical and Quality Review and update. Revised sections 2.1, 2.10, 4.2 through 4.6, 7.1, 7.6, 7.8, 7.10.2, 7.12, 7.13, 8.3, 8.6, 9.3, 9.4, 9.5, 9.10 through 9.13, 11.3, 11.6, 12.1; Added sections 2.27 through 2.30, 4.7, 7.14, state note following section 11.9, 11.10, and 13.4; Removed section 1.2.
14	2/24/12	Technical and Quality Review and update. Revised sections 2.1, 4.2, 4.5, 5.3, 6.1.4, 6.2, 7.8, 7.9, 7.10, 7.13, 8.2, 8.3, 8.5, 8.6, 8.8, 11.2, 11.10, 13.1 and Attachment IV; Added state note to section 1.0; Added sections 1.8.1, 2.31, 2.32, and 13.5.
15	6/12/12	Technical and Quality Review and update. Revised sections 2.1, 7.9, 7.10, 8.3.2, 9.9, 9.14, 11.2, 11.3, 11.4, and 11.11; Added sections 2.19, 2.34, 4.8, 11.9 through 11.10, and 11.11.4 through 11.11.7.

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Version	Date	Description of Revisions
16	3/26/13	Technical and Quality Review and update. Revised title, Attachment IV and sections 2.1, 7.8, 7.9, 7.10, 8.0 (state note), 8.3, 11.6, and 13.1; Added sections 7.13, 14.6 and state notes in sections 1.0 and 11.4; Removed sections 7.10.5 and 8.5.3.
17	6/10/14	Technical and Quality Review and update. Revised Attachments II, IVc through IVk, and V along with sections 5.3, 8.3.1, 8.3.6; 11.7; Added sections 5.4.7, 7.5.10 through 7.5.13, 7.7, 8.3.4; Removed sections 6.1.4 and 11.11.2.
18	8/14/14	Technical and Quality Review and update. Added sections 2.35, 7.5.14, and 13.6.
19	11/17/2015	Technical and quality review and update. Header and signature block re-formatting. Revised Sections 1.5, 1.8.1, 5.3, 7.9.1, 7.11.1, 8.1.1, 8.4.1, 8.4.4, 8.4.6, 8.7.1, 8.8, 8.9.1.1, 11.3, 11.5, 11.7, 11.11.4, 11.11.5, and 13.5. Added Section 8.6.1.7, 8.6.1.7.1 through 8.6.1.7.6, and Attachment VI. Deleted Attachment Iva, Attachment IVb, Attachment IVc, Attachment IVd, Attachment IVe, Attachment IVf, Attachment IVg, Attachment IVh, Attachment IVi, Attachment IVj, and Attachment IVk.
20	4/1/2016	Technical and quality review and update. Revised Sections 1.8.1, 2.8, 2.9, 2.10, 4.8, 7.1, 9.4, 9.5, 11.2, 11.4, 11.11.7, 12.2, and 13.6. Deleted Sections 2.11 through 2.35 and 9.6 through 9.13. Added Sections 7.5.16, 7.5.17, 7.5.18, and 8.9.7.
21	10/24/16	Technical and quality review and update to satisfy the requirements of SC DHEC (see correspondence dated 6/24/16) Header and signature block re-formatting. Revised Sections 11.2, 11.3, 11.4, 11.7, 14.1, 14.2, 14.3, 14.4, 14.6, 14.7, 14.8, and Attachment VII Table 2. Added Sections 1.8.2, 2.10, 9.5, 10.4 and all subsections, and 11.11.7.1.
22	6/19/2017	Technical and quality review and update. Revised Sections 1.8, 3.1, 7.5.14, 7.8, 7.11.1, 8.4.1, 8.8, 9.3, 10.3, 11.7, and Attachment III.
23	7/10/2017	Technical and quality review and update. Revised Sections 2.1, 2.11, 2.12, 7.9.2, 7.10.2, 7.10.3, 7.10.4, 7.11.4, 7.11.5, 9.3, 13.1, 13.5
24	10/6/2017	Technical and quality review and update. Revised Sections 7.9.2, 11.5, and Attachment IV. Added Table 8 in Attachment VII.
25	11/29/2017	Update in response to A2LA audit finding CAR2872. Revised Attachment IV.

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Attachment II: 8270/625 Common Calibration List & Reporting Limits *(may be updated without notice)**

Analyte	Water mg/L	Soil mg/Kg
Acenaphthene	0.001	0.033
Acenaphthylene	0.001	0.033
Acetophenone	0.01	0.33
Anthracene	0.001	0.033
Atrazine	0.01	0.33
Benzaldehyde	0.01	0.33
Benzidine	0.05	0.33
Benzo(a)anthracene	0.001	0.033
Benzo(b)fluoranthene	0.001	0.033
Benzo(k)fluoranthene	0.001	0.033
Benzo(g,h,i)perylene	0.001	0.033
Benzo(a)pyrene	0.001	0.033
Bis(2-chlorethoxy)methane	0.01	0.33
Bis(2-chloroethyl)ether	0.01	0.33
Bis(2-chloroisopropyl)ether	0.01	0.33
4-Bromophenyl-phenylether	0.01	0.33
Caprolactam	0.01	0.33
2-Chloronaphthalene	0.01	0.33
4-Chlorophenyl-phenylether	0.01	0.33
Chrysene	0.001	0.033
Dibenz(a,h)anthracene	0.001	0.033
3,3-Dichlorobenzidine	0.01	0.33
2,4-Dinitrotoluene	0.01	0.33
2,6-Dinitrotoluene	0.01	0.33
Fluoranthene	0.001	0.033
Fluorene	0.001	0.033
Hexachlorobenzene	0.01	0.33
Hexachloro-1,3-butadiene	0.01	0.33
Hexachlorocyclopentadiene	0.01	0.33
Hexachloroethane	0.01	0.33
Indeno(1,2,3-cd)pyrene	0.001	0.033
Isophorone	0.01	0.33
Naphthalene	0.001	0.033
Nitrobenzene	0.01	0.33

Analyte	Water mg/L	Soil mg/Kg
n-Nitrosodimethylamine	0.01	0.33
n-Nitrosodiphenylamine	0.01	0.33
n-Nitrosodi-n-propylamine	0.01	0.33
Phenanthrene	0.001	0.033
Benzylbutyl phthalate	0.003	0.033
Bis(2-ethylhexyl)phthalate	0.003	0.033
Di-n-butyl phthalate	0.003	0.033
Diethyl phthalate	0.003	0.033
Dimethyl phthalate	0.003	0.033
Di-n-octyl phthalate	0.003	0.033
Pyrene	0.001	0.033
1,2,4-Trichlorobenzene	0.01	0.33
4-Chloro-3-methylphenol	0.01	0.33
2-Chlorophenol	0.01	0.33
2,4-Dichlorophenol	0.01	0.33
2,4-Dimethylphenol	0.01	0.33
4,6-Dinitro-2-methylphenol	0.01	0.33
2,4-Dinitrophenol	0.01	0.33
2-Methylphenol	0.01	0.33
4-Methylphenol	0.01	0.33
2-Nitrophenol	0.01	0.33
4-Nitrophenol	0.01	0.33
Pentachlorophenol	0.01	0.33
Phenol	0.01	0.33
2,4,6-Trichlorophenol	0.01	0.33
1-Methylnapthalene	0.001	0.033
2-Methylnapthalene	0.001	0.033
4-Chloroaniline	0.01	0.33
2-Nitroaniline	0.01	0.33
3-Nitroaniline	0.01	0.33
4-Nitroaniline	0.01	0.33
1,2,3,4-Tetrachlorobenzene	0.05	1.65
1,2,3,5-Tetrachlorobenzene	0.05	1.65
1,2,4,5-Tetrachlorobenzene	0.05	1.65

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Analyte	Water mg/L	Soil mg/Kg
1,2,4,5-Tetrachlorobenzene	0.05	1.65
1,2-diphenylhydrazine	0.01	0.33
1,3-Dinitrobenzene	0.05	1.65
1,4-Naphthoquinone	0.05	1.65
1-Chloronaphthalene	0.05	1.65
1-Naphthylamine	0.05	1.65
2,3,4,6-Tetrachlorophenol	0.05	1.65
2,3-Dichloroaniline	0.01	0.33
2,6-Dichlorophenol	0.05	1.65
2-Acetylaminofluorene	0.05	1.65
2-Naphthylamine	0.05	1.65
2-Picoline	0.05	1.65
3,3'-Dimethylbenzidine	0.05	1.65
3-Methylcholanthrene	0.05	1.65
4-Aminobiphenyl	0.05	1.65
4-Nitroquinoline-1-oxide	0.05	1.65
5-Nitro-o-toluidine	0.05	1.65
7,12-Dimethylbenz(a)anthracene	0.05	1.65
7H-Dibenzo (c,g) carbazole	0.05	1.65
a,a-Dimethylphenethylamine	0.05	1.65
Acetophenone	0.01	0.33
Alpha-terpineol	0.01	0.33
Aniline	0.01	0.33
Aramite	0.05	1.65
Benzal Chloride	0.05	1.65
Benzo (j) fluoranthene	0.05	1.65
Benzotrichloride	0.05	1.65
Benzyl Chloride	0.05	1.65
Chlorobenzilate	0.05	1.65
Diallate (cis)	0.05	1.65
Diallate (trans)	0.05	1.65
Dibenz (a,e) pyrene	0.05	1.65
Dibenz (a,h) acridine	0.05	0.33
Dibenz (a,h) pyrene	0.05	1.65

Analyte	Water mg/L	Soil mg/Kg
Dibenz (a,i) pyrene	0.05	1.65
Dimethoate	0.05	1.65
Dinoseb	0.05	1.65
Diphenylamine	0.05	1.65
Disulfoton	0.05	1.65
Ethyl methanesulfonate	0.05	1.65
Famphur	0.05	1.65
Hexachlorophene	0.05	1.65
Hexachloropropene	0.05	1.65
Isodrin	0.05	1.65
Isosafrole (cis)	0.05	1.65
Isosafrole (trans)	0.05	1.65
Kepone	0.05	1.65
Methapyriline	0.05	1.65
Methyl methanesulfonate	0.05	1.65
Methyl parathion	0.05	1.65
N-Nitrosodiethylamine	0.05	1.65
n-nitrosodi-n-butylamine	0.01	0.33
N-Nitrosodi-n-butylamine	0.05	1.65
N-Nitrosomethylethylamine	0.05	1.65
N-Nitrosomorpholine	0.05	1.65
N-Nitrosopiperidine	0.05	1.65
N-Nitrosopyrrolidine	0.05	1.65
o,o,o-Triethylphoshorothioate	0.05	1.65
o-cresol	0.01	0.33
o-Toluidine	0.05	1.65
Parathion	0.05	1.65
p-cresol	0.01	0.33
p-Dimethylaminoazobenzene	0.05	1.65
Pentachlorobenzene	0.05	1.65
Pentachloroethane	0.05	1.65
Pentachloronitrobenzene	0.05	1.65
Phenacetin	0.05	1.65
Phorate	0.05	1.65

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Analyte	Water mg/L	Soil mg/Kg
p-Phenyleneamine	0.05	1.65
Pronamide	0.05	1.65
Safrole	0.05	1.65
Sulfotepp	0.05	1.65
sym-Trinitrobenzene	0.05	1.65
Thionazin	0.05	1.65
2-nitrodiphenylamine	0.01	0.33
n-decane	0.01	0.33
n-octadecane	0.01	0.33
Pentachlorphenol (SIM)	0.001	-
Sulfolane	0.0002	0.33
Mirex	0.02	NA
Dicofol	0.02	NA
Quinoline	0.05	0.33
Indene	NA	0.33
Benzenethiol	0.02	3.3

*Alternate reporting levels may be possible using different technologies (i.e. SIM, LVI, etc.). Please contact the laboratory for additional information.

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Attachment III – Appropriate Extraction Methods by Analyte *(printed from SW-846 Method 8270C)*

ANALYTE:	3510*	3520	3540/3541	3550*	3580*	CAS #(a)
Acenaphthene	X	X	X	X	X	83-32-9
Acenaphthylene	X	X	X	X	X	208-96-8
Acetophenone	X	ND	ND	ND	X	98-86-2
2-Acetylaminofluorene	X	ND	ND	ND	X	53-96-3
1-Acetyl-2-thiourea	LR	ND	ND	ND	LR	591-08-2
Aldrin	X	X	X	X	X	309-00-2
2-Aminoanthraquinone	X	ND	ND	ND	X	117-79-3
Aminoazobenzene	X	ND	ND	ND	X	60-09-3
4-Aminobiphenyl	X	ND	ND	ND	X	92-67-1
3-Amino-9-ethylcarbazole	X	X	ND	ND	ND	132-32-1
Anilazine	X	ND	ND	ND	X	101-05-3
Aniline	X	X	ND	X	X	62-53-3
Ortho-anisidine	X	ND	ND	ND	X	90-04-0
Anthracene	X	X	X	X	X	120-12-7
Aramite HS	(43)	ND	ND	ND	X	140-57-8
Aroclor 1016	X	X	X	X	X	12674-11-2
Aroclor 1221	X	X	X	X	X	11104-28-2
Aroclor 1232	X	X	X	X	X	11141-16-5
Aroclor 1242	X	X	X	X	X	53469-21-9
Aroclor 1248	X	X	X	X	X	12672-29-6
Aroclor 1254	X	X	X	X	X	11097-69-1
Aroclor 1260	X	X	X	X	X	11096-82-5
Azinphos-methyl HS	(62)	ND	ND	ND	X	86-50-0
Barban	LR	ND	ND	ND	LR	101-27-9
Benzidine	CP	CP	CP	CP	CP	92-87-5
Benzoic Acid	X	X	ND	X	X	65-85-0
Benz(a)anthracene	X	X	X	X	X	56-55-3
Benzo(b)fluoranthene	X	X	X	X	X	205-99-2
Benzo(k)fluoranthene	X	X	X	X	X	207-08-9
Benzo(g,h,i)perylene	X	X	X	X	X	191-24-2
Benzo(a)pyrene	X	X	X	X	X	50-32-8
Para-benzoquinone	OE	ND	ND	ND	X	106-51-4
Benzyl Alcohol	X	X	ND	X	X	100-51-6
Alpha-BHC	X	X	X	X	X	319-84-6
Beta-BHC	X	X	X	X	X	319-85-7
Delta-BHC	X	X	X	X	X	319-86-8
Gamma-BHC	X	X	X	X		58-89-9
Lindane	X	X	X	X	X	58-89-9
Bis(2-chloroethoxy)methane	X	X	X	X	X	111-91-1
Bis(2-chloroethyl) Ether	X	X	X	X	X	111-44-4

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ANALYTE:	3510*	3520	3540/3541	3550*	3580*	CAS #(a)
Bis(2-chloroisopropyl) Ether	X	X	X	X	X	108-60-1
Bis(2-ethylhexyl) Phthalate	X	X	X	X	X	117-81-7
4-Bromophenyl Phenyl Ether	X	X	X	X	X	101-55-3
Bromoxynil	X	ND	ND	ND	X	1689-84-5
Butyl Benzyl Phthalate	X	X	X	X	X	85-68-7
Captafol HS	(55)	ND	ND	ND	X	6/1/2425
Captan HS	(40)	ND	ND	ND	X	133-06-2
Carbaryl	X	ND	ND	ND	X	63-25-2
Carbofuran	X	ND	ND	ND	X	1563-66-2
Carbophenothion	X	ND	ND	ND	X	786-19-6
Chlordane	X	X	X	X	X	57-74-9
Chlorfenvinphos	X	ND	ND	ND	X	470-90-6
4-Chloroaniline	X	ND	ND	ND	X	106-47-8
Chlorobenzilate	X	ND	ND	ND	X	510-15-6
5-Chloro-2-methylaniline	X	ND	ND	ND	X	95-79-4
4-Chloro-3-methylphenol	X	X	X	X	X	59-50-7
hydrochloride	X	ND	ND	ND	X	6959-48-4
1-Chloronaphthalene	X	X	X	X	X	90-13-1
2-Chloronaphthalene	X	X	X	X	X	91-58-7
2-Chlorophenol	X	X	X	X	X	95-57-8
4-Chloro-1,2-phenylenendiamine	X	X	ND	ND	ND	95-83-0
4-Chloro-1,3-phenylenendiamine	X	X	ND	ND	ND	5131-60-2
4-Chlorophenyl Phenyl Ether	X	X	X	X	X	7005-72-3
Chrysene	X	X	X	X	X	218-01-9
Coumaphos	X	ND	ND	ND	X	56-72-4
Para-cresidine	X	ND	ND	ND	X	120-71-8
Crotoxyphos	X	ND	ND	ND	X	7700-17-6
2-Cyclohexyl-4,6-dinitrophenol	X	ND	ND	ND	LR	131-89-5
4,''-DDD	X	X	X	X	X	72-54-8
4,''-DDE	X	X	X	X	X	72-55-9
4,''-DDT	X	X	X	X	X	50-29-3
Demeton-O HS	(68)	ND	ND	ND	X	298-03-3
Demeton-S	X	ND	ND	ND	X	126-75-0
Diallate (cis or trans)	X	ND	ND	ND	X	2303-16-4
2,4-Diaminotoluene DC,	OE(42) ND	ND	ND	ND	X	95-80-7
Dibenz(a,j)acridine	X	ND	ND	ND	X	224-42-0
Dibenz(a,h)anthracene	X	X	X	X	X	53-70-3
Dibenzofuran	X	X	ND	X	X	132-64-9
Dibenzo(a,e)pyrene	ND	ND	ND	ND	X	192-65-4
1,2-Dibromo-3-chloropropane	X	X	ND	ND	ND	96-12-8
Di-n-butyl Phthalate	X	X	X	X	X	84-74-2

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ANALYTE:	3510*	3520	3540/3541	3550*	3580*	CAS #(a)
Dichlone	OE	ND	ND	ND	X	117-80-6
1,2-Dichlorobenzene	X	X	X	X	X	95-50-1
1,3-Dichlorobenzene	X	X	X	X	X	541-73-1
1,4-Dichlorobenzene	X	X	X	X	X	106-46-7
3,3''-Dichlorobenzidine	X	X	X	X	X	91-94-1
2,4-Dichlorophenol	X	X	X	X	X	120-83-2
2,6-Dichlorophenol	X	ND	ND	ND	X	87-65-0
Dichlorovos	X	ND	ND	ND	X	62-73-7
Dicrotophos	X	ND	ND	ND	X	141-66-2
Dieldrin	X	X	X	X	X	60-57-1
Diethyl Phthalate	X	X	X	X	X	84-66-2
Diethylstilbestrol	AW,OS(67)	ND	ND	ND	X	56-53-1
Diethyl Sulfate	LR	ND	ND	ND	LR	64-67-5
Dihydrosaffrole	ND	ND	ND	ND	ND	56312-13-1
Dimethoate	HE,HS	ND	ND	ND	X	60-51-5
3,''-Dimethoxybenzidine	X	ND	ND	ND	LR	119-90-4
Dimethylaminoazobenzene	X	ND	ND	ND	X	60-11-7
7,12-Dimethylbenz(a)-anthracene	CP(45)	ND	ND	ND	CP	57-97-6
3,''-Dimethylbenzidine	X	ND	ND	ND	X	119-93-7
α,α-Dimethylphenethylamine	ND	ND	ND	ND	X	122-09-8
2,4-Dimethylphenol	X	X	X	X	X	105-67-9
Dimethyl Phthalate	X	X	X	X	X	131-11-3
1,2-Dinitrobenzene	X	ND	ND	ND	X	528-29-0
1,3-Dinitrobenzene	X	ND	ND	ND	X	99-65-0
1,4-Dinitrobenzene	HE(14)	ND	ND	ND	X	100-25-4
4,6-Dinitro-2-methylphenol	X	X	X	X	X	534-52-1
2,4-Dinitrophenol	X	X	X	X	X	51-28-5
2,4-Dinitrotoluene	X	X	X	X	X	121-14-2
2,6-Dinitrotoluene	X	X	X	X	X	606-20-2
Dinocap	CP,HS(28)	ND	ND	ND	CP	39300-45-3
Dinoseb	X	ND	ND	ND	X	88-85-7
Dioxathion	ND	ND	ND	ND	ND	78-34-2
Diphenylamine	X	X	X	X	X	122-39-4
5,5-Diphenylhydantoin	X	ND	ND	ND	X	57-41-0
1,2-Diphenylhydrazine	X	X	X	X	X	122-66-7
Di-n-octyl Phthalate	X	X	X	X	X	117-84-0
Disulfoton	X	ND	ND	ND	X	298-04-4
Endosulfan I	X	X	X	X	X	959-98-8
Endosulfan II	X	X	X	X	X	33212-65-9
Endosulfan Sulfate	X	X	X	X	X	1031-07-8
Endrin	X	X	X	X	X	72-20-8

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ANALYTE:	3510*	3520	3540/3541	3550*	3580*	CAS #(a)
Endrin Aldehyde	X	X	X	X	X	7421-93-4
Endrin Ketone	X	X	ND	X	X	53494-70-5
EPN	X	ND	ND	ND	X	2104-64-5
Ethion	X	ND	ND	ND	X	563-12-2
Ethyl Carbamate	DC(28)	ND	ND	ND	X	51-79-6
Ethyl Methanesulfonate	X	ND	ND	ND	X	62-50-0
Famphur	X	ND	ND	ND	X	52-85-7
Fensulfothion	X	ND	ND	ND	X	115-90-2
Fenthion	X	ND	ND	ND	X	55-38-9
Fluchloralin	X	ND	ND	ND	X	33245-39-5
Fluoranthene	X	X	X	X	X	206-44-0
Fluorene	X	X	X	X	X	86-73-7
2-Fluorobiphenyl (Surr)	X	X	X	X	X	321-60-8
2-Fluorophenol (Surr)	X	X	X	X	X	367-12-4
Heptachlor	X	X	X	X	X	76-44-8
Heptachlor Epoxide	X	X	X	X	X	1024-57-3
Hexachlorobenzene	X	X	X	X	X	118-74-1
Hexachlorobutadiene	X	X	X	X	X	87-68-3
Hexachlorocyclopentadiene	X	X	X	X	X	77-47-4
Hexachloroethane	X	X	X	X	X	67-72-1
Hexachlorophene	AW,CP(62)	ND	ND	ND	CP	70-30-4
Hexachloropropene	X	ND	ND	ND	X	1888-71-7
Hexamethylphosphoramide	X	ND	ND	ND	X	680-31-9
Hydroquinone	ND	ND	ND	ND	X	123-31-9
Indeno(1,2,3-cd)pyrene	X	X	X	X	X	193-39-5
Isodrin	X	ND	ND	ND	X	465-73-6
Isophorone	X	X	X	X	X	78-59-1
Isosafrole	DC(46) ND	ND	ND	ND	X	120-58-1
Kepone	X	ND	ND	ND	X	143-50-0
Leptophos	X	ND	ND	ND	X	21609-90-5
Malathion	HS(5)	ND	ND	ND	X	121-75-5
Maleic Anhydride	HE	ND	ND	ND	X	108-31-6
Mestranol	X	ND	ND	ND	X	72-33-3
Methapyrilene	X	ND	ND	ND	X	91-80-5
Methoxychlor	X	ND	ND	ND	X	72-43-5
3-Methylcholanthrene	X	ND	ND	ND	X	56-49-5
4,''-Methylenebis (2-chloroaniline)	OE,OS(0)	ND	ND	ND	LR	101-14-4
4,''-Methylenebis-(N-n-dimethylaniline)	X	X	ND	ND	ND	101-61-1
Methyl methanesulfonate	X	ND	ND	ND	X	66-27-3
2-Methylnaphthalene	X	X	ND	X	X	91-57-6

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ANALYTE:	3510*	3520	3540/3541	3550*	3580*	CAS #(a)
Methyl Parathion	X	ND	ND	ND	X	298-00-0
2-Methylphenol	X	ND	ND	ND	X	95-48-7
3-Methylphenol	X	ND	ND	ND	X	108-39-4
4-Methylphenol	X	ND	ND	ND	X	106-44-5
2-Methylpyridine	X	X	ND	ND	ND	109-06-8
Mevinphos	X	ND	ND	ND	X	7786-34-7
Mexacarbate	HE,HS(68)	ND	ND	ND	X	315-18-4
Mirex	X	ND	ND	ND	X	2385-85-5
Monocrotophos	HE	ND	ND	ND	X	6923-22-4
Naled	X	ND	ND	ND	X	300-76-5
Naphthalene	X	X	X	X	X	91-20-3
1,4-Naphthoquinone	X	ND	ND	ND	X	130-15-4
1-Naphthylamine	OS(44)	ND	ND	ND	X	134-32-7
2-Naphthylamine	X	ND	ND	ND	X	91-59-8
Nicotine	DE(67)	ND	ND	ND	X	54-11-5
5-Nitroacenaphthene	X	ND	ND	ND	X	602-87-9
2-Nitroaniline	X	X	ND	X	X	88-74-4
3-Nitroaniline	X	X	ND	X	X	99-09-2
4-Nitroaniline	X	X	ND	X	X	100-01-6
5-Nitro-o-anisidine	X	ND	ND	ND	X	99-59-2
Nitrobenzene	X	X	X	X	X	98-95-3
4-Nitrobiphenyl	X	ND	ND	ND	X	92-93-3
Nitrofen	X	ND	ND	ND	X	1836-75-5
2-Nitrophenol	X	X	X	X	X	88-75-5
4-Nitrophenol	X	X	X	X	X	100-02-7
5-Nitro-o-toluidine	X	ND	ND	ND	X	99-55-8
Nitroquinoline-1-oxide	X	ND	ND	ND	X	56-57-5
N-nitrosodi-n-butylamine	X	ND	ND	ND	X	924-16-3
N-nitrosodiethylamine	X	ND	ND	ND	X	55-18-5
N-nitrosodimethylamine	X	X	X	X	X	62-75-9
N-nitrosomethylethylamine	X	ND	ND	ND	X	10595-95-6
N-nitrosodiphenylamine	X	X	X	X	X	86-30-6
N-nitrosodi-n-propylamine	X	X	X	X	X	621-64-7
N-nitrosomorpholine	ND	ND	ND	ND	X	59-89-2
N-nitrosopiperidine	X	ND	ND	ND	X	100-75-4
N-nitrosopyrrolidine	X	ND	ND	ND	X	930-55-2
Octamethyl Pyrophosphoramide	LR	ND	ND	ND	LR	152-16-9
Parathion	X	ND	ND	ND	X	56-38-2
Pentachlorobenzene	X	ND	ND	ND	X	608-93-5
Pentachloronitrobenzene	X	ND	ND	ND	X	82-68-8
Pentachlorophenol	X	X	X	X	X	87-86-5

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ANALYTE:	3510*	3520	3540/3541	3550*	3580*	CAS #(a)
Phenacetin	X	ND	ND	ND	X	62-44-2
Phenanthrene	X	X	X	X	X	85-01-8
Phenobarbital	X	ND	ND	ND	X	50-06-6
Phenol	DC(28)	X	X	X	X	108-95-2
1,4-Phenylenediamine	X	ND	ND	ND	X	106-50-3
Phorate	X	ND	ND	ND	X	298-02-2
Phosalone	HS(65)	ND	ND	ND	X	2310-17-0
Phosmet	HS(15)	ND	ND	ND	X	732-11-6
Phosphamidon	HE(63)	ND	ND	ND	X	13171-21-6
Phthalic Anhydride	CP,HE(1)	ND	ND	ND	CP	85-44-9
2-Picoline	X	X	ND	ND	ND	109-06-8
Piperonyl Sulfoxide	X	ND	ND	ND	X	120-62-7
Pronamide	X	ND	ND	ND	X	23950-58-5
Pyrene	X	X	X	X	X	129-00-0
Pyridine	ND	ND	ND	ND	ND	110-86-1
Resorcinol	DC, OE(10)	ND	ND	ND	X	94-59-7
Safrole	X	ND	ND	ND	X	60-41-3
Sulfallate	X	ND	ND	ND	X	95-06-7
Terbufos	X	ND	ND	ND	X	13071-79-9
Terphenyl d(l4)(surr)	X	X	ND	X	X	1718-51-0
1,2,4,5-Tetrachlorobenzene	X	ND	ND	ND	X	95-94-3
2,3,4,6-Tetrachlorophenol	X	ND	ND	ND	X	58-90-2
Tetrachlorvinphos	X	ND	ND	ND	X	961-11-5
Tetraethyl Dithiopyrophosphate	X	X	ND	ND	ND	3689-24-5
Tetraethyl Pyrophosphate	X	ND	ND	ND	X	107-49-3
Thionazine	X	ND	ND	ND	X	297-97-2
Thiophenol	X	ND	ND	ND	X	108-98-5
Benzenethiol	X	ND	ND	ND	X	108-98-5
Toluene Diisocyanate	HE(6)	ND	ND	ND	X	584-84-9
Ortho-toluidine	X	ND	ND	ND	X	95-53-4
Toxaphene	X	X	X	X	X	8001-35-2
1,2,4-Trichlorobenzene	X	X	X	X	X	120-82-1
2,4,5-Trichlorophenol	X	X	ND	X	X	95-95-4
2,4,6-Trichlorophenol	X	X	X	X	X	88-06-2
Trifluralin	X	ND	ND	ND	X	1582-09-8
2,4,5-Trimethylaniline	X	ND	ND	ND	X	137-17-7
Trimethyl Phosphate	HE(60)	ND	ND	ND	X	512-56-1
1,3,5-Trinitrobenzene	X	ND	ND	ND	X	99-35-4
Tris(2,3-dibromopropyl) phosphate	X	ND	ND	ND	LR	126-72-7
O,O,O-Triethyl Phosphorothioate	X	ND	ND	ND	X	126-68-1

KEY TO ANALYTE LIST ESC extraction technique Chemical Abstract Service Registry Number

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(b) See Sec. 1.2 for other acceptable preparation methods.
(IS) This compound may be used as an internal standard.
(surr) This compound may be used as a surrogate.
(AW) Adsorption to walls of glassware during extraction and storage.
(CP) Non-reproducible chromatographic performance.
(DC) Unfavorable distribution coefficient (number in parenthesis is percent recovery).
(HE) Hydrolysis during extraction accelerated by acidic or basic conditions (number in parenthesis is percent recovery).
(HS) Hydrolysis during storage (number in parenthesis is percent stability).
(LR) Low response.
(ND) Not determined.
(OE) Oxidation during extraction accelerated by basic conditions (number in parenthesis is percent recovery).
(OS) Oxidation during storage (number in parenthesis is percent stability).
(X) Greater than 70 percent recovery by this technique.

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Attachment IV: Characteristic Masses (m/z) for Extractable Organic Compounds

(Reprinted from SW-846 Method 8270C /Dec. 1996)

Compound	Primary Characteristic Ion	Secondary Characteristic Ion(s)
Pyridine	79	52,78,51
N-Nitrosodimethylamine	42	74,44
2-Picoline	93	66,92
Aniline	93	66,65
Phenol	94	65,66
Benzaldehyde	105	106,77,51
Bis(2-chloroethyl) ether	93	63,95
2-Chlorophenol	128	64,130
1,3-Dichlorobenzene	146	148,111
1,4-Dichlorobenzene-d4 (ISTD)	152	150,115
1,4-Dichlorobenzene	146	148,111
Benzyl alcohol	108	79,77
1,2-Dichlorobenzene	146	148,111
N-Nitrosomethylethylamine	88	42,43,56
Bis(2-chloroisopropyl) ether	45	77,121
Methyl methanesulfonate	80	79,65,95
N-Nitrosodi-n-propylamine	70	42,101,130
Hexachloroethane	117	201,199
Nitrobenzene	77	123,65
Isophorone	82	95,138
N-Nitrosodiethylamine	102	42,57,44,56
2-Nitrophenol	139	109,65
2,4-Dimethylphenol	122	107,121
Bis(2-chloroethoxy)methane	93	95,123
Benzoic acid	122	105,77
2,4-Dichlorophenol	162	164,98
Ethyl methanesulfonate	79	109,97,45,65
1,2,4-Trichlorobenzene	180	182,145
Naphthalene-d8 (ISTD)	136	68
Naphthalene	128	129,127
Hexachlorobutadiene	225	223,227
Caprolactam	113	55,56,42
4-Chloro-3-methylphenol	107	144,142
2-Methylnaphthalene	142	141
1-Methylnaphthalene	142	141
2-Methylphenol	107	108,77,79,90
Hexachloropropene	213	211,215,117,106,141
Hexachlorocyclopentadiene	237	235,272
N-Nitrosopyrrolidine	100	41,42,68,69

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Compound	Primary Characteristic Ion	Secondary Characteristic Ion(s)
Acetophenone	105	71,51,120
4-Methylphenol	107	108,77,79,90
2,4,6-Trichlorophenol	196	198,200
2,4,5-Trichlorophenol	196	198,200
o-Toluidine	106	107,77,51,79
3-Methylphenol	107	108,77,79,90
2-Chloronaphthalene	162	127,164
N-Nitrosopiperidine	114	42,55,56,41
1-Chloronaphthalene	162	127,164
2-Nitroaniline	65	92,138
Dimethyl phthalate	163	194,164
Acenaphthylene	152	151,153
2,6-Dinitrotoluene	165	63,89
3-Nitroaniline	138	108,92
Acenaphthene-d10 (ISTD)	164	162,160
Acenaphthene	154	153,152
2,4-Dinitrophenol	184	63,154
2,6-Dinitrophenol	162	164,126,98,63
4-Chloroaniline	127	129,65,92
Isosafrole	162	131,104,77,51
Dibenzofuran	168	139
2,4-Dinitrotoluene	165	63,89
4-Nitrophenol	139	109,65
2-Naphthylamine	143	115,116
1,4-Naphthoquinone	158	104,102,76,50,130
Diethyl phthalate	149	177,150
Fluorene	166	165,167
N-Nitrosodi-n-butylamine	84	57,41,116,158
4-Chlorophenyl phenyl ether	204	206,141
Atrazine	200	215,58
4,6-Dinitro-2-methylphenol	198	51,105
N-Nitrosodiphenylamine	169	168,167
Safrole	162	104,77,103,135
Diphenylamine	169	168,167
1,2,4,5-Tetrachlorobenzene	216	214,179,108,143,218
1-Naphthylamine	143	115,89,63
4-Bromophenyl phenyl ether	248	250,141
2,4,5-Trichlorophenol	196	198,97,132,99
Hexachlorobenzene	284	142,249
Pentachlorophenol	266	264,268
5-Nitro-o-toluidine	152	77,79,106,94

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Compound	Primary Characteristic Ion	Secondary Characteristic Ion(s)
Thionazine	107	96,97,143,79,68
4-Nitroaniline	138	65,108,92,80,39
Phenanthrene-d10 (ISTD)	188	94,80
Phenanthrene	178	179,176
Anthracene	178	176,179
Carbazole	167	166,168,139
1,3-Dinitrobenzene	168	76,50,75,92,122
Diallate (cis or trans)	86	234,43,70
Pentachlorobenzene	250	252,108,248,215,254
Pentachloronitrobenzene	237	142,214,249,295,265
4-Nitroquinoline-1-oxide	174	101,128,75,116
Di-n-butyl phthalate	149	150,104
2,3,4,6-Tetrachlorophenol	232	131,230,166,234,168
Demeton-O	88	89,60,61,115,171
Fluoranthene	202	101,203
1,3,5-Trinitrobenzene	75	74,213,120,91,63
Benzidine	184	92,185
Pyrene	202	200,203
Phorate	75	121,97,93,260
Demeton-S	88	60,81,89,114,115
Phenacetin	108	180,179,109,137,80
Dimethoate	87	93,125,143,229
4-Aminobiphenyl	169	168,170,115
Dimethylphenylamine	58	91,65,134,42
Pronamide	173	175,145,109,147
Dinoseb	211	163,147,117,240
Disulfoton	88	97,89,142,186
Butyl benzyl phthalate	149	91,206
Methyl parathion	109	125,263,79,93
Dimethylaminoazobenzene	225	120,77,105,148,42
Benz(a)anthracene	228	229,226
Chrysene-d12 (ISTD)	240	120,236
3,3'-Dichlorobenzidine	252	254,126
Chrysene	228	226,229
Kepone	272	274,237,178,143,270
Parathion	109	97,291,139,155
Bis(2-ethylhexyl) phthalate	149	167,279
3,3'-Dimethylbenzidine	212	106,196,180
Methapyrilene	97	50,191,71
Isodrin	193	66,195,263,265,147

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Compound	Primary Characteristic Ion	Secondary Characteristic Ion(s)
Di-n-octyl phthalate	149	167,43
Aramite	185	191,319,334,197,321
Benzo(b)fluoranthene	252	253,125
Benzo(k)fluoranthene	252	253,125
Famphur	218	125,93,109,217
Benzo(a)pyrene	252	253,125
Perylene-d12 (ISTD)	264	260,265
7,12-Dimethylbenz(a)anthracene	256	241,239,120
2-Acetylaminofluorene	181	180,223,152
3-Methylcholanthrene	268	252,253,126,134,113
Dibenz(a,j)acridine	279	280,277,250
Indeno(1,2,3-cd)pyrene	276	138,227
Dibenz(a,h)anthracene	278	139,279
Benzo(g,h,i)perylene	276	138,277
Hexachlorophene	196	198,209,211,406,408
1,2-Diphenylhydrazine/Azobenzene	77	105,182
Mirex	272	274, 237,270
Kelthane (Dicofol)	251	139.111.253
Indene	115	116,117
Quinoline	129	128,130,102
Benzenethiol	110	109,66
Diphenyl Disulfide	218	109,65
Surrogates		
2-Fluorobiphenyl (surr)	172	171
2-Fluorophenol (surr)	112	64
Nitrobenzene-d5 (surr)	82	128,54
Phenol-d6 (surr)	99	42,71
Terphenyl-d14 (surr)	244	122,212
2,4,6-Tribromophenol (surr)	330	332,141
2-Methylnaphthalene-d10 (surr)	152	150, 122, 151
Fluoranthene-d10 (surr)	212	208, 313, 210
PAH by SIM		
Naphthalene	128	129
2-Methylnaphthalene	142	141
1-Methylnaphthalene	142	141
2-Chloronaphthalene	162	127
Acenaphthylene	152	153, 151
Acenaphthene	153	154, 152, 151
Dibenzofuran	168	139
Fluorene	166	165
Phenanthrene	178	179

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Compound	Primary Characteristic Ion	Secondary Characteristic Ion(s)
Anthracene	178	179, 176
Fluoranthene	202	203, 200
Pyrene	202	203, 200
Benzo(a)anthracene	228	226
Chrysene	228	226, 229
Benzo(b)fluoranthene	252	253
Benzo(k)fluoranthene	252	253
Benzo(a)pyrene	252	253
Indeno(1,2,3-cd)pyrene	276	277, 138
Dibenz(a,h)anthracene	278	279, 139, 138
Benzo(g,h,i)perylene	276	138

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TITLE: SEMIVOLATILE ORGANICS BY GC/MS (EPA METHODS 8270C, 8270D, 625, 625.1 AND SM 6410B), INCLUDING PROVISIONS FOR ANALYSIS IN SIM MODE

Attachment V - QC Acceptance Criteria for Method 625

Compound	Test conc. (µg/L)	Limit for s (µg/L)	Range for x (µg/L)	Range p, p(s) (%)
Acenaphthene	100	27.6	60.1-132.3	47-145
Acenaphthylene	100	40.2	53.5-126.0	33-145
Aldrin	100	39	7.2-152.2	D-166
Anthracene	100	32	43.4-118.0	27-133
Benz(a)anthracene	100	27.6	41.8-133.0	33-143
Benzo(b)fluoranthene	100	38.8	42.0-140.4	24-159
Benzo(k)fluoranthene	100	32.3	25.2-145.7	11-162
Benzo(a)pyrene	100	39	31.7-148.0	17-163
Benzo(g,h,i)perylene	100	58.9	D-195.0	D-219
Benzyl butyl phthalate	100	23.4	D-139.9	D-152
beta-BHC	100	31.5	41.5-130.6	24-149
delta-BHC	100	21.6	D-100.0	D-110
Bis(2-chloroethyl) ether	100	55	42.9-126.0	12-158
Bis(2-chloroethoxy)methane	100	34.5	49.2-164.7	33-184
Bis(2-chloroisopropyl) ether	100	46.3	62.8-138.6	36-166
Bis(2-ethylhexyl) phthalate	100	41.1	28.9-136.8	8-158
4-Bromophenyl phenyl ether	100	23	64.9-114.4	53-127
2-Chloronaphthalene	100	13	64.5-113.5	60-118
4-Chlorophenyl phenyl ether	100	33.4	38.4-144.7	25-158
Chrysene	100	48.3	44.1-139.9	17-168
4,4'-DDD	100	31	D-134.5	D-145
4,4'-DDE	100	32	19.2-119.7	4-136
4,4'-DDT	100	61.6	D-170.6	D-203
Dibenzo(a,h)anthracene	100	70	D-199.7	D-227
Di-n-butyl phthalate	100	16.7	8.4-111.0	1-118
1,2-Dichlorobenzene	100	30.9	48.6-112.0	32-129
1,3-Dichlorobenzene	100	41.7	16.7-153.9	D-172
1,4-Dichlorobenzene	100	32.1	37.3-105.7	20-124
3,3'-Dichlorobenzidine	100	71.4	8.2-212.5	D-262
Dieldrin	100	30.7	44.3-119.3	29-136
Diethyl phthalate	100	26.5	D-100.0	D-114
Dimethyl phthalate	100	23.2	D-100.0	D-112
2,4-Dinitrotoluene	100	21.8	47.5-126.9	39-139
2,6-Dinitrotoluene	100	29.6	68.1-136.7	50-158
Di-n-octyl phthalate	100	31.4	18.6-131.8	4-146
Endosulfan sulfate	100	16.7	D-103.5	D-107
Endrin aldehyde	100	32.5	D-188.8	D-209
Fluoranthene	100	32.8	42.9-121.3	26-137
Fluorene	100	20.7	71.6-108.4	59-121
Heptachlor	100	37.2	D-172.2	D-192
Heptachlor epoxide	100	54.7	70.9-109.4	26.155

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Compound	Test conc. (µg/L)	Limit for s (µg/L)	Range for x (µg/L)	Range p, p(s) (%)
Hexachlorobenzene	100	24.9	7.8-141.5	D-152
Hexachlorobutadiene	100	26.3	37.8-102.2	24-116
Hexachloroethane	100	24.5	55.2-100.0	40-113
Indeno(1,2,3-cd)pyrene	100	44.6	D-150.9	D-171
Isophorone	100	63.3	46.6-180.2	21-196
Naphthalene	100	30.1	35.6-119.6	21-133
Nitrobenzene	100	39.3	54.3-157.6	35-180
N-Nitrosodi-n-propylamine	100	55.4	13.6-197.9	D-230
Aroclor 1260	100	54.2	19.3-121.0	D-164
Phenanthrene	100	20.6	65.2-108.7	54-120
Pyrene	100	25.2	69.6-100.0	52-115
1,2,4-Trichlorobenzene	100	28.1	57.3-129.2	44-142
4-Chloro-3-methylphenol	100	37.2	40.8-127.9	22-147
2-Chlorophenol	100	28.7	36.2-120.4	23-134
2,4-Chlorophenol	100	26.4	52.5-121.7	39-135
2,4-Dimethylphenol	100	26.1	41.8-109.0	32-119
2,4-Dinitrophenol	100	49.8	D-172.9	D-191
2-Methyl-4,6-dinitrophenol	100	93.2	53.0-100.0	D-181
2-Nitrophenol	100	35.2	45.0-166.7	29-182
4-Nitrophenol	100	47.2	13.0-106.5	D-132
Pentachlorophenol	100	48.9	38.1-151.8	14-176
Phenol	100	22.6	16.6-100.0	5-112
2,4,6-Trichlorophenol	100	31.7	52.4-129.2	37-144

(s) = Standard deviation of four recovery measurements, in µg/L

(x) = Average recovery for four recovery measurements, in µg/L

(p, p(s)) = Measured percent recovery

(D) = Detected; result must be greater than zero

(a) = Criteria from 40 CFR Part 136 for Method 625, using a packed GC column. These criteria are based directly on the method performance data. Where necessary, the limits for recovery have been broadened to assure applicability of the limits to concentrations below those used to develop method performance data. These values are for guidance only. Appropriate derivation of acceptance criteria for capillary columns should result in much narrower ranges. See Method 8000 for information on developing and updating acceptance criteria for method performance.

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Attachment VI - BNA Poor Performing Compounds

The following compounds are considered to be poor performing compounds.
Pyridine
Aniline
Benzoic Acid
n-Nitrosodimethylamine
Hexachlorocyclopentadiene
4-Chloroaniline
2-Nitroaniline
3-Nitroaniline
4-Nitroaniline
2,4-Dinitro-2-methylphenol
Pentachlorophenol
Carbazole
Benzidine
Atrazine
Acetophenone
Caprolactam
Benzaldehyde
1,2,4,5-Tetrachlorobenzene
Hexachlorophene

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Attachment VII – Method 625.1 Criteria

Analyte	ML (ug/L)	Range for Q (%)	Limit for s (%)	Range for $\bar{X}$ (%)	Range for P1, P2 (%)	Limit for RPD (%)
Acenaphthene*	5.7	70-130	29	60-132	47-145	48
Acenaphthylene*	10.5	60-130	45	54-126	33-145	74
Anthracene*	5.7	58-130	40	43-120	27-133	66
Benzidine*	132					
Benzo(a)anthracene*	23.4	42-133	32	42-133	33-143	53
Benzo(a)pyrene*	7.5	32-148	43	32-148	17-163	72
Benzo(b)fluoranthene*	14.4	42-140	43	42-140	24-159	71
Benzo(k)fluoranthene*	7.5	25-146	38	25-146	11-162	63
Benzo(ghi)perylene*	12.3	13-195	61	D-195	D-219	97
Benzyl butyl phthalate*	7.5	43-140	36	D-140	D-152	60
bis(2-Chloroethoxy)methane	15.9	52-164	32	49-165	33-184	54
bis(2-Ethylhexyl)phthalate*	7.5	43-137	50	29-137	8-158	82
bis(2-Chloroisopropyl) ether (2,2'-Oxybis[1-chloropropane])*	17.1	63-139	46	63-139	36-166	76
4-Bromophenyl phenyl ether*	5.7	70-130	26	65-120	53-127	43
2-Chloronaphthalene*	5.7	70-130	15	65-120	60-120	24
4-Chlorophenyl phenyl ether*	12.6	57-145	36	38-145	25-158	61
Chrysene*	7.5	44-140	53	44-140	17-168	87
Dibenz(a,h)anthracene*	7.5	13-200	75	D-200	D-227	126
Di-n-butylphthalate*	7.5	52-130	28	8-120	1-120	47
3,3'-Dichlorobenzidine*	49.5	18-213	65	8-213	D-262	108
Diethyl phthalate*	5.7	47-130	60	D-120	D-120	100
Dimethyl phthalate*	4.8	50-130	110	D-120	D-120	183
2,4-Dinitrotoluene*	17.1	53-130	25	48-127	39-139	42
2,6-Dinitrotoluene*	5.7	68-137	29	68-137	50-158	48
Di-n-octylphthalate*	7.5	21-132	42	19-132	4-146	69
Fluoranthene*	6.6	47-130	40	43-121	26-137	66
Fluorene*	5.7	70-130	23	70-120	59-121	38
Hexachlorobenzene*	5.7	38-142	33	8-142	D-152	55
Hexachlorobutadiene*	2.7	68-130	38	38-120	24-120	62
Hexachloroethane*	4.8	55-130	32	55-120	40-120	52
Indeno(1,2,3-cd)pyrene*	11.1	13-151	60	D-151	D-171	99
Isophorone*	6.6	52-180	56	47-180	21-196	93
Naphthalene*	4.8	70-130	39	36-120	21-133	65
Nitrobenzene*	5.7	54-158	37	54-158	35-180	62
N-Nitrosodi-n-propylamine*	—	59-170	52	14-198	D-230	
Phenanthrene*	16.2	67-130	24	65-120	54-120	39
Pyrene*	5.7	70-130	30	70-120	52-120	49
1,2,4-Trichlorobenzene*	5.7	61-130	30	57-130	44-142	50
4-Chloro-3-methylphenol	9.0	68-130	44	41-128	22-147	73
2-Chlorophenol	9.9	55-130	37	36-120	23-134	61

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Analyte	ML (ug/L)	Range for Q (%)	Limit for s (%)	Range for $\bar{X}$ (%)	Range for P1, P2 (%)	Limit for RPD (%)
2,4-Dichlorophenol	8.1	64-130	30	53-122	39-155	50
2,4-Dimethylphenol	8.1	58-130	35	42-120	32-120	58
2,4-Dinitrophenol	126	39-173	79	D-173	D-191	132
2-Methyl-4,6-dinitrophenol	72	56-130	122	53-130	D-181	203
2-Nitrophenol	10.8	61-163	33	45-167	29-182	55
4-Nitrophenol	7.2	35-130	79	13-129	D-132	131
Pentachlorophenol	10.8	42-152	52	38-152	14-176	86
Phenol	4.5	48-130	39	17-120	5-120	64
2,4,6-Trichlorophenol	8.1	69-130	35	52-129	37-144	58
4-Chloro-3-methylphenol	9.0					
2-Chlorophenol	9.9					
2,4-Dichlorophenol	8.1					
2,4-Dimethylphenol	8.1					
2,4-Dinitrophenol	126					
2-Methyl-4,6-dinitrophenol	72					
2-Nitrophenol	10.8					
4-Nitrophenol	7.2					
Acetophenone						
2-Acetylaminofluorene						
1-Acetyl-2-thiourea						
Alachlor						
Aldrin	5.7	7-152	39	7-152	D-166	81
Ametryn						
2-Aminoanthraquinone						
Aminoazobenzene						
4-Aminobiphenyl						
3-Amino-9-ethylcarbazole						
Anilazine						
Aniline						
o-Anisidine						
Aramite						
Atraton						
Atrazine						
Azinphos-methyl						
Barban						
Benzanthrone						
Benzenethiol						
Benzoic acid						
2,3-Benzofluorene						
p-Benzoquinone						
Benzyl alcohol						
alpha-BHC						

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Analyte	ML (ug/L)	Range for Q (%)	Limit for s (%)	Range for $\bar{X}$ (%)	Range for P1, P2 (%)	Limit for RPD (%)
beta-BHC	9.3	42-131	37	42-131	24-149	61
gamma-BHC (Lindane)	12.6					
delta-BHC		D-130	77	D-120	D-120	129
Biphenyl						
Bromacil						
2-Bromochlorobenzene						
3-Bromochlorobenzene						
Bromoxynil						
Butachlor						
Butylate						
n-C10 (n-decane)						
n-C12 (n-undecane)						
n-C14 (n-tetradecane)						
n-C16 (n-hexadecane)						
n-C18 (n-octadecane)						
n-C20 (n-eicosane)						
n-C22 (n-docosane)						
n-C24 (n-tetracosane)						
n-C26 (n-hexacosane)						
n-C28 (n-octacosane)						
n-C30 (n-triacontane)						
Captafol						
Captan						
Carbaryl						
Carbazole						
Carbofuran						
Carboxin						
Carbophenothion						
Chlordane 3,5						
bis(2-Chloroethyl) ether	17.1	52-130	65	43-126	12-158	108
Chloroneb						
4-Chloroaniline						
Chlorobenzilate						
Chlorfenvinphos						
4-Chloro-2-methylaniline						
3-(Chloromethyl)pyridine hydrochloride						
4-Chloro-2-nitroaniline						
Chlorpropham						
Chlorothalonil						
1-Chloronaphthalene						
3-Chloronitrobenzene						

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Analyte	ML (ug/L)	Range for Q (%)	Limit for s (%)	Range for $\bar{X}$ (%)	Range for P1, P2 (%)	Limit for RPD (%)
4-Chloro-1,2-phenylenediamine						
4-Chloro-1,3-phenylenediamine						
2-Chlorobiphenyl						
Chlorpyrifos						
Coumaphos						
m + p-Cresol						
o-Cresol						
p-Cresidine						
Crotoxyphos						
2-Cyclohexyl-4,6-dinitro-phenol						
Cyanazine						
Cycloate						
p-Cymene						
Dacthal (DCPA)						
4,4'-DDD	8.4	D-135	56	D-135	D-145	93
4,4'-DDE	16.8	19-130	46	19-120	4-136	77
4,4'-DDT	14.1	D-171	81	D-171	D-203	135
Demeton-O						
Demeton-S						
Diallate (cis or trans)						
2,4-Diaminotoluene						
Diazinon						
Dibenz(a,j)acridine						
Dibenzofuran						
Dibenzo(a,e)pyrene						
Dibenzothiophene						
1,2-Dibromo-3-chloropropane						
3,5-Dibromo-4-hydroxybenzonitrile						
2,6-Di-tert-butyl-p-benzoquinone						
Dichlone						
2,3-Dichloroaniline						
2,3-Dichlorobiphenyl						
2,6-Dichloro-4-nitroaniline						
2,3-Dichloronitrobenzene						
1,3-Dichloro-2-propanol						
2,6-Dichlorophenol						
Dichlorvos						
Dicrotophos						
Dieldrin 3	7.5	70-130	38	44-119	29-136	62
1,2:3,4-Diepoxybutane						
Di(2-ethylhexyl) adipate						

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Analyte	ML (ug/L)	Range for Q (%)	Limit for s (%)	Range for $\bar{X}$ (%)	Range for P1, P2 (%)	Limit for RPD (%)
Diethylstilbestrol						
Diethyl sulfate						
Dilantin (5,5-Diphenylhydantoin)						
Dimethoate						
3,3′-Dimethoxybenzidine						
Dimethylaminoazobenzene						
7,12-Dimethylbenz(a)anthracene						
3,3′-Dimethylbenzidine						
N,N-Dimethylformamide						
3,6-Dimethylphenathrene						
alpha, alpha-Dimethylphenethylamine						
Dimethyl sulfone						
1,2-Dinitrobenzene						
1,3-Dinitrobenzene						
1,4-Dinitrobenzene						
Dinocap						
Dinoseb						
Diphenylamine						
Diphenyl ether						
1,2-Diphenylhydrazine						
Diphenamid						
Diphenyldisulfide						
Disulfoton						
Disulfoton sulfoxide						
Disulfoton sulfone						
Endosulfan I						
Endosulfan II						
Endosulfan sulfate	16.8	D-130	42	D-120	D-120	70
Endrin						
Endrin aldehyde		D-189	45	D-189	D-209	75
Endrin ketone						
EPN						
EPTC						
Ethion						
Ethoprop						
Ethyl carbamate						
Ethyl methanesulfonate						
Ethylenethiourea						
Etridiazole						
Ethynylestradiol-3-methyl ether						
Famphur						

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Analyte	ML (ug/L)	Range for Q (%)	Limit for s (%)	Range for $\bar{X}$ (%)	Range for P1, P2 (%)	Limit for RPD (%)
Fenamiphos						
Fenarimol						
Fensulfothion						
Fenthion						
Fluchloralin						
Fluridone						
Heptachlor	5.7	D-172	44	D-172	D-192	74
Heptachlor epoxide	6.6	70-130	61	71-120	26-155	101
2,2′,3,3′,4,4′,6-Heptachlorobiphenyl						
2,2′,4,4′,5′,6-Hexachlorobiphenyl						
Hexachlorocyclopentadiene						
Hexachlorophene						
Hexachloropropene						
Hexamethylphosphoramide						
Hexanoic acid						
Hexazinone						
Hydroquinone						
Isodrin						
2-Isopropylnaphthalene						
Isosafrole						
Kepone						
Leptophos						
Longifolene						
Malachite green						
Malathion						
Maleic anhydride						
Merphos						
Mestranol						
Methapyrilene						
Methoxychlor						
2-Methylbenzothioazole						
3-Methylcholanthrene						
4,4′-Methylenebis(2-chloroaniline)						
4,4′-Methylenebis(N,N-dimethylaniline)						
4,5-Methylenephenanthrene						
1-Methylfluorene						
Methyl methanesulfonate						
2-Methylnaphthalene						
Methylparaoxon						
Methyl parathion						

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Analyte	ML (ug/L)	Range for Q (%)	Limit for s (%)	Range for $\bar{X}$ (%)	Range for P1, P2 (%)	Limit for RPD (%)
1-Methylphenanthrene						
2-(Methylthio)benzothiazole						
Metolachlor						
Metribuzin						
Mevinphos						
Mexacarbate						
MGK 264						
Mirex						
Molinate						
Monocrotophos						
Naled						
Napropamide						
1,4-Naphthoquinone						
1-Naphthylamine						
2-Naphthylamine						
1,5-Naphthalenediamine						
Nicotine						
5-Nitroacenaphthene						
2-Nitroaniline						
3-Nitroaniline.						
4-Nitroaniline.						
5-Nitro-o-anisidine						
4-Nitrobiphenyl						
Nitrofen						
5-Nitro-o-toluidine						
Nitroquinoline-1-oxide						
N-Nitrosodi-n-butylamine						
N-Nitrosodiethylamine						
N-Nitrosodimethylamine						
N-Nitrosodiphenylamine						
N-Nitrosomethylethylamine						
N-Nitrosomethylphenylamine						
N-Nitrosomorpholine						
N-Nitrosopiperidine						
N-Nitrosopyrrolidine						
trans-Nonachlor						
Norflurazon						
2,2′,3,3′,4,5′,6,6′-Octachlorobiphenyl						
Octamethyl pyrophosphoramide						
4,4'-Oxydianiline						
Parathion						

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Analyte	ML (ug/L)	Range for Q (%)	Limit for s (%)	Range for $\bar{X}$ (%)	Range for P1, P2 (%)	Limit for RPD (%)
PCB–1016						
PCB–1221	90					
PCB–1232						
PCB–1242						
PCB–1248						
PCB–1254	108					
PCB–1260		19-130	77	19-130	D-164	128
PCB–1268						
Pebulate						
Pentachlorobenzene						
Pentachloronitrobenzene						
2,2′,3,4′,6-Pentachlorobiphenyl						
Pentachloroethane						
Pentamethylbenzene						
Perylene						
Phenacetin						
cis-Permethrin						
trans-Permethrin						
Phenobarbital						
Phenothiazene						
1,4-Phenylenediamine						
1-Phenylnaphthalene						
2-Phenylnaphthalene						
Phorate						
Phosalone						
Phosmet						
Phosphamidon						
Phthalic anhydride						
alpha-Picoline (2-Methylpyridine)						
Piperonyl sulfoxide						
Prometon						
Prometryn						
Pronamide						
Propachlor						
Propazine						
Propylthiouracil						
Pyridine						
Resorcinol (1,3-Benzenediol)						
Safrole						
Simazine						
Simetryn						
Squalene						

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Analyte	ML (ug/L)	Range for Q (%)	Limit for s (%)	Range for $\bar{X}$ (%)	Range for P1, P2 (%)	Limit for RPD (%)
Stirofos						
Strychnine						
Styrene 9						
Sulfallate						
Tebuthiuron						
Terbacil..						
Terbufos						
Terbutryn						
alpha-Terpineol						
1,2,4,5-Tetrachlorobenzene						
2,2′,4,4′-Tetrachlorobiphenyl						
2,3,7,8-Tetrachlorodibenzo-p-dioxin						
2,3,4,6-Tetrachlorophenol						
Tetrachlorvinphos						
Tetraethyl dithiopyrophosphate						
Tetraethyl pyrophosphate						
Thianaphthene (2,3-Benzothiophene)						
Thioacetamide						
Thionazin						
Thiophenol (Benzenethiol)						
Thioxanthone						
Toluene-1,3-diisocyanate						
Toluene-2,4-diisocyanate						
o-Toluidine						
Toxaphene 3,5						
Triadimefon						
1,2,3-Trichlorobenzene						
2,4,5-Trichlorobiphenyl						
2,3,6-Trichlorophenol						
2,4,5-Trichlorophenol						
Tricyclazole						
Trifluralin						
1,2,3-Trimethoxybenzene						
2,4,5-Trimethylaniline						
Trimethyl phosphate						
Triphenylene						
Tripropyleneglycolmethyl ether						
1,3,5-Trinitrobenzene						
Tris(2,3-dibromopropyl) phosphate						

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Analyte	ML (ug/L)	Range for Q (%)	Limit for s (%)	Range for $\bar{X}$ (%)	Range for P1, P2 (%)	Limit for RPD (%)
Tri-p-tolyl phosphate						
O,O,O-Triethyl phosphorothioate.						
Trithiane						
Vernolate						

Many of the analytes in this table do not have QC acceptance criteria. If calibration is to be verified and other QC tests are to be performed for these analytes, acceptance criteria must be developed and applied. EPA has provided guidance for development of QC acceptance criteria (see 40 CFR 136.6(b)(2)(i) and *Protocol for EPA Approval of New Methods for Organic and Inorganic Analytes in Wastewater and Drinking Water* (EPA–821–B–98–003) March 1999). Alternatively, analytes that do not have acceptance criteria may be based on laboratory control charts, or 60 to 140% may be used.

* At a minimum, these compounds must be spiked into the MS/MSD analyses when direction cannot be obtained from the data user.

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Attachment VIII – Method 625.1 Suggested Internal Standards and Surrogates

Compound	Range for Surrogate Recovery	
	Calibration Verification	Recovery from Samples
Base/Neutral Fraction		
Acenaphthalene-d_8	66-152	33-168
Acenaphthene-d_{10}	71-141	30-180
Aniline-d5		
Anthracene-d_{10}	58-171	53-142
Benzo(a)anthracene-d_{12}	28-357	22-329
Benzo(a)pyrene-d_{12}	32-194	32-194
4-Chloroaniline-d_4	1-145	1-145
bis(2-Chloroethyl)ether-d_8	52-194	25-222
Chrysene-d_{12}	23-290	23-290
Decafluorobiphenyl		
4,4'-Dibromobiphenyl		
4,4'-Dibromooctafluorobiphenyl		
1,4-Dichlorobenzene-d_4	65-153	11-245
2,2'-Difluorobiphenyl		
Dimethyl phthalate-d_6	47-211	1-500
Fluoranthene-d_{10}	61-164	38-172
4-Fluoroaniline		
1-Fluoronaphthalene		
2-Fluoronaphthalene		
2-Methylnaphthalene-d_{10}	50-150	50-150
Naphthalene-d_8	71-141	22-192
Nitrobenzene-d_5	46-219	15-314
2,3,4,5,6-Pentafluorobiphenyl		
Perylene-d_{12}		
Phenanthrene-d_{10}	67-149	34-168
Pyrene-d_{10}	48-210	28-196
Pyridine-d_5		
Acid Fraction		
2-Chlorophenol-d_4	55-180	33-180
2,4-Dichlorophenol-d_3	64-157	34-182
4,6-Dinitro-2-methylphenol-d_2	56-177	22-307
2-Fluorophenol		
4-Methylphenol-d_8	25-111	25-111
2-Nitrophenol-d_4	61-163	37-163
4-Nitrophenol-d_4	35-287	6-500

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Compound	Range for Surrogate Recovery	
	Calibration Verification	Recovery from Samples
Pentafluorophenol		
2-Perfluoromethylphenol		
Phenol-d_5	48-208	8-424

Many of the surrogates in this table do not have QC acceptance criteria. If calibration is to be verified and other QC tests are to be performed for these surrogates, acceptance criteria must be developed and applied. EPA has provided guidance for development of QC acceptance criteria (see 40 CFR 136.6(b)(2)(i) and *Protocol for EPA Approval of New Methods for Organic and Inorganic Analytes in Wastewater and Drinking Water* (EPA–821–B–98–003) March 1999). Alternatively, surrogates that do not have acceptance criteria may be based on laboratory control charts, or 60 to 140% may be used.

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Attachment IX – DoD Requirements

1.0 Equipment/Instrument Maintenance

Instrument maintenance must be performed routinely to optimize instrument performance and improve chromatography. Commonly performed maintenance includes baking columns, changing injection port liners, changing pump oil, etc. A new calibration curve must be analyzed following any major maintenance performed on the analytical system.

2.0 Computer Hardware and Software

Software name and version: HP Chemstation G1701CA Version C.00.00 or equivalent

3.0 Troubleshooting

Table 1. GCMS Troubleshooting Guide

Problem	Cause	Treatment
Peaks broaden and tail	Poor column installation causing dead volume in the injector	Reinstall column in injector. Check seal at ferrule. Check insertion depth. Ensure a good column cut.
	Solvent flashing in hot injector	Reduce injection speed on hot injectors and if possible reduce injector temperature
	Injector not being purged properly after splitless injection	For splitless injection, the vent flow should be 70 ml/min, and the injector should be switched to the split mode 0.5_1.5 min after injection.
Tailing sample peaks for active components	Active sites in the injector insert or liner	Change or clean the injector insert
	Active sites or degraded phase in column	Remove the front 15 cm of the column and reinstall. If retention times are changing or cutting the column does not help, replace the column.
	Injector not hot enough for higher boiling compounds	Increase the injector temperature and lower the injection speed. Check that the graphite ferrule is free of cracks and the septum support is tight.
Low response and tailing of high boiling point compounds	Injector is not hot enough to vaporize high boilers	Increase injector temperature
	Interface/ion source not getting to adequate temperature	Change the manifold heater
Leading sample peaks	Column overload due to excess amount of component injected	Dilute the sample or do split injection
	Degradation of stationary phase	Change the column

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Table 1. GCMS Troubleshooting Guide

Problem	Cause	Treatment
	Carrier gas velocity too low	Increase carrier gas flow rate
Poor chromatographic resolution	Column temperature or program not optimized	Modify method by changing temperature ramp segment slopes
	Carrier gas flow rate not optimized	Decrease carrier gas linear velocity
	Stationary phase has degraded	Replace the column
Peak splitting, especially low boilers	Sample is flashing in the injector simulating two injections	Lower injector temperature
Retention times shift in chromatogram	Unstable carrier gas flow controller/regulator	Check pneumatics for leaks. Replace flow controller/ regulator if necessary.
	Column contamination or degradation	Condition or replace column
	Leaks at septum or column to injector connection	Replace septum regularly and check that the septum nut and the capillary column nut are tight
Cannot reach operating vacuum	Analyzer contaminated by diffusion pump oil	Shut down and clean mass spec
	Major air leak around column fitting into interface	Replace column ferrule and reseat compression fitting
No calibration gas peaks	Cal gas valve not open	Open cal gas valve
	Calibration gas solenoid valve stuck open. All calibration gas evaporated.	Have solenoid replaced. Put fresh PFBTA in the cal gas vial.
Analysis sensitivity has decreased	Background has increased	Check column bleed, septum bleed, pump oil, and ion source contamination
	Detector needs replacement	Replace detector
	Defective syringe	Try a new or proven syringe
	"Blown" septum or other massive leaks at the inlet or with carrier gas flow. Poor peak shapes usually result from bad leaks.	Find and fix leaks and adjust gas flow.
	Purge flow or split ratio too high	Adjust gas flow rates

4.0 Other Requirements

4.1 All hardcopy laboratory notebooks must be reviewed by the Supervisor, or their designee, on a monthly basis.

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4.2 If not self-explanatory (e.g., a typo or transposed number), corrections to technical and quality records shall also include a justification for the change.

4.3 A storage blank must be stored with all volatile organic samples, regardless of suspected concentration levels.

4.4 A person performing a manual integration must sign and date each manually integrated chromatogram and record the rationale for performing manual integration. Electronic signatures are acceptable.

4.5 The results of calibration and verification of support equipment must be within the specifications required of the application for which this equipment is used or the equipment must be removed from service until repaired. Calibration and verification records, including those of established correction factors, must be maintained. In the absence of method-specific requirements, the minimum requirements are as follows:

Table 2. Support Equipment Checks

Performance Check	Frequency	Acceptance Criteria
Balance calibration check [Using two standard weights that bracket the expected mass]	Daily prior to use	Top-loading balance: ±2% or ±0.02g, whichever is greater Analytical balance: ±0.1% or ±0.5 mg, whichever is greater
Verification of standard mass [Using weights traceable to the International System of Units (SI) through a NMI	Every 5 years	Certificate of Calibration from ISO/IEC 17025 accredited calibration laboratory
Monitoring of refrigerator/freezer temperatures	Daily (i.e. 7 days per week) [use MIN/MAX thermometers or data loggers equipped with notification of out of control event capabilities if personnel not available to record daily]	Refrigerators: 0˚C to 6˚C Freezers: ≤-10˚C
Thermometer verification check [Using a thermometer traceable to the SI through an NMI] [Performed at two temperatures that bracket the target temperature(s). Assume linearity between the two bracketing temperatures.] [If only a single temperature is used, at the temperature of use]	Liquid in glass: Before first use and annually Electronic: Before first use and quarterly	Apply correction factors or replace thermometer
Volumetric labware	Class B: By lot before first use Class A and B: Upon evidence of deterioration	Bias: Mean within ±2% of nominal volume Precision: RSD ≤1% of nominal volume (based on 10 replicate measurements)

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Table 2. Support Equipment Checks		
Performance Check	**Frequency**	**Acceptance Criteria**
Non-volumetric labware [Applicable only when used for measuring initial sample volume and final extract/ digestates volume]	By lot before first use or upon evidence of deterioration	Bias: Mean within ±3% of nominal volume Precision: RSD ≤3% of nominal volume (based on 10 replicate measurements)
Mechanical volumetric pipette	Quarterly	Bias: Mean within ±2% of nominal volume Precision: RSD ≤1% of nominal volume (based on minimum of 3 replicate measurements) [Note: for variable volume pipettes, the nominal volume is the volume of use]
Glass microliter syringe	Upon receipt and upon evidence of deterioration	General Certificate of Bias & Precision upon receipt Replace if deterioration is evident
Drying oven temperature check	Daily prior to and after use	Within ±5% of set temperature
Water purification system	Daily prior to use	See method blank criteria given in Section 4.20 of this addendum

4.6 The expiration date of the prepared standard shall not exceed the expiration date of the primary standard. All containers must bear a preparation date.

4.7 To avoid preparing non-representative samples, the laboratory shall not "target" within a relatively small mass range (e.g., 1.00 ± 0.01g) because such targeting will produce non-representative subsamples if the sample has high heterogeneity. The laboratory shall not manipulate the sample material so the sample aliquot weighs exactly 1.00g ± 0.01g, as an example.

4.8 In the absence of project-specific requirements, the minimum standard data qualifiers to be used are:

U Analyte was not detected and is reported as less than the LOD or as defined by the customer. The LOD has been adjusted for any dilution or concentration of the sample.

J The reported result is an estimated value (e.g., matrix interference was observed or the analyte was detected at a concentration outside the quantitation range).

B Blank contamination. The recorded result is associated with a contaminated blank.

N Non-target analyte. The analyte is a tentatively identified compound using mass spectrometry or any non-customer requested compounds that are tentatively identified.

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Q One or more quality control criteria failed (e.g., LCS recovery, surrogate spike recovery, or CCV recovery).

Additional data qualifiers may be used, or different letters or symbols to denote the qualifiers listed above, as long as they are appropriately defined and their use is consistent with project-specific requirements (e.g., QSM 5.0, the contract, and project-planning documents).

4.9 If the time of the sample collection is not provided, assume the most conservative time of day. For the purpose of batch processing, the start and stop dates and times of the batch preparation shall be recorded.

4.10 Each preparation method listed on the scope of accreditation must have quarterly LOD/LOQ verifications. However, not all possible combinations of preparation and cleanup techniques are required to have LOD/LOQ verifications. If LOD/LOQ verifications are not performed on all combinations, the laboratory must base the LOD/LOQ verifications on the worst case basis (preparation method with all applicable cleanup steps).

4.11 After each MDL determination, the laboratory must establish the LOD by spiking a quality system matrix at a concentration of at least 2 times but no greater than four times the MDL. This spike concentration establishes the LOD and the concentration at which the LOD shall be verified. It is specific to each suite of analyte, matrix, and method (including sample preparation). The following requirements apply to the initial LOD establishment and to the LOD verifications:

- The apparent signal to noise (S/N) ratio at the LOD must be at least three and the results must meet all method requirements for analyte identification (e.g., ion abundance, second column confirmation, or pattern recognition). For data systems that do not provide a measure of noise, the signal produced by the verification sample must produce a result that is at least three standard deviations greater than the mean method blank concentration. This is initially estimated based on a minimum of four method blank analyses and later established with a minimum of 20 method blank results.
- If the LOD verification fails, then the laboratory must repeat the MDL determination and LOD verification or perform and pass two consecutive LOD verifications at a higher spike concentration and set the LOD at the higher concentration.
- The laboratory shall maintain documentation for all MDL determinations and LOD verifications.
- The DL and LOD must be reported for all analyte-matrix-methods suites, unless it is not applicable to the test or specifically excluded by project requirements.

4.12 The LOD shall be verified quarterly. In situations where methods are setup and used on an infrequent basis, the laboratory may choose to perform LOD verifications on a one per batch basis. All verification data will be in compliance, reported, and available for review.

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4.13 For DoD, at a minimum, the LOQ shall be verified quarterly. In situations where methods are setup and used on an infrequent basis, the laboratory may choose to perform LOQ verifications on a one per batch basis.

4.14 All initial instrument calibrations must be verified with a standard obtained from a second manufacturer prior to analyzing any samples. The use of a standard from a second lot obtained from the same manufacturer (independently prepared from different source materials) is acceptable for use as a second source standard. The concentration of the second source standard shall be at or near the midpoint of the calibration range. The acceptance criteria for the initial calibration verification must be at least as stringent as those for the continuing calibration verification.

4.15 Exclusion of calibration points without documented scientifically valid technical justification is not permitted.

4.16 The concentration of the CCV standard shall be greater than the low calibration standard and less than or equal to the midpoint of the calibration range.

4.17 All CCVs analyzed must be evaluated and reported. If a CCV fails, reanalysis or corrective actions must be taken.

- If a CCV fails, the laboratory can immediately analyze two additional consecutive CCVs (immediately is defined as starting a consecutive pair within one hour; no samples can be run between the failed CCV and the two additional CCVs). This approach allows for spurious failures of analytes to be reported without reanalysis of samples. Any corrective actions that change the dynamics of the system (e.g., clip column, clean injection port, run blanks) requires that all samples since the last acceptable CCV be reanalyzed.
- Both of these CCVs must meet acceptance criteria in order for the samples to be reported without reanalysis.
- If either of these two CCVs fail or if the laboratory cannot immediately analyze two CCVs, the associated samples cannot be reported and must be reanalyzed.
- Corrective action(s) and recalibration must occur if the above scenario fails. All affected samples since the last acceptable CCV must be reanalyzed.
- Flagging of data for a failed CCV is only appropriate when the affected samples cannot be reanalyzed. The laboratory must notify the client prior to reporting data associated with a failed CCV.

4.18 The results of all MS/MSDs must be evaluated using the same acceptance criteria used for the DoD LCS limits (see Addendum Tables 3 through 6) or project limits, if specified. If the specific analyte(s) are not available in the Addendum Tables 3 through 6, the laboratory shall use their LCS in-house limits (see the LIMS) as a means of evaluating MS/MSDs. The MS and MSD must be spiked with all reported analytes.

4.19 Surrogate spike results shall be compared with DoD LCS limits (see Addendum Tables 3 through 6) or acceptance criteria specified by the client. If these criteria are not available, the laboratory shall compare the results with its in-house statistically established LCS criteria (see the LIMS).

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4.20 The method blank shall be considered to be contaminated if:

- The concentration of any target analyte (chemical of concern) in the blank exceeds 1/2 the LOQ and is greater than 1/10th the amount measured in any associated sample, or 1/0th the regulatory limit, whichever is greater;
- The concentration of any common laboratory contaminant in the blank exceeds the LOQ;
- If a method blank is contaminated as described above, then the laboratory shall reprocess affected samples in a subsequent preparation batch, except when sample results are below the LOD. If insufficient sample volume remains for reprocessing, the results shall be reported with appropriate data qualifiers.

4.21 Sporadic Marginal Exceedances are not allowed for target analytes (chemicals of concern as identified by a project) without project-specific approval. Target analytes are considered those few analytes that are critical for the success of a project (such as risk drivers) where sporadic marginal exceedances cannot be allowed. Laboratories should consult with clients whenever long lists of analytes are requested for analysis to determine if marginal exceedances will not be allowed.

4.22 DoD considers the same analyte exceeding the LCS control limit two (2) out of three (3) consecutive LCS to be indicative of non-random behavior, which requires corrective action and reanalysis of the LCS.

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Table 3. LCS Control Limits – Method 8270 Solid Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
92-52-4	1,1-Biphenyl	1645	78.5	13	40	117
95-94-3	1,2,4,5-Tetrachlorobenzene	1810	77.8	13.7	37	119
120-82-1	1,2,4-Trichlorobenzene	3577	75.7	13.9	34	118
95-50-1	1,2-Dichlorobenzene	3352	74.6	14	33	117
528-29-0	1,2-Dinitrobenzene [1,2-DNB]	203	79.4	11.9	44	115
122-66-7	1,2-Diphenylhydrazine [Azobenzene]	2039	83	13.9	41	125
99-35-4	1,3,5-Trinitrobenzene [1,3,5-TNB]	154	89.2	10.7	57	121
541-73-1	1,3-Dichlorobenzene	3288	72.6	14.1	30	115
99-65-0	1,3-Dinitrobenzene [1,3-DNB]	598	84.6	14	43	127
106-46-7	1,4-Dichlorobenzene	3793	73.1	13.9	31	115
100-25-4	1,4-Dinitrobenzene	248	84.4	15.7	37	132
130-15-4	1,4-Naphthoquinone	150	81.2	8.8	55	108
90-13-1	1-Chloronaphthalene	119	81.1	11.1	48	115
90-12-0	1-Methylnaphthalene	3004	79.2	13.2	40	119
58-90-2	2,3,4,6-Tetrachlorophenol	1724	84.7	13.6	44	125
935-95-5	2,3,5,6-Tetrachlorophenol	227	75.9	11.9	40	112
608-27-5	2,3-Dichloroaniline	108	82.4	13	44	121
95-95-4	2,4,5-Trichlorophenol	4014	82.6	13.7	41	124
118-79-6	2,4,6-Tribromophenol	2930	85.7	15.4	39	132
88-06-2	2,4,6-Trichlorophenol	4183	82.1	14.5	39	126
120-83-2	2,4-Dichlorophenol	3794	80.9	13.7	40	122
105-67-9	2,4-Dimethylphenol	3886	78.4	16.2	30	127
121-14-2	2,4-Dinitrotoluene	4075	86.8	12.9	48	126
87-65-0	2,6-Dichlorophenol	1364	79.2	12.6	41	117
606-20-2	2,6-Dinitrotoluene	3706	85	13	46	124
53-96-3	2-Acetylaminofluorene	175	94	13.3	54	134
91-58-7	2-Chloronaphthalene	3569	77.5	12.1	41	114
95-57-8	2-Chlorophenol	3977	77.3	14.5	34	121
321-60-8	2-Fluorobiphenyl	3191	79.5	11.8	44	115
367-12-4	2-Fluorophenol	3008	75.2	13.3	35	115
91-57-6	2-Methylnaphthalene	5059	80.1	14	38	122
95-48-7	2-Methylphenol (o-Cresol)	4016	77	14.9	32	122
88-74-4	2-Nitroaniline	3639	85.4	13.8	44	127
119-75-5	2-Nitrodiphenylamine	279	88.1	11.6	53	123
88-75-5	2-Nitrophenol	3804	79.6	14.5	36	123
109-06-8	2-Picoline [2-Methylpyridine]	181	64.5	12.7	27	103
91-94-1	3,3'-Dichlorobenzidine	3521	71.3	16.5	22	121
56-49-5	3-Methylcholanthrene	188	95.1	13	56	134

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Table 3. LCS Control Limits – Method 8270 Solid Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
99-09-2	3-Nitroaniline	3454	75.9	14.3	33	119
65794-96-9	3/4-Methylphenol [m/p-Cresol]	2900	76.5	14.1	34	119
534-52-1	4,6-Dinitro-2-methylphenol	3739	80.7	17.2	29	132
101-55-3	4-Bromophenyl phenyl ether	3708	85.1	13	46	124
59-50-7	4-Chloro-3-methylphenol	3880	83.3	12.9	45	122
106-47-8	4-Chloroaniline [p-Chloroanlinie]	3435	61.3	14.9	17	106
7005-72-3	4-Chlorophenyl phenyl ether	3673	83	12.7	45	121
106-44-5	4-Methylphenol [p-Cresol]	1555	84.1	14.1	42	126
100-02-7	4-Nitrophenol	3976	80.6	17	30	132
99-55-8	5-Nitro-o-toluidine [2-Amino-4-nitrotoluene]	187	69.8	15.8	23	117
57-97-6	7,12-Dimethylbenz(a)-anthracene	338	96.2	15.3	50	142
83-32-9	Acenaphthene	5300	81.3	13.7	40	123
208-96-8	Acenaphthylene	5194	81.8	16.8	32	132
98-86-2	Acetophenone	2101	73.9	13.6	33	115
120-12-7	Anthracene	5250	85.2	12.7	47	123
1912-24-9	Atrazine	1428	87.1	13.4	47	127
103-33-3	Azobenzene	378	82.1	14.2	39	125
56-55-3	Benz(a)anthracene	5385	87.4	12.9	49	126
50-32-8	Benzo(a)pyrene	5500	86.9	13.9	45	129
205-99-2	Benzo(b)fluoranthene	5323	88.3	14.5	45	132
191-24-2	Benzo(g,h,i)perylene	5263	88.5	15.1	43	134
207-08-9	Benzo(k)fluoranthene	5386	89.6	14.2	47	132
100-51-6	Benzyl alcohol	2895	75.7	15.6	29	122
111-91-1	bis(2-Chloroethoxy)methane	3705	78.4	14.2	36	121
111-44-4	Bis(2-chloroethyl) ether	3711	75.4	14.9	31	120
39638-32-9	bis(2-Chloroisopropyl) ether	769	82	16.3	33	131
117-81-7	Bis(2-ethylhexyl) phthalate	4018	91.9	13.7	51	133
103-23-1	bis(2-Ethylhexyl)adipate	156	90.8	10.1	61	121
85-68-7	Butyl benzyl phthalate	3956	90.3	14	48	132
105-60-2	Caprolactam	1203	81.3	11.9	46	117
86-74-8	Carbazole	3095	86.3	12	50	123
510-15-6	Chlorobenzilate	172	99.7	16.9	49	150
218-01-9	Chrysene	5395	87.1	12.2	50	124
84-74-2	Di-n-butyl phthalate	4041	89.4	12.8	51	128
117-84-0	Di-n-octyl phthalate	3985	92.4	16	45	140
2303-16-4	Diallate [cis or trans]	173	93.7	12.7	56	132
53-70-3	Dibenzo(a,h)anthracene	5393	89.5	14.7	45	134

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Table 3. LCS Control Limits – Method 8270 Solid Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
132-64-9	Dibenzofuran	3749	81.5	12.7	44	120
84-66-2	Diethyl phthalate	4012	87.2	12.3	50	124
60-51-5	Dimethoate	137	68	13.3	28	108
131-11-3	Dimethyl phthalate	4023	85.9	12.6	48	124
60-11-7	Dimethylaminoazobenzene	177	98.7	11.6	64	134
88-85-7	Dinoseb	123	67.3	17.1	16	119
101-84-8	Diphenyl ether	114	95.6	6	78	114
122-39-4	Diphenylamine	854	79.5	10.6	48	111
62-50-0	Ethyl methanesulfonate	174	85.1	16.9	34	136
206-44-0	Fluoranthene	5340	88.3	12.9	50	127
86-73-7	Fluorene	5150	84.2	13.8	43	125
118-74-1	Hexachlorobenzene	4138	83.5	13	45	122
87-68-3	Hexachlorobutadiene	4003	77.3	15.3	32	123
67-72-1	Hexachloroethane	4049	72.2	14.9	28	117
1888-71-7	Hexachloropropene	259	81.9	16.7	32	132
95-13-6	Indene	188	85.3	8.9	59	112
193-39-5	Indeno(1,2,3-cd)pyrene	5367	89.3	14.7	45	133
465-73-6	isodrin	167	93.8	12.8	56	132
78-59-1	Isophorone	3787	75.9	15.2	30	122
120-58-1	Isosafrole	174	89.5	15.4	43	136
66-27-3	Methyl methanesulfonate	150	77.9	13.1	38	117
100-75-4	N-Nitorosopiperidine	232	89.4	9.8	60	119
924-16-3	N-Nitrosodi-n-butylamine	236	91.7	10.8	59	124
621-64-7	N-Nitrosodi-n-propylamine	3857	78.2	13.9	36	120
55-18-5	N-nitrosodiethylamine	421	82.1	13.8	41	124
62-75-9	N-Nitrosodimethylamine	3170	71.6	16.2	23	120
86-30-6	N-Nitrosodiphenylamine	2968	82.7	14.8	38	127
10595-95-6	n-Nitrosomethylethylamine	265	78.7	14.9	34	123
59-89-2	n-Nitrosomorpholine	172	91.3	13.8	50	133
930-55-2	n-Nitrosopyrrolidine	326	85.5	13.6	45	126
91-20-3	Naphthalene	5342	78.8	14.7	35	123
98-95-3	Nitrobenzene	4103	77.8	14.7	34	122
4165-60-0	Nitrobenzene-d5	3226	79.3	14.2	37	122
56-57-5	Nitroquinoline-1-oxide	177	91.3	24.5	18	165
126-68-1	O,O,O-Triethyl phosphorothioate	138	91.6	10.8	59	124
593-45-3	Octadecane	113	87.4	14.5	44	131
608-93-5	Pentachlorobenzene	346	89.7	11.8	54	125
76-01-7	Pentachloroethane	131	70.4	10.6	39	102
87-86-5	Pentachlorophenol	4161	78.7	18	25	133

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Table 3. LCS Control Limits – Method 8270 Solid Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
82-68-8	Pentchloronitrobenzene	579	86.1	16	38	134
62-44-2	Phenacetin	185	95	12.5	57	133
85-01-8	Phenanthrene	5259	85.4	12	50	121
108-95-2	Phenol	4029	77.3	14.4	34	121
4165-62-2	Phenol-d5	1016	77.4	14.9	33	122
23950-58-5	Pronamide	179	93	12.4	56	130
129-00-0	Pyrene	5518	87.2	13.3	47	127
91-22-5	Quinoline	219	90	11.9	54	126
94-59-7	Safrole	176	87.8	13.6	47	129
1718-51-0	Terphenyl-d14	3111	90.5	12.3	54	127
3689-24-5	Tetraethyl dithiopyrophosphate [Sulfotep]	136	94.4	14	52	137
297-97-2	Thionazine	139	94.6	10.7	62	127

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Table 4. LCS Control Limits – Method 8270 Water Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
92-52-4	1,1-Biphenyl	2247	82.1	11.1	49	115
95-94-3	1,2,4,5-Tetrachlorobenzene	2326	77.9	14.5	35	121
120-82-1	1,2,4-Trichlorobenzene	4716	72.6	14.5	29	116
95-50-1	1,2-Dichlorobenzene	4442	71.4	13.3	32	111
528-29-0	1,2-Dinitrobenzene [1,2-DNB]	112	83.9	8.3	59	109
122-66-7	1,2-Diphenylhydrazine [Azobenzene]	2244	85.4	12.2	49	122
99-35-4	1,3,5-Trinitrobenzene [1,3,5-TNB]	241	89.1	16	41	137
541-73-1	1,3-Dichlorobenzene	4375	68.6	13.6	28	110
99-65-0	1,3-Dinitrobenzene [1,3-DNB]	601	88.2	13.1	49	128
106-46-7	1,4-Dichlorobenzene	5433	70.4	13.9	29	112
90-13-1	1-Chloronaphthalene	211	84.5	8.8	58	111
90-12-0	1-Methylnaphthalene	3742	80	13.1	41	119
134-32-7	1-Naphthylamine	258	73.7	16.6	24	124
58-90-2	2,3,4,6-Tetrachlorophenol	2293	89	13	50	128
935-95-5	2,3,5,6-Tetrachlorophenol	266	85.6	11.7	50	121
608-27-5	2,3-Dichloroaniline	150	99.2	9.8	70	129
95-95-4	2,4,5-Trichlorophenol	5707	88.1	11.8	53	123
118-79-6	2,4,6-Tribromophenol	2059	91.5	16	43	140
88-06-2	2,4,6-Trichlorophenol	6136	87.2	12.4	50	125
120-83-2	2,4-Dichlorophenol	5330	84	12.2	47	121
105-67-9	2,4-Dimethylphenol	5298	77.5	15.6	31	124
51-28-5	2,4-Dinitrophenol	5127	82.9	20	23	143
121-14-2	2,4-Dinitrotoluene	6032	92.3	11.8	57	128
87-65-0	2,6-Dichlorophenol	1583	84	11.4	50	118
606-20-2	2,6-Dinitrotoluene	5107	90.7	11.2	57	124
53-96-3	2-Acetylaminofluorene	228	98.9	12.9	60	138
91-58-7	2-Chloronaphthalene	5084	78	12.8	40	116
95-57-8	2-Chlorophenol	5571	77.5	13.2	38	117
93951-73-6	2-Chlorophenol-d4	119	79.9	8.7	54	106
321-60-8	2-Fluorobiphenyl	2263	81.2	12.4	44	119
367-12-4	2-Fluorophenol	2022	68.8	16.6	19	119
91-57-6	2-Methylnaphthalene	6330	80.7	13.6	40	121
95-48-7	2-Methylphenol (o-Cresol)	5800	73	14.5	30	117
88-74-4	2-Nitroaniline	4855	90.8	12.1	55	127
119-75-5	2-Nitrodiphenylamine	272	97.3	11.3	64	131
88-75-5	2-Nitrophenol	5097	84.6	12.7	47	123
109-06-8	2-Picoline [2-Methylpyridine]	195	71.6	12.6	34	109
91-94-1	3,3'-Dichlorobenzidine	4815	77.9	16.9	27	129

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Table 4. LCS Control Limits – Method 8270 Water Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
56-49-5	3-Methylcholanthrene	237	94	12.8	56	133
99-09-2	3-Nitroaniline	4808	84.4	14.5	41	128
65794-96-9	3/4-Methylphenol [m/p-Cresol]	3472	69.7	13.6	29	110
534-52-1	4,6-Dinitro-2-methylphenol	5097	90.1	15.5	44	137
101-55-3	4-Bromophenyl phenyl ether	5074	89.1	11.5	55	124
59-50-7	4-Chloro-3-methylphenol	5338	85.5	11.3	52	119
106-47-8	4-Chloroaniline [p-Chloroanlinie]	4687	75.3	14	33	117
7005-72-3	4-Chlorophenyl phenyl ether	5071	86.7	11.3	53	121
106-44-5	4-Methylphenol [p-Cresol]	2798	72.5	15.8	25	120
99-55-8	5-Nitro-o-toluidine [2-amino-4-nitrotoluene]	260	82.1	14.6	38	126
57-97-6	7,12-Dimethylbenz(a)-anthracene	373	97.1	11.9	61	133
83-32-9	Acenaphthene	6952	84.5	12.3	47	122
208-96-8	Acenaphthylene	6662	85.3	14.7	41	130
98-86-2	Acetophenone	2877	82.1	12	46	118
120-12-7	Anthracene	6792	89.6	11	57	123
140-57-8	Aramite	100	82.8	16.3	34	132
1912-24-9	Atrazine	2328	92.8	16.4	44	142
103-33-3	Azobenzene	578	88.5	9.3	61	116
56-55-3	Benz(a)anthracene	6867	91.6	11.1	58	125
50-32-8	Benzo(a)pyrene	7045	90.8	12.4	54	128
205-99-2	Benzo(b)fluoranthene	6767	92	12.9	53	131
191-24-2	Benzo(g,h,i)perylene	6624	92	13.9	50	134
207-08-9	Benzo(k)fluoranthene	6803	93.2	12.1	57	129
100-51-6	Benzyl alcohol	3349	71.2	13.5	31	112
111-91-1	bis(2-Chloroethoxy)methane	5094	83.9	11.9	48	120
111-44-4	Bis(2-chloroethyl) ether	5139	80.8	12.6	43	118
39638-32-9	bis(2-Chloroisopropyl) ether	1140	83.4	15.4	37	130
117-81-7	Bis(2-ethylhexyl) phthalate	5288	95.2	13.3	55	135
85-68-7	Butyl benzyl phthalate	5173	93.3	13.5	53	134
86-74-8	Carbazole	4187	91.1	10.4	60	122
510-15-6	Chlorobenzilate	226	104.3	15.4	58	150
218-01-9	Chrysene	6779	91.3	10.7	59	123
124-18-5	Decane	126	66.9	12.8	29	105
84-74-2	Di-n-butyl phthalate	5329	93	11.4	59	127
117-84-0	Di-n-octyl phthalate	5222	95.5	15	51	140
2303-16-4	Diallate [cis or trans]	249	95.3	9.6	67	124
226-36-8	Dibenz(a,h)acridine	136	104.4	9.7	75	134

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Table 4. LCS Control Limits – Method 8270 Water Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
53-70-3	Dibenzo(a,h)anthracene	6840	92.7	13.8	51	134
132-64-9	Dibenzofuran	4963	85.3	10.8	53	118
84-66-2	Diethyl phthalate	5207	90.1	11.5	56	125
131-11-3	Dimethyl phthalate	4977	86	13.7	45	127
60-11-7	Dimethylaminoazobenzene	238	97.1	11.6	62	132
88-85-7	Dinoseb	144	93.4	10.8	61	126
101-84-8	Diphenyl ether	142	91.7	7.8	68	115
122-39-4	Diphenylamine	754	83	9.2	55	111
298-04-4	Disulfoton	122	92.5	12.5	55	130
62-50-0	Ethyl methanesulfonate	215	90.1	9.4	62	118
206-44-0	Fluoranthene	6826	92.6	11.9	57	128
86-73-7	Fluorene	6786	88.1	12	52	124
118-74-1	Hexachlorobenzene	6263	88.7	12.1	53	125
87-68-3	Hexachlorobutadiene	5878	73.1	16.9	22	124
39638-32-9	bis(2-Chloroisopropyl) ether	1140	83.4	15.4	37	130
117-81-7	Bis(2-ethylhexyl) phthalate	5288	95.2	13.3	55	135
85-68-7	Butyl benzyl phthalate	5173	93.3	13.5	53	134
86-74-8	Carbazole	4187	91.1	10.4	60	122
510-15-6	Chlorobenzilate	226	104.3	15.4	58	150
218-01-9	Chrysene	6779	91.3	10.7	59	123
124-18-5	Decane	126	66.9	12.8	29	105
84-74-2	Di-n-butyl phthalate	5329	93	11.4	59	127
117-84-0	Di-n-octyl phthalate	5222	95.5	15	51	140
2303-16-4	Diallate [cis or trans]	249	95.3	9.6	67	124
226-36-8	Dibenz(a,h)acridine	136	104.4	9.7	75	134
53-70-3	Dibenzo(a,h)anthracene	6840	92.7	13.8	51	134
132-64-9	Dibenzofuran	4963	85.3	10.8	53	118
84-66-2	Diethyl phthalate	5207	90.1	11.5	56	125
131-11-3	Dimethyl phthalate	4977	86	13.7	45	127
60-11-7	Dimethylaminoazobenzene	238	97.1	11.6	62	132
88-85-7	Dinoseb	144	93.4	10.8	61	126
101-84-8	Diphenyl ether	142	91.7	7.8	68	115
122-39-4	Diphenylamine	754	83	9.2	55	111
298-04-4	Disulfoton	122	92.5	12.5	55	130
62-50-0	Ethyl methanesulfonate	215	90.1	9.4	62	118
206-44-0	Fluoranthene	6826	92.6	11.9	57	128
86-73-7	Fluorene	6786	88.1	12	52	124
118-74-1	Hexachlorobenzene	6263	88.7	12.1	53	125
87-68-3	Hexachlorobutadiene	5878	73.1	16.9	22	124
67-72-1	Hexachloroethane	5904	68	15.7	21	115

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Table 4. LCS Control Limits – Method 8270 Water Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
95-13-6	Indene	253	93.8	13.7	53	135
193-39-5	Indeno(1,2,3-cd)pyrene	6880	92.6	13.6	52	134
465-73-6	isodrin	212	97.6	10	68	128
78-59-1	Isophorone	5190	83.3	13.7	42	124
120-58-1	Isosafrole	230	91.1	11.8	56	126
66-27-3	Methyl methanesulfonate	237	70.1	12.3	33	107
298-00-0	Methyl parathion	121	101.6	19	45	159
100-75-4	N-Nitorosopiperidine	299	88.6	10.8	56	121
924-16-3	N-Nitrosodi-n-butylamine	322	90.4	10.3	60	121
621-64-7	N-Nitrosodi-n-propylamine	5145	84	11.7	49	119
55-18-5	N-nitrosodiethylamine	488	81.8	12.9	43	121
86-30-6	N-Nitrosodiphenylamine	3743	86.8	11.9	51	123
10595-95-6	n-Nitrosomethylethylamine	311	78.7	12.7	41	117
59-89-2	n-Nitrosomorpholine	214	86.2	10.3	55	117
930-55-2	n-Nitrosopyrrolidine	716	80.8	10.8	48	113
91-20-3	Naphthalene	6953	80	13.5	40	121
98-95-3	Nitrobenzene	5955	83	12.8	45	121
4165-60-0	Nitrobenzene-d5	2223	82.1	12.6	44	120
126-68-1	O,O,O-Triethyl phosphorothioate	212	92.6	8.8	66	119
95-53-4	o-Toluidine	296	69.9	13.2	30	110
593-45-3	Octadecane	151	89	13.1	50	128
56-38-2	Parathion	152	102.6	12.3	66	140
608-93-5	Pentachlorobenzene	401	91.1	10.7	59	123
76-01-7	Pentachloroethane	139	60.9	10.4	30	92
87-86-5	Pentachlorophenol	6083	86.4	17.1	35	138
82-68-8	Pentchloronitrobenzene	618	94.5	13.4	54	135
62-44-2	Phenacetin	241	97.9	8.9	71	124
85-01-8	Phenanthrene	6822	89.6	10.2	59	120
298-02-2	Phorate	126	88.6	16.8	38	139
23950-58-5	Pronamide	249	97	10.5	65	129
129-00-0	Pyrene	7013	91.1	11.5	57	126
91-22-5	Quinoline	249	100.1	10.5	69	132
94-59-7	Safrole	233	90	9.7	61	119
1718-51-0	Terphenyl-d14	1893	91.7	13.9	50	134
3689-24-5	Tetraethyl dithiopyrophosphate [Sulfotep]	200	96.7	11.9	61	133
297-97-2	Thionazine	196	102	10.1	72	132

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Table 5. LCS Control Limits – Method 8270 SIM Solid Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
90-12-0	1-Methylnaphthalene	2267	76.6	11.3	43	111
95-95-4	2,4,5-Trichlorophenol	169	79.9	14.9	35	125
91-58-7	2-Chloronaphthalene	615	76.7	10.5	45	108
321-60-8	2-Fluorobiphenyl	1961	80.6	11.6	46	115
91-57-6	2-Methylnaphthalene	2535	76.8	12.5	39	114
83-32-9	Acenaphthene	2813	77.7	11.2	44	111
208-96-8	Acenaphthylene	2761	77.1	12.8	39	116
120-12-7	Anthracene	2812	82.1	10.7	50	114
56-55-3	Benz(a)anthracene	2827	88	11.4	54	122
50-32-8	Benzo(a)pyrene	2789	87.3	12.5	50	125
205-99-2	Benzo(b)fluoranthene	2790	90.3	12.6	53	128
191-24-2	Benzo(g,h,i)perylene	2739	87.8	13	49	127
207-08-9	Benzo(k)fluoranthene	2761	89.3	11.2	56	123
111-44-4	Bis(2-chloroethyl) ether	192	65.4	15.8	18	113
117-81-7	Bis(2-ethylhexyl) phthalate	181	108.9	13.9	67	150
85-68-7	Butyl benzyl phthalate	144	103.5	10.6	72	135
86-74-8	Carbazole	183	79.3	14.6	36	123
218-01-9	Chrysene	2812	87.5	10.2	57	118
84-74-2	Di-n-butyl phthalate	150	106.5	12.9	68	145
117-84-0	Di-n-octyl phthalate	144	105.5	16.8	55	156
53-70-3	Dibenzo(a,h)anthracene	2778	89.2	13.2	50	129
132-64-9	Dibenzofuran	282	71.9	12.2	35	108
84-66-2	Diethyl phthalate	147	99.3	10.9	67	132
131-11-3	Dimethyl phthalate	149	99.3	9.3	71	127
206-44-0	Fluoranthene	2782	87.3	10.7	55	119
86-73-7	Fluorene	2795	80.6	11.2	47	114
118-74-1	Hexachlorobenzene	201	81.9	14.2	39	125
193-39-5	Indeno(1,2,3-cd)pyrene	2812	89.6	13.5	49	130
62-75-9	N-Nitrosodimethylamine	117	90.7	10.9	58	124
91-20-3	Naphthalene	2823	74.7	12.2	38	111
4165-60-0	Nitrobenzene-d5	531	84.7	13.6	44	125
87-86-5	Pentachlorophenol	259	82.4	15.5	36	129
85-01-8	Phenanthrene	2792	80.8	10.6	49	113
129-00-0	Pyrene	2792	85.8	10.2	55	117
1718-51-0	Terphenyl-d14	1864	95.3	12.6	58	133

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Table 6. LCS Control Limits – Method 8270 SIM Water Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
92-52-4	1,1-Biphenyl	106	77.3	7.3	56	99
90-12-0	1-Methylnaphthalene	2566	77.9	12.5	41	115
95-95-4	2,4,5-Trichlorophenol	488	84.1	13.4	44	124
118-79-6	2,4,6-Tribromophenol	164	83.7	12.7	46	122
606-20-2	2,6-Dinitrotoluene	118	67.2	15.8	20	115
91-58-7	2-Chloronaphthalene	717	72.4	12.7	34	111
321-60-8	2-Fluorobiphenyl	747	79.2	8.8	53	106
91-57-6	2-Methylnaphthalene	2984	76.5	12.6	39	114
83-32-9	Acenaphthene	3241	80.9	11.1	48	114
208-96-8	Acenaphthylene	3234	77.8	14.4	35	121
120-12-7	Anthracene	3224	85.8	11	53	119
56-55-3	Benz(a)anthracene	3277	89.3	10.1	59	120
50-32-8	Benzo(a)pyrene	3284	86.4	11.2	53	120
205-99-2	Benzo(b)fluoranthene	3248	89.7	12.3	53	126
191-24-2	Benzo(g,h,i)perylene	3178	86	14.1	44	128
207-08-9	Benzo(k)fluoranthene	3167	89.3	11.9	54	125
111-44-4	Bis(2-chloroethyl) ether	775	77.8	12.6	40	116
117-81-7	Bis(2-ethylhexyl) phthalate	275	114.1	19.6	55	173
85-68-7	Butyl benzyl phthalate	159	90.7	17.3	39	143
86-74-8	Carbazole	631	84	13.1	45	123
218-01-9	Chrysene	3215	88.3	10.4	57	120
84-74-2	Di-n-butyl phthalate	153	102.5	14.2	60	145
117-84-0	Di-n-octyl phthalate	157	103.3	19	46	160
53-70-3	Dibenzo(a,h)anthracene	3233	87.2	14.5	44	131
132-64-9	Dibenzofuran	864	77.5	14.1	35	120
84-66-2	Diethyl phthalate	142	94.5	13.5	54	135
206-44-0	Fluoranthene	3242	89.1	10.4	58	120
86-73-7	Fluorene	3232	84.1	11.3	50	118
118-74-1	Hexachlorobenzene	947	84.8	13	46	124
87-68-3	Hexachlorobutadiene	187	84.5	14.7	40	129
193-39-5	Indeno(1,2,3-cd)pyrene	3244	88.7	13.7	48	130
62-75-9	N-Nitrosodimethylamine	162	62.5	10	33	92
91-20-3	Naphthalene	3277	78.8	11.9	43	114
4165-60-0	Nitrobenzene-d5	444	83.1	9.2	55	111
87-86-5	Pentachlorophenol	808	88.4	17.6	36	141
85-01-8	Phenanthrene	3240	83.6	10.3	53	115
129-00-0	Pyrene	3252	87.1	11.3	53	121
1718-51-0	Terphenyl-d14	642	95.1	12.4	58	132

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TITLE: **SEMI-VOLATILE ORGANICS BY GC/MS (EPA METHODS 8270C, 8270D, 625, 625.1 AND SM 6410B), INCLUDING PROVISIONS FOR ANALYSIS IN SIM MODE**

Table 7. Quality Control Requirements – Organic Analysis by Gas Chromatography/Mass Spectrometry

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Tune Check	Prior to ICAL and prior to each 12-hour period of sample analysis.	Specific ion abundance criteria of DFTPP from method.	Retune instrument and verify.	Flagging is not appropriate.	No samples shall be analyzed without a valid tune.
Performance Check	At the beginning of each 12-hour period, prior to analysis of samples.	Degradation ≤ 20% for DDT. Benzidine and penta-chlorophenol shall be present at their normal responses, and shall not exceed a tailing factor of 2.	Correct problem, then repeat performance checks.	Flagging is not appropriate.	No samples shall be analyzed until performance check is within criteria. The DDT breakdown and Benzidine/Pentachlorophenol tailing factors are considered overall system checks to evaluate injector port inertness and column performance and are required regardless of the reported analyte list.
Initial calibration (ICAL) for all analytes (including surrogates)	At instrument set-up, prior to sample analysis	Each analyte must meet one of the three options below: **Option 1:** RSD for each analyte ≤ 15%; **Option 2:** linear least squares regression for each analyte: r2 ≥ 0.99; **Option 3**: non-linear least squares regression (quadratic) for each analyte: r2 ≥ 0.99.	Correct problem then repeat ICAL.	Flagging is not appropriate.	Minimum 5 levels for linear and 6 levels for quadratic. No samples shall be analyzed until ICAL has passed. If the specific version of a method requires additional evaluation (e.g., RFs or low calibration standard analysis and recovery criteria) these additional requirements must also be met.

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Table 7. Quality Control Requirements – Organic Analysis by Gas Chromatography/Mass Spectrometry

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Retention Time window position establishment	Once per ICAL and at the beginning of the analytical sequence.	Position shall be set using the midpoint standard of the ICAL curve when ICAL s performed. On days when ICAL is not performed, the initial CCV is used.	NA.	NA.	Required for each analyte and surrogate.
Evaluation of Relative Retention Times(RRT)	With each sample.	RRT of each reported analyte within ± 0.06 RRT units.	Correct problem, then rerun ICAL.	NA	RRTs may be updated based on the daily CCV. RRTs shall be compared with the most recently updated RRTs.
Initial Calibration Verification (ICV)	Once after each ICAL, analysis of a second source standard prior to sample analysis	All reported analytes within ± 20% of true value.	Correct problem. Rerun ICV. If that fails, repeat ICAL.	Flagging is not appropriate.	No samples shall be analyzed until calibration has been verified with a second source.

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Table 7. Quality Control Requirements – Organic Analysis by Gas Chromatography/Mass Spectrometry

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Continuing Calibration Verification (CCV)	Daily before sample analysis; after every 12 hours of analysis time; and at the end of the analytical batch run.	All reported analytes and surrogates within ± 20% of true value. All reported analytes and surrogates within ± 50% for end of analytical batch CCV.	Recalibrate, and reanalyze all affected samples since the last acceptable CCV; or Immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails, take corrective action(s) and re-calibrate; then reanalyze all affected samples since the	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) in all samples since last acceptable calibration verification.	Results may not be reported without a valid CCV. Flagging is only appropriate in cases where the samples cannot be reanalyzed. If the specific version of a method requires additional evaluation (e.g., average RFs) these additional requirements must also be met.
Internal standards (IS)	Every field sample, standard and QC sample.	Retention time within ± 10 seconds from retention time of the midpoint standard in the ICAL; EICP area within -50% to +100% of ICAL midpoint standard.	Inspect mass spectrometer and GC for malfunctions and correct problem. Reanalysis of samples analyzed while system was malfunctioning is mandatory.	If corrective action fails in field samples, data must be qualified and explained in the case narrative. Apply Q-flag to analytes associated with the non-compliant IS. Flagging is not appropriate for failed standards.	

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Table 7. Quality Control Requirements – Organic Analysis by Gas Chromatography/Mass Spectrometry

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Method Blank (MB)	One per preparatory batch.	No analytes detected > ½ LOQ or > 1/10 the amount measured in any sample or 1/10 the regulatory limit, whichever is greater. Common contaminants must not be detected > LOQ.	Correct problem. If required, reprep and reanalyze MB and all samples processed with the contaminated blank.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch.	Results may not be reported without a valid method blank. Flagging is only appropriate in cases where the samples cannot be reanalyzed.
Laboratory Control Sample (LCS)	One per preparatory batch.	A laboratory must use the limits in Tables 3 through 6 for batch control if project limits are not specified. If the analyte(s) are not listed, use in-house LCS limits (see the LIMS) if project limits are not specified.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Must contain all surrogates and all analytes to be reported. Results may not be reported without a valid LCS. Flagging is only appropriate in cases where the samples cannot be reanalyzed.

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Table 7. Quality Control Requirements – Organic Analysis by Gas Chromatography/Mass Spectrometry

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Matrix Spike (MS)	One per preparatory batch.	A laboratory must use the limits in Tables 3 through 6 for batch control if project limits are not specified. If the analyte(s) are not listed, use in-house LCS limits (see the LIMS) if project limits are not specified.	Examine the project specific requirements. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met and explain in the case narrative.	Must contain all surrogates and all analytes to be reported. If MS results are outside the limits, the data shall be evaluated to determine the source(s) of difference, i.e., matrix effect or analytical error.
Matrix Spike Duplicate (MSD) or Matrix Duplicate (MD)	One per preparatory batch.	A laboratory must use the limits in Tables 3 through 6 for batch control if project limits are not specified. If the analyte(s) are not listed, use in-house LCS limits (see the LIMS) if project limits are not specified. MSD or MD: RPD of all analytes ≤ 20% (between MS and MSD or sample and MD).	Examine the project specific requirements. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met and explain in the case narrative.	MSD: Must contain all surrogates and all analytes to be reported. The data shall be evaluated to determine the source of difference.

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Table 7. Quality Control Requirements – Organic Analysis by Gas Chromatography/Mass Spectrometry					
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**	**Flagging Criteria**	**Comments**
Surrogate Spike	All field and QC samples.	QC acceptance criteria specified by the project, if available; otherwise use limits in Tables 3 through 6 or in-house LCS limits (see the LIMS) if analyte(s) are not listed.	Correct problem, then reprep and reanalyze all failed samples for all surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary.	Apply Q-flag to all associated analytes if acceptance criteria are not met and explain in the case narrative.	Alternative surrogates are recommended when there is obvious chromatographic interference.

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Table 8. Quality Control Requirements – Organic Semi-Volatile Analysis by GC/MS in SIM Mode

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Tune Check	Prior to ICAL and prior to each 12-hour period of sample analysis.	Specific ion abundance criteria of DFTPP from method 8270. Tune check can be acquired as a full scan.	Retune instrument and verify.	Flagging is not appropriate.	No samples shall be analyzed without a valid tune. In addition to the full scan tune check, optimization for the analytes of interest is recommended.
Deuterated Monitoring Compounds (DMCs) (surrogates)	All field and QC samples.	PAH analysis: DMCs required for polyaromatic hydrocarbon (PAH) target analytes: fluoranthene-d10 and 2-methylnaphthalene-d10. Minimum RRF for PAH DMCs: 0.40. All DMCs: Requires 50-150% recovery until in-house limits can be established.	Correct problem, and then reprep and reanalyze all samples with failing DMCs if sufficient sample material is available. If obvious chromatographic interference is present, reanalysis may not be necessary, but the client must be notified prior to reporting data and the failures must be discussed in the Case Narrative.	Apply Q-flag to all associated samples and analytes if acceptance criteria are not met and explain in the Case Narrative.	For non-PAH target analytes, other DMCs with similar chemistry must be assigned. Laboratories may use the same extract for full scan and SIM analysis if the SIM-specific DMCs are added prior to extraction.

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Table 8. Quality Control Requirements – Organic Semi-Volatile Analysis by GC/MS in SIM Mode

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Performance Checks	At the beginning of each 12-hour period, prior to analysis of samples.	Degradation ≤ 20% for DDT.	Correct problem, then repeat performance checks.	Flagging is not appropriate.	No samples shall be analyzed until the performance checks are within criteria. DDT breakdown and tailing factors are considered overall measures of port inertness and column performance and are required checks for SIM operation. DDT breakdown and tailing factor checks can be acquired as a full scan.
Initial Calibration (ICAL) for all analytes	At instrument set-up, prior to sample analysis.	Each analyte must meet one of the following options: RSD for each analyte ≤ 20% [If pentachlorophenol is a target analyte, an RSD of ≤ 40% allowed] Or Linear least squares regression for each analyte: r2 ≥ 0.99.	Correct problem then repeat ICAL.	Flagging is not appropriate.	Minimum 5 levels required for ICAL with one calibration point at the same concentration as the daily CCV. No samples shall be analyzed until ICAL has passed.

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Table 8. Quality Control Requirements – Organic Semi-Volatile Analysis by GC/MS in SIM Mode

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Retention Time window position establishment	Once per ICAL and at the beginning of the analytical sequence.	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the initial CCV is used.	NA.	NA.	Calculated for each analyte.
Evaluation of Relative Retention Times (RRT)	With each sample.	RRT of each reported analyte within ± 0.06 RRT units of the mean RRT of the calibration standards. RRTs may be updated based on the daily CCV.	Correct problem, then rerun ICAL.	NA.	RRTs shall be compared with the most recently updated RRTs. Characteristic ions must maximize in the same scan or within one scan of each other. After any maintenance is performed which could affect retention times, RRTs may be updated based on the daily CCV.
Initial Calibration Verification (ICV)	Once after each ICAL, analysis of a second source standard prior to sample analysis.	All reported analytes within ± 20% of true value. If pentachlorophenol is a target analyte, a %D from the true value of ±50% is allowed.	Correct problem. Rerun ICV. If that fails, repeat ICAL.	Flagging is not appropriate.	No samples shall be analyzed until calibration has been verified with a second source.

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Table 8. Quality Control Requirements – Organic Semi-Volatile Analysis by GC/MS in SIM Mode

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Continuing Calibration Verification (CCV)	Daily before sample analysis; after every 12 hours of analysis time; and at the end of the analytical batch run.	Concentration the same as the mid-point calibration standard (or lower). All reported analytes within ± 20% of true value. If pentachlorophenol is a target analyte, a %D from true value of ± 50% is allowed. All reported analytes within ±50% for end of analytical batch within ± 50% for end of analytical batch CCV.	Immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails or if two consecutive CCVs cannot be run, perform corrective action(s) until a passing CCV is attained, and then reanalyze all associated samples since last acceptable CCV. Alternatively, perform an ICAL (including appropriate instrument QC) if necessary; then reanalyze all associated samples since the last acceptable CCV	If reanalysis cannot be performed, data must be qualified and explained in the Case Narrative. Apply Q-flag to all results for the specific analyte(s) in all samples since last acceptable calibration verification.	Results may not be reported without valid CCVs. Flagging is only appropriate in cases where the samples cannot be reanalyzed. If the specific version of a method requires additional evaluation (e.g., average RFs), these additional requirements must also be met.

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Table 8. Quality Control Requirements – Organic Semi-Volatile Analysis by GC/MS in SIM Mode

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Internal Standards (IS)	Every field sample, Standards, blanks, and QC sample.	Retention time within ± 10 seconds from retention time of the midpoint standard in the ICAL; EICP area within-50% to +100% of ICAL midpoint standard. On days when ICAL is not performed, the initial CCV is used.	Inspect mass spectrometer and GC for malfunctions and correct problem. Reanalysis of samples analyzed while system was malfunctioning is mandatory.	If corrective action fails in field samples, data must be qualified and explained in the Case Narrative. Apply Q-flag to analytes associated with the non-compliant IS. Flagging is not appropriate for failed standards.	Internal Standard is spiked no greater than0.40 ng/µL concentration. According to the EPA Contract Laboratory Program Statement of Work (CLP SOW), this is the concentration of internal standard specified for SIM analysis. The SOW indicates calibration standards range from 0.10 to 1.0 ng/µL, so 0.40 ng/µL is mid-range. 1, 4-dichlorobenzene-d4 is ignored for SIM
Method Blank (MB)	One per preparation batch, prior to analysis of any field samples.	No analytes detected > ½ LOQ or > 1/10th the amount measured in any sample or 1/10th the regulatory limit, whichever is greater.	Conduct investigation to determine the source of the contamination and take appropriate corrective actions. Correct problem. If required, reprep and reanalyze MB and all QC samples and field samples processed with the contaminated blank.	If reanalysis cannot be performed, data must be qualified and explained in the Case Narrative. Apply B-flag to all results for the specific analyte(s) in all samples in the associated analytical batch.	Laboratories may use the same extract for full scan and SIM analysis provided the applicable DMCs and IS are spiked at the appropriate concentrations. Results may not be reported without a valid Method Blank. Flagging is only appropriate in cases where the samples cannot be reanalyzed.

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Table 8. Quality Control Requirements – Organic Semi-Volatile Analysis by GC/MS in SIM Mode

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Laboratory Control Sample (LCS)	One per preparation batch.	A laboratory must use Table 3 through Table 6 Limits (8270 SIM) for batch control if project specific limits are not specified. If the analyte(s) are not listed, use in-house LCS limits if project limits are not specified.	Correct problem, and then reanalyze the LCS and all samples in the associated analytical batch for failed analytes if sufficient sample material is available.	If reanalysis cannot be performed, data must be qualified and explained in the Case Narrative. Apply Q-flag to specific analyte(s) in all samples in the associated analytical batch.	Must contain all analytes to be reported. Results may not be reported without a valid LCS. Flagging is only appropriate in cases where the samples cannot be reanalyzed.
Matrix Spike (MS)	One per preparation batch.	A laboratory must use the QSM Appendix C Limits (8270 SIM) for batch control if project specific limits are not specified. If the analyte(s) are not listed, use in-house LCS limits if project limits are not specified.	Examine the project-specific requirements. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply the J-flag if acceptance criteria are not met and explain in the Case Narrative.	Must contain all analytes to be reported spiked at concentrations appropriate for SIM analysis. For matrix evaluation only. If MS results are outside the limits, the data shall be evaluated to determine the source(s) of difference (i.e., matrix effect or analytical error).

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Table 8. Quality Control Requirements – Organic Semi-Volatile Analysis by GC/MS in SIM Mode

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Matrix Spike Duplicate (MSD) or Matrix Duplicate (MD)	One per preparation batch.	A laboratory must use the QSM Appendix C Limits (8270 SIM) for batch control if project specific limits are not specified. If the analyte(s) are not listed, use in-house LCS limits if project limits are not specified. MSD or MD: RPD of all analytes ≤ 40% (between MS and MSD or sample and MD).	Examine the project-specific requirements. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply the J-flag if acceptance criteria are not met and explain in the Case Narrative.	The MSD must contain all analytes to be reported spiked at concentrations appropriate for SIM analysis. All data must be evaluated to determine the source of difference. For Sample/MD: RPD criteria only apply to analytes whose concentration in the sample is greater than or equal to the LOQ.
Characteristic ions for MS confirmation	Minimum 3 ions.	The relative intensities of the characteristic ions of target analytes agree within 30% of the relative intensities in the reference spectrum and the relative intensities must be > 0. Confirmation requires S/N ratio of ≥ 3 for each quant and confirmation ion.	No data can be reported without MS confirmation.	NA.	Need 3 structurally significant ions that are logical fragments – not isotopic clusters. Internal standard and DMC can use fewer than 3 ions.

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Environmental Science Corporation
SOP MINOR REVISION FORM

SOP/DOC# 330345 Current revision date & number: 03/22/18 R26

Procedure/Method : SEMIVOLATILE ORGANICS BY GC/MS (EPA METHODS 8270C, 8270D, 625, 625.1 AND SM 6410B), INCLUDING PROVISIONS FOR ANALYSIS IN SIM MODE

Date	Requested By	Section	Revision	Reason*	Approvals	
					Supervisor	QA
06/01/18	Shakir Wani	8.1.2	**Add Section 8.1.2** - Peak detection thresholds will be set in the data acquisition software based on the lowest MDL. MDLs are posted in LIMS and are readily accessible. Current settings are 4.00 ppb for soils and 0.08 ppb for waters; these are based on our current lowest MDLs, however are subject to change with each MDL update. Global detection settings in data analysis software are mainly used for soil and water analysis for full BNA analysis. Detection thresholds settings for all SIM analysis must always be set to zero due to extreme low level reporting.	Internal Audit	Shakir Wani 6/1/18	Jim Brownfield 6/4/18
6/4/18	Shakir Wani	7.15.1	**Add Section 7.15.1** – Spike solutions are verified before use. Guideline for spike verification acceptance criteria: Typical acceptance criterion for spike verification is ±20% (±15% for ESI). Due to large number of compounds in the BNA list, it is expected that some poor performers will not meet this criteria. Analyst should use experience & judgment in evaluating these based on current instrument performance. Outliers may be discussed with department leads. If the spike fails to meet criteria for target analytes, corrective action is taken; the spike is re-prepped and reanalyzed.	Internal Audit	Shakir Wani 6/4/18	Jim Brownfield 6/4/18

*Comments:

SOP Minor Revision Summary

SOP:			
Title -	VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)		
Number -	330363	**Department -**	VOC
Revision -	25	**Rev. Date -**	1/2/2018

This Standard Operating Procedure has been amended to include changes required during normal business operations. These changes as defined by SOP 010103 (Document Control and Distribution) are routine modifications that will be incorporated into the SOP upon the next scheduled review.

Rev.	Date	Section	Brief Description
a	2/15/18	8.7.1	Add more options for a blank matrix.
b	3/12/18	8.3.2.2	Remove closing standard for Method SM6200 B.
		10.5	Remove closing standard for Method SM6200 B.
c	9/4/18	5.5	Updated storage blank requirements.

Standard Operating Procedure

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TITLE: VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)

Reviewed by: Heidi Ferrell, Steve Miller

Department Manager *QA Department*

1.0 SCOPE AND APPLICATION

STATE NOTE: For samples analyzed in conjunction with the Ohio Voluntary Action Program (VAP) please utilize SOP #330363OH.

STATE NOTE: For samples analyzed in conjunction with the NY ELAP or WA DOE, utilize the criteria for EPA Method 8260C.

CLIENT NOTE: For clients, whose environment laboratory quality program is administered by Environmental Standards Inc. (ESI), see controlled document QUA-30 VOA. \\FAP\NovDiskH\QAQC\Controlled Docs

1.1 This standard operating procedure is used to determine volatile organic compounds in a variety of matrices. This SOP is designed for EPA methods 8260B, 624, Standard Method 6200B, GRO, or similar volatile GC/MS analyses. This procedure is applicable to nearly all kinds of samples, regardless of water content, including ground water, aqueous sludge, caustic liquors, acid liquors, waste solvents, oily wastes, mousses, tars, fibrous wastes, polymeric emulsions, filter cakes, spent carbons, spent catalysts, soils and sediments. The compounds that can be determined using this SOP are listed in Attachment III, which contains a list of the typical primary and secondary ions used in determining these compounds.

1.2 Reporting Limits (RLs) are listed in the Attachment II. Compounds routinely analyzed by this method and their typical reporting limits are included in the following table (subject to change).

1.3 An MDL study must be completed at least annually or more frequently if major instrumentation changes occur. Method Detection Limits (MDLs) are performed based on ESC SOP #030206. Updated MDL records are filed and stored in a central location within the department.

1.3.1 Limit of Detection (LOD) and Limit of Quantitation (LOQ) studies are completed at the frequency required by the TNI standard per the procedure identified in the ESC SOP #030206, *Method Detection Limits (MDL), Limits of Detection (LOD) and Limits of Quantitation (LOQ).* Should the procedure be utilized for DOD support; then the frequency of these studies must meet the requirements of the current DOD QSM.

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TITLE: VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)

1.3.2 Lower Limit of Quantitation (LOQ) – For analyses performed per the requirements of Method 8000D, the LLOQ is established at concentrations where both quantitative and qualitative requirements can consistently be met (see Sections 2.3 and 10.15).

2.0 METHOD SUMMARY AND DEFINITIONS

2.1 Volatile organic compounds (VOCs) are determined from a 5mL sample withdrawn from a sealed 40mL vial. For water samples analyzed for low levels of analytes using Method 5030 (SOP #330752), the entire vial is placed into the instrument autosampler. The autosampler purges 5mL of sample and adds 1µL of surrogate standards and internal standards. An inert gas is bubbled through a sparger needle inserted into the sample. The purged volatile components then travel via a transfer line to a sorbent trap. When purging is complete, the trap is rapidly heated. The trap is backflushed with a helium carrier gas, to transport the desorbed sample components into a gas chromatographic (GC) column. The GC column separates and carries the components to a mass spectrometer (MS) or a specific detector, depending on the determinative method selected.

METHOD NOTE: For Method 624.1, different sample sizes in the range of 5–25 mL are allowed in order to meet differing sensitivity requirements. Calibration and QC samples must have the same volume as field samples.

2.2 For other samples, Method 5035 (SOP #330751), volatile organic compounds are determined from a 5g sample combined with 5mL reagent water.

2.3 Lower Limit of Quantitation (LLOQ) – For analyses performed according to the requirements of Method 8000D, the lowest concentration at which the laboratory has demonstrated target analytes can be reliably measured and reported with a certain degree of confidence, which must be greater than or equal to the lowest point in the calibration curve.

2.4 See the current Quality Assurance Manual for definitions associated with terms found in this document.

3.0 HEALTH AND SAFETY

3.1 The toxicity or carcinogenicity of each reagent used in the laboratory has not been fully established. Each chemical should be regarded as a potential health hazard and exposure to these compounds should be as low as reasonably achievable. A reference file of safety data sheets (SDSs) are made available on ESC's intranet to all personnel. Use hazardous reagents in a fume hood whenever possible and if eye or skin contact occurs, flush with large volumes of water. Always wear safety glasses or a shield for eye protection, protective clothing and observe proper mixing protocols.

3.2 Glycol ethers are suspected carcinogens. All solvent handling should be performed in a hood while using proper protective equipment to minimize exposure to liquid and vapor. Minimum personal protection includes the use of laboratory safety glasses, a lab coat or apron, and protective gloves.

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TITLE: VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)

4.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

4.1 All samples must have been collected using a sampling plan that addresses the considerations of this method.

4.2 Volatile analysis for water and sodium bisulfate preserved soil samples must be completed within 14 days from the time of sample collection. Water samples that are not chemically preserved must be analyzed within 7 days. It is also an ESC requirement that water samples with 2-chloroethylvinyl ether (2-CEVE), as a compound of interest, be collected unpreserved and analyzed within 7 days of collection. It has been shown that the acid preservative reacts with the 2-CEVE, which could result in false negative reporting of 2-CEVE in samples. Unpreserved soil samples must be analyzed within 48 hours from the time of collection, added to preservative or otherwise frozen at $\leq$-7°C. High-level soil samples collected in Encore™ or equivalent type sampling devices must be placed in vials of methanol according to Method 5035 (SOP #330751).

STATE NOTE: The State of South Carolina requires that all soil samples must be collected and analyzed using Method 5035. Samples must be preserved within 48 hours from the time of collection, if collected in Encore™ type sampling devices. The holding time for soil samples preserved with methanol or sodium bisulfate is 14 days from the time of collection. Non-Preserved South Carolina VOC's require 7-day Holding Time.

4.3 Aqueous samples must be collected in at least duplicate in 40mL vials with 0.008% $Na_2S_20_3$ per liter if residual chlorine is present. Sample kits can be configured to request additional vials per client request. The pH must be adjusted to <2 with HCl. Soil samples must be collected by one of the following: 1) A 4oz. soil jar filled with soil with zero headspace, 2) Two 5g samples preserved in the field with 5mL $NaHS0_4$ to a pH<2 and one 5g sample preserved in the field with methanol (for high level analysis or data generated on Agilent™ 5977A or 5977B instruments [with an extractor ion or high efficiency source] may be reported to low-level MDL/RL values due to the enhanced sensitivity associated with these instruments) or 3) A 5g or 25g sample collected in an Encore or equivalent type sampling device and frozen in the laboratory within 48 hours from the time of collection.

For all soil samples, a 4oz. soil jar should also be collected to determine percent solids. All samples and extracts must be shipped and stored at <6°C.

STATE NOTE: Soil and Water samples received from the states of Missouri or Kansas may be preserved with tri-sodium phosphate and will have a resulting pH>12.

STATE NOTE: For Alaska samples, when using a water miscible solvent (e.g. methanol) to extract soil volatile organic compounds (VOC), the adjustment of solvent volume for soil moisture content must be performed. Significant soil moisture can add to a pronounced dilution when performing methanol extractions. The potential under reporting of volatile

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concentrations is more pronounced as the percent moisture content increases. See section 9.9 for the calculation.

4.4 Method 624.1 Considerations

4.4.1 If acrolein is to be determined, analyze the sample within 3 days. To extend the holding time to 14 days, acidify a separate sample to pH 4–5 with HCl.

4.4.2 Experimental evidence indicates that some aromatic compounds, notably benzene, toluene, and ethyl benzene are susceptible to rapid biological degradation under certain environmental conditions. Refrigeration alone may not be adequate to preserve these compounds in wastewaters for more than seven days. To extend the holding time for aromatic compounds to 14 days, acidify the sample to approximately pH 2.

4.4.3 If halocarbons are to be determined, use an acidified sample.

4.4.4 Ethers are prone to hydrolysis at pH 2 when a heated purge is used. Aqueous samples should not be acid preserved if ethers are of interest or if the alcohols they would form upon hydrolysis are of interest and the ethers are anticipated to present.

4.4.5 Acidification will destroy 2- chloroethylvinyl ether; therefore, determine 2-chloroethylvinyl ether from the unacidified sample.

5.0 INTERFERENCES

5.1 Major sources of contamination are volatile materials in the laboratory and impurities in the inert purging gas and in the sorbent trap. The use of non-polytetrafluoroethylene (PTFE) thread sealants, plastic tubing, or flow controllers with rubber components must be avoided since such materials out-gas organic compounds which will be concentrated in the trap during the purge operation.

5.2 Analyses of reagent blanks provide information about the presence of contaminants. When potential interfering peaks are noted in blanks, the analyst should change the purge gas source and regenerate the molecular sieve purge gas filter. Subtracting blank values from sample results is not permitted.

5.3 Interfering contamination may occur when a sample containing low concentrations of volatile organic compounds is analyzed immediately after a sample containing high concentrations of volatile organic compounds. After analysis of a sample containing high concentrations, one or more instrument blanks must be analyzed to check for cross contamination.

5.3.1 This interference may be prevented by rinsing the purging apparatus and sample syringes with portions of organic-free reagent water between samples.

5.3.2 For samples containing large amounts of water soluble materials, suspended solids, high boiling compounds or high concentrations of compounds being determined, it may be necessary to wash the purging device with a soap solution,

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rinse it with organic-free reagent water, and then dry the purging device in an oven at 105°C.

5.3.3 In extreme situations, the whole purge and trap device may require dismantling and cleaning.

5.3.4 Screening of the samples prior to purge and trap GC/MS analysis is highly recommended to prevent contamination of the system. This is especially true for soil and waste samples. Screening may be accomplished with an automated headspace technique by SW-846 Method 3820, Hexadecane Extraction and Screening of Purgeable Organics), or screening the sample using an HNU or equivalent portable PID.

5.4 Special precautions must be taken to avoid contamination when analyzing for methylene chloride. The analytical and sample storage area must be isolated from all atmospheric sources of methylene chloride. Otherwise, random background levels will result. Since methylene chloride will permeate through PTFE tubing, all gas chromatography carrier gas lines and purge gas plumbing must be constructed from stainless steel or copper tubing. Laboratory clothing worn by the analyst must be clean since clothing previously exposed to methylene chloride fumes during liquid/liquid extraction procedures can contribute to sample contamination.

5.5 Samples can be contaminated by diffusion of volatile organics (particularly methylene chloride and fluorocarbons) through the septum seal into the sample during shipment and storage. A trip blank prepared from organic-free reagent water and carried through the sampling and handling protocol can serve as a check on such contamination. A storage blank must be analyzed every two weeks to check for cross contamination of samples while samples are stored in the volatiles laboratory walk-in cooler. The storage blank is prepared from organic-free water and is placed in the cooler for a period of two weeks. Every two weeks, it is analyzed to verify that no contamination of client samples has taken place due to contamination in the storage unit. Analysis of a storage blank must be performed for the volatiles laboratory walk-in cooler as well as the Drinking Water Refrigerator.

5.6 This procedure can be used to quantitate most volatile organic compounds that have boiling points below 200°C and that are insoluble or slightly soluble in water. Volatile water-soluble compounds can be included in this analytical technique. However, for the more soluble compounds, quantitation limits are approximately 50 times higher due to poor purging efficiency. Such compounds include low-molecular-weight halogenated hydrocarbons, aromatics, ketones, nitriles, acetates, acrylates, ethers, and sulfides.

5.7 Soil samples that contain carbonate minerals (either from natural sources or applied as an amendment) may effervesce upon contact with the acidic preservative solution in the low concentration sample vial. If a large amount of effervescent gas is generated, the sample may lose a significant amount of volatile analytes. If a sample effervesces, an unpreserved sample will be collected to eliminate volatiles loss whenever possible. The holding time for unpreserved VOC samples is seven days, rather than 14 days.

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5.8 An analyst may re-analyze any sample if instrumentation or human error is suspected. This includes all QC samples, which can only be re-analyzed twice. If failure continues, instrument maintenance must be performed and/or the instrument must be re-calibrated.

5.9 Glassware must be scrupulously cleaned. All glassware must be cleaned per EPA protocol, as stated in SOP #030701, *Glassware Cleaning*.

6.0 EQUIPMENT AND SUPPLIES

The operation, cleaning, and scheduled maintenance procedures, as prescribed by the equipment manufacturer, are followed as provided in the Operator's Manuals. Documentation of maintenance or system modifications is recorded in a maintenance logbook which accompanies each analytical system.

6.1 Instrumentation: All instrumentation meets or exceeds EPA method requirements. There are a total of 30 instruments; GCs include models 5890, 7890 or equivalent and MSs include 5973, 5975, 5977 or equivalent. Specific information for each instrument is included in the associated maintenance logbook.

Sample introduction system: Archon Autosampler, EST Centurion, OI 4760, Encon P & T, EST Evolution, OI 4660 or equivalent

6.2 Glassware must be scrupulously cleaned. All glassware must be cleaned per EPA protocol, as stated in SOP #030701, *Glassware Cleaning*. Rinsing with methanol and laboratory reagent water cleans the volumetric flasks and graduated cylinders. The volumetric flasks are dried in a low temperature oven at less than 120°C and never cleaned with a brush or strong alkali solution.

6.3 The carrier gas used for volatiles analysis is Helium-5.0 grade.

6.4 Syringes used for preparing the calibration curve and preparing samples and sample dilutions are Hamilton brand (or equivalent). Syringe sizes used are 0.50µL, 10µL, 25µL, 50µL, 100µL, 250µL, 500µL, 1mL, and 5mL.

6.5 Glass Sample (VOA) and Standard Vials:

6.5.1 40mL VOA vials with a Teflon™/silicone septa and polypropylene open-top cap.

6.5.2 8mL vials with Teflon™/silicone/Teflon™ septa and polypropylene open-top cap. (Used to store unused standards)

6.6 Miscellaneous:

6.6.1 Stainless Steel Spatula or wooden tongue depressor.

6.6.2 Disposable aluminum drying dishes - VWR #25433-008, or equivalent

6.6.3 Teflon™-coated stir bars, 8mm x 16mm

6.6.4 Glass beads –VWR #EM1.04015.0500, or equivalent.

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6.7 Oven: Fisher IsoTemp Forced-Air Oven with capabilities of 100°C, or equivalent

6.8 Analytical Balance, capable of weighing to 0.01g, or equivalent.

7.0 REAGENTS AND STANDARDS

7.1 All reagents and standards must be recorded in the appropriate preparation log and assigned a unique number. See SOP #030230, *Standards Logger – Tree Operation*. Additional information regarding reagent preparation can be found in the Standards Logger (Tree) digital archive system. All spiking solutions and surrogate standard solutions should be replaced at least every 6 months or sooner if a problem is detected unless otherwise noted.

7.2 Laboratory water created by reverse osmosis/DI filtration evaluated to .055uS/cm to ensure purity. Laboratory water is used in all blanks to assure that it contains less than the MDL of all compounds of interest. The blank must be assessed to ensure that the water does not show any detection of any VOC compounds. If volatile compounds are detected in the blank above MDL all samples associated with this blank must be flagged (see Section 11.4).

NOTE: For all DoD samples the laboratory water is used in all blanks to assure that it contains less than 1/2 LOQ of all compounds of interest. The blank must be assessed to ensure that the water does not show any detection of any VOC compounds. If volatile compounds are detected in the blank above 1/2 LOQ, then those samples must be flagged.

7.3 Methanol, CH_3OH – purge-and-trap grade, demonstrated to be free of analytes. Store apart from other solvents.

7.4 Sodium Bisulfate, Na2S2O3 - QEC Level 3 Certified, or equivalent

7.5 STOCK SOLUTIONS – Primary and Secondary Sources

- Stock calibration solutions must be purchased as certified solutions.
- Certificates must be kept on file.
- All Stock standards must be stored below -10°C
- All non-gas stock standards must be replaced after six months, or sooner, if check standards indicate a problem.
- Both gas and liquid standards must be monitored closely by comparison to the initial calibration curve and by comparison to a second source ICV, or Secondary Source Verification Standard (SSCV).
- Gas intermediate/secondary standards must be replaced weekly, or sooner, if comparison to check standards indicates a problem.
- Non-gas intermediate/secondary standards must be replaced after six months, or sooner, if comparison to check standards indicates a problem.

7.5.1 Primary Source - Primary source standards are used to prepare the initial 5-point calibration curve (additional levels may be used as needed), the continuing calibration verification (CCV) standard, LCS and matrix spikes. The CCV is

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analyzed to verify the initial calibration and is prepared using the primary source standard used to produce the calibration curve. See Section 8.2.6 through 8.2.8 for the instrument preparation of the calibration standards. When primary standards are consumed, new standards must meet the same QC criteria as the consumed standards. Stock standards must be stored below -10° C and have a six-month holding time once opened. The expiration date of the diluted standards must not exceed the expiration date of the stock standards from which they are prepared. Once diluted, the standard must be replaced weekly. The standard list of target LCS compounds are those compounds listed in Attachment VIII. The LCS must be prepared in the appropriate matrix (organic-free reagent water, or purified solid) depending upon the matrix within the analytical batch; and contain all of the method target analytes. A subset of the method target analytes could be used based on the project specific requirements."

STATE NOTE: South Carolina DHEC and the USACE require that all target analytes are present and evaluated in the LCS

Calibration Mix

The ICV solution is prepared in methanol in a 25mL volumetric flask by adding:

Manufacturer	Product	Cat. #	Amount added (mL)	Final Conc. (ppm)
NSI	8260 Custom Mix 2	Q-4147	1	500
Restek	Acrolein	30645	2.5	500
SPEX CertiPrep	AZ fuel additive 4 comps.	VO-ESCTN9	2	100
Ultra	Custom Standard	CUS-18354	1	100

7.5.1.1 The working ICV is prepared by making a 1:1 ratio of the gas standard (Ultra Scientific, Custom Standard CUS-13691 or equivalent at100µg/mL) and the ICV solution standard.

7.5.1.2 For soil autosamplers (5mL), a dilution of 10x is required for the ICV mix.

The solution is stored in 3mL aliquots in zero headspace vials. The storage temperature is below -10° C.

GRO Calibration Mix

Manufacturer	Product	Cat. #	Conc. (ppm)
Restek	TX TPH matrix spike mix	Cat 31484	10,000

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AP9/Oxygenates CalibrationMix

The AP9/Oxygenate ICV solution is prepared in methanol in a 25mL volumetric flask by adding:

Manufacturer	Product	Cat. #	Amount added (mL)	Final Conc. (ppm)
NSI	Ethyl Acetate	681	0.125	50
NSI	Custom AP9 Standard	Q-6603-O	3.125	5
Absolute	Isopropanol	70941	0.625	25

7.5.2 Secondary Source - Secondary source standards must be used to prepare the secondary source verification standard (SSCV) or initial calibration verification (ICV).These standards are purchased from a different vendor or the primary vendor can supply different lot numbers, if a separate vendor is not available. The standard is at a concentration near the mid-level calibration standard. Stock standards must be stored at or below -10°C and have a six month holding time once opened, except the ICV gases which have 1 week holding time. Once diluted, the standard must be replaced weekly.

SSCV

Prepare the SSCV mix in methanol in a 25mL volumetric flask as follows. A separate source or separate lot number is used for standard verification. The standard list of target LCS compounds are those compounds listed in Attachment VIII.

Manufacturer	Product	Cat. #	Amount added (mL)	Final Conc. (ppm)
Restek	Custom VOC Standard #1	570728	1	100
Restek	Custom VOC Standard #2	570729	1	100
Restek	Custom VOC Standard #3	570730	1	100
Restek	Custom VOC Standard #4	570731	1	100
NSI	8260 Custom Mix 2	Q-6354-O	1	500
Restek	Acrolein	30645	1	500
SpexCertiPrep	AZ Fuel Additive 4 Compounds	VO-ESCTN9	2	100

7.5.2.1 The working second source (SSCV) is prepared by making a 1:1 ratio of the gas standard (Ultra Scientific, Custom Standard CUS-13691 or equivalent at 100µg/mL) and the second source standard.

GRO SSCV

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Manufacturer	Product	Cat. #	Conc. (ppm)
Ultra	GRO-MO Mix	Q-4208	5000

7.5.2.2 For soil autosamplers (5mL), a dilution of 10x is required. The solution is stored in 3mL aliquots in zero headspace vials. The storage temperature is at or below -10° C.

AP9/Oxygenates SSCV

The AP9/Oxygenates SSCV is prepared in methanol in a 25mL volumetric flask by adding:

Manufacturer	Product	Cat. #	Amount added (mL)	Final Conc. (ppm)
NSI	Custom AP9 Standard	Q-6603-O	3.125	5
NSI	Ethyl Acetate	681	.125	50
Absolute	Isopropanol	70941	.625	25

7.5.2.3 For Method 624.1, prepare a QC check sample concentrate (LCS concentrate) containing each analyte of interest in methanol. The QC check sample concentrate must be prepared independently from those used for calibration, but may be from the same source as the second-source standard used for calibration verification/LCS. The concentrate should produce concentrations of the analytes of interest in water at the mid-point of the calibration range, and may be at the same concentration as the LCS.

7.6 Surrogate standard stock solutions must be purchased as certified solutions. Certificates must be kept on file. Stock standards must be stored at or below -10° C and have a six month holding time, once opened. Surrogate spiking solutions are purchased from Ultra as custom standard CUS-10259, or equivalent, at 20,000ug/mL, which contains both internal standards and surrogate compounds. This solution is then diluted by 100X to obtain a 200ug/mL working solution.

7.6.1 The following are ESC designated volatiles' analysis surrogates:

- Toluene-d8
- 4-Bromofluorobenzene
- Dibromofluoromethane
- ααα-Trifluorotoluene

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7.7 Internal standard stock solutions must be purchased as certified solutions. Certificates must be kept on file. Stock standards must be stored at or below -10° C and have a six month holding time, once opened. [Internal standard and surrogate standard – Ultra custom MS/IS/SS mix CUS-10259, or equivalent]

7.7.1 The following are ESC designated volatiles' analysis internal standards:

- 1,4-Difluorobenzene
- 2-Bromo-1chloropropane
- 1,4-Dichlorobenzene-d4
- Pentafluorobenzene

7.8 4-Bromofluorobenzene (BFB) standard - The BFB in the custom internal standard mix is used to verify mass spectrometer tuning. Since internal standards and surrogates are added to all samples and standards, BFB is included as part of our initial calibration and calibration verification standards. Certificates of analysis must be kept on file. Stock standards must be stored at or below -10° C and have a six month holding time, once opened.

7.9 Matrix spike (MS) standard - Stock standards must be stored at or below -10°C and have a six month holding time, once opened. Once diluted, the standard must be replaced weekly.

7.9.1 The matrix spike standard is prepared from the stock standard in Section 7.5.

7.9.2 The spike should be at a mid-level of the calibration range. Some contracts may require a site-specific concentration.

7.9.3 Standard spiking practice requires the use of ALL TARGET ANALYTES as specified in Attachment VIII and must be evaluated against the current control limits presented in the LIMS.

Project Specific Requirements (Non-South Carolina Projects): Individual projects may specify required spike compounds. In addition to any project specific requirements, the following table lists the minimum required compounds that must be included in the spike solution.

Minimum Spiking Compounds for Project Specific Requirements
1,1-Dichloroethene
Trichloroethene
Chlorobenzene
Toluene
Benzene
n-Hexane (when requested as a target analyte)

All compounds in the spike solution must be evaluated for acceptable recovery. In the absence of established control limits, default recovery limits are 70 - 130%.

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TITLE: VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)

8.0 PROCEDURE

Analysis Summary**:** Volatile compounds are introduced into the gas chromatograph by purge and trap, via the Archon autosampler, as described on Section 2. If soil samples are high in contamination, a methanolic extraction, SOP #330760, may be necessary prior to purge and trap analysis. Soils require method 5035 for sample preparation, See SOP #330751.

8.1 Chromatographic conditions: All changes in analytical conditions are listed in the Maintenance Log.

8.1.1 Typical conditions for each instrument and column are listed below:

Inlet	off
Detector	200°C
Oven Equib. Time:	0.50 minutes
Oven Max	240°C
Init Temp	45°C hold 1.0 minute
Ramp	20°C/min to 240 hold 1.0 minute

8.1.2 Typical conditions for each autosampler are listed below:

Heating sample	1 minute at 40°C
Purge	11 minutes at 40°C
Desorb	1 minutes at 250°C
Bake	2 minutes at 260°C

8.1.3 Typical condition for each MS detector are listed below:

Electron energy – 70 volts (nominal)
Mass range – 35 to 300 amu
Scan time – 1.2 sec/scan
Manifold vacuum – 3 x 10^{-6} torr

METHOD NOTE: Method 624.1 recommends that if acrolein, acrylonitrile, chloromethane, and vinyl chloride are to be determined, it may be necessary to scan from below 25 Daltons (amu) to measure the peaks in the 26–35 Dalton range for reliable identification.

8.2 **Initial calibration**

8.2.1 TUNING - Each GC/MS system must be hardware-tuned (1µL ≤ 50ng) with BFB to meet the criteria listed below. The mass-spectrometer must meet acceptable BFB sensitivity criteria before analysis can begin. The instrument must be tuned every 12 hours for 8260B, 8260C, and 6200B. BFB tuning for method 624 is every 24 hours.

BFB Key Ions and Ion Abundance Criteria	
Mass	**Ion Abundance Criteria**
50	15.0-40.0% of mass 95
75	30.0-60.0% of mass 95

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TITLE: VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)

BFB Key Ions and Ion Abundance Criteria	
95	base peak, 100% relative abundance
96	5.0-9.0% of mass 95
173	< 2.0% of mass 174
174	> 50.0% of mass 95
175	5.0-9.0% of mass 174
176	> 95.0%, but less than 101% of mass 174
177	5.0-9.0% of mass 176

STATE NOTE: BFB tuning must be performed every 12 hours when analyzing samples from South Carolina by Method 624.

8.2.2 Calibration Curve – General Criteria

- A minimum of 5-point calibration is performed using the primary standards listed in Section 7.5.1. Additional levels may be included to better meet project or client requirements. Regardless of the specific number, the calibration levels analyzed should correspond to a range of concentrations expected to be found in samples, without exceeding the working range of the GC/MS system.
- A calibration point must be analyzed at or below the reporting limit. The concentration of the lowest calibration standard analyzed should be at least 3-5 times the MDL. The instrument response must be distinguishable from the instrument background noise. The signal to noise ratio is the magnitude of the signal strength detected by the mass spectrometer relative to the magnitude of the background noise of the instrument. Instrument conditions must be optimized before the analysis of a calibration curve to minimize background effects.

STATE NOTE: A reporting level standard must be run after calibration is complete. This standard is required by the state of North Carolina and is used to verify the low end of the calibration curve.

STATE NOTE: When analyzing samples from Minnesota, the reporting limit must be verified with each calibration or at least monthly. Verification can be performed by re-quantitation of the low calibration standards using the newly updated calibration curve or by analyzing a separate reporting level standard following calibration curve update. This standard must recover ±40% of the expected concentration. If the criterion is not met, a higher level standard may be re-quantitated or analyzed; however the reporting limit must be amended to reflect the increased concentration of the standard utilized.

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Analytes known to be poor performers are dealt with on a case-by-case basis.

METHOD NOTE: For Method 624.1, one of the calibration standards should be at a concentration at or below the ML or as specified by a regulatory/control authority or in a permit. The ML value may be rounded to a whole number that is more convenient for preparing the standard, but must not exceed the ML values listed in the following table for those analytes which list ML values. Alternatively, the laboratory may establish the ML for each analyte based on the concentration of the lowest calibration standard in a series of standards produced in the laboratory or obtained from a commercial vendor, again, provided that the ML value does not exceed the MLs in the following table, and provided that the resulting calibration meets the acceptance criteria based on the RSD, RSE, or R2.

624.1 Purgeable Analytes	ML (ug/L)
Acrolein	
Acrylonitrile	
Benzene	13.2
Bromodichloromethane	6.6
Bromoform	14.1
Bromomethane	
Carbon tetrachloride	8.4
Chlorobenzene	18.0
Chloroethane	
2-Chloroethylvinyl ether	
Chloroform	4.8
Chloromethane	
Dibromochloromethane	9.3
1,2-Dichlorobenzene	
1,3-Dichlorobenzene	
1,4-Dichlorobenzene	
1,1-Dichloroethane	14.1
1,2-Dichloroethane	8.4
1,1-Dichloroethene	8.4
trans-1,2-Dichloroethene	4.8
1,2-Dichloropropane	18.0
cis-1,3-Dichloropropene	15.0
trans-1,3-Dichloropropene	
Ethylbenzene	21.6
Methylene chloride	8.4
1,1,2,2-Tetrachloroethane	20.7
Tetrachloroethene	12.3

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624.1 Purgeable Analytes	ML (ug/L)
Toluene	18.0
1,1,1-Trichloroethane	11.4
1,1,2-Trichloroethane	15.0
Trichloroethene	5.7
Vinyl chloride	

- The highest standard must not exceed the linear range of the detector. The concentration of the highest standard must produce a response, which does not cause the MS detector to become saturated. The highest concentration used in the calibration curve must allow the analyte to meet the calibration requirements outlined in Sections 8.2.6 through 8.2.8.
- When using Method 5035, SOP #330751, the calibration curve must be prepared in the same solutions used to preserve the field samples.
- **EPA 8260C NOTE:** The method of linear regression analysis has the potential for a significant bias to the lower portion of a calibration curve, while the relative percent difference and quadratic methods of calibration do not have this potential bias. When calculating the calibration curves using the linear regression model, a minimum quantitation check on the viability of the lowest calibration point should be performed by re-fitting the response from the low concentration calibration standard back into the curve. It is not necessary to reanalyze a low concentration standard; rather the data system can recalculate the concentrations as if it were an unknown sample. The recalculated concentration of the low calibration point should be within ±30% of the standard's true concentration.
- The method reference spectra must be updated from the mid-point of each calibration.

8.2.3 Calibration Levels for single analytes

8.2.3.1 Soil Samples - Soil samples are analyzed with a heated purge in the soil chamber of the Archon, or equivalent autosampler. The calibration curve is generated by injecting the following volumes of Calibration Mix (See Section 7.5.1) into 5mL of reagent water. Surrogate standard is prepared by diluting the surrogate by1:10 using (NSI lab solutions, 8260 Surrogate Mix Q-4392 or equivalent at1000µg/mL).

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TITLE: VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)

8260 Calibration Curve - GC/MS Soil (into 5mL water)			
Intermediate solution volume (µL)	Concentration of standard (ppb)	Surrogate Added (µL)	Concentration of Surrogate (ppb)
0.025	0.25 (LOD Point)	0	n/a
0.05	0.5	0	n/a
0.1	1	1	1
0.2	2	2	2
0.5	5	3	3
2.5	25	4	4
7.5	75	5	5
10	100	6	6
20	200	7	7

8260 Calibration Curve - GC/MS Soil (into 50mL water) for use with Agilent 5977A or 5977B Only			
Intermediate solution volume (µL)	Concentration of standard (ppb)	Surrogate Added (µL)	Concentration of Surrogate (ppb)
0.25	0.25 (LOD Point)	0	n/a
0.5	0.5	0	n/a
1	1	1	1
2	2	2	2
5	5	3	3
25	25	4	4
75	75	5	5
100	100	6	6
200	200	7	7

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AP9/Oxygenates Calibration Curve - GC/MS Soil (into 5mL of water)	
Intermediate solution volume (µL)	Concentration of standard (ppb)
1	1.0
5	5
10	10
15	15
20.	20

AP9/Oxygenates Calibration Curve - GC/MS Soil (into 50mL of water)	
Intermediate solution volume (µL)	Concentration of standard (ppb)
10	1.0
50	5
10	10
150	15
200.	20

Note 1: When analyzing soil samples by the low-concentration method (Section 8.7.1), the calibration standards must be heated to 40°C ± 1°C prior to purging.

Note 2: Injections should be performed from the lowest to the highest standards with a cleanup injected after the highest standard and followed by the secondary source standard to verify the initial calibration curve.

8.2.3.2 Water Samples - Water samples are run with a heated purge using the Archon, or equivalent autosampler. The calibration curve is generated by injecting the following volumes of Calibration Mix (See Section 7.5.1.) into 50mL of water. Surrogate standard is added to the curve points, (NSI lab solutions, 8260 Surrogate Mix Q-4392 or equivalent at1000µg/mL).

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8260 Calibration Curve - GC/MS Water (into 50mL water)			
Intermediate solution volume (µL)	Concentration of standard (ppb)	Surrogate Added (µL)	Concentration of Surrogate (ppb)
0.25	0.25 (LOD Point)	0	n/a
0.5	0.5	0	n/a
1	1	1	1
2	2	2	2
5	5	3	3
25	25	4	4
75	75	5	5
100	100	6	6
200	200	7	7

AP9/Oxygenates Calibration Curve - GC/MS Water (into 50mL of water)	
Intermediate solution volume (µL)	Concentration of standard (ppb)
10	1.0
50	5
10	10
150	15
200.	20

8.2.4 Calibration Levels for GRO by MS

8.2.4.1 Soil Samples - Soil samples are analyzed with a heated purge in the soil chamber of the Archon, or equivalent autosampler. The calibration curve is generated by injecting the following volumes of Calibration Mix (See Section 7.5.1.) into 5mL of reagent.

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TITLE: VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)

GRO Calibration Curve - GC/MS Soil (into 5mL water)	
Intermediate solution volume (µL)	Concentration of standard (ppm)
0.025	0.5
.5	1
1	2
2.5	5
5	10
10	20

Calibration Curve - GC/MS Soil and Water (into 50mL water)	
Intermediate solution volume (µL)	Concentration of standard (ppm)
0.25	0.5
5	1
10	2
25	5
50	10
100	20

8.2.5 Internal Standards and Surrogates – Soil/Water

The autosampler adds 1µL of the IS/surrogate mix to each sample. The addition of 1µL of the surrogate spiking/internal standard solution to 5mL of sample is equivalent of 40µg/L of each surrogate standard. Internal standard and surrogate standard are contained within the same spiking mix. Internal Standards are listed Section 7.7.1 and Surrogates are listed in Section 7.6.1.

Tabulation of the Internal Standards

Tabulate the area response of the characteristic ions (see Attachment III) against each compound's concentration and each internal standard concentration. Then calculate the response factor (RF) for the quantifying ion of each compound relative to the appropriate internal standard according to the calculation provided in Section 9.1. The internal standards used should permit most of the compounds of interest in a chromatogram to have retention times of 0.80 to 1.20, relative to one of the internal standards. The average RF must be calculated and recorded for each compound.

8.2.6 System Performance Check Compounds (SPCCs) – Soil/Water

A system performance check must be made before the calibration curve can be used. The minimum relative response factor for volatile SPCCs are as follows:

Chloromethane 0.10

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1,1-Dichlorethane	0.10
Bromoform	0.10
Chlorobenzene	0.30
1,1,2,2-Tetrachloroethane	0.30

These compounds are typically used to check compound instability and to check for degradation caused by contaminated lines or active sites in the system. Examples of these occurrences are:

Compound	Effect on stability
Chloromethane	This compound is the most likely compound to be lost if the purge flow is too fast.
Bromoform	This compound is one of the compounds most likely to be purged very poorly if the purge flow is too slow. Cold spots and/or active sites in the transfer lines may adversely affect response. Response of the quantitation ion (m/z 173) is directly affected by the tuning of BFB at ions m/z 174/176. Increasing the m/z 174/176 ratio relative to m/z 95 may improve bromoform response.
1,1,2,2-Tetrachlorethane and 1,1-Dichloroethane	Contaminated transfer lines degrade these compounds in purge-and-trap systems. Active sites in trapping materials also can cause problems.

Adjust the purge gas (helium) flow rate to 25-40mL/min on the purge-and-trap device. Optimize the flow rate to provide the best response for chloromethane and bromoform. Excessive flow rate reduces chloromethane response, whereas insufficient flow reduces bromoform response.

8.2.7 **EPA 8260B:** Response Factors (RF's) & Calibration Check Compounds (CCC's) - Soil/Water

Using the RF's for the initial calibration curve from Section 8.2.2, calculate and record the percent relative standard deviation (%RSD) for all compounds. Calculate the percent RSD as in Section 9.2. Linearity can be assumed if the RSD criteria is met, thus allowing quantitation calculations to be performed using RF.

8.2.7.1 CCC Criteria - The %RSD for each individual CCC must be less than 30%. The CCCs are:

1,1-Dichloroethene	Toluene
Chloroform	Ethylbenzene
1,2-Dichloropropane	Vinyl chloride

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TITLE: VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)

8.2.7.2 Target Analytes and other Non-CCC's - The RSD must meet the following criteria -

<15% RSD for all 8260B Target Analytes
<35% RSD for all 624 Target Analytes
<20% RSD for all KSGRO Samples
<15% RSD for n-Hexane
<20% RSD for 6200 Analytes
<15% appendix 9 Analytes
<10% RSD for all 601/602 Target Analytes

Compounds not meeting the RSD requirement may be considered for linear regression as stated in 8.2.7.3

8.2.7.3 Linear Regression - Criteria

When any compound does not meet the calibration criteria for RF, the most appropriate curve fitting model is used. If linear regression is used, it must be noted on the data (preferably on the CCV RF report), next to the affected compound. It must also meet correlation coefficient criteria of 0.99 or better. SM 6200 requires a linear regression correlation coefficient of >0.994.

Linear regression is achieved by plotting the instrument response versus the concentration of the standards. The resulting regression line must not be forced through the origin and the origin must not be included as a calibration point.

STATE NOTE: For all Wisconsin sample analyses, analysts must evaluate the %RSD of calibrations to ensure that they do not have unacceptable curvature. The %RSD limit criteria, as found in the specific methods listed above, applies to calibrations using average RF calibrations. For linear and quadratic curve fits, a limit of 40% RSD is used for normal target analytes and 50% RSD is utilized for known poor performing compounds.

The most appropriate curve fitting model from among the following choices must be utilized (given in the order of preference): Average Response Factor

- Linear – No Weighting
- Linear – 1/x Weighting
- Linear – $1/x^2$ Weighting
- Quadratic

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TITLE: VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)

8.2.7.4 Calibration Corrective Action

When the RSD exceeds 15% or linear regression criteria could not be met, plot and inspect the calibration data for abnormal chromatographic responses. The inspection may indicate analytical problems, including errors in standard preparation, the presence of active sites in the chromatographic system, analytes that exhibit poor chromatographic behavior, etc.

If calibration criteria are not met, then one of the following options must be applied to the GC/MS initial calibration:

8.2.7.4.1 Adjust the instrument and/or perform instrument maintenance and re-analyze the calibration standards until the RSD of the calibration meets criteria.

8.2.7.4.2 Narrow the calibration range until the response is linear. If the low standard is below the estimated quantitation limit (i.e., for the poor purgers in a commercially available prepared standard mix), then this standard may be dropped. Re-calculate the RSD without the low standard to determine if the RSD meets the QC limit. If the lowest standard is dropped, the reporting limit could require a change. Check with the supervisor to determine if a point can be removed and not affect reporting limits requirements.

Compounds that are very soluble in water generally are poor purgers. The ketones, vinyl acetate, acrolein, and acrylonitrilie fall into this category.

8.2.8 **EPA 8260C:** Response Factors (RF's)

8.2.8.1 Calibration Curve Criteria - Calculate the mean response factor and the relative standard deviation (RSD) of the response factors for each target analyte using the following equations. The RSD should be less than or equal to 20% for each target analyte. It is also recommended that a minimum response factor for the most common target analytes as noted in Attachment VII, be demonstrated for each individual calibration level as a means to ensure that these compounds are behaving as expected. In addition, meeting the minimum response factor criteria for the lowest calibration standard is critical in establishing and demonstrating the desired sensitivity. Due to the large number of compounds that may be analyzed by this method, some compounds will fail to meet these criteria. For these occasions, it is acknowledged that the failing compounds may not be critical to the specific project and therefore they may be used as qualified data or estimated values for screening purposes.

8.2.8.2 When the RSD exceeds 20% or linear regression criteria could not be met, plot and inspect the calibration data for abnormal chromatographic

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responses. The inspection may indicate analytical problems, including errors in standard preparation, the presence of active sites in the chromatographic system, analytes that exhibit poor chromatographic behavior, etc.

NOTE: To maximize batches calibration RSDs are held to the strictest method reported, The RSD used for all methods is 15%.

8.2.9 **Method 624.1**

Calculate the mean (average) and relative standard deviation (RSD) of the response factors. If the RSD is less than 35%, the RF can be assumed to be invariant and the average RF can be used for calculations. Alternatively, the results can be used to fit a linear or quadratic regression of response ratios vs. concentration ratios. If used, the regression must be weighted inversely proportional to concentration. The coefficient of determination (R2) of the weighted regression must be greater than 0.920 (this value roughly corresponds to the RSD limit of 35%). Alternatively, the relative standard error may be used as an acceptance criterion. As with the RSD, the RSE must be less than 35%. If an RSE less than 35% cannot be achieved for a quadratic regression, system performance is unacceptable, and the system must be adjusted and re-calibrated.

NOTE: Using capillary columns and current instrumentation, it is quite likely that a laboratory can calibrate the target analytes in this method and achieve a linearity metric (either RSD or RSE) well below 35%. Therefore, laboratories are permitted to use more stringent acceptance criteria for calibration than described here (e.g., to harmonize their application of this method with those from other sources).

8.3 Calibration Verification

8.3.1 Calibration Verification for EPA Methods 8260B, 624 and SM 6200B:

8.3.1.1 SSCV's

After a successful calibration, a Second Source Calibration Verification (SSCV) or Initial Calibration Verification (ICV) must be analyzed to verify the calibration. This standard must be made from a second source, preferable from a different vendor than the calibration standards. The second source calibration standard must perform within following criteria:

CCC and SPCC compounds	± 30%
Other compounds (non-poor performers)	± 40%
Poor Performers (8.3.2)	in-house LCS limits

8.3.1.2 CCC's

The curve must be verified daily by a calibration standard known as the Continuing Calibration Verification standard (CCV) and is analyzed every

12 hours. This standard is prepared at or near the mid-point of the calibration curve. A maximum of 20% criteria would be expected for CCC analytes (Listed in Section 8.2.7.1) and n-Hexane when requested as a target analyte.

Compounds on average response factor use % difference,

$$\% \text{ Difference} = (RF_v - Rf_{ave}) / Rf_{ave} \times 100\%$$

Compounds on regression fit model use percent drift,

% Drift = (Calculated conc - Theoretic conc) / Theoretic conc x 100%

Criteria for both is ≤20%.

8.3.1.3 SPCC's

The SPCC's must have a minimum response factor as stated in Section 8.2.6. If these criteria are exceeded, then corrective action is required.

8.3.1.4 All Target Analytes and Non-CCC's

When analyzing 8260B and 624 concurrently, calibration verifications are evaluated using both the 8260B criteria (sections. 8.3.1.2 through 8.3.1.3 and the 624 criteria (Attachment VI). For analytes not on the 624 list, all target analytes (except for the poor performers (8.3.3) must meet a maximum of 40% drift from the calibration curve. The analyst evaluates all analytes carefully and the experience of the analyst weighs heavily when determining the usability of the data.

Poor performers are allowed a maximum of 50% drift from the calibration curve. See section 8.3.3 for a listing of poor performing analytes.

STATE NOTE: For South Carolina 624 samples, the target analytes reported must agree with the compound list found in the EPA 624 published method.

8.3.2 Calibration Verification for EPA Method 8260C:

8.3.2.1 SSCV's

After a successful calibration, a Second Source Calibration Verification (SSCV) or Initial Calibration Verification (ICV) must be analyzed to verify the calibration. This standard must be made from a second source, preferable from a different vendor than the calibration standards. The second source calibration standard must perform within following criteria:

All compounds	± 30%
Poor Performers (8.3.3)	in-house LCS limits

8.3.2.2 Target Analytes

The curve must be verified initially by a calibration standard known as the Continuing Calibration Verification standard (CCV) and is analyzed every 12 hours). . This standard is prepared at or near the mid-point of the calibration curve. A maximum of 20% criteria would be expected for all target analytes and n-Hexane when requested as a target analyte.

If the percent difference or percent drift for a compound is less than or equal to 20%, then the initial calibration for that compound is assumed to be valid. Due to the large numbers of compounds that may be analyzed by this method, some compounds will fail to meet the criteria. If the criterion is not met (i.e., greater than 20% difference or drift) for more than 20% of the compounds included in the initial calibration, then corrective action must be taken prior to the analysis of samples. In cases where compounds fail, they may still be reported as non-detects if it can be demonstrated that there was adequate sensitivity to detect the compound at the applicable quantitation limit. For situations when the failed compound is present, the concentrations must be reported as estimated values.

A closing standard must also be analyzed at the end of the sequence for SM 6200.

8.3.3 Poor Performers:

The poor performers are as follows:

Propene	2-Chloroethylvinyl Ether
Dichlorodifluoromethane	Acrolein
Carbon Disulfide	Vinyl acetate
Bromomethane	trans-1, 4-dichloro-2-butene
Chloroethane	Alcohols (Ethanol, TBA, TAA, ETBA, Butanol)
1,3-Butadiene	Iodomethane.
2,2-Dibromo-3-chloropropane	Naphthalene
1- Methylnaphthalene	2-Butanone
2- Methylnaphthalene	2-Hexanone
Acetone	4-Methyl-2-pentanone
Pentachloroethane	Cyclohexanone
Tert-butyl Formate	Methyl cyclohexane

8.3.4 Method 624.1: Because the analytical system is calibrated by purge of the analytes from water, calibration verification is performed using the laboratory control sample (LCS).

8.3.5 Laboratory Control Standard (LCS): A laboratory control sample (LCS) should be included with each analytical batch. The LCS consists of an aliquot of a clean (control) matrix similar to the sample matrix and of the same weight or volume.

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The LCS is spiked with the same analytes at the same concentrations as the matrix spike, when appropriate. When the results of the matrix spike analysis indicate a potential problem due to the sample matrix itself, the LCS results are used to verify that the laboratory can perform the analysis in a clean matrix. Also note the LCS for water sample matrices is typically prepared in organic-free reagent water similar to the continuing calibration verification standard. In these situations, a single analysis can be used for both the LCS and continuing calibration verification.

- QC Limits are found in the LIMS for LCS and MS/MSD.
- If the stated criteria are exceeded, then corrective action is required.
- See Section 11.6.1, on marginal exceedances.

STATE NOTE: All **South Carolina** DHEC compliance testing, the LCS responses must be within 70 – 130% for Method 8260 and within the limits given in Attachment VI for Method 624. No failures are acceptable for 8260 or 624, qualifiers cannot be used. Failures require a batch re-analysis. See Section 10 for QC evaluation. For samples analyzed from South Carolina that are not utilized for compliance purposes, in house established acceptance limits are utilized to demonstrate controlled analyses.

STATE NOTE: For EPA Region IV only (AL, FL, GA, KY, MS, NC, SC, TN), when running Acrolein and Acrylonitrile by V624, the QC criteria from EPA Method 603 should be used for control demonstration. The LCS criteria from EPA Method 603 include Acrolein recovery within 88-118% and Acrylonitrile recovery within 71-135%.

8.3.5.1 Method 624.1 Requirements

8.3.5.1.1 Calibration verification/LCS—The working calibration curve or RF must be verified immediately after calibration and at the beginning of each 12-hour shift by the measurement of an LCS. The LCS must be from a source different from the source used for calibration, but may be the same as the sample prepared for the DOC.

8.3.5.1.2 Analyze the LCS prior to analysis of field samples in the batch of samples analyzed during the 12-hour shift. Determine the concentration of each analyte. Calculate the percent recovery (Q).

8.3.6 Internal Standard Evaluation

8.3.6.1 When a calibration is performed at the beginning of an analytical run:

The internal standard areas must be evaluated against the mid-point of the curve. Samples are analyzed within a 12-hour window; the internal standards of those samples are evaluated against mid-point of the curve.

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Then a CCV is analyzed, this is compared to the mid-point of the initial calibration curve. Addition samples are analyzed within a 12-hour window; the internal standards of those samples are evaluated against the previous acceptable CCV.

8.3.6.2 When an analytical run is started using a passing ICV (which is compared against the initial calibration mid-point to verify the calibration curve): Samples are analyzed within a 12-hour window, the internal standards of those samples are evaluated against the daily CCV. Then a CCV is analyzed, this is compared to the mid-point of the curve. Additional samples are analyzed within a 12-hour window; the internal standards of those samples are evaluated against the previous acceptable CCV.

8.4 Gas chromatographic analysis:

8.4.1 Typical sequence order for loading the autosampler with calibration:

Sample/QC Type	Use
Cleanup Blank	Verify system is contamination free
BFB Tune	Tuning criteria
Calibration standard(s)	Initial volatiles calibration and 5-point for GRO (if analyzed)
Second Source Calibration Verification (SSCV) or Initial Calibration Verification(ICV)	Verify initial calibration with second source.
Laboratory Control Sample	Laboratory blank, spiked with known amount(s) of analyte of interest
Matrix Spike/Matrix Spike Dup.	Sample spiked with known amount(s) of analytes of interest
Method blank	Ensure that carry over has not occurred from the calibration standard and that the analytical system does not show contamination above the established detection limits
12-hour window	Client samples
Continuing Calibration Verification (CCV)	Single-point calibration verification standard, if needed.
12-hour window	Client samples

8.4.2 Typical sequence order for loading the autosampler with calibration verification only:

Sample/QC Type	Use
Cleanup Blank	Verify system is contamination free
BFB Tune	Tuning criteria

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Sample/QC Type	Use
Initial Calibration Verification (ICV)	Verify initial calibration.
Laboratory Control Sample	Laboratory blank, spiked with known amount(s) of analyte of interest
Matrix Spike/Matrix Spike Dup.	Sample spiked with known amount(s) of analytes of interest
Method blank	Ensure that carry over has not occurred from the calibration standard and that the analytical system does not show contamination above the established detection limits
12-hour window	Client samples
Continuing Calibration Verification (CCV)	Single-point calibration verification standard, if needed.
12-hour window	Client samples

8.5 GC/MS Analysis -- Water Samples

8.5.1 Screening the sample prior to purge-and-trap analysis provides guidance on whether sample dilution is necessary and prevents contamination of the purge-and-trap system. Three screening techniques that can be used are the headspace sampler, using a gas chromatograph (GC) equipped with a photo ionization detector (PID) in series with an electrolytic conductivity detector (ELCD) (SW-846 Method 3810), extraction of the sample with hexadecane and analysis of the extract on a GC with a FID and/or an ECD (SW-846 Method 3820), and screening of 5mL of sample using an HNU or equivalent portable PID. See ESC SOP #330365, *Volatile Organic Compounds Screening using the RAE Systems Photoionization Gas Detector Model MiniRAE 3000.*

8.5.2 All samples and standard solutions must be allowed to warm to ambient temperature before analysis.

8.5.3 Set up the GC/MS system as outlined in Section 8.1.

8.5.4 BFB tuning criteria and GC/MS calibration criteria must be met (Section 8.2.1) before analyzing samples.

8.5.5 Load the unopened VOA vial onto the autosampler for analysis.

After the sample has been analyzed on the instrument, check the pH of the sample using the remaining sample in the VOA vial. Use universal pH paper and record the sample pH to the nearest whole pH unit. Samples not passing the pH requirements are flagged with a “G1” qualifier. All samples that report 2-CEVE as a target analyte and have a pH < 2 are qualified with a “G2”.

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STATE NOTE: For West Virginia compliance samples, check for residual chlorine after sample analysis. Samples containing residual chlorine must be flagged as such.

8.5.6 Sample Dilution -- When necessary, samples can be diluted before purging. This can be performed in a clean 50mL volumetric flask. The sample is measured through the use of an appropriate microliter syringes and added to the flask which is then filled with reagent water to the meniscus.

8.5.7 Compositing samples prior to GC/MS analysis – Site or project-specific requirements may require compositing of samples, which is performed according to the instructions below. Compositing of samples is only performed at the request of the client.

8.5.7.1 All vials for the sample are combined in an appropriate sized volumetric flask that will allow for the least amount of headspace. (If 4 vials are to be composited then a 200mL volumetric flask will be used to combine the samples.). Practice special precautions to maintain zero headspace in the syringe.

8.5.7.2 The samples must be cooled to 4°C or less during composition to minimize the loss of volatiles. Sample vials may be placed in a tray of ice to prevent volatile loss during this process.

8.5.7.3 Invert the volumetric flask 3 times. Pour the volume out of the volumetric flask into the original 40mL VOA vial containers. The sample is now ready to be analyzed.

NOTE: Samples are not routinely composited; however, if site-specific requirements state procedures for compositing samples, the laboratory makes every effort to comply with those requirements.

8.5.8 Surrogate/Internal Standards – The autosampler adds 1uL of the IS/surrogate mix to each sample. The addition of 1µL of the surrogate spiking/internal standard solution to 5mL of sample is equivalent of 40µg/L of each surrogate standard. Internal standard and surrogate standard are contained within the same spiking mix.

8.5.9 Refer to SOP #330752, *Purge and Trap for Aqueous Samples* and SOP #330751, *Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples* for additional information on sample introduction.

8.5.10 If the initial analysis of a sample or a dilution of the sample has a concentration of analytes that exceeds the initial calibration range, the sample must be re-analyzed at a higher dilution. All dilutions must keep the response of the major constituents (previously saturated peaks) in the upper half of the linear range of the curve. Secondary ion quantitation is allowed only when there are sample interferences with the routinely quantitated primary ion. When a sample is analyzed that has saturated the detector, the samples following must be

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analyzed for contamination. If any sample shows contamination, they must be re-analyzed.

8.6 GC/MS Analysis -- Water-miscible liquids

8.6.1 Water-miscible liquids are analyzed as water samples after first diluting them at least 50-fold with laboratory water.

8.6.2 Initial and serial dilutions can be prepared by pipetting a known amount of the sample to a 50mL volumetric flask and diluting to volume with organic-free reagent water. Transfer immediately to a clean/baked 40mL vial using a 5mL syringe.

8.6.3 Alternatively, prepare dilutions directly in a clean 40mL vial filled with organic-free reagent water by adding at least 0.5µL, but not more than 25mLs of liquid sample. The sample is ready for addition of internal and surrogate standards. Proceed with Section 8.5.8.

8.7 GC/MS Analysis -- Sediment/soil and waste samples

These samples may contain percent quantities of purgeable organics that will contaminate the purge-and-trap system, and require extensive cleanup and instrument downtime. The screening of samples is highly recommended. Screening data should be used in conjunction with site-specific DQOs, if known, to determine whether to use the low-concentration method (0.005 - 1 mg/Kg) or the high-concentration method (>1mg/Kg).

8.7.1 Low-concentration method -- This is designed for samples containing individual purgeable compounds of <1 mg/Kg. It is limited to sediment/soil samples and waste that is of a similar consistency (granular and porous). The low-concentration method is based on purging a heated sediment/soil sample mixed with organic-free reagent water containing the surrogate and internal standards. All QC samples and standards are to be analyzed under the same conditions as the samples, using 5g of clean sand or clean soil.

STATE NOTE: This option cannot be used for South Carolina samples. Please refer to SOP #330751 that addresses Method 5035 for sample preparation.

8.7.1.1 Use a 5g sample if the expected concentration is <0.1mg/Kg, or a 1g sample for expected concentrations between 0.1 and 1mg/Kg.

8.7.1.2 The GC/MS system must be set up as in Sections 8.1 and 8.2. This must be done prior to the preparation of the sample to avoid loss of volatiles from standards and samples. Both the initial and daily calibration standards (Sections 8.2 and 8.3) must be heated to 40°C purge temperature. Refer to Method 5035 (SOP #330751) for additional instructions for 8260B soil analysis.

8.7.1.3 The sample consists of the entire contents of the sample container. Do not discard any supernatant liquids. Mix the contents (using slow but

precise movement to limit the loss of volatiles) of the sample container with a narrow metal spatula. Weigh the amount determined in Section 8.7.1.1 into a tared purge device. Note and record the actual weight to the nearest 0.1 g.

8.7.1.4 Add distilled water to the purging vial, which contains the weighed amount of sample, and place the vial in the purge-and-trap system.

NOTE: Prior to the placement of the vial, the procedures in Sections 8.7.1.4 must be performed rapidly and without interruption to avoid loss of volatile organics. These steps must be performed in a laboratory free of solvent fumes.

8.7.2 High-concentration method -- The method is based on extracting the sediment/soil with methanol. A waste sample is either extracted or diluted, depending on its solubility in methanol. Wastes (i.e., petroleum and coke wastes) that are soluble in methanol are diluted. An aliquot of the extract is added to organic-free reagent water containing surrogate and internal standards. This is purged at ambient temperature. All samples with an expected concentration of >1.0 mg/Kg must be analyzed by this method.

STATE NOTE: This method is not suitable for samples from South Carolina, North Carolina or Indiana. South Carolina does not recognize the practices in sections 8.7.2.1 or 8.7.2.2. 5035 must be used for all high-level soil samples, see SOP #330751.

8.7.2.1 The sample (for volatile organics) consists of the entire contents of the sample container. Do not discard any supernatant liquids. Mix the contents (using slow but precise movement to limit the loss of volatiles) of the sample container with a narrow metal spatula. For sediment/soil and solid wastes that are insoluble in methanol, weigh 5g (wet weight) of sample into a tared 40-mL vial. Use a top-loading balance. Note and record the actual weight to 0.1g. For waste that is soluble in methanol, tetraglyme, or PEG, weigh 5g (wet weight) into a 40mL vial.

8.7.2.2 Add 5mL Methanol. Shake well for 2 minutes. See SOP #330751.

NOTE: Sections 8.7.2.1 and 8.7.2.2 must be performed rapidly and without interruption to avoid loss of volatile organics. These steps must be performed in a laboratory free from solvent fumes.

8.7.2.3 The GC/MS system must be set up as in Sections 8.1.

8.7.2.4 If a screening procedure was followed, use the estimated concentration to determine the appropriate volume. If the sample was submitted as a high-concentration sample, start with 200µL.

8.7.2.5 In a clean/baked vial filled with reagent water, inject the corresponding aliquot of methanol extract. Immediately cap and place in the

autosampler. The autosampler adds 1uL of the IS/surrogate mix to all of the samples.

8.7.2.6 Proceed with the analysis as outlined in Sections 8.5.9-8.5.10. Analyze all blanks on the same instrument as that used for the samples. The standards and blanks must also contain 200µL of the dilution solvent to simulate the sample conditions.

8.7.2.7 For a matrix spike in the high-concentration of sediment/soil samples, Add a 200µL aliquot of this extract to 5mL of organic-free reagent water for purging (as per Section 8.7.2.6) in a clean/baked 40mL VOA vial and add 20µL spiking solution, 1µL internal and surrogate standard solution (IS/Surr solution added by autosampler).

8.7.2.8 Data generated from soil samples prepared in methanol on Agilent™ 5977A or 5977B instruments (with an extractor ion or high efficiency source) may be reported to low-level MDL/RL values due to the enhanced sensitivity associated with these instruments.

8.8 Qualitative Identification

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 the laboratory using the conditions of this method. All hits must be visually compared to the reference spectrum for confirmation. The characteristic ions from the reference mass spectrum are defined to be 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 as present when the criteria below are met.

8.8.1 The intensities of the characteristic ions of a compound maximize in the same scan or within one scan of each other. Selection of a peak by a 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 is accepted as meeting this criterion.

8.8.2 The RRT of the sample component is within + 0.06 RRT units of the RRT of the standard component.

8.8.3 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%.)

8.8.4 Structural isomers that produce very similar mass spectra are identified as individual isomers if they have sufficiently different GC retention times. Sufficient GC resolution is achieved if the height of the valley between two isomer peaks is

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less than 25% of the sum of the two peak heights. Otherwise, structural isomers are identified as isomeric pairs.

8.8.5 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 are important. 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 can be met, but each analyte spectrum contains extraneous ions contributed by the co-eluting compound.

8.8.6 TIC's - Tentatively Identified Compounds

Periodically, clients may request additional identification of compounds that are not normally calibrated. This identification is limited to the compounds in the current mass spectral library employed by ESC.

For samples containing components not associated with the calibration standards, a library search may be made for the purpose of tentative identification. The necessity to perform this type of identification is determined by the type of analyses being conducted. At the client request, when serving the role of QA (or referee) laboratory, tentatively identified compounds (TICs) must always be reported. Guidelines for making tentative identification are:

(1) Relative intensities of major ions in the reference spectrum (ions >10% of the most abundant ion) should be present in the sample spectrum.

(2) The relative intensities of the major ions should agree within 15% to be consistent with target compound list identification. (Example: For an ion with an abundance of 50% in the standard spectrum the corresponding sample ion abundance must be between 20 and 80%).

(3) Molecular ions present in the reference spectrum should be present in the sample spectrum.

(4) Ions present in the sample spectrum but not in the reference spectrum should be reviewed for possible background contamination or presence of co-eluting compounds.

(5) Ions present in the reference spectrum but not in the sample spectrum must 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.

Computer generated library search routines must not use normalization routines that would misrepresent the library or unknown spectra when compared to each other. Only after visual comparison of sample with the nearest library searches does the mass spectral interpretation specialist assign a tentative identification.

8.8.6.1 Routinely, ESC employs a minimum Q value of 85% for tentative identifications and a minimum concentration of 10ppb. Peaks below a Q value of 85% but above 10ppb may be reported as "Unknown". Any identified peaks below 10ppb are removed as these could result from baseline noise or other interferences, not necessarily attributable to the field sample or reliably quantifiable using GCMS technology. Additionally, any peaks that are attributable to instrument contamination (e.g., siloxanes) are also removed.

8.8.6.2 If multiple TICs, with same exact name, exist for a sample, the LIMS will only display the TIC with the highest quality match per sample.

8.8.6.3 TIC names assigned as "Unknown" may initially have the same name as another "Unknown" until parsed and displayed in LIMS where it is given a hyphen and incremental number which then becomes a unique TIC (e.g., Unknown-1).

8.8.6.4 When reporting "Total TIC" for any client sample, only concentrations per above requirements will be used to sum the Total TIC concentration.

8.9 Quantitative Analysis

8.9.1 When a compound has been identified, the quantitation of that compound is based on the integrated abundance from the EICP of the primary characteristic ion. Quantitation is accomplished using the internal standard technique, as described in Section 9. The internal standard used must be the one nearest the retention time of that of a given analyte.

8.9.2 Sediment/soil samples are reported on a dry weight basis, while sludge and wastes are reported on a wet weight basis. The percent dry weight of the sample (see Section 9.7) must be reported along with the data in either instance. At ESC, the dry weight conversion calculations for sample reporting are performed by the LIMS system. [Dry weight only when requested]. The LIMS Final Client Report represents the reporting basis as either wet weight or dry weight, depending upon the calculation used.

9.0 DATA ANALYSIS AND CALCULATIONS

9.1 Concentration of Target Analytes in Water and Water-Miscible Waste

$$\text{Concentration}(ug/L) = \frac{(A_x)(I_s)(D)}{(A_{is})(\text{ave.RF})(V_s)}$$

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where:

A_x = Area (or height) of the peak for the analyte in the sample.
A_{is} = Area (or height) of the peak for the internal standard.
I_s = Mass (amount) of the internal standard in the concentrated sample extract (ng). This is not just the mass injected into the instrument, but the total mass of internal standard in the concentrated extract.
D = Dilution factor, if the sample or extract was diluted prior to analysis. If no dilution was made, D = 1. The dilution factor is always dimensionless.
ave.RF = Mean response factor from the initial calibration.
V_s = Volume of the aqueous sample extracted or purged (mL). If units of liters are used for this term, multiply the results by 1000.

9.2 Concentration of Target Analytes in Sediment/Soil, Sludge, and Waste

9.2.1 High-concentration procedure

$$\text{Concentration}(ug/L) = \frac{(A_x)(I_s)(V_t)}{(A_{is})(\text{ave.RF})(V_i)(W_s)}$$

where:
A_x, I_s, A_{is}, ave.RF are the same as in water and water-miscible waste above.
Vt = Volume of total extract (µL) (use 10,000µL or a factor of this when dilutions are made).
Vi = Volume of extract added (µL) for purging.
Ws = Weight of sample extracted or purged (g). The wet weight or dry weight may be used, depending upon the specific applications of the data.

9.2.2 Low-concentration procedure

$$\text{Concentration}(ug/L) = \frac{(A_x)(I_s)(V_t)}{(A_{is})(\text{ave.RF})(V_i)(W_s)}$$

where:
A, I_s, A_{is}, RF are the same as in water and water-miscible waste above.
V_t = Volume of total extract (µL) (use 10,000µL or a factor of this when dilutions are made).
V_i = Volume of extract added (µL) for purging.
W_s = Weight of sample extracted or purged (g). The wet weight or dry weight may be used, depending upon the specific applications of the data.

9.4.3 Soil Weight determination with Methanol (samples received with MeOH).

$$\text{SoilWeight} = \text{VialTotalWeight}(\text{vial},\text{soil},\text{MeOH}) - \text{TareVialWeight} - \text{MeOHWeight}.$$

9.3 In order to report results for volatiles analysis of samples prepared in methanol containing significant moisture (>10%) content on an "as received" basis, the calculated concentration needs to be corrected using the total solvent/water mixture volume represented as Vt. This total solvent/water volume is calculated as follows:

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$$\mu L\ solvent/water\ V_t = \left[\frac{mL\ of\ solvent + (\%\ moisture \times g\ of\ sample)}{100}\right] \times 1000\ \mu L/mL$$

9.4 Percent Error (%Error)

$$\%Error = \frac{x_i - x'_i}{x_i} * 100$$

where:
x'_i = Measured amount of analyte at the calibration level *i*, in mass or concentration units
x_i = True amount of analyte at calibration level *i*, in mass or concentration units

9.5 Relative Standard Error (%RSE) – As an alternative to using the average response factor when using Method 624.1, the quality of the calibration may be evaluated using the Relative Standard Error (RSE). The acceptance criterion for the RSE is the same as the acceptance criterion for Relative Standard Deviation (RSD), in the method. RSE is calculated as:

$$\%RSE = 100 \times \frac{\sum_{i=1}^{n}\left[\frac{x'_i - x_i}{x_i}\right]^2}{(n-p)}$$

where:
x'i = Calculated concentration at level i
xi = Actual concentration of the calibration level i
n = number of calibration points
p = Number of terms in the fitting equation (average = 1; linear = 2; quadratic = 3)

9.6 See the current Quality Assurance Manual for other equations associated with common calculations.

10.0 QUALITY CONTROL AND METHOD PERFORMANCE

10.1 All analysts must meet the qualifications specified in SOP #030205, *Technical Training and Personnel Qualifications* before approval to perform this method. Analysts must complete an initial demonstration of proficiency before being approved to perform this method. Continuing proficiency must be demonstrated using proficiency testing, laboratory control sample analysis and/or MDL studies. Method performance is assessed per analyst. Updated method performance records are filed and stored in a central location within the department.

STATE NOTE: IDOCs for South Carolinae DHEC compliance need to meet 70-130% for all compounds except the poor purgers. Poor purgers need to recover at 60-140%. For samples analyzed from South Carolina that are not

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utilized for compliance purposes, in house established acceptance limits are utilized to demonstrate controlled analyses.

METHOD NOTE: IDOCs for SM 6200B should have an average recovery of 80-120% for each target analyte and the RSD of the replicates should be <20%.

10.1.1 Method 624.1 Requirements

10.1.1.1 Establish MDLs for the analytes of interest using the MDL procedure at 40 CFR part 136, appendix B. The laboratory's MDLs must be equal to or lower than those listed in Table 1 for those analytes which list MDL values, or lower than one-third the regulatory compliance limit, whichever is greater. For MDLs not listed in Table 1, the laboratory must determine the MDLs using the MDL procedure at 40 CFR part 136, appendix B under the same conditions used to determine the MDLs for the analytes listed in Table 1. All procedures used in the analysis must be included in the DOC.

624.1 Purgeable Analytes	MDL (ug/L)	Limit for s (%)	Range for $\bar{X}$ (%)
Acrolein		30	50-150
Acrylonitrile		30	50-150
Benzene	4.4	33	75-125
Bromodichloromethane	2.2		
Bromoform	4.7		
Bromomethane		90	D-242
Carbon tetrachloride	2.8	26	65-125
Chlorobenzene	6.0	29	82-137
Chloroethane		47	42-202
2-Chloroethylvinyl ether		130	D-252
Chloroform	1.6	32	68-121
Chloromethane		472	D-230
Dibromochloromethane	3.1	30	69-133
1,2-Dichlorobenzene		31	59-174
1,3-Dichlorobenzene		24	75-144
1,4-Dichlorobenzene		31	59-174
1,1-Dichloroethane	4.7	24	71-143
1,2-Dichloroethane	2.8	29	72-137
1,1-Dichloroethene	2.8	40	19-212
trans-1,2-Dichloroethene	1.6	27	68-143
1,2-Dichloropropane	6.0	69	19-181
cis-1,3-Dichloropropene	5.0	79	5-195
trans-1,3-Dichloropropene		52	38-162
Ethylbenzene	7.2	34	75-134
Methylene chloride	2.8	192	D-205
1,1,2,2-Tetrachloroethane	6.9	36	68-136

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624.1 Purgeable Analytes	MDL (ug/L)	Limit for s (%)	Range for $\overline{X}$ (%)
Tetrachloroethene	4.1	23	65-133
Toluene	6.0	22	75-134
1,1,1-Trichloroethane	3.8	21	69-151
1,1,2-Trichloroethane	5.0	27	75-136
Trichloroethene	1.9	29	75-138
Trichlorofluoromethane		50	45-158
Vinyl chloride		100	D-218

10.1.1.2 Prepare and analyze four LCSs by adding an appropriate volume of the second source standard (Section 7.5.2.3) to each of four aliquots of reagent water. The volume of reagent water must be the same as the volume that will be used for the sample, blank, and MS/MSD.

10.1.1.3 Calculate the average percent recovery ($\overline{X}$) and the standard deviation of the percent recovery (s) for each analyte using the four results.

10.1.1.4 For each analyte, compare s and $\overline{X}$ with the corresponding acceptance criteria for precision and recovery in Section 10.1.1.1. For analytes not listed, DOC QC acceptance criteria must be developed by the laboratory. Alternatively, acceptance criteria for analytes not listed may be based on laboratory control charts. If s and $\overline{X}$ for all analytes of interest meet the acceptance criteria, system performance is acceptable and analysis of blanks and samples may begin. If any individual s exceeds the precision limit or any individual $\overline{X}$ falls outside the range for recovery, system performance is unacceptable for that analyte.

NOTE: The large number of analytes present, a substantial probability that one or more will fail at least one of the acceptance criteria when many or all analytes are determined simultaneously. Therefore, the analyst is permitted to conduct a ‘‘re-test’’ as described here.

When one or more of the analytes tested fail at least one of the acceptance criteria, repeat the test for only the analytes that failed. If results for these analytes pass, system performance is acceptable and analysis of samples and blanks may proceed. If one or more of the analytes again fail, system performance is unacceptable for the analytes that failed the acceptance criteria. Correct the problem and repeat the test. To maintain the validity of the test and re-test, system maintenance and/or adjustment is not permitted between this pair of tests.

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10.2 Batches:

10.2.1 Extraction Batches:

Extraction batches are defined as sets of 1 - 20 samples. Extraction batches must include the following: 1 method blank, 1 Laboratory Control Sample (LCS)), 1 Matrix Spike/Spike Duplicate (MS/MSD) pair (if sufficient sample is available). Exceptions are made for waste dilution samples where the minimum batch QC must include a blank, and an LCS.

Additional instructions on Batch QC including required frequency and corrective actions can be found in Section 11 while acceptance criteria are found in the LIMS.

STATE NOTE: For samples from FL, AZ, MN and MA, 1 Laboratory Control Sample/Laboratory Control Sample Duplicate pair (LCS/LCSD) is required per batch.

10.2.2 Analytical Batches (sequences):

Analytical batches analysis must include the following: 1 Initial Calibration Verification (ICV) and BFB tune at the beginning of run, and/or 1 Continuing Calibration Verification (CCV) and BFB tune every 12 hours.

10.3 Perform BFB tune every 12 hours for 8260B, 8260C, and 6200B. BFB tuning for method 624 is every 24 hours. Tuning acceptance criteria are presented in Section 8.2.1. The computer software automatically evaluates the tune information. The analyst must be aware of the process used. The following options are available for acquiring the spectra for reference to meet the BFB tuning requirements. It is recommended that each initial tune verification utilize the “Autofind” function and be set up to look at three scans (the apex & $\pm$1 scan) and average the three scans then perform background subtraction. Background subtraction is required prior to the start of the peak but no more than 20 scans prior. Background correction cannot include any parts of the target peak. The scans must be averaged and background corrected. Average scans 0.1 minute before to 0.1 minute after the target peak including 2 scans and the peak apex.

STATE NOTE: BFB tuning must be performed every 12 hours when analyzing samples from South Carolina by Method 624.

10.3.1 Method 624.1 Requirements

10.3.1.1 At the beginning of each 12-hour shift during which standards or samples will be analyzed, perform the following tests to verify system performance.

10.3.1.2 BFB—Inject $\leq$50ng of BFB solution directly on the column. Alternatively, add BFB to reagent water or an aqueous standard such that 50ng or less of BFB will be introduced into the GC. Confirm that all applicable criteria are met. If all criteria are not met, perform system

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repair, retune the mass spectrometer, and repeat the test until all criteria are met.

10.3.1.3 Verify calibration with the LCS after the criteria for BFB are met and prior to analysis of a blank or sample. After verification, analyze a blank to demonstrate freedom from contamination and carry-over at the MDL. Tests for BFB, the LCS, and the blank are outside of the 12-hour shift, and the 12-hour shift includes samples and matrix spikes and matrix spike duplicates. The total time for analysis of BFB, the LCS, the blank, and the 12-hour shift must not exceed 14 hours.

10.4 Run a minimum of a 5-point initial calibration curve (3-point can be used if 624/6200B are being run independently of 8260B), using the primary source standards each time major instrument maintenance occurs, or if the CCV does not meet acceptance criteria. Acceptance criteria for initial calibration are presented in Section 8.2. Calibration is verified by analyzing Second Source Calibration Verification (SSCV) standard; acceptance criteria for the SSCV are presented in Section 8.3.1.

10.4.1 **Method 624.1**

If the RSD is less than 35%, the RF can be assumed to be invariant and the average RF can be used for calculations. Alternatively, the results can be used to fit a linear or quadratic regression of response ratios vs. concentration ratios. If used, the regression must be weighted inversely proportional to concentration. The coefficient of determination (R2) of the weighted regression must be greater than 0.920 (this value roughly corresponds to the RSD limit of 35%). Alternatively, the relative standard error may be used as an acceptance criterion. As with the RSD, the RSE must be less than 35%. If an RSE less than 35% cannot be achieved for a quadratic regression, system performance is unacceptable, and the system must be adjusted and re-calibrated.

10.5 Run a mid-point Continuing Calibration Verification (CCV) using the primary source standards every 12 hours before sample analysis and every 12 hours during an analytical sequence for 8260B, 8260C, 624 and 6200B. For 6200B, a closing standard must also be analyzed at the end of the sequence. See sections 8.3.2 – 8.3.6 for acceptance criteria.

10.6 Retention Time Evaluation

10.6.1 Internal standard retention time - 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 10 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 be made, as required. When corrections are made, reanalysis of samples analyzed while the system was malfunctioning is required.

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10.6.2 Evaluation of retention times - The relative retention time (RRT) of each target analyte in each calibration standard should agree within 0.06 RRT units. Late-eluting target analytes usually have much better agreement.

10.7 Instrument maintenance must be performed routinely to optimize instrument performance and improve chromatography. Commonly performed maintenance includes baking traps and columns, polishing detector windows, changing injection port liners, changing pump oil, etc. A new calibration curve must be analyzed following any major maintenance performed on the analytical system.

10.7.1 Method 624.1: Because the analytical system is calibrated by purge of the analytes from water, calibration verification is performed using the laboratory control sample (LCS).

10.8 METHOD BLANK - The analyst must confirm that this blank was analyzed at the required frequency of 1 per batch of 20 samples. The method blank must not exhibit any contamination of any analyte above the method detection limit for any of the method target analytes.

10.8.1 If more than one instrument blank or method blanks are analyzed, evaluate and assess the blank and field samples under the same conditions for possible mid-level standard carryover using the subsequent blank after the mid-level standard on a per analyte basis.

10.8.2 Method 624.1 – If any analyte of interest is found in the blank at a concentration greater than the MDL for the analyte, at a concentration greater than one-third the regulatory compliance limit, or at a concentration greater than one-tenth the concentration in a sample analyzed during the 12-hour shift, whichever is greater; analysis of samples must be halted and samples affected by the blank must be re-analyzed. If, however, continued re-testing results in repeated blank contamination, the laboratory must document and report the failures (e.g., as qualifiers on results), unless the failures are not required to be reported as determined by the regulatory/control authority. Results associated with blank contamination for an analyte regulated in a discharge cannot be used to demonstrate regulatory compliance.

10.9 LABORATORY CONTROL SAMPLES - Assess that LCSs were prepared at the required frequency of 1 per batch of 20. If the same injection is used for the LCS and the CCV, ensure that no more than 20 samples are analyzed in conjunction. Routine LCS Control limits are presented in the LIMS.

STATE NOTE: For all samples analyzed from South Carolina, the LCS/LCSD RPD must be <20%, recoveries must be 70-130% in a soil matrix, and recoveries must be within the following limits in a water matrix:

Benzene	70 – 130%
Bromodichloromethane	70 – 130%
Bromoform	70 – 130%
Bromomethane	70 – 130%

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Carbon tetrachloride	70 – 130%
Chlorobenzene	70 – 130%
Chloroethane	70 – 130%
2-Chloroethyl vinyl ether	70 – 130%
Chloroform	70 – 130%
Chloromethane	70 – 130%
Dibromochloromethane	70 – 130%
Dichlorodifluoromethane	70 – 130%
1,2-Dichlorobenzene	70 – 130%
1,3-Dichlorobenzene	70 – 130%
1,4-Dichlorobenzene	70 – 130%
1,1-Dichloroethane	70 – 130%
1,2-Dichloroethane	70 – 130%
1,1-Dichloroethene	70 – 130%
Trans-1,2-Dichloroethene	70 – 130%
1,2-Dichloropropane	70 – 130%
Cis-1,3-Dichloropropene	70 – 130%
Trans-1,3-Dichloropropene	70 – 130%
Ethyl benzene	70 – 130%
Methylene chloride	70 – 130%
Methyl tert-butyl ether	70 – 130%
1,1,2,2-Tetrachloroethane	70 – 130%
Tetrachloroethene	70 – 130%
Toluene	70 – 130%
1,1,1-Trichloroethane	70 – 130%
1,1,2-Trichloroethane	70 – 130%
Trichloroethene	71 – 130%
Trichlorofluoromethane	70 – 130%
Vinyl chloride	70 – 130%
Xylenes, total	70 – 130%

10.9.1 Method 624.1 Requirements

10.9.1.1 Compare the percent recovery (Q) for each analyte with its corresponding QC acceptance criterion in the following table. For analytes of interest not listed in the following table, use QC acceptance criteria developed for the LCS. If the recoveries for all analytes of interest fall within their respective QC acceptance criteria, analysis of blanks and field samples may proceed. If any individual Q falls outside the range, proceed according to Section 8.3.5.1.4.

624.1 Purgeable Analytes	Range for Q (%)
Acrolein	60-140
Acrylonitrile	60-140
Benzene	65-135

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TITLE: VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)

624.1 Purgeable Analytes	Range for Q (%)
Bromodichloromethane	65-135
Bromoform	70-130
Bromomethane	15-185
Carbon tetrachloride	70-130
Chlorobenzene	65-135
Chloroethane	40-160
2-Chloroethylvinyl ether	D-225
Chloroform	70-135
Chloromethane	D-205
Dibromochloromethane	70-135
1,2-Dichlorobenzene	65-135
1,3-Dichlorobenzene	70-130
1,4-Dichlorobenzene	65-135
1,1-Dichloroethane	70-130
1,2-Dichloroethane	70-130
1,1-Dichloroethene	50-150
trans-1,2-Dichloroethene	70-130
1,2-Dichloropropane	35-165
cis-1,3-Dichloropropene	25-175
trans-1,3-Dichloropropene	50-150
Ethylbenzene	60-140
Methylene chloride	60-140
1,1,2,2-Tetrachloroethane	60-140
Tetrachloroethene	70-130
Toluene	70-130
1,1,1-Trichloroethane	70-130
1,1,2-Trichloroethane	70-130
Trichloroethene	65-135
Trichlorofluoromethane	50-150
Vinyl chloride	5-195

10.9.1.2 Repeat the test only for those analytes that failed to meet the acceptance criteria (Q). If these analytes now pass, system performance is acceptable and analysis of blanks and samples may proceed. Repeated failure, however, will confirm a general problem with the measurement system. If this occurs, repeat the test using a fresh LCS or an LCS prepared with a fresh QC check sample concentrate, or perform and document system repair. Subsequent to repair, repeat the calibration verification/LCS test. If the acceptance criteria for Q cannot be met, re-calibrate the instrument. To maintain the validity of the test and re-test, system maintenance and/or adjustment is not permitted between the pair of tests

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TITLE: VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)

10.10 MATRIX SPIKE/MATRIX SPIKE DUPLICATE ASSESSMENT: Assess that matrix spike/matrix spike duplicates were analyzed at required frequency of 1 per batch of 20 if volume allows.

- The analyst also verifies that the samples were spiked at the appropriate level.
- The order of preference for spiking levels is as follows;

1) If the target analyte concentrations are known, spike to increase the background concentration by a factor of approximately two;

2) If an action level exists, spike at this level

3) If neither of the first two conditions applies, spike at a level that corresponds between the low and mid-level calibration standards.

4) All RPD results must be within the indicated control limits found in the LIMS.

Acceptance criteria are that all %Recovery and/or RPD results must be within the indicated control limits on the appropriate MS control charts. See the LIMS for LCS/LCSD & MS/MSD limits and QC acceptance.

STATE NOTE: For all water samples analyzed from South Carolina, the MS/MSD recoveries must be within the most stringent limits comparing in-house derived recovery limits to those given in Table 3 of Method 608. The following are the current water limits:

Benzene	58.6 - 133%
Bromodichloromethane	69.2 – 127%
Bromoform	66.3 – 140%
Bromomethane	16.6 – 183%
Carbon tetrachloride	70 – 139%
Chlorobenzene	70.1 – 130%
Chloroethane	33.3 – 155%
2-Chloroethyl vinyl ether	5 – 149%
Chloroform	66.1 – 133%
Chloromethane	40.7 – 139%
Dibromochloromethane	69.2 – 127%
Dichlorodifluoromethane	42.2 – 146%
1,2-Dichlorobenzene	77.4 – 127%
1,3-Dichlorobenzene	67.9 – 136%
1,4-Dichlorobenzene	74.4 – 123%
1,1-Dichloroethane	64 – 134%
1,2-Dichloroethane	60.7 – 132%
1,1,-Dichloroethene	48.8 – 144%
Trans-1,2-Dichloroethene	61 – 132%
1,2-Dichloropropane	69.7 – 132%
Cis-1,3-Dichloropropene	71.1 – 129%

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Trans-1,3-Dichloropropene	66.3 – 136%
Ethyl benzene	62.7 – 136%
Methylene chloride	61.5 – 125%
Methyl tert-butyl ether	61.4 – 136%
1,1,2,2-Tetrachloroethane	64.9 – 145%
Tetrachloroethene	64 – 141%
Toluene	67.8 – 124%
1,1,1-Trichloroethane	58.7 – 134%
1,1,2-Trichloroethane	74.1 – 130%
Trichloroethene	71 – 148%
Trichlorofluoromethane	39.9 – 165%
Vinyl chloride	44.3 – 143%
Xylenes, total	65.6 – 133%

10.10.1 Method 624.1 Requirements

10.10.1.1 Spike at least 5% of the samples in duplicate from each discharge being monitored to assess accuracy (recovery and precision). If direction cannot be obtained from the data user, the laboratory must spike at least one sample in duplicate per extraction batch of up to 20 samples with the analytes in the table in Section 10.10.1.3. Spiked sample results should be reported only to the data user whose sample was spiked, or as requested or required by a regulatory/control authority, or in a permit.

10.10.1.2 If the concentration of a specific analyte will be checked against a regulatory concentration limit, the concentration of the spike should be at that limit; otherwise, the concentration of the spike should be one to five times higher than the background concentration, at or near the mid-point of the calibration range, or at the concentration in the LCS whichever concentration would be larger.

10.10.1.3 Compare the percent recoveries (P1 and P2) and the RPD for each analyte in the MS/MSD aliquots with the corresponding QC acceptance criteria in the following table. A laboratory may develop and apply QC acceptance criteria more restrictive than the presented criteria if desired.

624.1 Purgeable Analytes	Range for P1, P2 (%)	Limit for RPD
Acrolein	40-160	60
Acrylonitrile	40-160	60
Benzene	37-151	61
Bromodichloromethane	35-155	56
Bromoform	45-169	42
Bromomethane	D-206	61

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624.1 Purgeable Analytes	Range for P1, P2 (%)	Limit for RPD
Carbon tetrachloride	70-140	41
Chlorobenzene	37-160	53
Chloroethane	14-230	78
2-Chloroethylvinyl ether	D-305	71
Chloroform	51-138	54
Chloromethane	D-273	60
Dibromochloromethane	53-149	50
1,2-Dichlorobenzene	18-190	57
1,3-Dichlorobenzene	59-156	43
1,4-Dichlorobenzene	18-190	57
1,1-Dichloroethane	59-155	40
1,2-Dichloroethane	49-155	49
1,1-Dichloroethene	D-234	32
trans-1,2-Dichloroethene	54-156	45
1,2-Dichloropropane	D-210	55
cis-1,3-Dichloropropene	D-227	58
trans-1,3-Dichloropropene	17-183	86
Ethylbenzene	37-162	63
Methylene chloride	D-221	28
1,1,2,2-Tetrachloroethane	46-157	61
Tetrachloroethene	64-148	39
Toluene	47-150	41
1,1,1-Trichloroethane	52-162	36
1,1,2-Trichloroethane	52-150	45
Trichloroethene	70-157	48
Trichlorofluoromethane	17-181	84
Vinyl chloride	D-251	66

10.10.1.4 If any individual P falls outside the designated range for recovery in either aliquot, or the RPD limit is exceeded, the result for the analyte in the unspiked sample is suspect.

10.10.1.5 If in-house QC limits are developed, at least 80% of the analytes tested in the MS/MSD must have in-house QC acceptance criteria that are tighter than those in Section 10.10.1.3 and the remaining analytes (those other than the analytes included in the 80%) must meet the acceptance criteria in Section 10.10.1.3. If an in-house QC limit for the RPD is greater than the limit in Section 10.10.1.3, then the limit in the table must be used. Similarly, if an in-house lower limit for recovery is below the lower limit in Section 10.10.1.3, then the lower limit in the table must be used, and if an in-house upper limit for recovery is above the upper limit in Section 10.10.1.3, then the upper limit in the table must be used.

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10.11 SURROGATE EVALUATION: Check the surrogate calculations for correctness for all samples, blanks, ICV/CCV/SSCV, LCS/LCSD, MS, MSD, and MD. Acceptance criteria can be found in the LIMS: The surrogate recoveries for all QC samples must be within established control limits.

10.11.1 Method 624.1 – Spike the surrogates into all samples, blanks, LCSs, and MS/MSDs. Compare surrogate recoveries against limits must be developed by the laboratory. In-house QC acceptance criteria must be updated at least every two years. If any recovery fails its criteria, attempt to find and correct the cause of the failure.

10.12 INTERNAL STANDARD AREA COUNT: When a calibration is performed at the beginning of an analytical run, the internal standard areas must be evaluated against the mid-point of the curve. Internal standard responses must be -50% to 200% to be acceptable. Samples are analyzed within a 12-hour window; the internal standards of those samples are evaluated against mid-point of the curve. Then a CCV is analyzed, this is compared to the mid-point of the initial calibration curve. Addition samples are analyzed within a 12-hour window; the internal standards of those samples are evaluated against the previous acceptable CCV. When an analytical run is started using a passing ICV (which is compared against the initial calibration mid-point to verify the calibration curve): Samples are analyzed within a 12-hour window, the internal standards of those samples are evaluated against the daily CCV. Then a CCV is analyzed, this is compared to the mid-point of the curve. Additional samples are analyzed within a 12-hour window; the internal standards of those samples are evaluated against the previous acceptable CCV.

CLIENT NOTE: For Marathon, the internal standard area counts for all calibration standards, QC samples, and samples for quantitation must not change by a factor of greater than (-50% to +130%) as per section 8.3.6

10.12.1 Method 624.1 – The responses of each internal standard in each sample, blank, and MS/MSD must be within 50% to 200% (1/2 to 2×) of its respective response in the mid-point calibration standard. If, as a group, all internal standards are not within this range, perform and document system repair, repeat the calibration verification/LCS test, and re-analyze the affected samples. If a single internal standard is not within the 50% to 200% range, use an alternative internal standard for quantitation of the analyte referenced to the affected internal standard. It may be necessary to use the data system to calculate a new response factor from calibration data for the alternative internal standard/analyte pair. If an internal standard fails the 50–200% criteria and no analytes are detected in the sample, ignore the failure or report it if required by the regulatory/control authority.

10.13 SECOND SOURCE: The second source calibration verification standard must be analyzed following each new initial calibration to verify the validity of the calibration standards. The recovery of the analytes in the SSCV must be within 30% of the expected concentration for CCC and SPCC compounds and within 40% for non-

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CCC/SPCC compounds. Poor performers listed in section 8.3.4 must recover within in-house calculated LCS recovery acceptance limits.

STATE NOTE: For all samples analyzed from Minnesota, the reporting limit must be verified at least monthly. The reporting limit verification (RLV) must recovery within ±40% of the expected concentration. If these criteria are not met, the RLV may be re-analyzed once, instrument maintenance can be performed or a higher concentration standard can be analyzed. If a higher concentration standard is utilized, the reporting limit must be raised to the higher level verified.

10.13.1 Method 624.1 Calibration verification/LCS—The working calibration curve or RF must be verified immediately after calibration and at the beginning of each 12-hour shift by the measurement of an LCS. The LCS must be from a source different from the source used for calibration, but may be the same as the sample prepared for the DOC.

10.14 The laboratory participates in semi-annual proficiency testing that meets and/or exceeds the requirements of the Quality Control Sample as listed in the published Standard Method SM 6200B-2011, *Volatile Organic Compounds,* and SM 6020-2011, *Quality Assurance/Quality Control*.

10.15 For sample analyzed per the requirements of Method 8000D, the LLOQ (see Section 1.8.2) must be verified at least annually, and whenever significant changes are made to the preparation and/or analytical procedure, to demonstrate quantitation capability at lower analyte concentration levels.

10.15.1 The LLOQ verification (to be performed after the initial calibration) is prepared by spiking a clean control material with the analyte(s) of interest at 0.5-2 times the LLOQ concentration level(s).

10.15.2 The LLOQ check is carried through the same preparation and analytical procedures as environmental samples and other QC samples.

10.15.3 It is recommended to analyze the LLOQ verification on every instrument where data is reported; however, at a minimum, the lab must rotate the verification among similar analytical instruments such that all are included within 3 years.

10.15.4 Recovery of target analytes in the LLOQ verification must be within established in-house limits or within other such project-specific acceptance limits to demonstrate acceptable method performance at the LLOQ. Until the laboratory has sufficient data to determine acceptance limits, the LCS criteria ± 20% (i.e., lower limit minus 20% and upper limit plus 20%) may be used for the LLOQ acceptance criteria.

11.0 DATA VALIDATION AND CORRECTIVE ACTION

11.1 SITE-SPECIFIC requirements and STATE SPECIFIC criteria must be reviewed and used, if known, for data review.

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11.2 All data must undergo a primary review by the analyst. The analyst must check the performance of the initial calibration, mid-point check standard, and continuing calibrations to ensure that they meet the criteria of the method. The analyst must review any sample that has quantifiable compounds and make sure that they have been confirmed. The analyst must also verify that reported results are derived from quantitation between the MDL and the highest standard of the initial calibration curve. All calculations must be checked (any dilutions, %solids, etc.). Data must be checked for the presence or absence of appropriate flags. Comments must be noted when data is flagged.

11.3 INITIAL AND CONTINUING CALIBRATION VERIFICATION STANDARD: An Initial Calibration Verification (ICV) standard is analyzed before sample analysis can begin and a continuing calibration verification (CCV) standard was analyzed every 12 hours and meets the criteria in Section 8.0. If these criteria are exceeded and analysis of a second consecutive (immediate) calibration verification fails to produce results within acceptance criteria, corrective actions shall be performed. The laboratory shall demonstrate acceptable performance after the final round of corrective action with two consecutive calibration verifications, or a new initial instrument calibration shall be performed.

Method 8000D: To determine calibration function acceptability, refit the initial calibration data back to the calibration model and calculate %Error (see Section 9.5). Percent error between the calculated and expected amounts of an analyte must be $\leq$30% for all standards. For some data uses, $\leq$50% may be acceptable for the lowest calibration point.

11.4 METHOD BLANK -

Blank contamination above the report limit – All samples containing detectable amounts above the reporting limit must be re-analyzed or qualified. Samples with no detectable amounts above the reporting limit do not require re-analysis, but the samples must be qualified with blank contamination and it must be mentioned in the case narrative in the data package.

General guidelines for qualifying sample results with regard to method blank quality are as follows:

- If the method blank concentration is less than the MDL and sample results are greater than the RL, then no qualification is required.
- No qualification is necessary when an analyte is detected in the method blank but not in the associated samples.
- If the concentration in a sample is more than ten times the concentration in the method blank, then no qualification is required.
- If the method blank concentration is greater than the MDL but less than the RL and sample results are greater than the MDL, then qualify associated sample results to indicate that analyte was detected in the method blank.
- If the method blank concentration is greater than the RL, further corrective action and qualification is required. An analyst should consult their supervisor for further instruction.

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Instrument blanks may be injected at any time in the sequence to verify absence of contamination. The source of contamination must be investigated and reduced or eliminated. Any time contamination is noted in the method blank, the situation and impact on the data should be discussed in the case narrative.

11.4.1 **Method 8000D:** When samples that are extracted together are analyzed on separate instruments or in separate analytical shifts, the method blank associated with those samples (e.g., extracted with the samples) must be analyzed on at least one of those instruments. A solvent blank must be analyzed on all other instruments on which the set of samples was analyzed to demonstrate the instrument is not contributing contaminants to the samples. At least one method blank or instrument blank must be analyzed on every instrument after calibration standard(s) and prior to the analysis of any samples.

When sample extracts are subjected to cleanup procedures, the associated method blank must also be subjected to the same cleanup procedures.

Results of the method blank should be less than the LLOQ for the analyte or less than the level of acceptable blank contamination specified in the approved QAPP or other appropriate systematic planning document. Blanks are generally considered to be acceptable if target analyte concentrations are less than one-half the LLOQ or are less than project-specific requirements.

When new reagents or chemicals are received, the lab should monitor the blanks associated with samples for any signs of contamination. It is not necessary to test every new batch of reagents or chemicals prior to sample preparation if the source shows no prior problems. However, if reagents are changed during a preparation batch, separate blanks need to be prepared for each set of reagents.

11.5 LABORATORY CONTROL SAMPLES - If the recovery does not meet criteria, see section 11.6 for marginal failures. If it is still out of control limits, then all field and QC samples in the batch must be re-analyzed.

REQUIRED RE-ANALYSIS - None of the following compounds can recover beyond established criteria: 1,1-dichloroethene, trichloroethene, chlorobenzene, toluene, and benzene. If any of these compounds fail, the LCS and all affected batch samples must be re-analyzed.

STATE NOTE: **SOUTH CAROLINA DHEC Compliance LCS:** responses must be within 70 – 130% for Method 8260 and within the limits given in Attachment VI for Method 624. No failures are acceptable; Qualifiers cannot be used. (If an LCS standard is above the acceptable QC criteria and all samples being reported are below the reporting limit, the data is acceptable based on a high bias with undetectable levels in the field samples. Any positive samples require reanalysis.) Failures require a batch re-analysis. For samples analyzed from South Carolina that are not utilized for compliance purposes, in house established acceptance limits are utilized to demonstrate controlled analyses.

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Qualifiers must be applied to any LCS compound that does not meet these criteria and are considered out of control. The percent difference for all method target analytes must be within QC RPD limits. If not, re-analyze the duplicate(s) or prepare a new calibration curve, as necessary.

11.6 LCS/LCSD & MS/MSD CRITERIA

11.6.1 Quality control criteria must be checked for the LCS and LCSD.

LCS samples that do not pass the acceptable QC criteria must be re-analyzed. LCS failures can meet marginal exceedance criteria below. Normal compound list for 8260/624 contains typical 90 analytes; therefore only five analyte can be considered as marginal exceedances. If the failure persists, re-prepare and re-analyze the entire sample batch.

When a large number of analytes exist in the LCS, it is statistically possible for a few analytes to be outside of control limits. Upper and lower marginal exceedance (ME) limits are established by +/- four times the standard deviation. The number of marginal exceedance is based on the number of analytes in the LCS.

Number of allowable marginal exceedances:

>90 analytes, 5 analytes allowed in the ME limit
71 – 90 analytes, 4 analytes allowed in the ME limit.
51 – 70 analytes, 3 analytes allowed in the ME limit.
31 – 50 analytes, 2 analytes allowed in the ME limit.
11 – 30 analytes, 1 analyte allowed in the ME limit.
< 11 analytes, no analyte allowed in the ME limit.

Marginal exceedances must be random events.

STATE NOTE: For South Carolina DHEC compliance samples, marginal exceedances do not apply. All outliers in QC require corrective action when possible and the data must be flagged when necessary.

11.6.2 **Method 8000D:** If, as in compliance monitoring, the concentration of a specific analyte in the sample is being checked against a regulatory concentration limit or action level, the spike should be at or below the limit, or 1 - 5 times the background concentration (if historical data are available), whichever concentration is higher. If historical data are not available, a background sample of the same matrix from the site may be submitted for matrix spiking purposes to ensure that high concentrations of target analytes and/or interferences will not prevent calculation of recoveries. If the background sample concentration is very low or non-detect, a spike of greater than 5 times the background concentration is still acceptable. To assess data precision with duplicate analyses, it is preferable to use a low concentration field sample to prepare a MS/MSD for organic analyses. This spiking procedure will be performed when project-specific instructions are received from the client.

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If the concentration of a specific analyte in a sample is not being checked against a limit specific to that analyte, then the analyst may spike the matrix spike or MS/MSD sample(s) at the same concentration as the reference sample at 20 times the estimated LLOQ in the matrix of interest, or at a concentration near the middle of the calibration range. It is suggested that a background sample of the same matrix from the site be submitted as a sample for matrix spiking purposes. NOTE: Preparing the spiking solution from the same source as the calibration standards helps minimize additional variability due to differences between sources. Typically, spiking concentrations are near the middle of the calibration range.

To develop precision and bias data for the spiked compounds, the analyst has two choices: analyze the original sample, and an MS/MSD pair; or analyze the original sample, a duplicate sample, and one spiked sample. If samples are not expected to contain the target analytes of concern, then the laboratory may use a MS/MSD pair. If samples are expected to contain the target analytes of concern, then the laboratory may use one matrix spike and a duplicate analysis of an unspiked field sample as an alternative to the MS/MSD pair.

The laboratory should use 70 - 130% as interim acceptance criteria for recoveries of spiked analytes, until in-house LCS limits are developed. Where in-house limits have been developed for matrix spike percent recoveries, the LCS results should be similar to or tighter than those limits, as the LCS is prepared in a clean matrix.

11.7 MATRIX SPIKE ASSESSMENT: If acceptance criteria are not met, perform the following corrective actions as appropriate.

- If both LCS and MS/MSD recoveries are unacceptable, then the entire batch of field and QC samples must be re-analyzed.
- If the MS/MSD is unacceptable, but the LCS is acceptable, then a potential matrix effect has been identified. Re-analyze to verify the matrix effect. If a matrix effect is still suspected, then the project manager must be contacted to discuss further alternatives and the potential impact on the project. Reported data must be flagged. Reasonable attempts must be made to address matrix interference.

Acceptance criteria are that all RPD results must be within the current control limits found in the LIMS. If these conditions are not met, perform the following corrective actions as appropriate.

- Re-analyze the sample to verify a matrix effect.
- If the duplicate precision is still unacceptable, and LCS precision is acceptable, then a potential matrix effect has been identified. The project manager must be contacted to discuss further alternatives and the potential impact on the project.

STATE NOTE: South Carolina DHEC compliance analyses require that all target compounds meet the established MS/MSD criteria. No qualifiers

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can be applied, except in the circumstance where matrix interference is apparent and confirmed.

PROJECT SPECIFIC CRITERIA (Non-South Carolina Samples): Acceptance criteria are that all %Recovery and/or RPD results meet project-established goals.

11.8 SURROGATE EVALUATION: If the surrogate recoveries are outside limits for Blank, ICV/CCV/SSCV, and LCS/LCSD, re-analysis must be performed for verification. If recoveries are still outside control limits, corrective action is necessary. All samples associated with batch or sequence needs to be re-analyzed. The surrogate recoveries for all field samples must be within established control limits. If more than one surrogates recoveries are outside limits, re-analysis must be performed for verification. If recoveries are still outside control limits, corrective action is necessary which includes qualifying data with J1 (outside upper limit) or J2 (outside lower limit). When one or two surrogates fail, data is qualified with J1 (outside upper limit) or J2 (outside lower limit).

11.9 INTERNAL STANDARD AREA COUNT: If the area response for any of the internal standards changes by a factor of two (-50% to +100%) as per section 8.3.6, the mass spectrometer must be inspected for malfunctions and corrections must be made, as appropriate. In the event the internal standard area counts fail these criteria, the following corrective actions should be considered.

- Check to be sure there are no errors in the internal standards preparation or addition. Also check instrument performance.
- If any internal standard criteria fails high (> +100%), sample must be re-analyzed with possible dilution. If recoveries are still outside control limits, corrective action is necessary which includes qualifying compounds with associated internal standard with J9 (IS high, data is likely to show low bias).
- If more than two internal standard criteria fails low « -50%), sample must be re-analyzed. If recoveries are still outside control limits, corrective action is necessary which includes qualifying compounds with associated internal standard with J8 (IS low, data is likely to show high bias).
- If one or two internal standard criteria fails low « -50%), corrective action is necessary which includes qualifying compounds with associated internal standard with J8 (IS low, data is likely to show high bias).

11.10 CALIBRATION RANGE: The analyst must verify all reported results are derived from analytical results that are below the highest standard of the initial calibration curve and above the low standard. Values reported below the low standard are to be reported as estimated values (J values). For samples that exceed the calibration curve, dilute and analyze an appropriate sample aliquot.

11.11 SECOND SOURCE: If the SSCV does not meet acceptance criteria, if can be reanalyzed once. If the failure persists, a new initial calibration curve must be prepared and analyzed.

11.12 Data that does not meet acceptable QC criteria may be acceptable for use in certain circumstances.

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11.12.1 If a method blank contains an amount of target analyte, but all samples are non-detected or the samples contain analyte at a level that is greater than 10 times the level present in the blank, the data is reported with the appropriate "B" flag.

11.12.1.1 When comparing analyte contamination in the blank to possible analyte contamination in the field sample, utilize the sample concentration without applying the multiplier value unless the same multiplier has been applied to the quantitation of the target analytes in the blank.

11.12.2 If the sample surrogate is above the acceptable QC range, but the samples are non-detected for all target analytes, flag the sample with a J1 and report. If the surrogate is below the acceptable QC range, re-analyze the sample if the surrogate still fails, re-extract and re-analyze or flag data.

11.12.3 Matrix spike failures must be flagged with "J5" (high) or "J6" (low), when QC limits are exceeded. If there is an RPD failure, the data is flagged with a "J3".

11.13 Quantitation and manual integration of all QC samples and client samples must follow the procedures outlined in SOP #030215, *Manual Integration Procedure*. "Before" and "After" quantitation reports must be printed in order to verify that any manual integration is performed properly and consistently.

11.14 Data must be checked to ascertain if it conforms to accepted practices. All sample analytical results used for final data reporting must be between the low standard and the high calibration standard. Values falling above the high standard must be diluted and re-analyzed.

11.14.1 Site specific DQO's may require values below the reporting limit but above the method detection limit be reported as "UJ" or estimated value. The reporting limit is the concentration of the lowest standard used in the calibration.

11.14.2 All tentatively identified compounds (TICs) are reported with a "J" qualifier for estimated value and an "N" for presumptive evidence of material.

11.15 For samples analyzed per the requirements of Method 8000D, reported concentrations of target analytes between the MDL and the LLOQ must be qualified as estimated.

12.0 POLLUTION PREVENTION AND WASTE MANAGEMENT

12.1 The EPA requires that laboratory waste management practice to be conducted consistent with all applicable federal and state laws and regulations. Excess reagents, samples and method process wastes must be characterized and disposed of in an acceptable manner. See *ESC Waste Management Plan.*

12.2 See SOP #030302, *Environmental Sustainability & Pollution Prevention*.

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13.0 METHOD MODIFICATIONS/CLARIFICATIONS

13.1 Adjustments to the concentrations of standards/spiking solutions, standards providers, and quality control are subject to change to better meet client/project/regulatory needs or to improve laboratory method performance.

13.2 Modifications to this method are noted in the body of the text as state notes. Compliance analyses performed in conjunction with specific state requirements must be performed as noted within the specific state(s) note listed.

13.3 Heated purge may be used for all samples regardless of matrix or method.

14.0 REFERENCES

14.1 *Determinative Chromatographic Separations*, SW846 Method 8000B, Revision 2, December 1996.

14.2 *Determinative Chromatographic Separations*, SW846 Method 8000C, Revision 3, March 2003.

14.3 *Determinative Chromatographic Separations*, SW846 Method 8000D, Revision 4, July 2014.

14.4 *Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)*, SW-846 Method 8260B, Revision 2, December 1996.

14.5 *Purgeables*, 40 CFR 136, EPA Method 624

14.6 *Volatile Organic Compounds by the Purge and Trap Capillary-Column Gas Chromatographic/Mass Spectrometric Method*, SM 6200B, 20th edition.

14.7 Policy Document, NELAC Standard, Chapter 2: Proficiency Testing Program Standard and the relevant section of NELAC Standard Chapter 5 National Environmental Laboratory Accreditation Conference

14.8 *Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)*, SW-846 Method 8260C, Revision 3, August 2006.

14.9 *Volatile Organic Compounds by the Purge and Trap Capillary-Column Gas Chromatographic/Mass Spectrometric Method*, SM 6200B-2011.

14.10 *Purgeables by GC/MS*, EPA Method 624.1, Federal Register, Volume 82, Number 165, August 28, 2017.

14.11 40 Code of Federal Regulations §136.6(b)(4)(j).

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Attachment I: Revision History

Current Version:

Version	Date	Description of Revisions
25	1/2/2018	Technical and quality review and update. Added Method 624.1 to title. Revised Sections 2.1, 8.1.3, and 8.2.2. Added Section 4.4 and all subsections, 7.5.2.3, 8.2.9, 8.3.4, 8.3.5.1 and all subsections, 8.8.6.1, 8.8.6.2, 8.8.6.3, 8.8.6.4, 9.5, 10.1.1 and all subsections, 10.3.1 and all subsections, 10.4.1, 10.7.1, 10.8.2, 10.9.1 and all subsections, 10.10.1 and all subsections, 10.11.1, 10.12.1, 10.13.1, 14.10, and 14.11.

Superseded Versions:

This document supersedes the following:

Version	Date	Description of Revisions
0	8/23/94	Origination
1	7/25/95	
2	9/12/97	
3	8/4/98	
4	2/11/00	
5	8/21/00	
6	4/1/01	
7	10/16/01	
8	8/19/02	
9	7/23/03	
10	10/30/03	
11	1/26/04	
12	6/28/04	
13	12/11/04	
14	3/23/05	
15	12/19/07	
16	1/30/09	Technical and Quality Review and update. Updated Table 1; Clarified holding times; Updated Note in Section 7; Updated section 7.4.1 & 7.4.2; Updated section 7.6, 7.8.4, 8.1.2, 8.2.3, 8.2.3.2, 8.2.4.1, 8.2.6.2 & 12.0; Added state note (MN) section 8.2.2, added final bullet item, added state note (OH); Added section 8.2.6.4; section 9.11 (state note), section 11.1 (state note), section 11.7.1 (state note), section 11.13, & 13.1; Ohio VAP approved 1/30/09

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Standard Operating Procedure

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TITLE: VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)

Version	Date	Description of Revisions
17	3/12/12	Technical and Quality Review and update. Added Attachment VIII and sections 2.15 through 2.17, 8.2.7, 8.3.2, 9.10, 10.8 through 10.13, 13.2 14.5, 14.6, state note in section 1.0, and client note in section 11.11; Revised Attachments II through IV, VII and sections 1.3, 3.1, 4.1, 4.2, 4.3, 7.1, 7.5.1, 7.5.2, 7.9.3, 8.2.2, 8.2.3, 8.2.6, 8.3.1, 8.3.3, 8.3.4, 8.7.2, 9.1, 9.2, 9.6 through 9.8, 10.2, 10.3, 10.5, and 12.1; Removed section 9.3.
18	12/11/13	Technical and Quality Review and update. Added state notes in sections 1.0, 10.1, 10.3 and sections 10.14 and 14.7; Revised state notes in sections 1.0, 4.2 and sections 5.5, 6.1, 6.4, 7.1, 7.2, 7.5.1, 7.5.2, 7.6, 7.7, 8.2.4, 8.2.7.3, 8.3.1.4, 8.3.2.2, 8.5.1 and 10.5; Revised Attachments II, IV, VIII; Removed state notes pertaining to Ohio VAP throughout and sections 8.2.3.3 and 11.14.1.
19	2/13/15	Technical and Quality Review and update. Revised all state notes regarding South Carolina sample analyses; Revised sections 7.5.1, 7.5.2 and 8.3.3; Revised Attachments VIII.
20	9/2/2015	Header and signature block re-formatting. Technical and Quality Review and update. Added Section 9.11 and Attachment IX. Revised Sections 10.2.1, 10.6, 10.6.1, 10.6.2, 10.9, 10.10, 10.11, and 11.7. Deleted Sections 10.6.3 and 10.6.4. Revised footnote in Attachment II. Replaced Attachment VIII.
21	10/29/2015	Technical and quality review and update. Revised Sections 8.3.4, 10.8, and 11.4. Added State Note in Sections 8.2.1 and 10.3.
22	11/17/2015	Technical and quality review and update. Revised Sections 1.3.1, 7.1, 8.3.4, 8.5.9, 10.9, 11.5, and 12.2.
23	10/19/2016	Technical and quality review and update. Header and signature block re-formatting. Revised Sections 1.0, 2.3, 2.4, 4.2, 4.3, 5.3.4, 5.5, 6.1, 6.6.4, 6.8, 7.2, 7.5.1.1, 7.5.2.1, 8.2.3.1, 8.2.4.1, 8.2.7.3, 8.2.8.2, 8.5.5, 8.5.6, 8.5.7.1, 8.5.7.3, 8.6.3, 8.7.2.4, 8.7.2.6, 8.7.2.7, 9.1, 9.2, 9.3, 9.5, 10.2.2, 10.9, 10.10, 11.3, 11.13, 14.1, 14.4, 14.5, 14.6, 14.8, 14.9, Attachment V, Attachment VIII, and Attachment IX Table 2. Added Sections 1.3.2, 9.4, 10.15, 10.15.1, 10.15.2, 10.15.3, 10.15.4, 11.4.1, 11.6.2, 11.15, 13.3, 14.2, and 14.3. Deleted Sections 2.4 through 2.17, 8.5.7.4, 8.5.7.5, 9.1, 9.2, 9.5, 9.6, 9.7, and 9.8.
24	11/28/2017	Technical and quality review and update. Changed ESC logo. Revised Sections 1.0, 3.1, 4.3, 7.5, 7.5.1, 7.5.1.1, 7.5.1.2, 7.5.2, 7.5.2.1, 7.5.2.2, 8.2.3.1, 8.2.3.2, 8.2.4.1, 8.3.1.1, 8.3.1.2, 8.3.2.1, 8.3.2.2, 8.3.3, 8.4.1, 8.4.2, 10.2.1, 10.5, 10.9, 10.10, 10.12, 11.5, and Attachment IX Table 5. Added Sections 8.7.2.8 and 10.8.1.

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TITLE: VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)

Attachment II: 8260/624/6200B Reporting Limits and Common Analyte List

Compound	Water		Low Soil		High Soil	
	RL	Units	RL*	Units	RL	Units
Acetone	0.050	mg/L	0.050	mg/Kg	2.5	mg/Kg
Acrolein	0.050	mg/L	0.050	mg/Kg	2.5	mg/Kg
Acrylonitrile	0.010	mg/L	0.010	mg/Kg	0.5	mg/Kg
Benzene	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
Bromobenzene	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
Bromodichloromethane	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
Bromoform	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
Bromomethane	0.005	mg/L	0.005	mg/Kg	0.25	mg/Kg
1,3-Butadiene	0.0025	mg/L	0.0025	mg/Kg	0.125	mg/Kg
n-Butylbenzene	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
sec-Butylbenzene	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
tert-Butylbenzene	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
Carbon tetrachloride	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
Chlorobenzene	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
Chlorodibromomethane	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
Chloroethane	0.005	mg/L	0.005	mg/Kg	0.25	mg/Kg
2-Chloroethyl vinyl ether	0.050	mg/L	0.050	mg/Kg	2.5	mg/Kg
Chloroform	0.002	mg/L	0.002	mg/Kg	0.10	mg/Kg
Chloromethane	0.0025	mg/L	0.001	mg/Kg	0.05	mg/Kg
2-Chlorotoluene	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
4-Chlorotoluene	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
1,2-Dibromo-3-Chloropropane	0.005	mg/L	0.005	mg/Kg	0.25	mg/Kg
1,2-Dibromoethane	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
Dibromomethane	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
1,2-Dichlorobenzene	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
1,3-Dichlorobenzene	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
1,4-Dichlorobenzene	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
Dichlorodifluoromethane	0.005	mg/L	0.005	mg/Kg	0.25	mg/Kg
1,1-Dichloroethane	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
1,2-Dichloroethane	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
1,1-Dichloroethene	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
cis-1,2-Dichloroethene	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
trans-1,2-Dichloroethene	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
1,2-Dichloropropane	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
1,1-Dichloropropene	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
1,3-Dichloropropane	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg

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TITLE: VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)

Compound	Water		Low Soil		High Soil	
	RL	Units	RL*	Units	RL	Units
cis-1,3-Dichloropropene	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
trans-1,3-Dichloropropene	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
2,2-Dichloropropane	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
Dicyclopentadiene	0.001	Mg/L	0.001	mg/Kg	0.05	mg/Kg
Di-isopropyl ether	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
4-Ethyltoluene	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
Ethylbenzene	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
Hexachlorobutadiene	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
Hexane	0.010	mg/L	0.010	mg/Kg	0.50	mg/Kg
Isopropylbenzene	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
p-Isopropyltoluene	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
Propene	0.0025	mg/L	0.0025	mg/Kg	0.125	mg/Kg
2,2,4-Trimethyl Pentane	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
2-Butanone (MEK)	0.010	mg/L	0.010	mg/Kg	0.50	mg/Kg
Methylene Chloride	0.005	mg/L	0.005	mg/Kg	0.25	mg/Kg
4-Methyl-2-pentanone (MIBK)	0.010	mg/L	0.010	mg/Kg	0.50	mg/Kg
Methyl tert-butyl ether	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
Naphthalene	0.005	mg/L	0.005	mg/Kg	0.25	mg/Kg
n-Propylbenzene	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
Styrene	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
1,1,1,2-Tetrachloroethane	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
1,1,2,2-Tetrachloroethane	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
Tetrachloroethene	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
Toluene	0.005	mg/L	0.005	mg/Kg	0.25	mg/Kg
1,2,3-Trichlorobenzene	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
1,2,4-Trichlorobenzene	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
1,1,1-Trichloroethane	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
1,1,2-Trichloroethane	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
Trichloroethene	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
Trichlorofluoromethane	0.005	mg/L	0.005	mg/Kg	0.25	mg/Kg
1,2,3-Trichloropropane	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
1,2,4-Trimethylbenzene	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
1,3,5-Trimethylbenzene	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
Vinyl chloride	0.001	mg/L	0.001	mg/Kg	0.05	mg/Kg
Xylenes, Total	0.003	mg/L	0.003	mg/Kg	0.15	mg/Kg
Additional Compounds						
Acetonitrile	0.050	mg/L	0.050	mg/Kg	2.5	mg/Kg
Allyl Chloride	0.005	mg/L	0.005	mg/Kg	0.25	mg/Kg

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TITLE: VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)

Compound	Water		Low Soil		High Soil	
	RL	Units	RL*	Units	RL	Units
Chloroprene	0.050	mg/L	0.050	mg/Kg	2.5	mg/Kg
Trans-1,4-Dichloro-2-butene	0.0025	mg/L	0.0025	mg/Kg	0.125	mg/Kg
Isobutanol	0.100	mg/L	0.100	mg/Kg	5.0	mg/Kg
1,4-Dioxane+	0.100	mg/L	0.100	mg/Kg	5.0	mg/Kg
Methacrylonitrile	0.050	mg/L	0.050	mg/Kg	2.5	mg/Kg
Methyl Methacrylate	0.005	mg/L	0.005	mg/Kg	0.25	mg/Kg
Ethyl methacrylate	0.005	mg/L	0.005	mg/Kg	0.25	mg/Kg
Propionitrile	0.050	mg/L	0.050	mg/Kg	2.5	mg/Kg
Pentachloroethane	0.005	mg/L	0.005	mg/Kg	0.25	mg/Kg
Carbon Disulfide	0.001	mg/L	0.001	mg/Kg	0.050	mg/Kg
Cyclohexanone	0.010	mg/L	0.010	mg/Kg	0.50	mg/Kg
2-Hexanone	0.010	mg/L	0.010	mg/Kg	0.50	mg/Kg
Iodomethane	0.010	mg/L	0.010	mg/Kg	0.50	mg/Kg
Isobutanol	0.001	mg/L	0.001	mg/Kg	0.050	mg/Kg
Propionitrile	0.001	mg/L	0.001	mg/Kg	0.050	mg/Kg
Vinyl Acetate	0.050	mg/L	0.050	mg/Kg	2.5	mg/Kg
Tetrahydrofuran	0.005	mg/L	0.005	mg/Kg	0.25	mg/Kg
Bromoethane	0.001	mg/L	0.001	mg/Kg	0.050	mg/Kg
2-Butanol	0.050	mg/L	0.050	mg/Kg	2.5	mg/Kg
Ethanol	0.050	mg/L	0.050	mg/Kg	2.5	mg/Kg
Tert-Butyl Alcohol	0.050	mg/L	0.050	mg/Kg	2.5	mg/Kg
Di-isopropyl ether	0.001	mg/L	0.001	mg/Kg	0.050	mg/Kg
Ethyl tert-butyl ether	0.001	mg/L	0.001	mg/Kg	0.050	mg/Kg
Methyl-tert-butyl ether	0.001	mg/L	0.001	mg/Kg	0.050	mg/Kg
Tert-Butyl alcohol	0.050	mg/L	0.050	mg/Kg	2.5	mg/Kg
Tert-Amyl Methyl Ether	0.001	mg/L	0.001	mg/Kg	0.050	mg/Kg
Tert-Butyl Formate	0.020	mg/L	0.020	mg/Kg	1.0	mg/Kg
Tert Butyl Ethyl Alcohol	0.100	mg/L	0.100	mg/Kg	5.0	mg/Kg
Tert Amyl Alcohol	0.005	mg/L	0.005	mg/Kg	0.25	mg/Kg
Dichlorofluoromethane	0.005	mg/L	0.005	mg/Kg	0.25	mg/Kg
2-Propanol	0.005	mg/L	0.005	mg/Kg	0.25	mg/Kg

RLs are based on a 5mL purge volume
Low Soil - Using a 5g soil sample to 5mL water – See Method 5035 (SOP #330751) Section 8.2.4.1
High Soil – Using 200uL extract from 5g. soil sample to 5mL methanol; see Method 5035 (SOP #330751) Sect. 8.3.1.2
+ 1-4,Dioxane has a RL of .002 when run using the SIM mode.

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TITLE: **VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)**

Attachment III: Characteristic Masses (m/z) for Purgeable Organic Compounds as printed from SW-846 Method 8260B Table 5

Compound	Primary Characteristic Ion	Secondary Characteristic Ion(s)
Acetone	58	43
Acetonitrile	41	40, 39
Acrolein	56	55, 58
Acrylonitrile	53	52, 51
Allyl alcohol	57	58, 39
Allyl chloride	76	41, 39, 78
Benzene	78	-
Benzyl chloride	91	126, 65, 128
Bromoacetone	136	43, 138, 93, 95
Bromobenzene	156	77, 158
Bromochloromethane	128	49, 130
Bromodichloromethane	83	85, 127
Bromoform	173	175, 254
Bromomethane	94	96
1,3-Butadiene	39	54
iso-Butanol	74	43
n-Butanol	56	41
2-Butanone	72	43
n-Butylbenzene	91	92, 134
sec-Butylbenzene	105	134
tert-Butylbenzene	119	91, 134
Carbon disulfide	76	78
Carbon tetrachloride	117	119
Chloral hydrate	82	44, 84, 86, 111
Chloroacetonitrile	48	75
Chlorobenzene	112	77, 114
1-Chlorobutane	56	49
Chlorodibromomethane	129	208, 206
Chloroethane	64 (49*)	66 (51*)
2-Chloroethanol	49	44, 43, 51, 80
Bis(2-chloroethyl) sulfide	109	111, 158, 160
2-Chloroethyl vinyl ether	63	65, 106
Chloroform	83	85
Chloromethane	50 (49*)	52 (51*)
Chloroprene	53	88, 90, 51
3-Chloropropionitrile	54	49, 89, 91
2-Chlorotoluene	91	126
4-Chlorotoluene	91	126
Dicyclopentadiene	66	132
1,2-Dibromo-3-chloropropane	75	155, 157
Dibromochloromethane	129	127

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TITLE: VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)

Compound	Primary Characteristic Ion	Secondary Characteristic Ion(s)
1,2-Dibromoethane	107	109, 188
Dibromomethane	93	95, 174
1,2-Dichlorobenzene	146	111, 148
1,2-Dichlorobenzene-d4	152	115, 150
1,3-Dichlorobenzene	146	111, 148
1,4-Dichlorobenzene	146	111, 148
cis-1,4-Dichloro-2-butene	75	53, 77, 124, 89
trans-1,4-Dichloro-2-butene	53	88, 75
Dichlorodifluoromethane	85	87
1,1-Dichloroethane	63	65, 83
1,2-Dichloroethane	62	98
1,1-Dichloroethene	96	61, 63
cis-1,2-Dichloroethene	96	61, 98
trans-1,2-Dichloroethene	96	61, 98
1,2-Dichloropropane	63	112
1,3-Dichloropropane	76	78
2,2-Dichloropropane	77	97
1,3-Dichloro-2-propanol	79	43, 81, 49
1,1-Dichloropropene	75	110, 77
cis-1,3-Dichloropropene	75	77, 39
trans-1,3-Dichloropropene	75	77, 39
1,2,3,4-Diepoxybutane	55	57, 56
Diethyl ether	74	45, 59
1,4-Dioxane	88	58, 43, 57
Epichlorohydrin	57	49, 62, 51
Ethanol	31	45, 27, 46
Ethyl acetate	88	43, 45, 61
Ethylbenzene	91	106
Ethylene oxide	44	43, 42
Ethyl methacrylate	69	41, 99, 86, 114
4-Ethyltoluene	105	120
Hexachlorobutadiene	225	223, 227
Hexachloroethane	201	166, 199, 203
Hexane	57	86, 56
2-Hexanone	43	58, 57, 100
2-Hydroxypropionitrile	44	43, 42, 53
Iodomethane	142	127, 141
Isobutyl alcohol	43	41, 42, 74
Isopropylbenzene	105	120
p-Isopropyltoluene	119	134, 91
Malononitrile	66	39, 65, 38
Methacrylonitrile	41	67, 39, 52, 66
Methyl acrylate	55	85
Methyl-t-butyl ether	73	57

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TITLE: VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)

Compound	Primary Characteristic Ion	Secondary Characteristic Ion(s)
Methylene chloride	84	86, 49
Methyl ethyl ketone	72	43
Methyl iodide	142	127, 141
Methyl methacrylate	69	41, 100, 39
4-Methyl-2-pentanone	100	43, 58, 85
Naphthalene	128	-
Nitrobenzene	123	51, 77
2-Nitropropane	46	-
2-Picoline	93	66, 92, 78
Pentachloroethane	167	130, 132, 165, 169
Propargyl alcohol	55	39, 38, 53
Propene	41	39, 42
Propiolactone	42	43, 44
Propionitrile (ethyl cyanide)	54	52, 55, 40
n-Propylamine	59	41, 39
n-Propylbenzene	91	120
Pyridine	79	52
Styrene	104	78
1,2,3-Trichlorobenzene	180	182, 145
1,2,4-Trichlorobenzene	180	182, 145
1,1,1,2-Tetrachloroethane	131	133, 119
1,1,2,2-Tetrachloroethane	83	131, 85
Tert-butyl formate	59	57, 41
Tetrachloroethene	164	129, 131, 166
Toluene	92	91
1,1,1-Trichloroethane	97	99, 61
1,1,2-Trichloroethane	83	97, 85
Trichloroethene	95	97, 130, 132
Trichlorofluoromethane	151	101, 153
1,2,3-Trichloropropane	75	77
1,2,4-Trimethylbenzene	105	120
1,3,5-Trimethylbenzene	105	120
Vinyl acetate	43	86
Vinyl chloride	62	64
o-Xylene	106	91
m-Xylene	106	91
p-Xylene	106	91
Internal Standards/Surrogates:		
1,4-Difluorobenzene	114	63
1,4-Dichlorobenzene-d4	152	115, 150
1,1,2-Trichloroethane-d3	100	
4-Bromofluorobenzene	95	174, 176
Chloroform-d1	84	
Dibromofluoromethane	113	

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TITLE: VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)

Compound	Primary Characteristic Ion	Secondary Characteristic Ion(s)
4-Bromofluorobenzene	95	174, 176
Chloroform-d1	84	
Dibromofluoromethane	113	
Dichloroethane-d4	102	
Toluene-d8	98	
Pentafluorobenzene	168	
Fluorobenzene	96	77

* Characteristic ion for an ion trap mass spectrometer (to be used when ion-molecule reactions are observed).

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TITLE: VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)

Attachment IV: Potential Compounds to be Analyzed by this Procedure

Acetone
Acetonitrile
Acrolein
Acrylonitrile
Allyl alcohol
Allyl chloride
Benzene
Benzyl chloride
Bromoacetone
Bromochloromethane (I.S.)
Bromodichloromethane
4-Bromofluorobenzene (Surr.)
Bromoform
Bromomethane
2-Butanone
Carbon disulfide
Carbon tetrachloride
Chloral hydrate
Chlorobenzene
Chlorobenzene d-5 (I.S.)
Chlorodibromomethane
2-Propanol
Chloroethane
2-Chloroethanol
bis-(2-Chloroethyl) sulfide
2-Chloroethyl vinyl ether
Chlorofrom
Chloromethane
Chloroprene
3-Chloropropionitrile
1,2- Dibromo-3-chloropropane
1,2-Dibromoethane
Dibromomethane
1,4-Dichloro-2-butene
dichlorodifluoromethane
1,1-Dichloroethane
1,2-Dichloroethane
1,2-Dichloroethane d-4 (surr.)
1,1-Dichloroethene
Trans-1,2-dichloroethene
Cis-1,2-dichloroethene
1,2-dichloropropane
Dicyclopentadiene
1,4-Dioxane
Epichlorohydrin
Ethanol
Ethylbenzene
Ethylene oxide
Ethyl methacrylate
n-Hexane
2-Hexanone
2-Hydroxypropionitrile
Iodomethane
Isobutylalcohol
Malononitrile
Methacrylonitrile
Methylene chloride
Methyl iodide
Methyl methacrylate
4-methyl-2-pentanone
Pentachloroethane
2-Picoline
Propargyl alcohol
Propene
B-propiolactone
Propionitrile
n-Propylamine
Pyridine
Styrene
1,1,1,2-Tetrachloroethane
1,1,2,2-Tetrachloroethane
Tetrachloroethene
Toluene
1,3-Butadiene
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Trichloroethene
Trichlorofluoromethane
1,2,3-Trichloropropane
Vinyl acetate
Vinyl chloride
Xylene (total)
1,2,3,4-Diepoxybutane
4-Ethyltoluene

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TITLE: **VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)**

Attachment V: The SIM Mode:

An alternate way of running compounds to achieve lower detection limits is by way of the Single Ion Monitoring (SIM) method. The SIM method allows the Mass spec to dwell on certain ions rather than scanning the full range of masses from 35 to 300. This process allows for much lower detection limit of desired compounds. This method is only for the detection of known compounds while a TIC cannot be performed while running the SIM method. Currently 1,4-Dioxane is the only compound that is analyzed using the SIM method in the volatiles laboratory.

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TITLE: VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)

Attachment VI: EPA 624 CCC Criteria:

TABLE 5—CALIBRATION AND QC ACCEPTANCE CRITERIA—METHOD 624[a]

Parameter	Range for Q (µg/L)	Limit for s (µg/L)	Range for X (µg/L)	Range for P, P_s (%)
Benzene	12.8 27.2	6.8	15.2 26.0	37 151
Bromodichloromethane	13.1 26.9	6.4	16.1 28.0	35 155
Bromoform	14.2 25.8	5.4	11.4 31.1	45 169
Bromomethane	2.8 37.2	17.9	D 41.2	D 242
Carbon tetrachloride	14.6–25.4	5.2	17.2–23.5	70–140
Chlorobenzene	13.2–26.8	6.3	16.4–27.4	37–160
Chloroethane	7.6 32.4	11.4	8.4 40.4	14 230
2-Chloroethylvinyl ether	D 44.8	25.9	D 50.4	D 305
Chloroform	13.5–26.5	6.1	13.7–24.2	51–138
Chloromethane	D–40.8	19.8	D–45.9	D–273
Dibromochloromethane	13.5–26.5	6.1	13.8–26.8	53–149
1,2-Dichlorobenzene	12.6–27.4	7.1	11.8–34.7	18–190
1,3-Dichlorobenzene	14.6–25.4	5.5	17.0–28.8	59–156
1,4-Dichlorobenzene	12.6–27.4	7.1	11.8–34.7	18–190
1,1-Dichloroethane	14.5–25.5	5.1	14.2–28.5	59–155
1,2-Dichloroethane	13.6 26.4	6.0	14.3 27.4	49 155
1,1-Dichlorothene	10.1 29.9	9.1	3.7 42.3	D 234
trans-1,2-Dichloroethene	13.9 26.1	5.7	13.6 28.5	54 156
1,2-Dichloropropane	6.8–33.2	13.8	3.8–36.2	D–210
cis-1,3-Dichloropropene	4.8–35.2	15.8	1.0–39.0	D–227
trans-1,3-Dichloropropene	10.0–30.0	10.4	7.6–32.4	17–183
Ethyl benzene	11.8–28.2	7.5	17.4–26.7	37–162
Methylene chloride	12.1–27.9	7.4	D–41.0	D–221
1,1,2,2-Tetrachloroethane	12.1–27.9	7.4	13.5–27.2	46–157
Tetrachloroethene	14.7–25.3	5.0	17.0–26.6	64–148
Toluene	14.9–25.1	4.8	16.6–26.7	47–150
1,1,1-Trichloroethane	15.0–25.0	4.6	13.7–30.1	52–162
1,1,2-Trichloroethane	14.2–25.8	5.5	14.3–27.1	52–150
Trichloroethene	13.3–26.7	6.6	18.6–27.6	71–157
Trichlorofluoromethane	9.6–30.4	10.0	8.9–31.5	17–181
Vinyl chloride	0.8–39.2	20.0	D–43.5	D–251

Q= Concentration measured in QC check sample, in µg/L (Section 7.5.3).
s= Standard deviation of four recovery measurements, in µg/L (Section 8.2.4).
X= Average recovery of four recovery measurements, in µg/L (Section 8.2.4).
P, P_s= Percent recovery measured, (Section 8.3.2, Section 8.4.2).
D= Detected; result must be greater than zero.
[a]Criteria were calculated assuming a QC check sample concentration of 20 µg/L.

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TITLE: **VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)**

Attachment VII: EPA 8260C Minimum Relative Response Factor Criteria for Initial and Continuing Calibration Verification:

Volatile Compound	Minimum Response Factor (RF)
Dichlorodifluoromethane	0.100
Chloromethane	0.100
Vinyl chloride	0.100
Bromomethane	0.100
Chloroethane	0.100
Trichlorofluoromethane	0.100
1,1-Dichloroethene	0.100
1,1,2-Trichloro-1,2,2-trifluoroethane	0.100
Acetone	0.100
Carbon disulfide	0.100
Methyl Acetate	0.100
Methylene chloride	0.100
trans-1,2-Dichloroethene	0.100
cis-1,2-Dichloroethene	0.100
Methyl tert-Butyl Ether	0.100
1,1-Dichloroethane	0.200
2-Butanone	0.100
Chloroform	0.200
1,1,1-Trichloroethane	0.100
Cyclohexane	0.100
Carbon tetrachloride	0.100
Benzene	0.500
1,2-Dichloroethane	0.100
Trichloroethene	0.200
Methylcyclohexane	0.100

Volatile Compound	Minimum Response Factor (RF)
1,2-Dichloropropane	0.100
Bromodichloromethane	0.200
cis-1,3-Dichloropropene	0.200
trans-1,3-Dichloropropene	0.100
4-Methyl-2-pentanone	0.100
Toluene	0.400
1,1,2-Trichloroethane	0.100
Tetrachloroethene	0.200
2-Hexanone	0.100
Dibromochloromethane	0.100
1,2-Dibromoethane	0.100
Chlorobenzene	0.500
Ethylbenzene	0.100
meta-/para-Xylene	0.100
ortho-Xylene	0.300
Styrene	0.300
Bromoform	0.100
Isopropylbenzene	0.100
1,1,2,2-Tetrachloroethane	0.300
1,3-Dichlorobenzene	0.600
1,4-Dichlorobenzene	0.500
1,2-Dichlorobenzene	0.400
1,2-Dibromo-3-chloropropane	0.050
1,2,4-Triichlorobenzene	0.200

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TITLE: VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)

Attachment VIII: Laboratory Control Standard and Matrix Spike Typically Spiked Compounds

STANDARD ANALYTE LIST

1,1,1,2-TETRACHLOROETHANE
1,1,1-TRICHLOROETHANE
1,1,2,2-TETRACHLOROETHANE
1,1,2-TRICHLOROETHANE
1,1,2-TRICHLOROTRIFLUOROETHANE
1,1-DICHLOROETHANE
1,1-DICHLOROETHENE
1,1-DICHLOROPROPENE
1,2,3-TRICHLOROBENZENE
1,2,3-TRICHLOROPROPANE
1,2,3-TRIMETHYLBENZENE
1,2,4-TRICHLOROBENZENE
1,2,4-TRIMETHYLBENZENE
1,2-DIBROMO-3-CHLOROPROPANE
1,2-DIBROMOETHANE
1,2-DICHLOROBENZENE
1,2-DICHLOROETHANE
1,2-DICHLOROPROPANE
1,3,5-TRIMETHYLBENZENE
1,3-BUTADIENE
1,3-DICHLOROBENZENE
1,3-DICHLOROPROPANE
1,4-DICHLOROBENZENE
1-METHYLNAPHTHALENE
2,2,4-TRIMETHYLPENTANE
2,2-DICHLOROPROPANE
2-BUTANONE (MEK)
2-CHLOROETHYL VINYL ETHER
2-CHLOROTOLUENE
2-HEXANONE
2-METHYLNAPHTHALENE
4-CHLOROTOLUENE
4-ETHYLTOLUENE
CHLORODIBROMOMETHANE
CHLOROETHANE
CHLOROFORM
CHLOROMETHANE
CIS-1,2-DICHLOROETHENE
CIS-1,3-DICHLOROPROPENE
DIBROMOMETHANE
DICHLORODIFLUOROMETHANE
DICHLOROFLUOROMETHANE
DICYCLOPENTADIENE
DI-ISOPROPYL ETHER
ETHYL ETHER
ETHYLBENZENE
HEXACHLORO-1,3-BUTADIENE
IODOMETHANE
ISOPROPYLBENZENE
M&P-XYLENE
METHYL TERT-BUTYL ETHER
METHYLENE CHLORIDE
NAPHTHALENE
N-BUTYLBENZENE
N-HEXANE
N-PROPYLBENZENE
O-XYLENE
P-ISOPROPYLTOLUENE
PROPENE
SEC-BUTYLBENZENE
STYRENE
TERT-BUTYLBENZENE
TETRACHLOROETHENE
TETRAHYDROFURAN
TOLUENE
TPH (GC/MS) LOW FRACTION

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TITLE: VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)

STANDARD ANALYTE LIST

4-METHYL-2-PENTANONE (MIBK)
ACETONE
ACROLEIN*
ACRYLONITRILE*
BENZENE
BROMOBENZENE
BROMOCHLOROMETHANE
BROMODICHLOROMETHANE
BROMOFORM
BROMOMETHANE
CARBON DISULFIDE
CARBON TETRACHLORIDE
CHLOROBENZENE
TRANS-1,2-DICHLOROETHENE
TRANS-1,3-DICHLOROPROPENE
TRANS-1,4-DICHLORO-2-BUTENE
TRICHLOROETHENE
TRICHLOROFLUOROMETHANE
VINYL ACETATE
VINYL CHLORIDE
XYLENES, TOTAL

SURROGATE LIMITS

4-BROMOFLUOROBENZENE
A,A,A-TRIFLUOROTOLUENE
DIBROMOFLUOROMETHANE
TOLUENE-D8

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TITLE: VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)

Attachment IX: DoD Requirements

1.0 Equipment/Instrument Maintenance

Instrument maintenance must be performed routinely to optimize instrument performance and improve chromatography. Commonly performed maintenance includes baking traps and columns, changing injection port liners, changing pump oil, etc. A new calibration curve must be analyzed following any major maintenance performed on the analytical system.

2.0 Computer Hardware and Software

Software name and version: HP Chemstation G1701CA Version C.00.00 or equivalent

3.0 Troubleshooting

Table 1. GCMS Troubleshooting Guide

Problem	Cause	Treatment
Peaks broaden and tail	Poor column installation causing dead volume in the injector	Reinstall column in injector. Check seal at ferrule. Check insertion depth. Ensure a good column cut.
	Solvent flashing in hot injector	Reduce injection speed on hot injectors and if possible reduce injector temperature
	Injector not being purged properly after splitless injection	For splitless injection, the vent flow should be 70 ml/min, and the injector should be switched to the split mode 0.5_1.5 min after injection.
Tailing sample peaks for active components	Active sites in the injector insert or liner	Change or clean the injector insert
	Active sites or degraded phase in column	Remove the front 15 cm of the column and reinstall. If retention times are changing or cutting the column does not help, replace the column.
	Injector not hot enough for higher boiling compounds	Increase the injector temperature and lower the injection speed. Check that the graphite ferrule is free of cracks and the septum support is tight.
Low response and tailing of high boiling point compounds	Injector is not hot enough to vaporize high boilers	Increase injector temperature
	Interface/ion source not getting to adequate temperature	Change the manifold heater
Leading sample peaks	Column overload due to excess amount of component injected	Dilute the sample or do split injection
	Degradation of stationary phase	Change the column
	Carrier gas velocity too low	Increase carrier gas flow rate

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TITLE: VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)

Table 1. GCMS Troubleshooting Guide		
Problem	**Cause**	**Treatment**
Poor chromatographic resolution	Column temperature or program not optimized	Modify method by changing temperature ramp segment slopes
	Carrier gas flow rate not optimized	Decrease carrier gas linear velocity
	Stationary phase has degraded	Replace the column
Peak splitting, especially low boilers	Sample is flashing in the injector simulating two injections	Lower injector temperature
Retention times shift in chromatogram	Unstable carrier gas flow controller/regulator	Check pneumatics for leaks. Replace flow controller/ regulator if necessary.
	Column contamination or degradation	Condition or replace column
	Leaks at septum or column to injector connection	Replace septum regularly and check that the septum nut and the capillary column nut are tight
Cannot reach operating vacuum	Analyzer contaminated by diffusion pump oil	Shut down and clean mass spec
	Major air leak around column fitting into interface	Replace column ferrule and reseat compression fitting
No tune peaks	Cal gas valve not open	Open cal gas valve
	PFTBA solenoid valve stuck open. All PFTBA has evaporated.	Have solenoid replaced. Put fresh PFTBA in the cal gas vial.
Analysis sensitivity has decreased	Background has increased	Check column bleed, septum bleed, pump oil, and ion source contamination
	Detector needs replacement	Replace detector
	Defective syringe	Try a new or proven syringe
	"Blown" septum or other massive leaks at the inlet or with carrier gas flow. Poor peak shapes usually result from bad leaks.	Find and fix leaks and adjust gas flow.
	Purge flow or split ratio too high	Adjust gas flow rates

4.0 Other Requirements

4.1 All hardcopy laboratory notebooks must be reviewed by the Supervisor, or their designee, on a monthly basis.

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4.2 If not self-explanatory (e.g., a typo or transposed number), corrections to technical and quality records shall also include a justification for the change.

4.3 A storage blank must be stored with all volatile organic samples, regardless of suspected concentration levels.

4.4 A person performing a manual integration must sign and date each manually integrated chromatogram and record the rationale for performing manual integration. Electronic signatures are acceptable.

4.5 The results of calibration and verification of support equipment must be within the specifications required of the application for which this equipment is used or the equipment must be removed from service until repaired. Calibration and verification records, including those of established correction factors, must be maintained. In the absence of method-specific requirements, the minimum requirements are as follows:

Table 2. Support Equipment Checks

Performance Check	Frequency	Acceptance Criteria
Balance calibration check [Using two standard weights that bracket the expected mass]	Daily prior to use	Top-loading balance: ±2% or ±0.02g, whichever is greater Analytical balance: ±0.1% or ±0.5 mg, whichever is greater
Verification of standard mass [Using weights traceable to the International System of Units (SI) through a NMI	Every 5 years	Certificate of Calibration from ISO/IEC 17025 accredited calibration laboratory
Monitoring of refrigerator/freezer temperatures	Daily (i.e. 7 days per week) [use MIN/MAX thermometers or data loggers equipped with notification of out of control event capabilities if personnel not available to record daily]	Refrigerators: 0˚C to 6˚C Freezers: ≤-10˚C
Thermometer verification check [Using a thermometer traceable to the SI through an NMI] [Performed at two temperatures that bracket the target temperature(s). Assume linearity between the two bracketing temperatures.] [If only a single temperature is used, at the temperature of use]	Liquid in glass: Before first use and annually Electronic: Before first use and quarterly	Apply correction factors or replace thermometer
Volumetric labware	Class B: By lot before first use Class A and B: Upon evidence of deterioration	Bias: Mean within ±2% of nominal volume Precision: RSD ≤1% of nominal volume (based on 10 replicate measurements)

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TITLE: VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)

Table 2. Support Equipment Checks		
Performance Check	**Frequency**	**Acceptance Criteria**
Non-volumetric labware [Applicable only when used for measuring initial sample volume and final extract/ digestates volume]	By lot before first use or upon evidence of deterioration	Bias: Mean within ±3% of nominal volume Precision: RSD ≤3% of nominal volume (based on 10 replicate measurements)
Mechanical volumetric pipette	Quarterly	Bias: Mean within ±2% of nominal volume Precision: RSD ≤1% of nominal volume (based on minimum of 3 replicate measurements) [Note: for variable volume pipettes, the nominal volume is the volume of use]
Glass microliter syringe	Upon receipt and upon evidence of deterioration	General Certificate of Bias & Precision upon receipt Replace if deterioration is evident
Drying oven temperature check	Daily prior to and after use	Within ±5% of set temperature
Water purification system	Daily prior to use	See method blank criteria given in Section 4.20 of this addendum

4.6 The expiration date of the prepared standard shall not exceed the expiration date of the primary standard. All containers must bear a preparation date.

4.7 To avoid preparing non-representative samples, the laboratory shall not "target" within a relatively small mass range (e.g., 1.00 ± 0.01g) because such targeting will produce non-representative subsamples if the sample has high heterogeneity. The laboratory shall not manipulate the sample material so the sample aliquot weighs exactly 1.00g ± 0.01g, as an example.

4.8 In the absence of project-specific requirements, the minimum standard data qualifiers to be used are:

U Analyte was not detected and is reported as less than the LOD or as defined by the customer. The LOD has been adjusted for any dilution or concentration of the sample.

J The reported result is an estimated value (e.g., matrix interference was observed or the analyte was detected at a concentration outside the quantitation range).

B Blank contamination. The recorded result is associated with a contaminated blank.

N Non-target analyte. The analyte is a tentatively identified compound using mass spectrometry or any non-customer requested compounds that are tentatively identified.

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Q One or more quality control criteria failed (e.g., LCS recovery, surrogate spike recovery, or CCV recovery).

Additional data qualifiers may be used, or different letters or symbols to denote the qualifiers listed above, as long as they are appropriately defined and their use is consistent with project-specific requirements (e.g., QSM 5.0, the contract, and project-planning documents).

4.9 If the time of the sample collection is not provided, assume the most conservative time of day. For the purpose of batch processing, the start and stop dates and times of the batch preparation shall be recorded.

4.10 Each preparation method listed on the scope of accreditation must have quarterly LOD/LOQ verifications. However, not all possible combinations of preparation and cleanup techniques are required to have LOD/LOQ verifications. If LOD/LOQ verifications are not performed on all combinations, the laboratory must base the LOD/LOQ verifications on the worst case basis (preparation method with all applicable cleanup steps).

4.11 After each MDL determination, the laboratory must establish the LOD by spiking a quality system matrix at a concentration of at least 2 times but no greater than four times the MDL. This spike concentration establishes the LOD and the concentration at which the LOD shall be verified. It is specific to each suite of analyte, matrix, and method (including sample preparation). The following requirements apply to the initial LOD establishment and to the LOD verifications:

- The apparent signal to noise (S/N) ratio at the LOD must be at least three and the results must meet all method requirements for analyte identification (e.g., ion abundance, second column confirmation, or pattern recognition). For data systems that do not provide a measure of noise, the signal produced by the verification sample must produce a result that is at least three standard deviations greater than the mean method blank concentration. This is initially estimated based on a minimum of four method blank analyses and later established with a minimum of 20 method blank results.
- If the LOD verification fails, then the laboratory must repeat the MDL determination and LOD verification or perform and pass two consecutive LOD verifications at a higher spike concentration and set the LOD at the higher concentration.
- The laboratory shall maintain documentation for all MDL determinations and LOD verifications.
- The DL and LOD must be reported for all analyte-matrix-methods suites, unless it is not applicable to the test or specifically excluded by project requirements.

4.12 The LOD shall be verified quarterly. In situations where methods are setup and used on an infrequent basis, the laboratory may choose to perform LOD verifications on a one per batch basis. All verification data will be in compliance, reported, and available for review.

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4.13 For DoD, at a minimum, the LOQ shall be verified quarterly. In situations where methods are setup and used on an infrequent basis, the laboratory may choose to perform LOQ verifications on a one per batch basis.

4.14 All initial instrument calibrations must be verified with a standard obtained from a second manufacturer prior to analyzing any samples. The use of a standard from a second lot obtained from the same manufacturer (independently prepared from different source materials) is acceptable for use as a second source standard. The concentration of the second source standard shall be at or near the midpoint of the calibration range. The acceptance criteria for the initial calibration verification must be at least as stringent as those for the continuing calibration verification.

4.15 Exclusion of calibration points without documented scientifically valid technical justification is not permitted.

4.16 The concentration of the CCV standard shall be greater than the low calibration standard and less than or equal to the midpoint of the calibration range.

4.17 All CCVs analyzed must be evaluated and reported. If a CCV fails, reanalysis or corrective actions must be taken.

- If a CCV fails, the laboratory can immediately analyze two additional consecutive CCVs (immediately is defined as starting a consecutive pair within one hour; no samples can be run between the failed CCV and the two additional CCVs). This approach allows for spurious failures of analytes to be reported without reanalysis of samples. Any corrective actions that change the dynamics of the system (e.g., clip column, clean injection port, run blanks) requires that all samples since the last acceptable CCV be reanalyzed.
- Both of these CCVs must meet acceptance criteria in order for the samples to be reported without reanalysis.
- If either of these two CCVs fail or if the laboratory cannot immediately analyze two CCVs, the associated samples cannot be reported and must be reanalyzed.
- Corrective action(s) and recalibration must occur if the above scenario fails. All affected samples since the last acceptable CCV must be reanalyzed.
- Flagging of data for a failed CCV is only appropriate when the affected samples cannot be reanalyzed. The laboratory must notify the client prior to reporting data associated with a failed CCV.

4.18 The results of all MS/MSDs must be evaluated using the same acceptance criteria used for the DoD LCS limits (see Addendum Tables 3 and 4) or project limits, if specified. If the specific analyte(s) are not available in the Addendum Tables 3 and 4, the laboratory shall use their LCS in-house limits (see the LIMS) as a means of evaluating MS/MSDs. The MS and MSD must be spiked with all reported analytes.

4.19 Surrogate spike results shall be compared with DoD LCS limits (see Addendum Tables 3 and 4) or acceptance criteria specified by the client. If these criteria are not available, the laboratory shall compare the results with its in-house statistically established LCS criteria (see the LIMS).

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TITLE: VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)

4.20 The method blank shall be considered to be contaminated if:

- The concentration of any target analyte (chemical of concern) in the blank exceeds 1/2 the LOQ and is greater than 1/10th the amount measured in any associated sample, or 1/0th the regulatory limit, whichever is greater;
- The concentration of any common laboratory contaminant in the blank exceeds the LOQ;
- If a method blank is contaminated as described above, then the laboratory shall reprocess affected samples in a subsequent preparation batch, except when sample results are below the LOD. If insufficient sample volume remains for reprocessing, the results shall be reported with appropriate data qualifiers.

4.21 Sporadic Marginal Exceedances are not allowed for target analytes (chemicals of concern as identified by a project) without project-specific approval. Target analytes are considered those few analytes that are critical for the success of a project (such as risk drivers) where sporadic marginal exceedances cannot be allowed. Laboratories should consult with clients whenever long lists of analytes are requested for analysis to determine if marginal exceedances will not be allowed.

4.22 DoD considers the same analyte exceeding the LCS control limit two (2) out of three (3) consecutive LCS to be indicative of non-random behavior, which requires corrective action and reanalysis of the LCS.

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TITLE: VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)

Table 3. LCS Control Limits – Method 8260 Solid Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
630-20-6	1,1,1,2-Tetrachloroethane	11115	101.1	7.8	78	125
71-55-6	1,1,1-Trichloroethane	12156	101.6	9.4	73	130
79-34-5	1,1,2,2-Tetrachloroethane	11670	97	8.9	70	124
79-00-5	1,1,2-Trichloroethane	11772	99.7	7.2	78	121
76-13-1	1,1,2-Trifluoro-1,2,2-trichloroethane [Freon-113]	9760	100.8	11.7	66	136
75-34-3	1,1-Dichloroethane	11856	100.4	8.1	76	125
75-35-4	1,1-Dichloroethene	12352	100.3	10.1	70	131
563-58-6	1,1-Dichloropropene	10793	100.5	8.3	76	125
87-61-6	1,2,3-Trichlorobenzene	10572	97.8	10.6	66	130
96-18-4	1,2,3-Trichloropropane	10925	99.1	8.8	73	125
526-73-8	1,2,3-Trimethylbenzene	1948	99.8	6	82	118
120-82-1	1,2,4-Trichlorobenzene	10980	98	10.4	67	129
95-63-6	1,2,4-Trimethylbenzene	11085	98.7	7.9	75	123
96-12-8	1,2-Dibromo-3-chloropropane	11380	96.6	11.7	61	132
106-93-4	1,2-Dibromoethane	11408	100.1	7.3	78	122
95-50-1	1,2-Dichlorobenzene	11785	99.1	7.2	78	121
107-06-2	1,2-Dichloroethane	12328	100.5	9.2	73	128
17060-07-0	1,2-Dichloroethane-d4	5951	103.1	10.8	71	136
540-59-0	1,2-Dichloroethene	7748	99.9	7.3	78	122
78-87-5	1,2-Dichloropropane	12145	99.5	7.8	76	123
354-23-4	1,2-Dichlorotrifluoroethane [Freon 123a]	1269	97.8	11.3	64	132
108-70-3	1,3,5-Trichlorobenzene	4723	99.4	9.6	71	128
108-67-8	1,3,5-Trimethylbenzene	11080	98.4	8.4	73	124
541-73-1	1,3-Dichlorobenzene	11619	98.9	7.4	77	121
142-28-9	1,3-Dichloropropane	10713	99.1	7.3	77	121
542-75-6	1,3-Dichloropropene	3714	101.6	8.1	77	126
106-46-7	1,4-Dichlorobenzene	11848	97.5	7.6	75	120
105-05-5	1,4-Diethylbenzene	1896	96.6	5.9	79	114
123-91-1	1,4-Dioxane	7698	96.4	13.7	55	138
544-10-5	1-Chlorohexane	2543	100.4	9.8	71	130
594-20-7	2,2-Dichloropropane	10703	99.7	11.1	67	133
78-93-3	2-Butanone [MEK]	11514	99.6	16.3	51	148
126-99-8	2-Chloro-1,3-butadiene	6667	99	11.3	65	133
110-75-8	2-Chloroethyl vinyl ether	6957	96.1	17.6	43	149
95-49-8	2-Chlorotoluene	10838	98.5	7.9	75	122
591-78-6	2-Hexanone	11004	99.1	15.4	53	145
79-46-9	2-Nitropropane	4969	98.3	17.1	47	150
67-63-0	2-Propanol [Isopropyl alcohol]	1696	99.8	13.4	60	140

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TITLE: VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)

Table 3. LCS Control Limits – Method 8260 Solid Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
460-00-4	4-Bromofluorobenzene	6267	98.9	6.8	79	119
106-43-4	4-Chlorotoluene	10785	98.3	8.6	72	124
108-10-1	4-Methyl-2-pentanone [MIBK]	11364	99.6	11.6	65	135
67-64-1	Acetone	11089	99.6	21.4	36	164
75-05-8	Acetonitrile	5697	98.5	14.8	54	143
107-02-8	Acrolein [Propenal]	7528	101.1	18	47	155
107-13-1	Acrylonitrile	8293	99.7	11.4	65	134
107-05-1	Allyl chloride	6908	101.1	11.2	68	135
71-43-2	Benzene	12853	99.2	7.4	77	121
100-44-7	Benzyl chloride	2743	92.1	9.4	64	120
108-86-1	Bromobenzene	10974	99.3	7.3	78	121
74-97-5	Bromochloromethane	11023	101.4	7.8	78	125
75-27-4	Bromodichloromethane	11850	101	8.5	75	127
75-25-2	Bromoform	11890	99.1	10.8	67	132
74-83-9	Bromomethane	11416	98.3	15	53	143
75-15-0	Carbon disulfide	11132	97.9	11.5	63	132
56-23-5	Carbon tetrachloride	12090	102.3	10.7	70	135
108-90-7	Chlorobenzene	12382	99.7	6.9	79	120
124-48-1	Chlorodibromomethane	11852	100.2	8.7	74	126
75-00-3	Chloroethane	11444	98.8	13.3	59	139
67-66-3	Chloroform	12344	100.3	7.6	78	123
74-87-3	Chloromethane	11876	93.3	14.3	50	136
156-59-2	cis-1,2-Dichloroethene	11645	99.9	7.6	77	123
10061-01-5	cis-1,3-Dichloropropene	11805	99.8	8.7	74	126
1476-11-5	cis-1,4-Dichloro-2-butene	977	106	12.4	69	143
110-82-7	Cyclohexane	8827	98.9	10.6	67	131
108-94-1	Cyclohexanone	3764	93.2	20.9	30	156
1868-53-7	Dibromofluoromethane	2142	98.1	6.8	78	119
74-95-3	Dibromomethane	10913	101.1	7.9	78	125
75-71-8	Dichlorodifluoromethane [Freon-12]	11467	88.9	20.1	29	149
75-05-8	Acetonitrile	5697	98.5	14.8	54	143
107-02-8	Acrolein [Propenal]	7528	101.1	18	47	155
107-13-1	Acrylonitrile	8293	99.7	11.4	65	134
107-05-1	Allyl chloride	6908	101.1	11.2	68	135
71-43-2	Benzene	12853	99.2	7.4	77	121
100-44-7	Benzyl chloride	2743	92.1	9.4	64	120
108-86-1	Bromobenzene	10974	99.3	7.3	78	121
74-97-5	Bromochloromethane	11023	101.4	7.8	78	125
75-27-4	Bromodichloromethane	11850	101	8.5	75	127

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TITLE: VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)

Table 3. LCS Control Limits – Method 8260 Solid Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
75-25-2	Bromoform	11890	99.1	10.8	67	132
74-83-9	Bromomethane	11416	98.3	15	53	143
75-15-0	Carbon disulfide	11132	97.9	11.5	63	132
56-23-5	Carbon tetrachloride	12090	102.3	10.7	70	135
108-90-7	Chlorobenzene	12382	99.7	6.9	79	120
124-48-1	Chlorodibromomethane	11852	100.2	8.7	74	126
75-00-3	Chloroethane	11444	98.8	13.3	59	139
67-66-3	Chloroform	12344	100.3	7.6	78	123
74-87-3	Chloromethane	11876	93.3	14.3	50	136
156-59-2	cis-1,2-Dichloroethene	11645	99.9	7.6	77	123
10061-01-5	cis-1,3-Dichloropropene	11805	99.8	8.7	74	126
1476-11-5	cis-1,4-Dichloro-2-butene	977	106	12.4	69	143
110-82-7	Cyclohexane	8827	98.9	10.6	67	131
108-94-1	Cyclohexanone	3764	93.2	20.9	30	156
1868-53-7	Dibromofluoromethane	2142	98.1	6.8	78	119
74-95-3	Dibromomethane	10913	101.1	7.9	78	125
75-71-8	Dichlorodifluoromethane [Freon-12]	11467	88.9	20.1	29	149
75-43-4	Dichlorofluoromethane	717	100.8	18	47	155
60-29-7	Diethyl ether	6283	99.6	9.6	71	129
108-20-3	Diisopropyl ether	8542	98.3	9.7	69	127
64-17-5	Ethanol	3958	102.2	18.9	45	159
141-78-6	Ethyl acetate	4516	95.4	14.5	52	139
97-63-2	Ethyl methacrylate	7075	98.9	9.9	69	129
637-92-3	Ethyl tert-butyl ether	7514	98.9	9.1	72	126
100-41-4	Ethylbenzene	12427	99.1	7.7	76	122
462-06-6	Fluorobenzene	689	97.3	5.4	81	114
142-82-5	Heptane	5420	93.4	14.9	49	138
87-68-3	Hexachlorobutadiene	10264	98.1	12.4	61	135
67-72-1	Hexachloroethane	3265	102.5	10.1	72	133
110-54-3	Hexane	7116	93.6	16.1	45	142
74-88-4	Iodomethane	9457	100.9	10.1	71	131
78-83-1	Isobutyl alcohol	6162	97.5	12.6	60	135
108-21-4	Isopropyl acetate [Acetic acid]	2885	94.2	12.2	58	131
98-82-8	Isopropylbenzene	11596	100.8	11.1	68	134
179601-23-1	m/p-Xylene [3/4-Xylene]	10612	100.4	7.7	77	124
126-98-7	Methacrylonitrile	6736	99.2	11.1	66	132
79-20-9	Methyl acetate	8320	98.7	15.2	53	144
80-62-6	Methyl methacrylate	7050	98.4	11.9	63	134
1634-04-4	Methyl tert-butyl ether [MTBE]	11253	98.9	8.7	73	125

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TITLE: VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)

Table 3. LCS Control Limits – Method 8260 Solid Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
108-87-2	Methylcyclohexane	8565	99.4	11.2	66	133
75-09-2	Methylene chloride	12024	98.9	9.7	70	128
123-86-4	n-Butyl acetate	2981	95.1	11	62	128
71-36-3	n-Butyl alcohol	4800	92.9	12.6	55	131
104-51-8	n-Butylbenzene	10921	98.7	9.7	70	128
103-65-1	n-Propylbenzene	10947	98.9	8.8	73	125
91-20-3	Naphthalene	10602	95.6	11.2	62	129
95-47-6	o-Xylene	11940	100	7.7	77	123
99-87-6	p-Isopropyltoluene [p-Cymene]	10953	100.3	9	73	127
76-01-7	Pentachloroethane	5957	102	11.1	69	135
107-12-0	Propionitrile [Ethyl cyanide]	6734	101	11.1	68	134
135-98-8	sec-Butylbenzene	10960	99	8.8	73	126
100-42-5	Styrene	11809	100.2	8	76	124
994-05-8	tert-Amyl methyl ether [TAME]	7153	99.8	8.9	73	126
75-65-0	tert-Butyl alcohol	7492	100.5	10.7	68	133
98-06-6	tert-Butylbenzene	10974	98.8	8.6	73	125
127-18-4	Tetrachloroethene	12091	100.5	9.2	73	128
109-99-9	Tetrahydrofuran	8039	98	12.4	61	135
108-88-3	Toluene	12499	99.3	7.3	77	121
2037-26-5	Toluene-d8	6232	100.7	5.2	85	116
156-60-5	trans-1,2-Dichloroethene	11849	99.2	8.6	74	125
10061-02-6	trans-1,3-Dichloropropene	11805	100.9	9.8	71	130
110-57-6	trans-1,4-Dichloro-2-butene	8307	98.6	12.3	62	136
79-01-6	Trichloroethene	12440	100.2	7.6	77	123
75-69-4	Trichlorofluoromethane [Freon-11]	11530	101	13.1	62	140
108-05-4	Vinyl acetate	7260	100.3	16.9	50	151
75-01-4	Vinyl chloride	12129	95.6	13.2	56	135
1330-20-7	Xylenes [total]	8623	100.7	7.7	78	124
104-51-8	n-Butylbenzene	10921	98.7	9.7	70	128
103-65-1	n-Propylbenzene	10947	98.9	8.8	73	125
91-20-3	Naphthalene	10602	95.6	11.2	62	129
95-47-6	o-Xylene	11940	100	7.7	77	123
99-87-6	p-Isopropyltoluene [p-Cymene]	10953	100.3	9	73	127
76-01-7	Pentachloroethane	5957	102	11.1	69	135
107-12-0	Propionitrile [Ethyl cyanide]	6734	101	11.1	68	134
135-98-8	sec-Butylbenzene	10960	99	8.8	73	126
100-42-5	Styrene	11809	100.2	8	76	124

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TITLE: VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)

Table 3. LCS Control Limits – Method 8260 Solid Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
994-05-8	tert-Amyl methyl ether [TAME]	7153	99.8	8.9	73	126
75-65-0	tert-Butyl alcohol	7492	100.5	10.7	68	133
98-06-6	tert-Butylbenzene	10974	98.8	8.6	73	125
127-18-4	Tetrachloroethene	12091	100.5	9.2	73	128
109-99-9	Tetrahydrofuran	8039	98	12.4	61	135
108-88-3	Toluene	12499	99.3	7.3	77	121
2037-26-5	Toluene-d8	6232	100.7	5.2	85	116
156-60-5	trans-1,2-Dichloroethene	11849	99.2	8.6	74	125
10061-02-6	trans-1,3-Dichloropropene	11805	100.9	9.8	71	130
110-57-6	trans-1,4-Dichloro-2-butene	8307	98.6	12.3	62	136
79-01-6	Trichloroethene	12440	100.2	7.6	77	123
75-69-4	Trichlorofluoromethane [Freon-11]	11530	101	13.1	62	140
108-05-4	Vinyl acetate	7260	100.3	16.9	50	151
75-01-4	Vinyl chloride	12129	95.6	13.2	56	135
1330-20-7	Xylenes [total]	8623	100.7	7.7	78	124

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TITLE: VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)

Table 4. LCS Control Limits – Method 8260 Water Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
630-20-6	1,1,1,2-Tetrachloroethane	24511	101.1	7.6	78	124
71-55-6	1,1,1-Trichloroethane	28223	102.7	9.6	74	131
79-34-5	1,1,2,2-Tetrachloroethane	27450	96.4	8.3	71	121
79-00-5	1,1,2-Trichloroethane	27338	99.5	6.5	80	119
76-13-1	1,1,2-Trifluoro-1,2,2-trichloroethane [Freon-113]	21122	103	11.1	70	136
75-34-3	1,1-Dichloroethane	28154	101.3	8	77	125
75-35-4	1,1-Dichloroethene	29436	101	10	71	131
563-58-6	1,1-Dichloropropene	23631	102	7.8	79	125
87-61-6	1,2,3-Trichlorobenzene	24271	98.7	10.1	69	129
96-18-4	1,2,3-Trichloropropane	24525	97.5	8	73	122
526-73-8	1,2,3-Trimethylbenzene	2965	100.9	6.2	82	120
120-82-1	1,2,4-Trichlorobenzene	25290	99.8	10.1	69	130
95-63-6	1,2,4-Trimethylbenzene	27917	99.6	8	76	124
96-12-8	1,2-Dibromo-3-chloropropane	24955	94.9	11.1	62	128
106-93-4	1,2-Dibromoethane	29096	99	7.2	77	121
95-50-1	1,2-Dichlorobenzene	27583	99.4	6.5	80	119
107-06-2	1,2-Dichloroethane	32965	100.3	9.2	73	128
17060-07-0	1,2-Dichloroethane-d4	8673	99.5	6.1	81	118
540-59-0	1,2-Dichloroethene	18667	100.2	7.1	79	121
78-87-5	1,2-Dichloropropane	27787	100.1	7.2	78	122
354-23-4	1,2-Dichlorotrifluoroethane [Freon 123a]	3144	103.1	10.9	70	136
108-70-3	1,3,5-Trichlorobenzene	10037	102.1	9.2	75	130
108-67-8	1,3,5-Trimethylbenzene	27820	99.5	8.1	75	124
106-99-0	1,3-Butadiene	1202	100.6	19.2	43	158
541-73-1	1,3-Dichlorobenzene	26951	99.7	6.5	80	119
142-28-9	1,3-Dichloropropane	23811	99.1	6.5	80	119
542-75-6	1,3-Dichloropropene	9784	99.9	7.6	77	123
106-46-7	1,4-Dichlorobenzene	27715	98.3	6.5	79	118
105-05-5	1,4-Diethylbenzene	1980	98.4	6.4	79	118
123-91-1	1,4-Dioxane	17866	99	13.4	59	139
544-10-5	1-Chlorohexane	5790	99.6	8	76	124
540-84-1	2,2,4-Trimethylpentane [Isooctane]	5432	95.2	12.3	58	132
594-20-7	2,2-Dichloropropane	23775	99.7	13.2	60	139
75-85-4	2-Butanol	4332	92.7	9.1	66	120
78-93-3	2-Butanone [MEK]	26659	99.6	14.6	56	143
126-99-8	2-Chloro-1,3-butadiene	15673	100	11.7	65	135
110-75-8	2-Chloroethyl vinyl ether	18225	94.7	14.7	51	139

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TITLE: VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)

Table 4. LCS Control Limits – Method 8260 Water Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
95-49-8	2-Chlorotoluene	23750	100	7.2	79	122
591-78-6	2-Hexanone	25368	97.9	13.5	57	139
91-57-6	2-Methylnaphthalene	3754	79.4	20.9	17	142
79-46-9	2-Nitropropane	10213	92.6	14.5	49	136
67-63-0	2-Propanol [Isopropyl alcohol]	2034	98.8	14.4	56	142
624-95-3	3,3-Dimethyl-1-butanol	6491	90.9	13.9	49	133
460-00-4	4-Bromofluorobenzene	9971	99.7	4.9	85	114
106-43-4	4-Chlorotoluene	23616	99.9	7.4	78	122
108-10-1	4-Methyl-2-pentanone [MIBK]	25796	98.5	10.6	67	130
67-64-1	Acetone	25006	99.5	20.1	39	160
75-05-8	Acetonitrile	13308	95.8	15.2	50	142
106-99-0	1,3-Butadiene	1202	100.6	19.2	43	158
541-73-1	1,3-Dichlorobenzene	26951	99.7	6.5	80	119
142-28-9	1,3-Dichloropropane	23811	99.1	6.5	80	119
542-75-6	1,3-Dichloropropene	9784	99.9	7.6	77	123
106-46-7	1,4-Dichlorobenzene	27715	98.3	6.5	79	118
105-05-5	1,4-Diethylbenzene	1980	98.4	6.4	79	118
123-91-1	1,4-Dioxane	17866	99	13.4	59	139
544-10-5	1-Chlorohexane	5790	99.6	8	76	124
540-84-1	2,2,4-Trimethylpentane [Isooctane]	5432	95.2	12.3	58	132
594-20-7	2,2-Dichloropropane	23775	99.7	13.2	60	139
75-85-4	2-Butanol	4332	92.7	9.1	66	120
78-93-3	2-Butanone [MEK]	26659	99.6	14.6	56	143
126-99-8	2-Chloro-1,3-butadiene	15673	100	11.7	65	135
110-75-8	2-Chloroethyl vinyl ether	18225	94.7	14.7	51	139
95-49-8	2-Chlorotoluene	23750	100	7.2	79	122
591-78-6	2-Hexanone	25368	97.9	13.5	57	139
91-57-6	2-Methylnaphthalene	3754	79.4	20.9	17	142
79-46-9	2-Nitropropane	10213	92.6	14.5	49	136
67-63-0	2-Propanol [Isopropyl alcohol]	2034	98.8	14.4	56	142
624-95-3	3,3-Dimethyl-1-butanol	6491	90.9	13.9	49	133
460-00-4	4-Bromofluorobenzene	9971	99.7	4.9	85	114
106-43-4	4-Chlorotoluene	23616	99.9	7.4	78	122
108-10-1	4-Methyl-2-pentanone [MIBK]	25796	98.5	10.6	67	130
67-64-1	Acetone	25006	99.5	20.1	39	160
75-05-8	Acetonitrile	13308	95.8	15.2	50	142
107-02-8	Acrolein [Propenal]	16380	96.8	19.3	39	155
107-13-1	Acrylonitrile	20173	99	11.9	63	135
107-05-1	Allyl chloride	15758	99	10.4	68	130

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TITLE: **VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)**

Table 4. LCS Control Limits – Method 8260 Water Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
71-43-2	Benzene	34376	99.4	6.9	79	120
100-44-7	Benzyl chloride	10675	90.1	15.9	42	138
108-86-1	Bromobenzene	23762	99.7	6.7	80	120
74-97-5	Bromochloromethane	24356	100.8	7.5	78	123
75-27-4	Bromodichloromethane	26888	101.8	7.8	79	125
75-25-2	Bromoform	27675	97.8	10.8	66	130
74-83-9	Bromomethane	26717	97	14.7	53	141
75-15-0	Carbon disulfide	25719	98.8	11.5	64	133
56-23-5	Carbon tetrachloride	28870	103.8	10.7	72	136
108-90-7	Chlorobenzene	29802	100	6.1	82	118
124-48-1	Chlorodibromomethane	27424	100	8.5	74	126
75-45-6	Chlorodifluoromethane	7197	84.4	14.9	40	129
75-00-3	Chloroethane	27069	99	13	60	138
67-66-3	Chloroform	29373	101.1	7.5	79	124
74-87-3	Chloromethane	27697	94.5	15	50	139
156-59-2	cis-1,2-Dichloroethene	27935	100.1	7.5	78	123
10061-01-5	cis-1,3-Dichloropropene	27197	99.5	8	75	124
1476-11-5	cis-1,4-Dichloro-2-butene	1524	101.5	14.9	57	146
110-82-7	Cyclohexane	20438	100.4	10	71	130
1868-53-7	Dibromofluoromethane	5702	99.1	6.5	80	119
74-95-3	Dibromomethane	24473	101.1	7.3	79	123
75-71-8	Dichlorodifluoromethane [Freon-12]	25410	92	20.1	32	152
107-02-8	Acrolein [Propenal]	16380	96.8	19.3	39	155
107-13-1	Acrylonitrile	20173	99	11.9	63	135
107-05-1	Allyl chloride	15758	99	10.4	68	130
71-43-2	Benzene	34376	99.4	6.9	79	120
100-44-7	Benzyl chloride	10675	90.1	15.9	42	138
108-86-1	Bromobenzene	23762	99.7	6.7	80	120
74-97-5	Bromochloromethane	24356	100.8	7.5	78	123
75-27-4	Bromodichloromethane	26888	101.8	7.8	79	125
75-25-2	Bromoform	27675	97.8	10.8	66	130
74-83-9	Bromomethane	26717	97	14.7	53	141
75-15-0	Carbon disulfide	25719	98.8	11.5	64	133
56-23-5	Carbon tetrachloride	28870	103.8	10.7	72	136
108-90-7	Chlorobenzene	29802	100	6.1	82	118
124-48-1	Chlorodibromomethane	27424	100	8.5	74	126
75-45-6	Chlorodifluoromethane	7197	84.4	14.9	40	129
75-00-3	Chloroethane	27069	99	13	60	138
67-66-3	Chloroform	29373	101.1	7.5	79	124

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TITLE: VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)

Table 4. LCS Control Limits – Method 8260 Water Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
74-87-3	Chloromethane	27697	94.5	15	50	139
156-59-2	cis-1,2-Dichloroethene	27935	100.1	7.5	78	123
10061-01-5	cis-1,3-Dichloropropene	27197	99.5	8	75	124
1476-11-5	cis-1,4-Dichloro-2-butene	1524	101.5	14.9	57	146
110-82-7	Cyclohexane	20438	100.4	10	71	130
1868-53-7	Dibromofluoromethane	5702	99.1	6.5	80	119
74-95-3	Dibromomethane	24473	101.1	7.3	79	123
75-71-8	Dichlorodifluoromethane [Freon-12]	25410	92	20.1	32	152
75-43-4	Dichlorofluoromethane	1504	101.5	9.8	72	131
60-29-7	Diethyl ether	17189	98.6	10.2	68	129
108-20-3	Diisopropyl ether	22989	97.5	10.3	67	128
64-17-5	Ethanol	9543	99.2	17.1	48	151
141-78-6	Ethyl acetate	9208	96.8	13.9	55	138
97-63-2	Ethyl methacrylate	16674	98.7	9	72	126
637-92-3	Ethyl tert-butyl ether	19841	98.3	9.4	70	127
100-41-4	Ethylbenzene	33325	99.8	7	79	121
462-06-6	Fluorobenzene	1373	97.9	6.1	80	116
142-82-5	Heptane	11878	94.4	15	49	140
87-68-3	Hexachlorobutadiene	23535	100.1	11.3	66	134
67-72-1	Hexachloroethane	8718	102.9	10.3	72	134
110-54-3	Hexane	15545	95.5	15.9	48	143
74-88-4	Iodomethane	20229	100	10.4	69	131
78-83-1	Isobutyl alcohol	14123	97.7	11.7	63	133
108-21-4	Isopropyl acetate [Acetic acid]	7216	97.8	11.6	63	133
98-82-8	Isopropylbenzene	28636	101.5	9.9	72	131
179601-23-1	m/p-Xylene [3/4-Xylene]	28168	100.5	6.9	80	121
126-98-7	Methacrylonitrile	15982	97.9	11.6	63	133
79-20-9	Methyl acetate	19698	96	13.2	56	136
80-62-6	Methyl methacrylate	16524	97.7	10.2	67	128
1634-04-4	Methyl tert-butyl ether [MTBE]	29660	97.3	8.8	71	124
108-87-2	Methylcyclohexane	20025	101.8	10.1	72	132
75-09-2	Methylene chloride	27659	99.4	8.3	74	124
123-86-4	n-Butyl acetate	7247	96.8	9.4	69	125
75-43-4	Dichlorofluoromethane	1504	101.5	9.8	72	131
60-29-7	Diethyl ether	17189	98.6	10.2	68	129
108-20-3	Diisopropyl ether	22989	97.5	10.3	67	128
64-17-5	Ethanol	9543	99.2	17.1	48	151
141-78-6	Ethyl acetate	9208	96.8	13.9	55	138
97-63-2	Ethyl methacrylate	16674	98.7	9	72	126

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TITLE: VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)

Table 4. LCS Control Limits – Method 8260 Water Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
637-92-3	Ethyl tert-butyl ether	19841	98.3	9.4	70	127
100-41-4	Ethylbenzene	33325	99.8	7	79	121
462-06-6	Fluorobenzene	1373	97.9	6.1	80	116
142-82-5	Heptane	11878	94.4	15	49	140
87-68-3	Hexachlorobutadiene	23535	100.1	11.3	66	134
67-72-1	Hexachloroethane	8718	102.9	10.3	72	134
110-54-3	Hexane	15545	95.5	15.9	48	143
74-88-4	Iodomethane	20229	100	10.4	69	131
78-83-1	Isobutyl alcohol	14123	97.7	11.7	63	133
108-21-4	Isopropyl acetate [Acetic acid]	7216	97.8	11.6	63	133
98-82-8	Isopropylbenzene	28636	101.5	9.9	72	131
179601-23-1	m/p-Xylene [3/4-Xylene]	28168	100.5	6.9	80	121
126-98-7	Methacrylonitrile	15982	97.9	11.6	63	133
79-20-9	Methyl acetate	19698	96	13.2	56	136
80-62-6	Methyl methacrylate	16524	97.7	10.2	67	128
1634-04-4	Methyl tert-butyl ether [MTBE]	29660	97.3	8.8	71	124
108-87-2	Methylcyclohexane	20025	101.8	10.1	72	132
75-09-2	Methylene chloride	27659	99.4	8.3	74	124
123-86-4	n-Butyl acetate	7247	96.8	9.4	69	125
71-36-3	n-Butyl alcohol	10122	95.1	12	59	131
104-51-8	n-Butylbenzene	24088	101.1	8.8	75	128
109-60-4	n-Propyl acetate	602	100.8	8.3	76	126
103-65-1	n-Propylbenzene	24419	101	8.5	76	126
91-20-3	Naphthalene	27847	94.6	11.3	61	128
95-47-6	o-Xylene	31776	100	7.2	78	122
99-87-6	p-Isopropyltoluene [p-Cymene]	24335	102	8.5	77	127
76-01-7	Pentachloroethane	11688	101.1	10.7	69	133
109-66-0	Pentane	3915	74.8	19.7	16	134
107-12-0	Propionitrile [Ethyl cyanide]	15701	99.9	12	64	136
135-98-8	sec-Butylbenzene	24191	101.1	8.1	77	126
100-42-5	Styrene	26985	100.5	7.6	78	123
994-05-8	tert-Amyl methyl ether [TAME]	19726	98.1	10.1	68	128
75-65-0	tert-Butyl alcohol	21112	98.6	10.1	68	129
762-75-4	tert-Butyl formate	6651	98.1	11.1	65	132
98-06-6	tert-Butylbenzene	23919	101	7.7	78	124
127-18-4	Tetrachloroethene	29017	101.3	9.3	74	129
109-99-9	Tetrahydrofuran	18021	95	12.8	57	133
108-88-3	Toluene	33510	100.1	6.8	80	121

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TITLE: VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)

Table 4. LCS Control Limits – Method 8260 Water Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
2037-26-5	Toluene-d8	9809	100.4	3.8	89	112
156-60-5	trans-1,2-Dichloroethene	27663	99.5	8.2	75	124
10061-02-6	trans-1,3-Dichloropropene	27134	100	8.9	73	127
110-57-6	trans-1,4-Dichloro-2-butene	19320	91.5	16.1	43	140
79-01-6	Trichloroethene	30150	101.1	7.3	79	123
75-69-4	Trichlorofluoromethane	26108	103	12.8	65	141
71-36-3	n-Butyl alcohol	10122	95.1	12	59	131
104-51-8	n-Butylbenzene	24088	101.1	8.8	75	128
109-60-4	n-Propyl acetate	602	100.8	8.3	76	126
103-65-1	n-Propylbenzene	24419	101	8.5	76	126
91-20-3	Naphthalene	27847	94.6	11.3	61	128
95-47-6	o-Xylene	31776	100	7.2	78	122
99-87-6	p-Isopropyltoluene [p-Cymene]	24335	102	8.5	77	127
76-01-7	Pentachloroethane	11688	101.1	10.7	69	133
109-66-0	Pentane	3915	74.8	19.7	16	134
107-12-0	Propionitrile [Ethyl cyanide]	15701	99.9	12	64	136
135-98-8	sec-Butylbenzene	24191	101.1	8.1	77	126
100-42-5	Styrene	26985	100.5	7.6	78	123
994-05-8	tert-Amyl methyl ether [TAME]	19726	98.1	10.1	68	128
75-65-0	tert-Butyl alcohol	21112	98.6	10.1	68	129
762-75-4	tert-Butyl formate	6651	98.1	11.1	65	132
98-06-6	tert-Butylbenzene	23919	101	7.7	78	124
127-18-4	Tetrachloroethene	29017	101.3	9.3	74	129
109-99-9	Tetrahydrofuran	18021	95	12.8	57	133
108-88-3	Toluene	33510	100.1	6.8	80	121
2037-26-5	Toluene-d8	9809	100.4	3.8	89	112
156-60-5	trans-1,2-Dichloroethene	27663	99.5	8.2	75	124
10061-02-6	trans-1,3-Dichloropropene	27134	100	8.9	73	127
110-57-6	trans-1,4-Dichloro-2-butene	19320	91.5	16.1	43	140
79-01-6	Trichloroethene	30150	101.1	7.3	79	123
75-69-4	Trichlorofluoromethane [Freon-11]	26108	103	12.8	65	141
108-05-4	Vinyl acetate	18941	100.2	15.3	54	146
75-01-4	Vinyl chloride	29472	97.4	13.2	58	137
1330-20-7	Xylenes [total]	23426	100.1	7	79	121

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TITLE: VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)

Table 5. Quality Control Requirements – Organic Analysis by Gas Chromatography/Mass Spectrometry

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Tune Check	Prior to ICAL and prior to each 12-hour period of sample analysis.	Specific ion abundance criteria of BFB from method.	Retune instrument and verify.	Flagging is not appropriate.	No samples shall be analyzed without a valid tune.
Initial calibration (ICAL) for all analytes (including surrogates)	At instrument set-up, prior to sample analysis	Each analyte must meet one of the three options below: **Option 1:** RSD for each analyte ≤ 15%; **Option 2:** linear least squares regression for each analyte: $r^2 \geq 0.99$; **Option 3**: non-linear least squares regression (quadratic) for each analyte: $r^2 \geq 0.99$.	Correct problem then repeat ICAL.	Flagging is not appropriate.	Minimum 5 levels for linear and 6 levels for quadratic. No samples shall be analyzed until ICAL has passed. If the specific version of a method requires additional evaluation (e.g., RFs or low calibration standard analysis and recovery criteria) these additional requirements must also be met.
Retention Time window position establishment	Once per ICAL and at the beginning of the analytical sequence.	Position shall be set using the midpoint standard of the ICAL curve when ICAL s performed. On days when ICAL is not performed, the initial CCV is used.	NA.	NA.	Calculated for each analyte and surrogate.

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TITLE: VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)

Table 5. Quality Control Requirements – Organic Analysis by Gas Chromatography/Mass Spectrometry

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Evaluation of Relative Retention Times(RRT)	With each sample.	RRT of each reported analyte within ± 0.06 RRT units.	Correct problem, then rerun ICAL.	NA	After maintenance is performed which may affect retention times, RRTs may be updated based on the daily CCV. RRTs shall be compared with the most recently updated RRTs.
Initial Calibration Verification (ICV)	Once after each ICAL, analysis of a second source standard prior to sample analysis	All reported analytes within ± 20% of true value.	Correct problem. Rerun ICV. If that fails, repeat ICAL.	Flagging is not appropriate.	No samples shall be analyzed until calibration has been verified with a second source.

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TITLE: VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)

Table 5. Quality Control Requirements – Organic Analysis by Gas Chromatography/Mass Spectrometry

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Continuing Calibration Verification (CCV)	Daily before sample analysis; after every 12 hours of analysis time; and at the end of the analytical batch run.	All reported analytes and surrogates within ± 20% of true value. All reported analytes and surrogates within ± 50% for end of analytical batch CCV.	Immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails or if two consecutive CCVs cannot be run, perform corrective action(s) and repeat the CCV and all associated samples since the last successful CCV. Alternately, Recalibrate if necessary; then reanalyze all associated samples since the last acceptable CCV	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) in all samples since last acceptable calibration verification.	Results may not be reported without a valid CCV. Flagging is only appropriate in cases where the samples cannot be reanalyzed. If the specific version of a method requires additional evaluation (e.g., average RFs) these additional requirements must also be met.
Internal standards (IS)	Every field sample, standard and QC sample.	Retention time within ± 10 seconds from retention time of the midpoint standard in the ICAL; EICP area within - 50% to +100% of ICAL midpoint standard. On days when ICAL is not performed, the daily initial CCV can be used.	Inspect mass spectrometer and GC for malfunctions and correct problem. Reanalysis of samples analyzed while system was malfunctioning is mandatory.	If corrective action fails in field samples, data must be qualified and explained in the case narrative. Apply Q-flag to analytes associated with the non-compliant IS. Flagging is not appropriate for failed standards.	

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TITLE: VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)

Table 5. Quality Control Requirements – Organic Analysis by Gas Chromatography/Mass Spectrometry

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Method Blank (MB)	One per preparatory batch.	No analytes detected > ½ LOQ or > 1/10 the amount measured in any sample or 1/10 the regulatory limit, whichever is greater. Common contaminants must not be detected > LOQ.	Correct problem. If required, reprep and reanalyze MB and all samples processed with the contaminated blank.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch.	Results may not be reported without a valid method blank. Flagging is only appropriate in cases where the samples cannot be reanalyzed.
Laboratory Control Sample (LCS)	One per preparatory batch.	A laboratory must use the limits in Tables 3 and 4 for batch control if project limits are not specified. If the analyte(s) are not listed, use in-house LCS limits (see the LIMS) if project limits are not specified.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Must contain all surrogates and all analytes to be reported. Results may not be reported without a valid LCS. Flagging is only appropriate in cases where the samples cannot be reanalyzed.
Matrix Spike (MS)	One per preparatory batch.	A laboratory must use the limits in Tables 3 and 4 for batch control if project limits are not specified. If the analyte(s) are not listed, use in-house LCS limits (see the LIMS) if project limits are not specified.	Examine the project specific requirements. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met and explain in the case narrative.	Must contain all surrogates and all analytes to be reported. For matrix evaluation only. If MS results are outside the limits, the data shall be evaluated to determine the source(s) of difference, i.e., matrix effect or analytical error.

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TITLE: VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)

Table 5. Quality Control Requirements – Organic Analysis by Gas Chromatography/Mass Spectrometry

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Matrix Spike Duplicate (MSD) or Matrix Duplicate (MD)	One per preparatory batch.	A laboratory must use the limits in Tables 3 and 4 for batch control if project limits are not specified. If the analyte(s) are not listed, use in-house LCS limits (see the LIMS) if project limits are not specified. MSD or MD: RPD of all analytes ≤ 20% (between MS and MSD or sample and MD).	Examine the project specific requirements. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met and explain in the case narrative.	MSD: Must contain all surrogates and all analytes to be reported. The data shall be evaluated to determine the source of difference. For Sample/MD: RPD criteria only apply to analytes whose concentration in the sample is greater than or equal to the LOQ.
Surrogate Spike	All field and QC samples.	QC acceptance criteria specified by the project, if available; otherwise use limits in Tables 3 and 4 or in-house LCS limits (see the LIMS) if analyte(s) are not listed.	Correct problem, then reprep and reanalyze all failed samples for all surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference is present, reanalysis may not be necessary, but the client must be notified prior to reporting data and the failures must be discussed in the case narrative.	Apply Q-flag to all associated analytes if acceptance criteria are not met and explain in the case narrative.	Alternative surrogates are recommended when there is obvious chromatographic interference.

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Environmental Science Corporation
SOP MINOR REVISION FORM

SOP/DOC# 330363 Current revision date & number: R25 1/2/2018

Procedure/Method : VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)

Date	Requested By	Section	Revision	Reason*	Approvals	
					Supervisor	QA
2/15/18	Steve Miller	8.7.1	Revise last sentence of first paragraph from: "All QC samples and standards are to be analyzed under the same conditions as the samples, using 5g of clean sand or clean soil." To: "All QC samples and standards are to be analyzed under the same conditions as the samples, using 5g of clean blank matrix (e.g., sand, glass beads, soil, etc.)."	CAR2537	HF 3/1/18	Sam 2/15/18

*Comments:

Appendix C

Environmental Science Corporation
SOP MINOR REVISION FORM

SOP/DOC# 330363 Current revision date & number: 1/2/18 R25a

Procedure/Method : VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)

Date	Requested By	Section	Revision	Reason*	Approvals	
					Supervisor	QA
3/12/18	H. Ferrell	8.3.2.2	Remove: "A closing standard must also be analyzed at the end of the sequence for SM 6200"	Method Update	HF 3/13/18	SCM 3/13/18
		10.5	Remove: "For 6200B, a closing standard must also be analyzed at the end of the sequence. See sections 8.3.2 – 8.3.6 for acceptance criteria."		HF 3/13/18	SCM 3/13/18

*Comments: The method was interpreted for PID when originally implemented, but analyzed by GC/MS.

Appendix C

Environmental Science Corporation
SOP MINOR REVISION FORM

SOP/DOC# 330363 Current revision date & number: 1/2/18 R25b

Procedure/Method : VOLATILE ORGANIC COMPOUNDS BY GC/MS (EPA 8260B, 8260C, 624, 624.1 AND SM6200B)

Date	Requested By	Section	Revision	Reason*	Approvals	
					Supervisor	QA
9/4/18	H. Ferrell	5.5	Update from: "The storage blank is prepared from organic-free water and is placed in the cooler for a period of two weeks. Every two weeks, it is analyzed to verify that no contamination of client samples has taken place due to contamination in the storage unit." Update to: "The storage blanks are purchased from a vendor and must matrix match the contents of the cold room and is placed in the cooler for a period of two weeks. Every two weeks, the applicable storage blanks are analyzed to verify that no contamination of client samples has taken place due to contamination in the storage unit."	CAR3201	Heidi Ferrell 9/4/2018	JHB 9/5/18

*Comments:

Standard Operating Procedure

H:\QAQC\SOPS\METALS\340384B_SOLID MERCURY 7471A_072718.DOCX

TITLE: MERCURY IN SOLID WASTE (COLD-VAPOR TECHNIQUE) (EPA METHODS 7471A & 7471B)

Reviewed by: Jeremy Gupton, Jim Brownfield

Metals Department *QA Department*

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STATE NOTE: For samples analyzed in conjunction with the Ohio Voluntary Action Program (VAP) please utilize SOP #340384B_OH.

1.0 SCOPE AND APPLICATION

1.1 This cold vapor atomic absorption procedure is for determining the concentration of mercury in solids, sediments and sludge. The routine laboratory reporting limit is 0.02mg/kg; however reporting limits are subject to change to better meet client/project/regulatory needs or to improve laboratory method performance.

1.2 An MDL study must be completed at least annually or more frequently if major instrumentation changes occur. Method Detection Limits (MDLs) are performed based on Pace National SOP #030206. Updated MDL records are filed and stored in a central location within the department.

1.2.1 Limit of Detection (LOD) and Limit of Quantitation (LOQ) studies are completed at the frequency required by the TNI standard per the procedure identified in the Pace National SOP #030206, *Method Detection Limits (MDL), Limits of Detection (LOD) and Limits of Quantitation (LOQ).* Should the procedure be utilized for DoD support; then the frequency of these studies must meet the requirements of the current DoD QSM (see Attachment II).

2.0 METHOD SUMMARY AND DEFINITIONS

2.1 The goals of the mercury system are to convert all Hg species to Hg^{++} ions and break down all organic molecules in each sample. Organic molecules must be broken down to prevent their interference with mercury sample analysis. By adding an appropriate sequence of reagents to each sample and heating in a hot block for 30 minutes, all organic molecules are broken down and all Hg species are completely oxidized to Hg^{++} ions, used for cold vapor atomic absorption analysis.

2.2 A soil sample digestate with mercury in the divalent form enters the system and is mixed with a reducing agent ($SnCl_2$) to form elemental mercury vapor.

2.3 The dry vapor then enters the optical cell that has been optimized for fast response time and sensitivity. A mercury light source emits a stable source of light at 253.7nm wavelength. The intensity of the light source passing through the mercury cold vapor cell is measured using a solid-state detector with a wide dynamic range. To measure the mercury concentration, the

resulting sample absorbance signal is compared to the absorbance of the pure carrier gas flowing through the optical path under identical conditions.

2.4 Instrument Detection Limit (IDL) - The smallest signal above background noise that an instrument can reliably detect.

2.5 Linear Dynamic Range (LDR) – The concentration range where absorbance and concentration remain directly proportional to each other. A wide linear dynamic range permits the analysis of a wide range of sample concentrations (optical densities) and reduces sample preparation (dilution) requirements.

2.6 Serial Dilution (SD) – A subsequent dilution of a high concentration field sample that should agree within acceptance criteria of the original undiluted analysis. This is generally used as a test for matrix interferents or matrix effects.

2.7 Post Spike (PS) – A standard prepared from a previously analyzed spiked sample digestate that yielded reduced recovery for the target analyte due to a suspected matrix interferent.

2.8 See the current Quality Assurance Manual for other definitions associated with terms found in this document.

3.0 HEALTH AND SAFETY

3.1 The toxicity or carcinogenicity of each reagent used in this method has not been fully established. Each chemical should be regarded as a potential health hazard and exposure to these compounds should be as low as reasonably achievable. A reference file of safety data sheets (SDSs) are made available on Pace National's intranet to all personnel. Use hazardous reagents in a fume hood whenever possible and if eye or skin contact occurs, flush with large volumes of water. Always wear safety glasses or a shield for eye protection, protective clothing and observe proper mixing protocols.

3.2 Use of this procedure requires handling acid preserved samples, standards and concentrated acids. Always wear safety glasses, protective gloves and laboratory coat. Also, fume hoods must be used for both the automated and manual preparation of mercury samples. Mercury vapor is toxic: precaution must be taken to avoid inhalation.

3.3 Before preparing any samples, analyst must be familiar with all safety techniques involving strong acids and any of the other chemicals or reagents used. Refer to the appropriate Material Safety Data Sheets (MSDS) for all pertinent information.

3.4 Before starting a sample preparation run, check to ensure that the vent hood connection is drawing at the required flow rate. The exhaust may contain minute amounts of mercury or other potentially dangerous chemicals.

3.5 Many mercury-containing compounds are highly toxic, if swallowed, inhaled or absorbed through the skin. Extreme care must be exercised in the handling of concentrated mercury reagents. These reagents should only be handled by analysts knowledgeable of their risks and of safe handling procedures.

Standard Operating Procedure

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TITLE: MERCURY IN SOLID WASTE (COLD-VAPOR TECHNIQUE) (EPA METHODS 7471A & 7471B)

4.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

4.1 All samples must have been collected using a sampling plan that addresses the considerations of this method.

4.2 Soil samples are stored at 4°± 2°C.

4.3 Holding times for field samples are 28 days from sample collection to preparation.

4.4 All glassware must be washed with a laboratory detergent (e.g., Alconox), tap water rinsed, nitric acid rinsed and then rinsed with DI water. See Pace National SOP #030701, *Glassware Cleaning*.

4.5 Samples can be collected in either plastic or glass containers.

4.6 Samples submitted for analysis that do not meet the requirements contained within this section must be addressed before performing the logging process within the laboratory. In some cases, exceeding the appropriate preservation and storage criteria can cause significant bias in the resulting data. Clients may need to resubmit samples where the conditions during shipment cause uncertainty regarding sample integrity. If samples do not meet the requirements for preservation, sampling, shipment and storage and the client approves the completion of the analytical process, sample results can be qualified per the Pace National SOP #030201, *Data Handling and Reporting*.

5.0 INTERFERENCES

5.1 Potassium permanganate is added to eliminate possible interference from sulfide. The $KMnO_4$ oxidizes the sulfides.

5.2 It has been reported that copper could cause interference though the laboratory has not detected this effect.

5.3 Chlorides can also cause interferences; so additional potassium permanganate is added to oxidize chloride to free chlorine. Free chlorine absorbs radiation at 254nm, so an excess of hydroxylamine sulfate is added to remove free chlorine.

5.4 Some volatile organic materials that absorb at 253.7nm could cause interference. If interference is a problem during a sample run, a preliminary run without reagents determine if this type of interference is present.

6.0 EQUIPMENT AND SUPPLIES

6.1 Perkin Elmer FIMS400 Mercury Analyzer, Leeman Hydra II or equivalent.

6.2 Polypropylene culture test tubes, 15mL and 50mL capacity.

6.3 10mL graduated glass disposable serological pipettes. (Pyrex or equivalent)

6.4 Class A 100mL volumetric flasks (Pyrex or equivalent).

6.5 Class A volumetric pipettes, 1mL and 5mL.

6.6 8 cup capacity standards rack

6.7 98 cup capacity sample rack

6.8 50mL disposable polypropylene sample containers

6.9 Mettler analytical balance or equivalent

6.10 Bulk Liquid Compressed Argon gas, pre-purified, used as instrument carrier gas.

6.11 Precision Hot Block (Brand name - MOD Blocks or equivalent).

6.12 Computer software used: (AA WINLAB, version 2.50 or equivalent).

6.13 Sample introduction system (auto sampler) - (Model, instrument #1 & #3 is a Perkin Elmer AS91, and for instrument #2 a Perkin Elmer AS90, or equivalent).

6.14 Peristaltic pump, to pump reagents and samples through the detector.

6.15 Computer used is a COMPAQ or equivalent.

6.16 Adjustable-volume pipetter (Eppendorf, or equivalent)

7.0 REAGENTS AND STANDARDS

7.1 All reagents and standards must be recorded in the appropriate preparation log and assigned a unique number. See SOP #030230, *Standards Logger – Tree Operation*. Additional information regarding reagent preparation can be found in the Standards Logger (Tree) digital archive system. All spiking solutions and surrogate standard solutions should be replaced at least every 6 months or sooner if a problem is detected, unless otherwise noted.

7.2 ASTM Type 1 water - Water must be free of mercury or anything that may interfere with the mercury analysis.

7.3 Stock standards expiration date is one year from the date received or the expiration date assigned by the manufacturer whichever is sooner.

7.4 Concentrated hydrochloric acid (HCl) – Concentrated, trace metal grade (OMNI TRACE, catalog# HX0607-2 or equivalent). NOTE: manufacturer shelf life/expiration date.

7.5 Concentrated nitric acid (HNO_3) – Concentrated, trace metal grade (VWR EM-Nx0407-2 or equivalent). NOTE: manufacturer shelf life/expiration date.

7.6 5% Potassium Permanganate ($KMnO_4$) solution – JT Baker 3227-01 or equivalent. Weigh 500 ± 0.01g of potassium permanganate per 10L reagent water.

7.7 Sodium Chloride-Hydroxylamine Sulfate – prepared by placing 240 ± 0.01g of Hydroxylamine sulfate, JT Baker N646-07, or equivalent, and 240 ± 0.01gof sodium chloride (EM Science SX0420-1 or equivalent) into 2L reagent water.

7.8 1.1% Stannous Chloride – JT Baker 3980-11 or equivalent. Weigh 22.0 ± 0.01g $SnCl_2$ and 60mL conc. HCl (3%) in a 2L volumetric flask and dilute to 2L with DI water. See section 13.2. **Made fresh DAILY. The reagents used to make this are recorded separately on the Prep sheets.**

7.9 10% Stannous Chloride – JT Baker 3980-11 or equivalent. Weigh 100.0 g SnCl2 and 100mL conc. HCL (3%) in a 1L volumetric flask and dilute to 1L with DI water. See section 13.2. **Made fresh DAILY. The reagents used to make this are recorded separately on the Prep sheets.**

7.10 Aqua Regia – Prepare immediately before use, by carefully adding three volumes of concentrated HCl to one volume of concentrated HNO_3. **The reagents used to make this are recorded separately on the Prep sheets.**

7.11 Primary Stock Mercury Solution: 1000ppm, Ultra Scientific, Cat # ICP-080, Inorganic Ventures, cat# AAHG1-5 or equivalent. This primary stock solution is used for calibration standards, continuing calibration verification (CCV), Low Level Calibration Verification (ICVLL/CCVLL)), Matrix Spike (MS), Matrix Spike Duplicate (MSD), (see section 13.4).

7.12 Secondary Source Stock Mercury Solution: Must be a stock solution equivalent to the Primary stock solution but MUST be from a different vendor. This stock solution is used for initial calibration verification (ICV), Laboratory control sample (LCS), and Laboratory control sample duplicate (LCSD) (see section 13.4).

7.13 1PPM Intermediary Standards: Make up this concentration from both sources: the Primary 1000PPM source and the Secondary 1000PPM source. For the 1PPM Primary intermediate solution, spike 0.5mL of the 1000PPM stock solution into 50mL Class A volumetric flask with approximately 10mL of DI water and 5mL of concentrated nitric acid and bring up to volume with DI water. For the 1PPM Secondary Intermediate solution, spike 0.5mL of the 1000PPM secondary stock solution into 50mL Class A volumetric flask with approximately 10mL of DI water and 5mL of concentrated nitric acid and bring up to volume with DI water. These intermediate standards are prepared fresh weekly. The 1PPM secondary stock solution is used for the ICV, LCS, LCSD. See section 13.4.

8.0 PROCEDURE

8.1 Digestion

8.1.1 For the calibration curve and instrument QC (ICVs and CCVs), using a continuously adjustable-volume pipetter, add 5mL of DI water to the digestion tubes and spike each level with the appropriate amount of intermediate standard, and continue prepping per method. Typical spiking levels are as follows; however see Section 13.4 for more information:

- 0.0ppb - No spike
- 0.2ppb - 6uL of 1PPM Primary Intermediate
- 0.4ppb - 12uL of 1PPM Primary Intermediate
- 1.0ppb - 30uL of 1PPM Primary Intermediate
- 2.0ppb - 60uL of 1PPM Primary Intermediate

- 5.0ppb - 150uL of 1PPM Primary Intermediate
- 10.0ppb - 300uL of 1PPM Primary Intermediate
- ICV-3.0ppb - 90uL of 1PPM Secondary Intermediate
- CCV-2.5ppb - 75uL of 1PPM Primary Intermediate
- ICVLL/CCVLL --0.2ppb –6uL of 1PPM Primary Intermediate

8.1.2 For the method blank, weigh out 0.3 ± 0.05g of Chemware Teflon chips into the digestion tube. Using an adjustable volume pipetter, add 2.5mL of DI water to the digestion tube. Aliquots of this blank will serve as the method blank, the ICB, and the CCB during analysis.

8.1.3 For the LCS/LCSD, weigh out 0.3g of Chemware Teflon chips into the digestion tube, spike 90uL of 1PPM Secondary Intermediate standard into the digestive tube, then using adjustable volume pipetter add 2.5mL of DI water to the digestion tube. This weight may vary, depending on the concentration of the Hg standard from one lot# to the next.

8.1.4 For the samples, weigh out 0.3 ± 0.05g of each field sample and record the weight. Prior to weighing, mix the sample to ensure that it is adequately homogenized. If there are large solid artifacts such as stones and concrete, these can be broken up with a mortar and pestle before the sample is weighed. Note the final weight in the prep log. With the adjustable volume pipetter, add 2.5mL of DI water into each of the digestive tubes. See section 13.5.

8.1.5 For the MS/MSD, weigh out 0.3 ± 0.05g of a specified client sample, or a randomly selected client sample if none are specified, into the digestive tube. Spike 90uL of 1PPM Primary Intermediate standard into the digestive tube then using adjustable volume pipetter, add 2.5mL of DI water to the digestive tube.

8.1.6 Add 2.5mL of Aqua Regia to all samples, standards and QC samples and cap tightly.

8.1.7 Heat for two minutes in a hot block at 95 ± 3°C.

8.1.8 Cool for a minimum of five minutes. Add 25mL of DI water, swirl to mix, then add 7.5mL of 5% potassium permanganate solution. Swirl to mix. Allow purple color to persist for at least fifteen minutes. If the purple color persists move to step 8.1.9. If the purple color does not persist, add additional amounts of potassium permanganate crystals until the sample stays purple. Add the same amount of additional crystals to the LCS/LCSD and blanks as well.

8.1.9 Heat in a hot block for at least thirty minutes at 95 ± 3°C. Record the time-in and temperature-in of the hot block on the Hg bench sheet.

8.1.10 After thirty minutes of digestion, take the sample out of the hot block and allow them to cool for a minimum of ten minutes. Record the time-out and temperature-out of the hot block. If any sample is colorless, it must be re-digested since the sample may have been lost due to insufficient amount of potassium permanganate added prior to digestion, or due to the matrix of the

sample. If the temperature-out is outside the 95 ± 3°C range, the samples must be re-digested.

8.1.11 After cooling, add 3mL of sodium chloride-hydroxylamine sulfate to reduce the excess potassium permanganate. Swirl until purple color is gone. If the purple color persists, extra hydroxylamine sulfate crystals can be added. Allow sample to cool further, approximately 10-15 minutes, or to room temperature, and then adjust the volume to 50mL with DI water, as needed, using the graduations on the digestion vessel that are certified volumetrically by the manufacturer. The samples are ready for analysis.

NOTE: Final volume is recorded as 27.5mL for calculation purposes.

8.1.12 Stannous Chloride-HCl ($SnCl_2$) mix is not added during the digestion process, but is added during analysis through the instrument peristaltic pump. It is mixed with each sample, QC sample and all standards during the analysis.

8.2 Mercury Calibration and Analysis:

8.2.1 Daily maintenance- For FIMS100 instruments change tubing, change membrane, and flush system daily. For Leeman Hydra II AA instrument the system is flushed daily.

8.2.2 Allow the detector to warm up at least thirty minutes before analyzing samples.

8.2.3 Turn on the auto sampler and pump. Clamp pump tubing down. Make sure the argon gas is turned on and that argon gas flow is present. Ensure that the $SnCl_2$ and DI water are flowing. If the pump is not running correctly, re-adjust the tubing on the pump.

8.2.4 Turn on the Flow Injection Automated System (FIAS) Mercury unit and prime the instrument with regents for thirty minutes.

8.2.5 Enter in the computer, the sample run (standards, QC samples and then the samples).

8.2.6 After all the information for the sample run has been entered in the computer, and the instrument has been primed, load the digested calibration standards, QC samples, and then the samples into the auto sampler rack. The peristaltic pump mixes the $SnCl_2$-HCl solution into the field samples and transfers the standards and samples into the analyzer. Begin the analytical sequence.

8.3 Method performance criteria and corrective action procedures are found in Sections 10 & 11 of this procedure.

9.0 DATA ANALYSIS AND CALCULATIONS

See the current Quality Assurance Manual for equations associated with common calculations.

10.0 QUALITY CONTROL AND METHOD PERFORMANCE

Standard Operating Procedure

TITLE: MERCURY IN SOLID WASTE (COLD-VAPOR TECHNIQUE) (EPA METHODS 7471A & 7471B)

10.1 All analysts must meet the qualifications specified in SOP #030205, *Technical Training and Personnel Qualifications* before approval to perform this method. Analysts must complete an initial demonstration of proficiency before being approved to perform this method. Continuing proficiency must be demonstrated using proficiency testing, laboratory control sample analysis and/or MDL studies. Method performance is assessed per analyst. Updated method performance records are filed and stored in a central location within the department.

10.2 Use the designated Run log to record batch order and standards/reagents used during analysis. See SOP #030201, *Data Handling and Reporting*.

10.3 Batches:

Preparation batches are defined as sets of 1 – 20 samples. Preparation batch analysis must include the following: 1 method blank, 1 Laboratory Control Sample (LCS), 1 Laboratory Control Sample Duplicate (LCSD), 1 Matrix Spike/Spike Duplicate (MS/MSD) pair. All batch information must be maintained in the preparation documentation assigned to the department.

10.4 Analytical batches require all the samples contained within the previous preparation batches and additional instrument operating requirements. Analytical batches include: 1 Initial Calibration Verification (ICV) sample, 1 Low Level Calibration Verification (ICVLL/CCVLL) sample, 1 Initial Calibration Blank (ICB, 1 Continuing Calibration Verification (CCV) sample following every 10th sample and at the conclusion of the sequence, 1 Continuing Calibration Blank following each CCV, Initial Calibration - The curve is prepared daily and must consist of at least five standards and a blank. The calibration is acceptable when the correlation coefficient is $\geq$ 0.998. The concentrations of the curve analyzed are as follows, 0.0, 0.2, 0.4, 1.0, 2.0, 5.0, and 10.0ppb. See section 13.4. The calibration curve must contain a standard at or below the reporting limit. The blank is included as a point in the calibration curve to account for any background interferences that may be present in the digestion solutions. Do not force the curve regression fit through zero.

10.5 Initial Calibration Verification (ICV)/Low Level Calibration Verification (ICVLL/CCVLL) - After the passing standardization is achieved, analyze the calibration verification standard (ICV). The ICV recovery must be within $\pm$10% of the true value. Following the ICB, a Low Level calibration verification (ICVLL/CCVLL) is analyzed, recovery must be within $\pm$30% of the true value. CCVLL must be run at the end of the analysis.

10.6 Continuing Calibration Verification (CCV) - After every ten samples and at the end of the analysis, analyze the mid-range CCV. The mid-range CCV must be within $\pm$10% of the true value.

10.7 Method Blank/Initial & Continuing Calibration Blank (ICB/CCB) - One method blank must be analyzed for every twenty samples. The ICB is analyzed following every Initial Calibration Verification (ICV) standard and the CCB is analyzed following each CCV and at the conclusion of the sequence. Mercury should not be detected in the blank >½ reporting limit (RL).

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10.8 Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) – An LCS/LCSD must be performed with each batch of twenty field samples. The LCS/LCSD recoveries must be ±20% The RPD of the LCS/LCSD must be <20%.

10.9 Matrix Spike/Matrix Spike Duplicate (MS/MSD) - An MS & MSD must be analyzed with every batch of samples. The MS/MSD are prepared by spiking two separate aliquots of a field sample with a known amount of standard. The MS and MSD are prepped and analyzed in the same manner as the samples. Recovery must be within ±25% of the true value for accuracy and the relative percent difference (RPD) must be <20%.

10.10 Serial Dilution - A serial dilution is analyzed if a sample is x25 the MDL or higher. A serial dilution is, at a minimum, a 5 times dilution of the sample, and must agree within 10% of the original value.

10.11 Post Spike - If the MS/MSD recovery fails, or if an MS/MSD is not analyzed, due to insufficient sample, a post spike must be analyzed when the sample concentration is less than x25 the MDL. If the sample concentration is less than the MDL, spike the sample at x20 the MDL. The criteria for the post spike must be within ±15% of the true value. **If the MS/MSD recovery passes, a post spike need not be analyzed**.

10.12 Dilutions - Any sample, with a concentration over the high standard in the curve, must be diluted within the range of the calibration. This dilution must be at the lowest dilution possible, to keep reporting limits as low as possible.

10.13 Digestion Temperature - The hot block's temperature is monitored using a temperature blank containing a thermometer that is calibrated against a NIST traceable reference thermometer. The temperature blank is moved to a different position in the hot block each time samples are digested. The daily temperature blank is documented each day in the appropriate logbook.

10.14 Sample Analysis - During the analysis of the samples, the instrument supplies triplicate readings. The responses must have a %RSD of <20% for all results >RL. The instrument automatically reports the mean of triplicate scans using a simple average calculation: A+B+C/3 = reported concentration for the sample.

Do not report data below the determined analyte reporting limit concentration or below an adjusted detection limit reflecting smaller sample aliquots used in processing or additional dilutions required by the analysis.

Sample data should be reported in units of mg/Kg for soil samples on a dry weight basis. For soil samples report the data generated directly from the instrument with allowance for any sample dilution.

When reporting, round the data values to the tenth place and report analyte concentrations up to two significant figures. Extract concentrations for solids data are rounded in a similar manner before calculations in Section 9.2 are performed.

10.15 Instrument Detection Limit (IDL) - The instrument detection limit is calculated by performing ten sequential replicate measurements of a method blank. The standard

deviation of these measurements is calculated and the IDL is equal to three times the standard deviation of the measurements. The IDL assures with 99% certainty that a value is above the instrument noise level. This IDL study is done on a quarterly basis.

NOTE: An IDL is a statistical determination without analytes present and an MDL is determined with low levels of analytes present.

10.16 For corrective actions, see section 11.0.

11.0 DATA VALIDATION AND CORRECTIVE ACTION

11.1 All sample data must undergo a QC review.

11.1.1 The reviewer must verify that all reportable results are derived from data that are within the calibration range.

11.1.2 Analysts signs and dates the appropriate raw data, printouts and bench sheets

11.1.3 All calculations must be checked.

11.1.4 Data must be checked to confirm that all required QC checks have been analyzed and that they are within acceptable limits.

11.1.5 Data must be checked for the presence or absence of appropriate flags. Comments must be noted when data is flagged.

11.1.6 See SOP #030201, *Data Handling and Reporting*.

11.2 Initial Calibration – Since calibration curves are prepared and digested with field samples, any curve that is prepared and analyzed that does not meet the acceptance criteria must be re-prepared, along with all the relevant field samples and QC that are prepared in conjunction with the calibration curve.

11.3 ICV – If the first run of the mid-range ICV does not pass the ± 10% criteria and/or the Low Level does not pass the ±30% criteria, rinse and rerun the standard once. If this fails, corrective action must be taken. The corrective action includes re-calibration and re-analysis, using the same ICV/LL standard. If acceptance criteria are still not met, re-check the standard curve and ICV/LL preparation and/or perform instrument maintenance. If still does not pass, refer to manufacturer's instruction manual, or call a service representative. Since the standards are digested in conjunction with the field sample, if failures result from the standards, all samples within the preparation batch must be re-digested.

11.4 CCV – If the first run of the CCV or the Low Level does not pass and analysis of a second consecutive (immediate) calibration verification fails to produce results within acceptance criteria, corrective actions shall be performed. The laboratory shall demonstrate acceptable performance after the final round of corrective action with two consecutive calibration verifications, or a new initial instrument calibration shall be performed.

11.5 Blanks (Method/ICB/CCB) - If the Method Blank, ICB, or CCB fails the acceptance criteria, stop the run and re-analyze once. . If the contamination still occurs, corrective actions

can include instrument maintenance, reviewing data for errors and review of the calibration curve. If the contamination still occurs after maintenance has been performed the batch must be re-distilled. A passing method blank must be analyzed before any samples are analyzed.

State Note: For Wisconsin samples, the method blank must not contain analytes more negative than the MDL value. If target analytes are more negative than the MDL, the instrument must be recalibrated or a new LOD study performed.

General guidelines for qualifying sample results with regard to method blank quality are as follows:

- If the method blank concentration is less than the MDL and sample results are greater than the RL, then no qualification is required.
- No qualification is necessary when an analyte is detected in the method blank but not in the associated samples.
- If the concentration in a sample is more than ten times the concentration in the method blank, then no qualification is required.
- If the method blank concentration is greater than the MDL but less than the RL and sample results are greater than the MDL, then qualify associated sample results to indicate that analyte was detected in the method blank.

If the method blank concentration is greater than the RL, further corrective action and qualification is required. An analyst should consult their supervisor for further instruction.

11.6 LCS/LCSD – If the LCS fails the criteria, stop the run and re-analyze one more time. If the LCS still fails, re-calibrate the instrument. After recalibration, if the LCS fails again, all samples within the prep batch must be re-digested. If an LCSD is performed, it must also meet the LCS acceptance criteria provided by the manufacturer. If a LCS/LCSD are outside the control limits (>20%), results are flagged with a “J3” (the associated batch QC was outside the established quality control range for precision), re-digestion may be necessary. Consult your supervisor.

11.7 MS/MSD – If the MS/MSD fails the criteria, stop the sequence and re-analyze once. If the MS/MSD failure persists, run a post spike. The post spike must pass within the acceptance criteria listed in section 10.12. If the post fails and the LCS was within method limits, then the recovery problem with the MS/MSD is judged to matrix-related. If the LCS is within method control limits, this demonstrates the laboratory performance was in control in a clean matrix. Re-digestion may still be necessary however, if the supervisor or the client requests a re-digestion. If re-digestion is not performed, the failures must be flagged with a “J5” (the sample matrix interfered with the ability to make any accurate determination; spike value is high), or “J6” (the sample matrix interfered with the ability to make any accurate determination; spike value is low). If there is a RPD failure, a re-prep is be used to confirm results, when possible.

11.8 Sample Duplicate - If a duplicate is analyzed and the duplicate RPD is outside the control limits (>20%), results are flagged with a “J3” (the associated batch QC was outside the

established quality control range for precision), re-digestion may be necessary. Consult your supervisor.

11.9 Serial Dilution – If the dilution does not meet the required acceptance criteria, re-dilute the sample and re-analyze. If the failure persists, re-analyze both the parent sample and the dilution. If failure still occurs, re-calibrate and re-analyze both the parent and the dilution.

11.10 Post Spike – If the MS/MSD recoveries pass the acceptance criteria, a post spike is not required. If performed and the post spike does not meet the acceptance criteria, re-analyze once. If the failure persists, re-analyze both the parent sample and the spike. If failure still occurs, dilute the parent sample and re-spike and re-analyze. If the re-analysis passes, the confirmation of a matrix effect is confirmed and must be noted on the final client report.

11.11 Digestion Temperature - If the temperature-out is outside 95 ± 3°C range after the thirty minutes of digestion, re-digest the entire batch.

11.12 Digestate - If any sample is colorless after digestion, the sample must be re-digested since the sample may have been lost due to insufficient amount of potassium permanganate added prior to the digestion or due to the matrix of the sample.

11.13 Sample Concentrations - The analyst must verify all reported results are derived from the analytical results that are both above the MDL and below the high standard used in the curve.

Sample concentrations that have been analyzed using the extracts in its most concentrated form, and are <RL, report the result as <RL.

For sample results that are above the MDL, but below, the reporting limit, these results must be flagged as estimated values (J flag).

11.14 CCVLL - The %R for the CCVLL must be within 30% of the expected concentration. If the recovery does not meet this criterion, re-analyze once. If the failure persists, the instrument should be checked, the reagents and standards should be checked, and the instrument must be re-calibrated. If no obvious cause is identified for the failure, re-prepare and re-analyze the workgroup

STATE NOTE: If the sample is analyzed in conjunction with the Ohio VAP, corrective action for failing QC (i.e. blank, spike, etc.) must be performed prior to flagging data, if sufficient sample volume was submitted by the client. Corrective action can include re-analysis, if instrument malfunction is suspected, or re-preparation and re-analysis, if the failure is suspected as either extraction or sample related.

Standard Operating Procedure

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TITLE: MERCURY IN SOLID WASTE (COLD-VAPOR TECHNIQUE) (EPA METHODS 7471A & 7471B)

12.0 POLLUTION PREVENTION AND WASTE MANAGEMENT

12.1 The EPA requires that laboratory waste management practice to be conducted consistent with all applicable federal and state laws and regulations. Excess reagents, samples and method process wastes must be characterized and disposed of in an acceptable manner. See *Pace National Waste Management Plan.*

12.2 See SOP #030302, *Environmental Sustainability & Pollution Prevention*.

13.0 METHOD MODIFICATIONS/CLARIFICATIONS

13.1 HCl is used in the $SnCl_2$ mixture per the instrument manufacturer's instruction manual that specifies HCl in the $SnCl_2$ instead of sulfuric acid.

13.2 The stannous chloride solution concentration has been modified in this procedure to reflect the instrument manufacturer's recommendation (Mercury Hydride Analysis Flow Injection (pg. 2/13).

13.3 Modifications to this method are noted in the body of the text as state notes. Compliance analyses performed in conjunction with specific state requirements must be performed as noted within the specific state(s) listed.

13.4 Adjustments to the concentrations of standards/spiking solutions, standards providers, and quality control are subject to change to better meet client/project/regulatory needs or to improve laboratory method performance.

13.5 The sample amount utilized by this procedure has been modified from the method due to the capacity of the digestion containers. Digestion solutions have been reduced proportionally with this reduction in sample used to remain as consistent as possible with method requirements.

14.0 REFERENCES

14.1 *Mercury in Solid or Semisolid Waste (Manual Cold-Vapor Technique)*, SW-846 Method 7471A, Revision 1, September 1994.

14.2 Perkin Elmer FIMS 400 Instruction Manual.

14.3 *Mercury in Solid or Semisolid Waste (Manual Cold-Vapor Technique)*, SW-846 Method 7471B, Revision 2, February 2007.

14.4 *Flame Atomic Absorption Spectrophotometry*, SW-846 Method 7000B, Revision 2, February 2007.

14.5 *Atomic Absorption Methods*, SW-846 Method 7000A, Revision1, July 1992.

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TITLE: **MERCURY IN SOLID WASTE (COLD-VAPOR TECHNIQUE) (EPA METHODS 7471A & 7471B)**

Attachment I: Revision History

Current Version:

Version	Date	Description of Revisions
13	7/27/18	Update in response to WI audit. Changed logo. Added state note to 11.5

Superseded Versions:

This document supersedes the following:

Version	Date	Description of Revisions
0	7/30/04	Origination
1	12/5/05	
2	11/3/06	
3	1/23/09	
4	1/29/09	
5	9/20/10	
6	5/4/12	Technical and Quality Review and update. Revised sections 8.1.1 through 8.1.5, 12.1 and 13.4; Added state notes prior to section 1.0 and following section 10.17; Added sections 1.2.1, 2.20 through 2.27, 4.6, 10.17 and 11.15.
7	10/15/13	Technical and Quality Review and update. Revised sections 1.1, 7.1, 7.8, 8.1.2 through 8.1.5, 8.1.8 and 8.1.11; Added section 13.5.
8	8/17/2015	Technical and Quality Review and update. Revised Sections 2.10, 2.13, 2.14, 6.1, 6.8, 7.8, 7.10 through 7.12, 8.1.1 through 8.1.3, 8.1.5, 8.1.8, 10.3, 10.5 through 10.10, 11.3, 11.4, and 11.6. Revised State Note Prior to Section 1.0. Deleted State Note in Section 10.7. Deleted Sections 2.10, 7.13, 10.10, and 11.11.
9	9/9/2015	Header and signature block formatting. Technical and quality review and update. Revised Sections 1.2.1 and 8.1.5. Added Attachment II.
10	10/20/2015	Technical review and update. Added Section 8.2.1.
11	10/14/2016	Technical and quality review and update. Header and signature block re-formatting. Revised Sections 2.4, 2.5, 2.6, 2.7, 2.8, 7.1, 7.8, 7.9, 7.10, 7.11, 7.12, 7.13, 8.1.3, 8.1.11, 9.0, 10.16, 11.4, 11.5, 11.14, 14.1, 14.2, 14.3, 14.4, 14.5, and Attachment II Table 2. Deleted Sections 2.4, 2.6, 2.8 through 2.16, 2.19 through 2.26, 9.1 through 9.6, 10.5, and 10.16.
12	11/30/2017	Update in response to A2LA audit finding CAR2872. Changed ESC logo. Updated Section 3.1 and Attachment II Table 4.

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TITLE: MERCURY IN SOLID WASTE (COLD-VAPOR TECHNIQUE) (EPA METHODS 7471A & 7471B)

Attachment II: DoD Requirements

1.0 Equipment/Instrument Maintenance

Instrument maintenance must be performed routinely to optimize instrument performance and improve chromatography. Commonly performed maintenance includes lamp replacement, optical cell and UV window cleaning, mirror cleaning, tubing replacement, etc. A new calibration curve must be analyzed following any major maintenance performed on the analytical system.

2.0 Computer Hardware and Software

Software name and version: AA WINLAB, version 2.50 or equivalent

3.0 Troubleshooting

Table 1. Mercury Troubleshooting Guide

Problem	Cause	Treatment
Hydra II		
No or Low Signal for Standards	Stannous Chloride	Check tubing. Replace stannous chloride solution.
	Carrier Gas	Check liquid/gas separator to ensure proper gas flow. Check exhaust of the CVAAS module by placing tubing into container of water and observe bubbling.
	Leak in the sample vapor path	Check all tubing and connections. Ensure that the absorption cell windows are in place.
	Blockage in the sample vapor path	Submerge the CVAAS exhaust line in water to confirm that the carrier gas is flowing throughout the system.
No or Low Signal for Samples	Incomplete Digestion	Samples high in organic content may require additional oxidant or heating during the digestion to complete oxidation.
	Sample Interferences	Samples with high iodide (or other interferent) content will cause low signal. Dilute sample.
Poor Precision	Signal has not reached plateau	Increase the uptake time or gas flow
	Integration	Longer integration times should result in better precision.
	Low light intensity	The signal value displayed on the Method/Instrument Control should be 250000 or greater. If low, make sure cells are properly held in clamps and clean optics if necessary.
Lamp does not light	Instrument not powered	Check electrical connections. Ensure instrument is powered up.

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TITLE: MERCURY IN SOLID WASTE (COLD-VAPOR TECHNIQUE) (EPA METHODS 7471A & 7471B)

Table 1. Mercury Troubleshooting Guide		
Problem	**Cause**	**Treatment**
	Instrument status is idle	Restart instrument by completely powering down. If problem persists, schedule outside maintenance.
	Lamp status is off	Change status to on in instrument menu bar.
	Lamp assembly is not fully inserted into control board	Power down the instrument before touching the lamp. Release lamp contacts then re-insert lamp.
	Defective lamp	Replace lamp.
FIMS		
Poor Sensitivity	Reagents	Prepare fresh solutions. Install new tubes and manifold.
	Gas/Liquid Separator	Adjust the flow. Install a new dry membrane. Clean the gas/liquid separator.
	Carrier Gas Flow	Optimize the carrier gas flow.
	Leaks, Blockages, Contamination	Ensure the carrier and reductant tubes are in the correct containers. Replace worn pump tubes. Clean the fluid system. Clean the manifold.
	FIMS-Cell	Clean the cell or windows. Reduce the extraction rate of the fumes from the exhaust outlet of the cell.
All replicates following the first reading give low absorbance readings	Fill Step in FIAS program too short	Increase the time for the Fill step on the FIAS page of the method editor
First replicate of a series gives low absorbance reading	Prefill step in FIAS program too short	Increase the time for the prefill step on the FIAS page of the method editor or shorten the tube between the sample container and the FIAS valve.
Double peak in peak display	Concentration of samples too high	Dilute the samples
	Air trapped in the fluid system	Check all tubing connections. Tighten by hand. Replace damaged connectors
	Carrier or reductant flows are incorrect	Ensure the carrier and reductant tubes are in the correct containers. Set the flows correctly.
	No acid in sample solutions or acid too weak	Add acid to the samples
Baseline shift in Peak Profile	Air trapped in the fluid system	Check all tubing connections. Tighten by hand. Replace damaged connectors
Pump heads stop rotating	Pressure on the pump tube magazines is too high	Reduce the pressure with the pressure adjustment screws

4.0 Other Requirements

4.1 All hardcopy laboratory notebooks must be reviewed by the Supervisor, or their designee, on a monthly basis.

4.2 If not self-explanatory (e.g., a typo or transposed number), corrections to technical and quality records shall also include a justification for the change.

4.3 A person performing a manual integration must sign and date each manually integrated chromatogram and record the rationale for performing manual integration. Electronic signatures are acceptable.

4.4 The results of calibration and verification of support equipment must be within the specifications required of the application for which this equipment is used or the equipment must be removed from service until repaired. Calibration and verification records, including those of established correction factors, must be maintained. In the absence of method-specific requirements, the minimum requirements are as follows:

Table 2. Support Equipment Checks

Performance Check	Frequency	Acceptance Criteria
Balance calibration check [Using two standard weights that bracket the expected mass]	Daily prior to use	Top-loading balance: ±2% or ±0.02g, whichever is greater Analytical balance: ±0.1% or ±0.5 mg, whichever is greater
Verification of standard mass [Using weights traceable to the International System of Units (SI) through a NMI	Every 5 years	Certificate of Calibration from ISO/IEC 17025 accredited calibration laboratory
Monitoring of refrigerator/freezer temperatures	Daily (i.e. 7 days per week) [use MIN/MAX thermometers or data loggers equipped with notification of out of control event capabilities if personnel not available to record daily]	Refrigerators: 0˚C to 6˚C Freezers: ≤-10˚C
Thermometer verification check [Using a thermometer traceable to the SI through an NMI] [Performed at two temperatures that bracket the target temperature(s). Assume linearity between the two bracketing temperatures.] [If only a single temperature is used, at the temperature of use]	Liquid in glass: Before first use and annually Electronic: Before first use and quarterly	Apply correction factors or replace thermometer

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TITLE: MERCURY IN SOLID WASTE (COLD-VAPOR TECHNIQUE) (EPA METHODS 7471A & 7471B)

Table 2. Support Equipment Checks		
Performance Check	**Frequency**	**Acceptance Criteria**
Volumetric labware	Class B: By lot before first use Class A and B: Upon evidence of deterioration	Bias: Mean within ±2% of nominal volume Precision: RSD ≤1% of nominal volume (based on 10 replicate measurements)
Non-volumetric labware [Applicable only when used for measuring initial sample volume and final extract/ digestates volume]	By lot before first use or upon evidence of deterioration	Bias: Mean within ±3% of nominal volume Precision: RSD ≤3% of nominal volume (based on 10 replicate measurements)
Mechanical volumetric pipette	Quarterly	Bias: Mean within ±2% of nominal volume Precision: RSD ≤1% of nominal volume (based on minimum of 3 replicate measurements) [Note: for variable volume pipettes, the nominal volume is the volume of use]
Glass microliter syringe	Upon receipt and upon evidence of deterioration	General Certificate of Bias & Precision upon receipt Replace if deterioration is evident
Drying oven temperature check	Daily prior to and after use	Within ±5% of set temperature
Water purification system	Daily prior to use	See method blank criteria given in Section 4.20 of this addendum

4.5 The expiration date of the prepared standard shall not exceed the expiration date of the primary standard. All containers must bear a preparation date.

4.6 To avoid preparing non-representative samples, the laboratory shall not "target" within a relatively small mass range (e.g., 1.00 ± 0.01g) because such targeting will produce non-representative subsamples if the sample has high heterogeneity. The laboratory shall not manipulate the sample material so the sample aliquot weighs exactly 1.00g ± 0.01g, as an example.

4.7 In the absence of project-specific requirements, the minimum standard data qualifiers to be used are:

U Analyte was not detected and is reported as less than the LOD or as defined by the customer. The LOD has been adjusted for any dilution or concentration of the sample.

J The reported result is an estimated value (e.g., matrix interference was observed or the analyte was detected at a concentration outside the quantitation range).

B Blank contamination. The recorded result is associated with a contaminated blank.

N Non-target analyte. The analyte is a tentatively identified compound using mass spectrometry or any non-customer requested compounds that are tentatively identified.

Q One or more quality control criteria failed (e.g., LCS recovery, surrogate spike recovery, or CCV recovery).

Additional data qualifiers may be used, or different letters or symbols to denote the qualifiers listed above, as long as they are appropriately defined and their use is consistent with project-specific requirements (e.g., QSM 5.0, the contract, and project-planning documents).

4.8 If the time of the sample collection is not provided, assume the most conservative time of day. For the purpose of batch processing, the start and stop dates and times of the batch preparation shall be recorded.

4.9 Each preparation method listed on the scope of accreditation must have quarterly LOD/LOQ verifications. However, not all possible combinations of preparation and cleanup techniques are required to have LOD/LOQ verifications. If LOD/LOQ verifications are not performed on all combinations, the laboratory must base the LOD/LOQ verifications on the worst case basis (preparation method with all applicable cleanup steps).

4.10 After each MDL determination, the laboratory must establish the LOD by spiking a quality system matrix at a concentration of at least 2 times but no greater than four times the MDL. This spike concentration establishes the LOD and the concentration at which the LOD shall be verified. It is specific to each suite of analyte, matrix, and method (including sample preparation). The following requirements apply to the initial LOD establishment and to the LOD verifications:

- The apparent signal to noise (S/N) ratio at the LOD must be at least three and the results must meet all method requirements for analyte identification (e.g., ion abundance, second column confirmation, or pattern recognition). For data systems that do not provide a measure of noise, the signal produced by the verification sample must produce a result that is at least three standard deviations greater than the mean method blank concentration. This is initially estimated based on a minimum of four method blank analyses and later established with a minimum of 20 method blank results.
- If the LOD verification fails, then the laboratory must repeat the MDL determination and LOD verification or perform and pass two consecutive LOD verifications at a higher spike concentration and set the LOD at the higher concentration.
- The laboratory shall maintain documentation for all MDL determinations and LOD verifications.

- The DL and LOD must be reported for all analyte-matrix-methods suites, unless it is not applicable to the test or specifically excluded by project requirements.

4.11 The LOD shall be verified quarterly. In situations where methods are setup and used on an infrequent basis, the laboratory may choose to perform LOD verifications on a one per batch basis. All verification data will be in compliance, reported, and available for review.

4.12 For DoD, at a minimum, the LOQ shall be verified quarterly. In situations where methods are setup and used on an infrequent basis, the laboratory may choose to perform LOQ verifications on a one per batch basis.

4.13 All initial instrument calibrations must be verified with a standard obtained from a second manufacturer prior to analyzing any samples. The use of a standard from a second lot obtained from the same manufacturer (independently prepared from different source materials) is acceptable for use as a second source standard. The concentration of the second source standard shall be at or near the midpoint of the calibration range. The acceptance criteria for the initial calibration verification must be at least as stringent as those for the continuing calibration verification.

4.14 Exclusion of calibration points without documented scientifically valid technical justification is not permitted.

4.15 The concentration of the CCV standard shall be greater than the low calibration standard and less than or equal to the midpoint of the calibration range.

4.16 All CCVs analyzed must be evaluated and reported. If a CCV fails, reanalysis or corrective actions must be taken.

- If a CCV fails, the laboratory can immediately analyze two additional consecutive CCVs (immediately is defined as starting a consecutive pair within one hour; no samples can be run between the failed CCV and the two additional CCVs). This approach allows for spurious failures of analytes to be reported without reanalysis of samples. Any corrective actions that change the dynamics of the system (e.g., clip column, clean injection port, run blanks) requires that all samples since the last acceptable CCV be reanalyzed.
- Both of these CCVs must meet acceptance criteria in order for the samples to be reported without reanalysis.
- If either of these two CCVs fail or if the laboratory cannot immediately analyze two CCVs, the associated samples cannot be reported and must be reanalyzed.
- Corrective action(s) and recalibration must occur if the above scenario fails. All affected samples since the last acceptable CCV must be reanalyzed.
- Flagging of data for a failed CCV is only appropriate when the affected samples cannot be reanalyzed. The laboratory must notify the client prior to reporting data associated with a failed CCV.

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4.17 The results of all MS/MSDs must be evaluated using the same acceptance criteria used for the DoD LCS limits (see Addendum Table 3) or project limits, if specified. If the specific analyte(s) are not available in the Addendum Table 3, the laboratory shall use their LCS in-house limits (see the LIMS) as a means of evaluating MS/MSDs. The MS and MSD must be spiked with all reported analytes.

4.19 Surrogate spike results shall be compared with DoD LCS limits (see Addendum Table 3) or acceptance criteria specified by the client. If these criteria are not available, the laboratory shall compare the results with its in-house statistically established LCS criteria (see the LIMS).

4.20 The method blank shall be considered to be contaminated if:

- The concentration of any target analyte (chemical of concern) in the blank exceeds 1/2 the LOQ and is greater than 1/10th the amount measured in any associated sample, or 1/0th the regulatory limit, whichever is greater;
- The concentration of any common laboratory contaminant in the blank exceeds the LOQ;
- If a method blank is contaminated as described above, then the laboratory shall reprocess affected samples in a subsequent preparation batch, except when sample results are below the LOD. If insufficient sample volume remains for reprocessing, the results shall be reported with appropriate data qualifiers.

4.21 Sporadic Marginal Exceedances are not allowed for target analytes (chemicals of concern as identified by a project) without project-specific approval. Target analytes are considered those few analytes that are critical for the success of a project (such as risk drivers) where sporadic marginal exceedances cannot be allowed. Laboratories should consult with clients whenever long lists of analytes are requested for analysis to determine if marginal exceedances will not be allowed.

4.22 DoD considers the same analyte exceeding the LCS control limit two (2) out of three (3) consecutive LCS to be indicative of non-random behavior, which requires corrective action and reanalysis of the LCS.

Table 3. LCS Control Limits – Method 7470 – 7471 Series Solid Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
7439-97-6	Mercury	6471	102	7.5	80	124

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TITLE: MERCURY IN SOLID WASTE (COLD-VAPOR TECHNIQUE) (EPA METHODS 7471A & 7471B)

Table 4. Quality Control Requirements – Inorganic Analysis by Atomic Absorption Spectrophotometry (AA)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Initial Calibration (ICAL) for all analytes	Daily ICAL prior to sample analysis.	r2 ≥ 0.99.	Correct problem, then repeat ICAL.	Flagging is not appropriate.	FLAA and GFAA: minimum three standards and a calibration blank. CVAA/Mercury: minimum 5 standards and a calibration blank. No samples shall be analyzed until ICAL has passed.
Initial Calibration Verification(ICV)	Once after each ICAL, analysis of a second source standard prior to sample analysis.	All reported analytes within ± 10% of the true value.	Correct problem. Rerun ICV. If that fails, rerun ICAL.	Flagging is not appropriate.	No samples shall be analyzed until calibration has been verified with a second source.

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TITLE: MERCURY IN SOLID WASTE (COLD-VAPOR TECHNIQUE) (EPA METHODS 7471A & 7471B)

Table 4. Quality Control Requirements – Inorganic Analysis by Atomic Absorption Spectrophotometry (AA)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Low-level Calibration Check Standard (LLCCV)	Daily.	All reported analytes within ± 20% of the true value.	Correct problem and repeat ICAL.	Flagging is not appropriate.	No samples shall be analyzed without a valid Low-Level Calibration Check Standard (LLCCV). LLCCV should be less than or equal to the LOQ. If the concentration of the lowest calibration standard is less than or equal to the LOQ, the lowest standard may be re-quantified against the calibration curve as a LLCCV. Otherwise, a separate standard must be analyzed as the LLCCV prior to the analysis of any samples.

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TITLE: MERCURY IN SOLID WASTE (COLD-VAPOR TECHNIQUE) (EPA METHODS 7471A & 7471B)

Table 4. Quality Control Requirements – Inorganic Analysis by Atomic Absorption Spectrophotometry (AA)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Continuing Calibration Verification (CCV)	After every 10 field samples and at the end of the analysis sequence.	All reported analytes within ± 10% of the true value.	Immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails or if two consecutive CCVs cannot be run, take perform corrective action(s) and repeat CCV and all affected samples since the last successful CCV. Alternately, recalibrate if necessary; then reanalyze all associated samples since the last acceptable CCV.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable CCV.	Results may not be reported without a valid CCV. Flagging is only appropriate in cases where the samples cannot be reanalyzed.

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TITLE: MERCURY IN SOLID WASTE (COLD-VAPOR TECHNIQUE) (EPA METHODS 7471A & 7471B)

Table 4. Quality Control Requirements – Inorganic Analysis by Atomic Absorption Spectrophotometry (AA)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Method Blank (MB)	One per preparatory batch.	The absolute values of all analytes must be < ½ LOQ or < 1/10th the amount measured in any sample or 1/10 the regulatory limit, whichever is greater.	Correct problem. If required, reprep and reanalyze MB and all QC samples and field samples processed with the contaminated blank.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch.	Results may not be reported without a valid method blank. Flagging is only appropriate in cases where the samples cannot be re-prepped or reanalyzed. Non-detects associated with positive blank infractions may be reported. Sample results > 10X the LOQ associated with negative blanks may be reported.
Initial and Continuing Calibration Blank (ICB/CCB)	Immediately after the ICV and immediately after every CCV.	The absolute values of all analytes must be < ½ LOQ or < 1/10th the amount measured in any sample or 1/10th the regulatory limit, whichever is greater.	ICB: Correct problem and repeat ICV/ICB analysis. If that fails, rerun ICAL. All samples following the last acceptable Calibration Blank must be reanalyzed. CCBs may not be reanalyzed without reanalysis of the associated samples and CCV(s).	Flagging is not appropriate.	Results may not be reported without a valid calibration blank. Non-detects associated with positive blank infractions may be reported. Sample results > 10X the LOQ associated with negative blanks may be reported. For CCB, failures due to carryover may not require an ICAL.

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TITLE: MERCURY IN SOLID WASTE (COLD-VAPOR TECHNIQUE) (EPA METHODS 7471A & 7471B)

Table 4. Quality Control Requirements – Inorganic Analysis by Atomic Absorption Spectrophotometry (AA)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Laboratory Control Sample(LCS)	One per preparatory batch.	A laboratory must use Table 3 limits for batch control if project limits are not specified. If the analyte(s) are not listed, use in-house LCS limits if project limits are not specified.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Results may not be reported without a valid LCS. Flagging is only appropriate in cases where the samples cannot be reanalyzed.
Matrix Spike (MS)	One per preparatory batch.	A laboratory must use Table 3 limits for batch control if project limits are not specified. If the analyte(s) are not listed, use in-house LCS limits if project limits are not specified.	Examine the project-specific requirements. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met and explain in the case narrative.	For matrix evaluation only. If MS results are outside the limits, the data shall be evaluated to the source of difference (i.e., matrix effect or analytical error).
Matrix Spike Duplicate (MSD) or Matrix Duplicate (MD)	One per preparatory batch.	A laboratory must use Table 3 limits for batch control if project limits are not specified. If the analyte(s) are not listed, use in-house LCS limits if project limits are not specified. MSD or MD: RPD of all analytes ≤ 20% (between MS and MSD or sample and MD).	Examine the project-specific requirements. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met and explain in the case narrative.	The data shall be evaluated to determine the source of difference. For Sample/MD: %Recovery and RPD criteria only apply to analytes whose concentration in the sample is greater than or equal to the LOQ.

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TITLE: MERCURY IN SOLID WASTE (COLD-VAPOR TECHNIQUE) (EPA METHODS 7471A & 7471B)

Table 4. Quality Control Requirements – Inorganic Analysis by Atomic Absorption Spectrophotometry (AA)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Dilution Test (Flame AA and GFAA only)	One per preparatory batch if MS or MSD fails.	Five-fold dilution must agree within ± 10% of the original measurement.	No specific CA, unless required by the project.	For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met and explain in the case narrative.	Only applicable for samples with concentrations > 50 X LOQ (prior to dilution). Use along with MS/MSD or PDS data to confirm matrix effects.
Post-Digestion Spike (PDS) Addition (Flame AA and GFAA only)	One per preparatory batch if MS or MSD fails.	Recovery within 80-120%.	No specific CA, unless required by the project.	For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met and explain in the case narrative.	Criteria apply for samples with concentrations < 50 X LOQ prior to dilution.
Method of Standard Additions (MSA)	When dilution or post digestion spike fails and if the required by project.	NA.	NA.	NA.	Document use of MSA in the case narrative.

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TITLE: DETERMINATION OF METALS AND TRACE ELEMENTS IN VARIOUS MATRICES BY ICP-AES (EPA METHODS 6010B, 6010C,6010D [ICP-OES], AND 200.7) INCLUDING HARDNESS (EPA METHODS 200.7 AND 6010B/C/D AND SM 2340B)

Reviewed by: Jeremy Gupton, Jim Brownfield

Department Manager *QA Department*

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1.0 SCOPE AND APPLICATION

STATE NOTE: For samples analyzed in conjunction with the Ohio Voluntary Action Program (VAP) please utilize SOP #340386OH.

1.1 Inductively coupled plasma-atomic emission spectrometry (ICP-AES) determines trace elements, including metals and some non-metals in solution. This procedure follows the guidelines established in EPA method 200.7 and SW-846 Method 6010B, 6010C, and 6010D for drinking water, waste water, ground water, TCLP, SPLP, and STLC leachates, soils, sludge, sediments, solid wastes, oils, and other digestates after appropriate preparatory procedure is performed.

This procedure is also applicable to reporting calculated values for Calcium, Magnesium, and Total Hardness from values determined using EPA methods 200.7 or 6010B/C/D from groundwater, wastewater and drinking waters. Reporting limits for Hardness are derived from the annual MDL studies for Calcium and Magnesium of the appropriate determinative EPA method. The routine reporting limits for each category of hardness are listed in Table 1.2c.

1.2 This method is applicable for the analytes listed in Table 1.2a, b and c. Detection limits, sensitivity, and the optimum and linear concentration ranges of the elements can vary with the wavelength, spectrometer, matrix, and instrument operating conditions. Table 1.2 also lists the Reporting Limits (RLs), used routinely by Pace National.

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Table 1.2a: Environmental Analytes and Reporting Limits *(Subject to change, see section 13.1)*

Analyte	Aqueous				Sediment		
	Ground Water/ Wastewater 6010B/C/D/200.7	Drinking Water 200.7*	RL	Units	Solids 6010B/C/D	RL	Units
Aluminum	✓	✓	00.200	mg/L	✓	2.00	mg/Kg
Antimony	✓	✓	0.010	mg/L	✓	1.00	mg/Kg
Arsenic	✓	✓	00.010	mg/L	✓	1.00	mg/Kg
Barium	✓	✓	0.005	mg/L	✓	0.50	mg/Kg
Beryllium	✓	✓	0.002	mg/L	✓	0.20	mg/Kg
Boron	✓	✓	0.050	mg/L	✓	5.0	mg/Kg
Cadmium	✓	✓	0.002	mg/L	✓	0.20	mg/Kg
Calcium	✓	✓	1.000	mg/L	✓	100	mg/Kg
Chromium	✓	✓	0.010	mg/L	✓	1.00	mg/Kg
Cobalt	✓	✓	0.010	mg/L	✓	1.00	mg/Kg
Copper	✓	✓	0.010	mg/L	✓	1.00	mg/Kg
Iron	✓	✓	0.100	mg/L	✓	10.0	mg/Kg
Lead	✓	✓	0.005	mg/L	✓	0.50	mg/Kg
Lithium	✓		0.015	mg/L	✓	1.50	mg/Kg
Magnesium	✓	✓	1.000	mg/L	✓	100	mg/Kg
Manganese	✓	✓	0.010	mg/L	✓	1.00	mg/Kg
Molybdenum	✓	✓	0.005	mg/L	✓	0.50	mg/Kg
Nickel	✓	✓	0.010	mg/L	✓	1.00	mg/Kg
Potassium	✓	✓	1.000	mg/L	✓	100	mg/Kg
Selenium	✓	✓	0.010	mg/L	✓	1.00	mg/Kg
Silicon	✓	✓	0.050	mg/L	✓	5.00	mg/Kg
Silver	✓	✓	0.005	mg/L	✓	5.00	mg/Kg
Sulfur	✓	✓	1.0	mg/L	✓		mg/Kg
Sodium	✓	✓	1.000	mg/L	✓	100	mg/Kg
Strontium	✓	✓	0.010	mg/L	✓	1.00	mg/Kg
Thallium	✓	✓	0.010	mg/L	✓	1.00	mg/Kg
Tin	✓	✓	0.050	mg/L	✓	5.00	mg/Kg
Titanium	✓	✓	0.050	mg/L	✓	5.00	mg/Kg
Vanadium	✓	✓	0.010	mg/L	✓	1.00	mg/Kg
Zinc	✓	✓	0.050	mg/L	✓	5.00	mg/Kg

**May not meet required Drinking Water Maximum Contamination Levels (MCLs) using this methodology.*

Table 1.2b: Hardness Categories and Reporting Limits

(Subject to change, see section 13.1)

Hardness:	RL (mg/L)
Calcium Hardness	1.25
Magnesium Hardness	0.41
Total Hardness	1.6

1.3 For the determination of total recoverable analytes in aqueous and solid samples, an acid digestion process is required. Environmental samples for analysis by Method 6010B, 6010C, or 6010D including, TCLP or EP leachates, soils, sludge, sediments, and other solid wastes require an acid digestion prior to analysis. Samples are digested by SW-846 methods 3005 (Acid Digestion of Waters for Total Recoverable Metals), 3010 (Acid Digestion of Aqueous Samples), 3015 (Microwave Digestion of Aqueous Samples), 3050 (Acid Digestion of Sediments, Sludge, Soil, and Oils) and 3051 (Microwave Assisted Digestion of Sediments, Sludge, Soil, and Oils). Digestion methods are found in Pace National SOPs 340388 and 340389.

1.4 The Clean Water Act has approved EPA Method 200.7 for demonstrating compliance on discharge monitoring for NPDES (National Pollution Discharge Elimination System) permits. 40 CFR136.3 has Guidelines for Establishing Test Procedures for Analysis of Pollutants. The National Primary Drinking Water Regulations for inorganic chemical sampling and analytical requirements can be found in 40 CFR141.23. Updates to these regulations can be found in the current Code of the Federal Register.

1.5 To determine dissolved analytes in aqueous samples, a 0.45µm filtration method is employed then the filtered samples are acidified. To reduce potential interferences, dissolved solids must be < 0.2% (w/v).

1.6 Analysis without acid digestion can be used for drinking water samples if the samples have been properly preserved with acid and have turbidity of < 1 NTU at the time of analysis. These samples must be acidified to match the acid matrix of the calibration standards and analyzed directly. This total recoverable determination procedure is referred to as "direct analysis". Silver concentration cannot be determined from direct analysis when chloride ions are present as a silver chloride precipitate may be formed. The sample must be acid digested to form a soluble silver chloride complex. Some primary drinking water metal contaminants may require sample concentration to meet regulatory drinking water reporting limits criteria[14.2].

Method 6010D – Samples that are not digested necessitate the use of either an internal standard or should be matrix-matched with the standards. If using the former option, the instrument software should be programmed to correct for the intensity differences of the internal standard between samples and standards. NOTE: All samples analyzed by Method 6010 are typically digested.

1.7 When determining boron and silicon in aqueous samples, only plastic, PTFE (Teflon®) sample containers and laboratory glassware must be used. For accurate determination of boron in solid samples, only quartz or PTFE tubes must be used during acid digestion with immediate transfer of an aliquot of the final volume of digestate to a plastic centrifuge tube[14.2].

1.8 For the determination of titanium, white plastic and white printed containers must be avoided as titanium dioxide is used as a white pigment.

1.9 The total recoverable sample digestion procedure dissolves and maintains in solution only minimal concentrations of barium in the presence of free sulfate. For the analysis of barium in samples having varying and unknown concentrations of sulfate, analysis must be completed as soon as possible following sample preparation[14.2].

1.10 Detection limits and linear ranges for the elements vary with the wavelength selected, the spectrometer, and the matrix. Table 1.11 provides a list of routinely used wavelengths and the type of spectrometer view used.

Method 6010D – IDLs are necessarily instrument-specific. Therefore, if needed, an IDL must be determined through a separate experimental study for each instrument. IDLs should be established, at a minimum, on an annual basis for each matrix and for each preparatory/determinative method combination used.

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TABLE 1.10: WAVELENGTHS
(exact wavelengths vary slightly depending on the instrument)

Analyte	Wavelength (nm)	Type of View
Aluminum	308.215	Radial
Antimony	206.836	Axial
Arsenic	188.979	Axial
Barium	233.527	Axial
Beryllium	313.107	Radial
Boron	249.772	Radial
Cadmium	214.440	Axial
Calcium	317.933 373.690	Radial
Chromium	205.560	Axial
Cobalt	228.616	Axial
Copper	324.752	Radial
Iron	259.940 271.441	Radial
Lead	220.353	Axial
Lithium	670.784	Radial
Magnesium	279.077	Radial
Manganese	257.610	Axial
Molybdenum	202.031	Axial
Nickel	232.003	Axial
Potassium	766.490	Radial
Selenium	196.026	Axial
Silicon	251.611	Axial
Silver	328.068	Axial
Sodium	589.592 818.326	Radial
Strontium	407.771	Radial
Sulfur	181.972	Axial
Thallium	190.801	Axial
Tin	189.927	Axial
Titanium	334.940	Radial
Vanadium	292.402	Radial
Zinc	213.857	Axial

1.11 Users of the data generated using this method must state the data-quality objectives (DQOs) prior to analysis.

1.12 Any deviations from this SOP must be documented. Deviations are reflected in a case narrative and the method is reported as modified. Per customer requirement, the procedure and QC criteria described in this SOP can be changed/modified. Authorization from the Operations Manager and Project Manager is required for each modification and Regulatory Affairs approval must also be secured for any deviation.

1.13 An MDL study must be completed at least annually or more frequently if major instrumentation changes occur. Method Detection Limits (MDLs) are performed based on Pace National SOP #030206. Updated MDL records are filed and stored in a central location within the department.

1.13.1 Limit of Detection (LOD) and Limit of Quantitation (LOQ) studies are completed at the frequency required by the TNI standard per the procedure identified in the Pace National SOP #030206, *Method Detection Limits (MDL), Limits of Detection (LOD), and Limits of Quantitation (LOQ).* Should the procedure be utilized for DOD support; then the frequency of these studies must meet the requirements of the current DOD QSM.

1.14 Linear Dynamic Range (LDR) and Inter-element correction factor (IEC) studies must be analyzed semi-annually for each analytical instrument or when there are major changes/repairs to the instrument[14.5, 14.1]. Instrument Detection Limit studies must be analyzed at least quarterly for each analytical instrument[14.5].

2.0 METHOD SUMMARY AND DEFINITIONS

2.1 The analysis described in this method involves multi-elemental determinations by ICP-AES using sequential or simultaneous instruments. The instrument measures characteristic atomic-line emission spectra by optical spectrometry. Samples are aspirated into the nebulizer and the resulting aerosol is transported to the plasma torch. The emission spectra are dispersed by a grating spectrometer separating the light emitted into the distinct wavelengths generated by each element in the sample. A photosensitive device monitors the intensities of each wavelength line in the spectra. The intensity of light on the photosensitive device produces a signal that is measured and processed by a computer system. Due to the many possible wavelengths of light generated by each element and possible overlapping of high intensity peaks, a background correction technique is required for trace element determination. Background intensities must be measured adjacent to the analyte spectra lines during analysis. The position selected for background intensity measurement can be selected on either or both sides of the analyte wavelength line and must be determined by the complexity of the spectrum adjacent to the analyte line. The position used for background correction must be as free from spectral interference as possible and must reflect the same change in background intensity as occurs at the analyte wavelength. Background correction is not required in cases of line broadening where the background correction measurement would actually degrade the analytical result. The possibility of additional interferences should also be recognized and appropriate corrections made.

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2.2 Dissolved Analyte - The concentration of analyte in an aqueous sample that has been passed through a 0.45µm membrane filter assembly prior to sample acidification and digestion.

2.3 Total (Total Recoverable) Analyte – The concentration of analyte determined either by ‘‘direct analysis’’ of an unfiltered acid preserved drinking water sample with turbidity of <1 NTU or by analysis of the solution extract of a solid sample or an unfiltered aqueous sample following digestion by refluxing with hot dilute mineral acid(s) as specified in the method

2.4 Instrument Detection Limit (IDL) - The concentration equivalent to the analyte signal which is equal to three times the standard deviation of a series of 10 replicate measurements of the calibration blank signal at the same wavelength. The IDL assures with 99% certainty that a value is above the instrument noise level.

Note: An IDL is a statistical determination without analytes present used to assess background correction protocols and an MDL is determined with low levels of analytes present to determine instrument sensitivity for each analyte.

2.5 Linear Dynamic Range (LDR) - The range over which the instrument response to analyte concentration remains linear.

2.6 Plasma Solution - A solution that is used to determine the optimum torch height relative to the radio frequency (RF) coil for viewing the spectrum.

2.7 Interference Check Sample (ICS) – A series of two solutions (ICSA & ICSAB) to verify that inter-element interferences are correctly compensated. The ICSA and ICSAB provide an adequate on-going test of inter-element correction (IEC) factors. These standards are referred to the Spectra Interference Check (SIC) in EPA Method 200.7

2.8.1 ICSA – A solution containing only the interfering analytes at high concentrations.

2.8.2 ICSAB – A solution containing interferents plus other method analytes at the level of concern, which corresponds to the project specific action limits.

2.8 Water Sample - For the purpose of this method, a sample taken from one of the following sources: drinking water, surface water, ground water, storm water, industrial or domestic wastewater.

2.9 Preparation Batch - For method 6010B/C/D/ EPA 200.7 (WW only): A group of samples (not to exceed twenty) of a similar matrix, which have been digested at the same time using the same digestion process and have all necessary QC associated with them. For method 200.7 (DW only): A group of samples (not to exceed ten) of similar matrix, which have been digested at the same time using the same digestion process and have all necessary associated QC.

2.10 Analytical batch - A group of samples that are analyzed in the same sequence with all appropriate preparation and analytical QC.

2.11 Inter-element correction (IEC) coefficient - analyte concentration equivalent arising from a given interferent's concentration.

2.12 Serial Dilution - a dilution and reanalysis of a field sample that is performed once per batch of samples. One sample is diluted 5X and reanalyzed.

2.13 Post Spike – A second aliquot of a field sample that is spiked with known concentrations of target analytes and analyzed to assess recovery of the spike. A post spike must be analyzed when the MS and/or MSD fail due to a suspected matrix effect. One sample is spiked after digestion and analyzed per batch.

2.14 Lower Limit of Quantitation (LLOQ) - A term associated with analysis per the requirements of Method 6010D. The lowest point of quantitation which, in most cases, is the lowest concentration in the calibration curve.

2.15 See the current Quality Assurance Manual for other definitions associated with terms found in this document.

3.0 HEALTH AND SAFETY

3.1 The toxicity or carcinogenicity of each reagent used in the laboratory has not been fully established. Each chemical should be regarded as a potential health hazard and exposure to these compounds should be as low as reasonably achievable. A reference file of safety data sheets (SDSs) are made available on Pace National's intranet to all personnel. Use hazardous reagents in a fume hood whenever possible and if eye or skin contact occurs, flush with large volumes of water. Always wear safety glasses or a shield for eye protection, protective clothing and observe proper mixing protocols.

3.2 The acidification of samples containing reactive materials may result in the release of toxic gases, such as cyanides or sulfides. Acidification of samples should be done in a fume hood.

3.3 All personnel handling environmental samples known to contain or to have been in contact with human waste should be immunized against known disease causative agents.

3.4 All ICP instruments provide protection from ultraviolet light emission. These shielding screens cannot be removed.

4.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

4.1 All samples must have been collected using a sampling plan that addresses the considerations of this method.

4.2 Samples submitted for analysis that do not meet the requirements contained within this section must be addressed before performing the logging process within the laboratory. In some cases, exceeding the appropriate preservation and storage criteria can cause significant bias in the resulting data. Clients may need to resubmit samples where the conditions during shipment cause uncertainty regarding sample integrity. If samples do not meet the requirements for preservation, sampling, shipment and storage and the

client approves the completion of the analytical process, sample results can be qualified per the Pace National SOP #030201, *Data Handling and Reporting*.

4.3 Prior to the collection of an aqueous sample, consideration must be given to the type of data required, (i.e., dissolved or total recoverable), so that appropriate preservation and pre-treatment steps can be taken. The pH of all aqueous samples must be assessed immediately prior to sample digestion or "direct analysis" to ensure the sample has been properly preserved. If the field sample is properly preserved, the sample can be held up to 6 months prior to analysis.

4.4 For the determination of dissolved elements, the sample must be filtered through a 0.45µm pore diameter membrane filter to remove the suspended elements or particles. This filtration must take place at the time of collection or as soon thereafter as practically possible. Glass or plastic filtering apparatus are recommended to avoid possible contamination. Only plastic apparatus must be used when the determinations of boron and silica are critical. Use a portion of the filtered sample to rinse the filter flask, discard this portion and collect the required volume of filtrate. Acidify the filtrate with (1:1) nitric acid: water immediately following filtration to pH < 2.

4.5 For the determination of total recoverable elements in aqueous samples, samples must not be filtered, but acidified with (1:1) nitric acid: water to pH <2. Preservation may be done at the time of collection; however, to avoid the hazards of strong acid use in the field, possible transport restrictions, or possible contamination, it is recommended that the samples be returned to the laboratory within two weeks of collection and acid preserved upon receipt in the laboratory. Following acidification, the sample must be mixed and equilibrated for 24 hours. The pH is verified at <2 prior to withdrawing an aliquot for acid digestion or "direct analysis". If, for reasons such as high alkalinity, the sample pH is verified to be >2, more acid must be added and the sample equilibrated for another sixteen hours until verified to be pH <2.

4.6 Solid samples require no preservation prior to analysis. Solid samples can be held up to six months from the time of sample collection until preparation and analysis.

4.7 For aqueous samples, a field blank must be prepared and analyzed as required by the data user. Use the same container and preservative as is used in field sample collection. The sample holding time is 6 months from the date and time of collection until analysis. Samples are preserved to pH <2 with nitric acid.

5.0 INTERFERENCES

5.1 Spectral interferences are caused by background emission from continuous or recombination phenomena, stray light from the line emission of high concentration elements, overlap of a spectral line from another element, or unresolved overlap of molecular band spectra.

5.1.1 Subtracting the background emission determined by measurement(s) adjacent to the analyte wavelength peak can usually compensate for background emission and stray light. The location(s) selected for the measurement of background

intensity is determined by the complexity of the spectrum adjacent to the wavelength peak. The location(s) used for routine measurement must be free of off-line spectral interference (inter-element or molecular) or adequately corrected to reflect the same change in background intensity as occurs at the wavelength peak. Changes in background correction must be saved in the instrument method. Background correction can be established by scanning the following three solutions: 1) blank (same as calibration blank); 2) solution, containing analytes at significant concentration to raise a signal above background signal (CCV solution may be used) at mid-range of the curve; 3) solution(s) containing most common interfering elements at high concentration and other interferents as well (ICSAB solution may be used).

5.1.2 Spectral overlaps can be compensated for by equations that correct for inter-element contributions, which involve measuring the interfering elements. When operative and uncorrected, these interferences produce false-positive determinations and are reported as analyte concentrations. Users may apply inter-element correction factors determined on their instruments within tested concentration ranges to compensate (offline or online) for the effects of interfering elements. Consult the method for specific identified interferences.

5.1.3 When inter-element corrections are applied, there is a need to verify their accuracy by analyzing spectral interference check solutions. The IEC's are established by analyzing a solution of the interfering element at a high concentration within the LDR limit, measuring the analyte concentration equivalents arising from the interfering element, calculating the interference factor as analyte reading in mg/L, then dividing by the interfering element concentration. The IEC's are changed in the stored ICP instrument method. Inter-element corrections vary for the same emission line among instruments because of differences in resolution, as determined by the grating plus the entrance and exit slit widths, and by the order of dispersion. Inter-element corrections also vary depending upon the choice of background correction points. Selecting a background correction point where an interfering emission line may appear should be avoided. Inter-element corrections that constitute a major portion of an emission signal may not yield accurate data. Users must not forget that some samples might contain uncommon elements that could contribute spectral interferences.

5.1.4 Interference effects must be evaluated for each individual instrument. For each instrument, intensities vary not only with optical resolution but also with operating conditions (such as power, viewing height and argon flow rate). To determine the appropriate location for offline background correction, the user must scan the area on either side of the peak adjacent to the wavelength and record the apparent emission intensity from all other method analytes. The location selected for background correction must be either free from offline inter-element spectral interference or a computer routine must be used for their automatic correction on all determinations.

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5.2 Physical interferences are effects associated with the sample nebulization and transport processes. Changes in viscosity and surface tension can cause significant inaccuracies, especially in samples containing high dissolved solids or high acid concentrations. If physical interferences are present, they must be reduced by such means as using a high-solids nebulizer, diluting the sample, using a peristaltic pump, or using an appropriate internal standard element. Another problem that can occur with high dissolved solids is salt buildup at the tip of the nebulizer, which affects aerosol flow rate and causes instrumental drift. This can be controlled using a high-solids nebulizer, wetting the argon prior to nebulization, using a tip washer, or diluting the sample. Also, it has been reported that better control of the argon flow rates, especially for the nebulizer, improves instrument stability and precision. This is accomplished with the use of mass flow controllers.

5.3 Chemical interferences include molecular-compound formation, ionization effects, and solute-vaporization effects. Normally, these effects are not significant with the ICP-AES technique. If observed, they can be minimized by careful selection of operating conditions (such as incident power and observation height), by buffering of the sample, by matrix matching, and by standards addition procedures. Chemical interferences are highly dependent on matrix type.

5.4 Memory interferences result when analytes in a previous sample contribute to the signals measured in a new sample. Memory effects can result from sample deposition on the uptake tubing to the nebulizer and from the buildup of sample material in the plasma torch and spray chamber. The site where these effects occur is dependent on the element and can be minimized by flushing the system with a rinse blank between samples. The possibility of memory interferences must be recognized within an analytical run and suitable rinse times must be used to reduce them.

5.5 Linear Dynamic Range (LDR) study is performed by analyzing a solution of each element at maximal concentration unless the result falls outside 10% RPD. The highest calibration standard for each analyte cannot be greater than the LDR for that analyte. If an interferent is found greater than the LDR and an IEC factor is established between the interferent and analyte of interest, the sample must be diluted for proper correction of inter-element interferences. Instrument methods with different calibration standard concentrations require separate LDR studies.

5.6 Background correction is performed as needed and LDR and IEC studies are completed as required by each published analytical method and whenever significant changes to instrumentation are made. Background, or blank matrix, subtraction is not performed for environmental samples.

6.0 EQUIPMENT AND SUPPLIES

6.1 Inductively coupled plasma emission spectrometer:

6.1.1 Perkin Elmer Model 5300or Thermo Model 7000 series ICP, or equivalent, with background correction and computer control.

6.1.2 Cetac Autosampler or ESI autosampler

6.1.3 Argon gas supply - High purity grade (99.99%). When analyses are conducted frequently, liquid argon is more economical and requires less frequent replacement of tanks than compressed argon in conventional cylinders.

6.2 Narrow-mouth storage bottles, FEP (fluorinated ethylene propylene) with screw closure, 125mL to 1L capacities.

6.3 One-piece stem FEP wash bottle with screw closure, 125mL capacity.

6.4 Adjustable pipettes (Eppendorf or equivalent), ranges from 2µL to 5000µL.

6.5 Class A volumetric flasks for standards preparations.

6.6 Polypropylene (PP) conical tubes.

6.7 Peristaltic pump.

7.0 REAGENTS AND STANDARDS

7.1 All reagents and standards must be recorded in the appropriate preparation log and assigned a unique number. See Pace National SOP #030230, *Standard Logger – Tree Operation*. Additional information regarding reagent preparation can be found in the Standards Logger (Tree) digital archive system. All spiking solutions and surrogate standard solutions should be replaced at least every 6 months or sooner if a problem is detected unless otherwise noted.

7.2 Hydrochloric acid, concentrated (sp. gr. 1.19) - HCl.

7.2.1 Hydrochloric acid (1+1) - Add 500mL concentrated HCl to 400mL reagent water and dilute to 1L with reagent water.

7.3 Nitric acid, concentrated (sp. gr. 1.41) - HNO_3.

7.3.1 Nitric acid (1+1) - Add 500mL concentrated HNO_3 to 400mL reagent water and dilute to 1L with reagent water.

7.4 Reagent water. All references to water in this method refer to ASTM Type I grade water.

7.5 Blanks - Three types of blanks are required for ICP-AES analysis.

7.5.1 The calibration blank is used to establish the baseline for the instrument prior to the analysis of the analytical curve. The calibration blank is prepared by acidifying reagent water to the same acid concentration as used for the standards.

NOTE: The calibration blank must be stored in a FEP bottle to minimize leaching from other container materials that can cause an elevation in the target analytes leached causing an inherent bias in the calibration and quantitation of field samples when baselines are established prior to calibration of the ICP-AES.

7.5.1.1 Following calibration, the Initial Calibration Blank (ICB) is analyzed prior to field sample analyses. A Continuing Calibration Blank (CCB) is analyzed following the CCV after every ten samples and at the end of the analytical sequence to verify on-going acceptable instrument conditions.

7.5.2 The method blank is used to assess possible contamination from the sample preparation procedure. The method blank must contain all the reagents in the same volumes as used in sample preparation. The method blank must be prepared in the same manner as the samples including sample digestion, when applicable

7.5.3 The rinse blank is prepared by acidifying reagent water to the same concentrations as the acids as used in the calibration blank. This solution is stored in a convenient manner. The rinse blank is used for equipment "wash out" to flush the sample delivery system and eliminate memory effects (carryover) from previous samples or standards.

7.6 Mixed Calibration Standard Solutions – Environmental Express Custom Mixes, or equivalent, is used to make the following calibration solutions. All standards are prepared in Class A volumetric flasks using adjustable pipettes. The final acid concentration is matrix matched to digested field sample concentrations. Use the calculation in section 9.14 to calculate the volume of the stock needed to produce each standard.

Note: **Environmental Express Custom Mix #HP 6373-1L** contains the following elements and concentrations in **mg/L**: Ag-20, Al-200, As-40, Ba-10, Be-4.0, B-40, Cd-10, Ca-1000, Cr-20, Co-20, Cu-40, Fe-200, Pb-10, Li-30, Mg-200, Mn-20, Mo-10, Ni-40, K-1000, Sb-40, Se-40, Si- 40, Sn-40, Na-1000, Sr-20, Ti-20, Tl-40, V-20, Zn-60, S-100.

Concentration of Target Analytes in Calibration Standards in mg/L.

Analyte	STD 1	STD 2	STD 3	STD 4	STD 5	STD 6	STD 7
Silver	0.005	0.5	1.0	2.0			
Aluminum	0.2				10	250	500
Arsenic	0.1	0.5	1.0				
Boron	0.05		1.0	2.0			
Barium	0.005	0.5	1.0	2.0	10		
Beryllium	0.002	0.5	1.0	2.0			
Calcium	1.0		1.0	2.0	10	250	500
Cadmium	0.002	0.5	1.0				
Cobalt	0.01	0.5	1.0	2.0			
Chromium	0.01	0.5	1.0	2.0			
Copper	0.01	0.5	1.0	2.0			
Iron	0.10	0.5	1.0	2.0	10	100	200
Potassium	1.0				10	50	100

Analyte	STD 1	STD 2	STD 3	STD 4	STD 5	STD 6	STD 7
Lithium	0.015	0.5	1.0				
Magnesium	1.0				10	250	500
Manganese	0.01	0.5	1.0	2.0			
Molybdenum	0.005	0.5	1.0	2.0			
Sodium	1.0		1.0	2.0	10	250	500
Nickel	0.01	0.5	1.0	2.0			
Lead	0.005	0.5	1.0				
Antimony	1.0	0.5	1.0	2.0			
Selenium	0.01	0.5	1.0				
Silicon	0.01	0.5	1.0	2.0	10		
Strontium	0.05	0.5	1.0	2.0			
Sulfur	0.05		1.0	2.0	10	50	100
Tin	0.01	0.5	1.0	2.0			
Thallium	0.05	0.5	1.0				
Vanadium	0.01	0.5	1.0	2.0			
Zinc	0.02	0.5	1.0	2.0			
Titanium	0.02	0.5	1.0	2.0			

NOTE: If the addition of silver to the recommended mixed-acid calibration standard results in an initial precipitation, add 15mL of reagent water and warm the flask until the solution clears. For this acid combination, the silver concentration should be limited to 0.5mg/L.

7.7 Initial Calibration Verification (ICV) – The ICV is an analytical standard solution from a second source different from the calibration and CCV standards. The ICV is prepared at a mid-range concentration within the linear working range of the instrument. The ICV must have the same acid matrix as the Calibration Standards, CCV, blanks and the field sample digestates.

The ICV solutions are purchased from High Purity Standard SP2762-3227HPZ-A, High Purity Standard SP2762-3227HPZ-B, and Ultra Scientific ICP-016, or equivalents.

Custom Mix # SM-2552-008 Solution A, SM-2552-008 Solution B-1L (stock) contains the following element and concentrations in µg/mL: Ag-(B) 50, Al- 500, Sb- 50, As- 50, Ba- 50, Be- 50, B- 50, Cd- 50, Ca- 500, Cr- 50, Co- 50, Cu- 50, Fe- 500, Pb- 50, Li- 50, Mg- 500, Mo(B)- 50, Mn- 50, Na- 500, Ni- 50, K- 500, Se- 50, Si(B)- 50, Sn(B)- 50, (listed 2x), Sr- 20, Tl- 50, Ti(B)- 50, V- 50, Zn- 50., S(B)-500

This solution is prepared, by spiking 10mL of the custom stock solution A and 10mL of the custom stock solution B into a 100mL volumetric flask, then diluting to 100mL using 10% Nitric Acid.

All analytes are present in the mid-level ICV solution at the following concentrations (mg/L):

Standard Operating Procedure

TITLE: DETERMINATION OF METALS AND TRACE ELEMENTS IN VARIOUS MATRICES BY ICP-AES (EPA METHODS 6010B, 6010C,6010D [ICP-OES], AND 200.7) INCLUDING HARDNESS (EPA METHODS 200.7 AND 6010B/C/D AND SM 2340B)

Analyte	Concentration
Silver	1
Aluminum	10.0
Arsenic	1.0
Boron	1.0
Barium	1.0
Beryllium	1.0
Calcium	10.0
Cadmium	1.0
Cobalt	1.0
Chromium	1.0
Copper	1.0
Iron	10.
Potassium	10.
Lithium	1.0
Magnesium	10.

Analyte	Concentration
Manganese	1.0
Molybdenum	1.0
Sodium	10.
Nickel	1.0
Lead	1.0
Antimony	1.0
Selenium	1.0
Silicon	1.0
Strontium	0.4
Tin	1.0
Thallium	1.0
Vanadium	1.0
Zinc	1.0
Titanium	1.0
Sulfur	10.0

7.8 Continuing Calibration Verification (CCV) – The CCV is the mid-range calibration standard prepared from the same source as the initial calibration curve. The CCV is used to verify the regression of the initial calibration of the instrument and must be repeated following every ten samples and at the conclusion of the sequence. EPA Method 200.7 refers to this standard as the Instrument Performance Check (IPC) standard.

All analytes are present in the mid-level CCV solution at the following concentrations (mg/L):

Analyte	Concentration
Silver	.5
Aluminum	10.
Arsenic	1.0
Boron	1.0
Barium	0.50
Beryllium	0.20
Calcium	50.0
Cadmium	0.50
Cobalt	1.0
Chromium	1.0
Copper	1.0
Iron	10.
Potassium	50.
Lithium	1.0
Magnesium	10.

Analyte	Concentration
Manganese	1.0
Molybdenum	.25
Sodium	50.
Nickel	1.0
Lead	0.50
Antimony	.5
Selenium	1.0
Silicon	2.0
Strontium	1.0
Tin	.5
Thallium	1.0
Vanadium	1.0
Zinc	1.0
Titanium	1.0
Sulfur*	5

7.9 Low Level Initial/Continuing Calibration Verification for EPA 6010C (ICVLL/CCVLL) – The ICVLL/CCVLL HP6590-500. See section 7.6. The ICVLL/CCVLL is prepared at a low concentration within the linear working range of the instrument and defines the lowest level of quantitation/reporting. The ICVLL/CCVLL must have the same acid matrix as the calibration standards, CCV, blanks and the field samples.

The working standard for the ICVLL/CCVLL is prepared by diluting 50mL of the solution(s) above into 1000mL of DI water that has been acidified to 10% Nitric Acid solution to matrix match the solution with the calibration standards and samples.

The concentration of the low-level ICVLL/CCVLL solution is listed in the table below:

Analyte	Concentration (mg/L)
Silver	0.005
Aluminum	0.2
Arsenic	0.01
Boron	0.05
Barium	0.005
Beryllium	0.002
Calcium	1
Cadmium	0.002
Cobalt	0.01
Chromium	0.01
Copper	0.01
Iron	0.10
Potassium	1
Lithium	0.015
Magnesium	1

Analyte	Concentration (mg/L)
Manganese	0.01
Molybdenum	0.005
Sodium	1
Nickel	0.01
Lead	0.005
Antimony	0.01
Selenium	0.01
Silicon	0.05
Strontium	0.01
Tin	0.02
Thallium	0.01
Vanadium	0.02
Zinc	0.02
Titanium	0.05
Sulfur	1.00

7.10 Interference Check Solutions (ICSA and ICSAB) – The ICSA and ICSAB are prepared to contain known concentrations of interfering elements that provides a test of the correction factors. The ICSA solution contains the interfering elements at a high concentration and the ICSAB contains both the interfering analytes at a high concentration and the analytes of interest at 0.5 to 1.0mg/L. EPA Method 200.7 refers to this standard as the Spectral Interference Check (SIC) standard.

7.10.1 The ICSA solution contains 5000mg/L of each Al, Ca, Mg and 2000 mg/L Fe. This solution is prepared from a 1:10 dilution of purchased stock from Environmental Express, Catalog No. ICL500-6.

7.10.2 The ICSAB solution contains all the components at the same concentrations of the ICSA and other target analytes of interest spiked. The solution is prepared from a 1:10 dilution of the stock from Section 7.10.1 (Environmental Express,

Catalog No. HP 2739-1L) and a 1:100 dilution of the purchased stock from Environmental Express, Catalog No. HP2739-1L.

In the working solution, silver, boron, cadmium, nickel, lead, silica, and zinc are present at 1.0mg/L. All other analytes (arsenic, barium, beryllium, cobalt, chromium, copper, manganese, molybdenum, antimony, selenium, tin, thallium, vanadium and titanium are present at 0.5mg/L.

7.10.3 Method 6010D refers to the use of spectral interference check (SIC) solutions.

7.10.3.1 Individual element SIC solutions - Individual element SIC solutions are used to evaluate possible spectral interferences and to set interelement corrections if necessary. A solution of each element is prepared at the highest concentration in the linear range likely to be observed in samples. The acid strength should be equivalent to that of the calibration standards. See Section 10.11.1.1 for use of the individual element SIC solutions. SIC solutions should be tested to verify that they are not contaminated with elements of interest. The verification of purity can be done by analysis using an alternate technology, such as ICP-MS. For ICP-OES instruments with solid-state detectors, the verification might also be done by examining alternate wavelengths. If the SIC solutions are purchased ready-made, the vendor should provide details of any contaminants. In some cases it may not be possible to obtain solutions completely free of contaminants, in which case the known, verified concentration can be subtracted from the instrument result before assessing any interferences.

7.10.3.2 Mixed element SIC solution - The mixed element SIC solution is used as an ongoing daily check of freedom from spectral interferences. The mixed element SIC solution contains the following elements and is made up in an acid solution equivalent to the calibration standards. See Section 10.11.1.2 for use of the mixed element SIC solution. As for the single element solutions described in 7.10.3.1, known and documented contaminants are subtracted from the observed values in the mixed element SIC check. Mixed element SIC solution: Aluminum, 500mg/L; Calcium, 500mg/L; Iron, 200mg/L; Magnesium, 500mg/L.

7.11 The aqueous laboratory control standard (LCSW) is purchased with all analytes at a concentration of 100µg/mL except calcium, magnesium, potassium, and sodium, which are at 1000µg/mL. The LCSW is purchased from Ultra Scientific, Number ICUS-3490 or equivalent. For 6010/200.7 .45mL of ICUS-3490 is used for spiking LCS's for waters and .5mLs for soil LCS's.

7.12 The aqueous and solid matrix spike and matrix spike duplicate are prepared from the purchased standard specified in Section 7.11.

7.13 Internal Standard (10,000µg/mL) – Yttrium is used as an internal standard. The yttrium is prepared from a 10.00µg/mL purchased standard (Environmental Express or equivalent) and diluted to a final concentration of 5ppm. The internal standard response is used to measure the relative responses of other method analytes in each sample. Indium (1000 ug/ml) is used as an internal standard purchased from Environmental Express and diluted to a final volume of 30 ppm. See the acceptance criteria in Section 10.14 of this procedure.

7.14 Lower limit of quantitation check sample when analyzing samples by EPA method 6010C (LLOQ): The sample should be analyzed after calibration curve to establish the lower laboratory reporting limits and on an as needed basis to demonstrate the desired detection capability. Ideally, this check sample and the low-level calibration verification standard will be prepared at the same concentrations with the only difference being the LLOQ sample is carried through the entire preparation and analytical procedure. Lower limits of quantitation are verified when all analytes in the LLOQ sample are detected within historical laboratory accuracy limits of their true value. This check should be used to both establish and confirm the lowest quantitation limit.

The lower limits of quantitation determination using reagent water represents a best case situation and does not represent possible matrix effects of real-world samples. For the application of lower limits of quantitation on a project-specific basis with established data quality objectives, low-level matrix specific spike studies may provide data users with a more reliable indication of the actual method sensitivity and minimum detection capabilities.

8.0 PROCEDURE

8.1 Sample Analysis

8.1.1 **Initializing the Instrument:** Prior to daily calibration of the instrument, inspect the sample introduction system including the nebulizer, torch, injector tube for salt deposits, dirt, and debris that would restrict solution flow and affect instrument performance.

8.1.1.1 Replace the uptake tubing daily.

8.1.1.2 If any of the sample introduction parts appear soiled, first remove the part from the instrument by following the maintenance procedure in the instrument manual. Once removed, attempt to clean the part with a dilute solution of 5% nitric acid. Cleaning may be performed using a cotton swab or by submersing the part in the acid solution for no longer than 5 minutes. If cleaning is successful, dry the part using compressed air or argon and replace it in the instrument. If cleaning does not adequately remove the residue, the part must be replaced with a new one in accordance with the manufacturer's directions. Replacement parts are kept in the cabinet in the instrument lab.

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8.1.2 **Instrument Stability:** The instrument must be allowed to become thermally stable before calibration and analyses. This usually requires at least 30 minutes of operation.

8.1.3 **Instrument Calibration:** For initial and daily operation, calibrate the instrument according to the instrument manufacturer's recommended procedures using mixed calibration standard solutions and the calibration blank. A peristaltic pump is used to introduce all solutions, samples, and the internal standard to the nebulizer. To allow adequate time for equilibrium to be reached in the plasma, aspirate all solutions for at least 30 seconds after the solution reaches the plasma before obtaining the sample analyte response.

8.1.3.1 Use the average value from three replicate analyte responses per sample to be correlated to the overall analyte concentration in the solution being sampled. Flush the system with the rinse blank for a minimum of 60 seconds between each standard.

8.1.3.2 The calibration regression is generated using first order linear regression of a calibration blank and three calibration standards where each element is present. The blank is included as a point in the calibration curve to determine the baseline correction needed for the instrument to effectively quantitate target analyte concentrations.

8.1.3.3 Calibration acceptance criteria are described in section 10.4.

8.1.4 **Internal Standard:** All standards/samples/QC etc. contain yttrium and indium as the internal standards. The instrument adds the internal standards automatically. The instrument injects a constant volume into each solution being analyzed (i.e. standard, blank, field sample, LCS/LCSD/MS/MSD/DUP) and monitors the intensity at the sample level. An internal standard is the chosen alternative to the method of standard additions (MSA). If signal variation results from the sample introduction system (samples of different viscosity, matrix constitution), all the elements are corrected in the same way by an internal standard. If variation results from a variation of the energy transfer, the internal standard most accurately corrects elements of similar energy. Internal standard acceptance criteria are described in section 10.14.

8.1.5 **Calibration Accuracy:** Verify the acceptable initial calibration of the instrument using a standard source that is either an independent lot or entirely different manufacturer to ensure calibration accuracy. After calibrating and rinsing the instrument, analyze the ICV and, if analyzing samples using EPA 6010C, analyze the ICVLL standards. These standards are prepared as directed in section 7.7 and 7.9. Acceptance criteria are described in section 10.5.

8.1.6 **On-going Calibration Stability:** Verify the acceptable on-going instrument calibration by analyzing appropriate check standards during the sequence. Instrument calibration acceptability is demonstrated after every 10 samples and at

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the end of the analytical run using the CCV, CCVLL (if analyzing EPA 6010C samples), and CCB that must meet the criteria described in sections 10.6 & 10.14.

8.1.7 **Accurate Background Corrections:** The interference check standards (ICSA and ICSAB) are used to verify the inter-element and background correction factors at the beginning and end of an analytical sequence or twice during every 8-hour work shift, whichever is more frequent. The interference check standards must meet the criteria found in section 10.10.

8.1.8 An Initial Calibration Blank (Section 7.5.1) is analyzed before sample analysis is initiated to verify the cleanliness of the analytical system. Acceptance criteria are described in section 10.14.

8.1.9 **Field Sample Analysis:** After completion of the above calibration requirements, samples must be analyzed in the same operational manner used in the calibration routine with the rinse blank also being used between all sample solutions, method blanks, Laboratory Control Standards, matrix spike, matrix spike duplicates, and check solutions.

8.1.10 **Dilutions:** If a sample analyte concentration is quantitated within 90% or greater of the upper limit of the analyte's determined Linear Dynamic Range (LDR), see section 10.4.2 for further guidance.

9.0 DATA ANALYSIS AND CALCULATIONS

9.1 Sample data should be reported in units of mg/L for aqueous samples and mg/kg dry weight corrected for solid samples.

9.2 For dissolved aqueous analytes, report the data generated directly from the instrument with compensation for sample dilution. Never report analyte concentrations below the MDL and if reporting between the MDL and the routine RL, results should be qualified with the appropriate indicator for estimated target analyte concentrations.

9.3 For total recoverable aqueous analytes, multiply solution analyte concentrations by the dilution factor 0.5 when a 100mL aliquot is used to produce the 50mL final digestate volume, and report data. If a different aliquot volume other than 100mL is used for sample preparation, adjust the dilution factor accordingly. Account for any additional dilution of the prepared sample digestate required to complete the determination of any analytes exceeding 90% or greater of the LDR upper limit. Never report analyte concentrations below the MDL and if reporting between the MDL and the routine RL, results should be qualified with the appropriate indicator for estimated target analyte concentration. Routine reporting limits are adjusted for any dilution required by the sample analysis.

9.4 Results are reported to Three significant figures by the laboratory LIMS. Analyte concentrations for solids data should be rounded in a similar manner following dry weight corrections.

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9.5 For total recoverable analytes in solid samples, calculate the target analyte concentration using the equation below and do not report analyte data below the estimated solids RL or an adjusted RL based on additional dilutions required to complete the analysis:

$$\text{Sample Conc. (mg/Kg) dry-weight basis} = \frac{C \times V \times D}{W}$$

where: C = Concentration in extract (mg/L)
V = Volume of extract (L, 100 mL = 0. 1L)
D = Dilution factor (undiluted = 1)
W = Weight in Kg of sample aliquot extracted (g x 0.001 = Kg)

9.6 Soil samples are routinely reported on a dry weight basis. Soil samples must be processed using the Pace National SOP #340326, *Percent Moisture*. After a dry weight for each sample has been obtained, the calculations are performed automatically by the laboratory LIMS as follows:

$$\% \text{ solids (S)} = \frac{DW}{WW} \times 100$$

where: DW = Sample weight (g) dried
WW = Sample weight (g) before drying

9.7 Hardness calculations:

Total Hardness, mg equivalent $CaC0_3$/L = 2.497 [Ca, mg/L] + 4.118 [Mg, mg/L]

Calcium Hardness = 2.497 [Ca, mg/L]

Magnesium Hardness = 4.118 [Mg, mg/L]

9.8 To calculate the silica concentration from silicon analysis:

Silica (mg/L) = 2.14*[Silicon, mg/L]

9.9 Formula needed to calculate dilution of stock standards of known concentration to a known final volume, using the basic chemistry formula, $C_1*V_1=C_2*V_2$:

$$V_{stock} = V_{std} * C_{std} / C_{stock}$$

where: V_{stock} = volume of stock standard required (mL)
V_{std} = final volume of diluted standard required (mL)
C_{stock} = concentration of stock standard required (ug/mL or ug/L)
C_{std} = final concentration of diluted standard required (ug/mL or ug/L)

NOTE: Be sure to maintain consistent units for both concentration and volume during the use of the calculation and keep in mind that (1ug/mL = 1mg/L=1000ug/L, 1L=1000mL=1000000uL, and 1mL=1000uL)

9.10 Percent Relative Intensity (%RI) for internal standard assessment (ISTD):

$$\%RI = \text{Intensity of ISTD}_{sample} / \text{Intensity of ISTD}_{CalBlk} * 100\%$$

9.11 Relative Standard Error (RSE – expressed as a percentage)

$$RSE = 100 \times \sqrt{\sum_{i=1}^{n}\left[\frac{x'_i - x_i}{x_i}\right]^2 \Big/ (n-p)}$$

where:

x'_i = Measured amount of analyte at the calibration level *i*, in mass or concentration units

x_i = True amount of analyte at calibration level *i*, in mass or concentration units

p = Number of terms in the fitting equation (average – 1, linear = 2, quadratic = 3)

9.12 See the current Quality Assurance Manual for other equations associated with common calculations.

10.0 QUALITY CONTROL AND METHOD PERFORMANCE

10.1 All analysts must meet the qualifications specified in SOP #030205, *Technical Training and Personnel Qualifications,* before approval to perform this method. Analysts must complete an initial demonstration of proficiency before being approved to perform this method. Continuing proficiency must be demonstrated using proficiency testing, laboratory control sample analysis and/or MDL studies. Method performance is assessed per analyst. Updated method performance records are filed and stored in a central location within the department.

10.1.1 Prior to using Method 6010D for quantitation of samples, an initial demonstration of performance packet must be completed. This packet must document:

- The selection criteria for background correction points
- Analytical dynamic ranges including the applicable equations and upper limits of ranges
- IDLs and Method LLOQs
- The determination and verification of interelement correction equations or other routines for correcting spectral interferences. These data must be generated using the same instrument, operating conditions, and calibration routine to be used for sample analysis. The data must be kept on file and available for review by the data user or auditor.

10.2 Use Prep Data to record batch order and standards/reagents used during analysis. See SOP #030201, *Data Handling and Reporting*.

10.3 Batch Analyses:

10.3.1 Environmental Preparation Batches: Preparation batches are defined as sets of 1 - 20 samples as defined in Chapter 1 of SW-846 and in section 9.3.1 of EPA 200.7. Preparation batch analysis must include the following: 1 Method Blank, 1 Laboratory Control Sample (LCS), 1 Laboratory Control Sample Duplicate (LCSD), 1 Serial Dilution, 1 Sample Post Digestion Spike, 1 Matrix Spike/Spike Duplicate (MS/MSD) pair. All batch information is maintained in Prep Data computer program.

10.3.2 Analytical Batches: Analytical batches are defined as a sequence of samples analyzed concurrently using the same calibrated instrument. Analytical batches include the QC samples produced in the Preparation Batches, in addition to: 1 Serial Dilution, 1 Sample Post Digestion Spike, 1 Initial Calibration Verification (ICV) following initial calibration, 1 Initial Calibration Verification-Low Level (ICVLL) following initial calibration (when analyzing EPA 6010C only) 1 Initial Calibration Blank following the ICVLL, 1 Continuing Calibration Verification (CCV) following each 10 samples and at the conclusion of the sequence, 1 Continuing Calibration Verification-Low Level (CCVLL) following each 10 samples and at the conclusion of the sequence (when analyzing EPA 6010C only), 1 Continuing Calibration Blank (CCB) following each CCV/CCVLL pair, 1 Interference Check Sample A (ICSA) and 1 Interference Check Sample AB (ICSAB) following each initial calibration and at the end of the sequence or at least twice per each 8 hour shift. All batch information is maintained in Prep Data computer program.

10.4 Supporting Analytical Studies:

10.4.1 Instrument Detection Limits (IDL) Studies - IDLs in µg/L can be determined as the mean of the calibration blank results plus three times the standard deviation of 10 replicate analyses of the solution. Use zero for the mean if the mean is determined to be a negative value.

IDLs must be verified quarterly[14.13] or when major instrumentation change occurs.

10.4.2 Linear Dynamic Range (LDR) Studies – Linear dynamic ranges are established for each instrument to allow for quantitation above the highest level of calibration without qualification. ICP instruments are known to remain linear at high levels, but each upper limit of linearity is based on the target analyte being measured and the routine instrument operating conditions.

To perform a linear dynamic range study, the instrument must be calibrated normally as used with client field samples. The LDR is determined by the analysis of a minimum of three, but preferably five, different increasing concentrations of standards containing each target analyte across a range. One concentration should be near the expected upper linear range for each analyte. The highest concentration, where the instrument calibration remains linear, is determined when the observed concentration of the increasing standards is no

more than 10% below the expected concentration of the analyte. If more than a 10% deviation exists, the instrument is proven to no longer be linear at that value for that analyte. The upper linear range is therefore the next lower concentration of standards used in the determination. Samples quantitated above that upper determined LDR require dilution to quantitate within the proven linear range of the instrument.

LDR studies must be verified semi-annually[14.1] or when major instrumentation change occurs.

Method 6010D - LDR standards must be ran daily within ten percent of true value, or dilute all samples above the high standard in the curve.

STATE NOTE: For work performed in support of the NC Department of Natural Resources (15A NCAC 02H.0805(a)(7)(l)) for target analytes quantitated by ICP or ICPMS, a series of at least three standards must be analyzed along with each group of samples. The concentrations of these standards must bracket the concentration of the analytes in the field samples analyzed. Samples with target analyte concentrations above the highest level of calibration must be diluted to quantitate analytes within the calibration range. The use of the dynamic linear range studies to validate analyte/instrument calibration linearity must not be used for NC sample analysis

10.4.3 Method Detection Limits – See also Pace National SOP #030206, *Method Detection Limits (MDL), Limits of Detection (LOD) and Limits of Quantitation (LOQ)*.

MDL studies are required annually or when instrumentation change occurs. Method detection limit studies are performed on blank matrices most closely matching field sample matrices.

10.4.4 Inter-element Correction Factors – All inter-element spectral correction factors must be verified and updated every six months or when major instrumentation change occurs.[14.1,14.5,].

Criteria for determining an inter-element spectral interference is an apparent positive or negative concentration of an analyte that is outside the 3-sigma control limits of the calibration blank for the analyte. See Attachment II for a listing of potential interfering analytes and their contributions from SW-846 method EPA 6010B. Testing is performed using 100 mg/L single element solutions; however, for analytes such as iron that may be found at high concentration, a more appropriate test would be to use a concentration near the upper analytical range limit.

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Suggested analytes that are known to commonly interfere include: Ag, Al, As, B, Ba, Be, Ca, Cd, Ce, Co, Cr, Cu, Fe, K, Li, Mg, Mn, Mo, Na, Ni, P, Pb, Sb, Se, Si, Sn, Sr, Ti, Tl, V, and Zn.

10.4.5 Proficiency Testing (PT) – See also Pace National SOP #030212, *Proficiency Testing Program*. Proficiency testing is performed in the metals department in support of both environmental and industrial hygiene analyses. Environmental PTs are performed semi-annually for Water Supply (Safe Drinking Water Act), Water Pollution (Clean Water Act), and soils (RCRA) testing.

10.5 Initial Calibration - Run a calibration curve on a daily basis that employs a minimum of a calibration blank and three standards for each target analyte. If the correlation coefficient does not meet the acceptance criteria, see the corrective action guidance listed in Section 11.1.

NOTE: For EPA Methods 200.7 & 6010B/D, the linear regression correlation coefficient for the each analyte in the calibration curve lines must be ≥0.995.

NOTE: For Method 6010D - Relative Standard Error (see Section 9.11) may be used as an alternative to r or r^2, and should be < 20%. If a multipoint calibration is used the low standard must be at or below the LLOQ. Inversely weighted linear regressions are recommended in order to minimize curve fitting errors at the low end of the calibration curve.

NOTE: For EPA Method 6010C, the regression correlation coefficient must be ≥0.998.

CLIENT NOTE: For Marathon sample analysis, simple linear curve fitting is identified in the instrument regression choices will be utilized when possible. When utilizing calibration curve fits identified by PE regression as “linear forced through 0” accuracy within 70-130% must be demonstrated at the reporting limit utilizing the most recent MDL study.

10.6 Initial Calibration Verification (ICV/ICVLL) - Verify the accuracy of the initial instrument standardization by analyzing appropriate check standards following calibration. The routine mid-level ICV must be prepared from a source that is independent of the stock standard used for the preparation of the initial calibration curve. For EPA Method 6010C, a low-level ICV (ICVLL) is also performed as required; however the low level ICV is not required to be from a second source. It may be made from the same stock standard as the calibration standards as long as the initial calibration is verified by a second source in the mid-level ICV.

10.6.1 **EPA Method 6010B/D** - The routine ICV standard recovery results must be ±10% of the true value for EPA method 6010B/D. The RSD must be <5% for the triplicate passes of the spectrometer. If the RSD exceeds 5% and/or the recovery exceeds 10%, locate and correct the cause of the problem and do not proceed until this criterion is met. Corrective actions for failures can be found in section 11.2.

10.6.2 **EPA Method 200.7** - The routine ICV standard recovery results must be ± 5% of the true value for EPA method 200.7. The RSD must be within 3% for the four replicate passes of the spectrometer. If the RSD exceeds 3% and/or the recovery exceeds 5%, locate and correct the cause of the problem and do not proceed until this criterion is met. Corrective actions for failures can be found in section 11.2.

10.6.3 **EPA Method 6010C -** The routine ICV standard recovery results must be ±10% of the true value for EPA methods 6010C. The RSD must be <5% for the triplicate passes of the spectrometer. The ICVLL standard recovery results should be within historical laboratory accuracy limits. If the recovery does not meet the criteria for either level of ICV and/or the %RSD is exceeded, locate and correct the cause of the problem and do not proceed until this criterion is met. Corrective actions for failures can be found in section 11.2.

10.6.4 Method 6010D Low-level Readback or Verification - For a multi-point calibration, the low level standard should quantitate to within 80-120% of the true value. For a single point calibration, a standard from the same source as the calibration standard and at the LLOQ is analyzed and should recover within 80-120% of the true value.

10.6.5 Method 6010D Mid-level Readback or Verification - For a multi-point calibration, the midlevel standard should quantitate to within 90-110% of the true value. For a single point calibration, a standard from the same source as the calibration standard and at the midpoint of the linear range is analyzed and should recover within 90-110% of the true value.

10.7 Continuing Calibration Verification (CCV/CCVLL) - Verify the on-going instrument standardization by analyzing appropriate check standards during the sequence. Verification is achieved by analyzing both a CCV standard and a CCB (instrument blank). Continuing calibration verification standards can be created from either primary or secondary source standards from those used in instrument calibration. Continuing instrument calibration acceptability is demonstrated after every 10 samples and at the end of the analytical run using the CCV that must meet the following criteria per the method being analyzed:

10.7.1 **For SW-846 Method 6010B/D** – Continuing calibration verification (CCV) analyzed after every 10 samples and at the conclusion of the sequence must have a recovery within ±10%. The RSD must be within 5% for the triplicate passes of the spectrometer.

10.7.2 **For EPA Method 200.7 -** Continuing calibration verification (CCV) analyzed after every 10 samples and at the conclusion of the sequence must have a recovery within ±10%. The RSD must be within 3% for the triplicate passes of the spectrometer.

10.7.3 **For SW-846 Method 6010C** - Continuing calibration verification (CCV) analyzed after every 10 samples and at the conclusion of the sequence must have a

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recovery within ±10%. The RSD must be within 5% for the triplicate passes of the spectrometer. The CCVLL recovery should be within ±30%.

10.8 Method/Calibration/Rinse Blanks:

10.8.1 Method Blank:

10.8.1.1 A method blank is generated for each analytical batch during sample preparation to determine if any contamination is introduced during sample processing. A method blank is routinely a volume of reagent water that is carried through the entire digestion and analysis procedure with the samples.

10.8.1.2 The method blank must not contain analytes >MDL or, in the case of common laboratory contaminants, the concentrations should not exceed the RL. Common laboratory contaminants include: Calcium, Potassium, Magnesium, Zinc, Iron and Sodium. If target analytes are present in the method blank, corrective action must be taken. See section 11.5 for corrective actions.

NOTE: Per DOD QSM, version 5.0, Section 1.7.4.1, DoD/DOE require that method blanks be evaluated to ½ RL (LOQ) for target analytes and RL (LOQ) for common laboratory contaminants. If contaminants are present in the blank above this level, samples must be re-prepared and re-analyzed or reported with appropriate qualification.

NOTE: Method 6010D – The method blank is considered to be acceptable if target analyte concentrations are less than ½ the LLOQ or are less than project-specific requirements.

State Note: For Wisconsin samples, the method blank must not contain analytes more negative than the MDL value. If target analytes are more negative than the MDL, the instrument must be recalibrated or a new LOD study performed.

10.8.2 Calibration Blank:

10.8.2.1 An initial calibration blank is generated for each analytical sequence using acidified reagent water. The CALBLK analyzed prior to the initial calibration standards is used to establish a baseline for the instrument prior to calibration. Great care is required during this analysis to ensure that the baseline is correctly established prior to the calibration of the instrument and the analysis of field samples. Inaccurate baselines established with contaminated calibration blanks degrade precision and accuracy of the analyses performed by creating biases in target analyte calibration.

If the initial calibration blank is grossly negative for a target analyte, then the quantitation of that target analyte in the calibration standards will be biased high due to over compensation by the instrument. This will lead to low recovery issues with the CCV, ICV, field samples, and batch QC samples. If target analytes are present in the CALBLK leading the instrument to make an over correction of the baseline for these targets, then the calibration curve will be biased high yielding a low bias for those target analytes in the CCV, ICV, field samples, and batch QC.

10.8.2.2 Continuing calibration blank (ICB/CCB) is also analyzed following each initial and continuing calibration verification standard within an instrument sequence to verify instrument stability and system cleanliness. This does not baseline correct the instrument for possible contaminants in the background and must be evaluated to ensure that background corrections are appropriate and consistently applied throughout the sequence.

The ICB must not contain analytes > ½ RL, for CCB must not contain analytes >RL for all 6010 methods or, in the case of common laboratory contaminants, the concentrations should not exceed the RL. Common laboratory contaminants include: Calcium, Potassium, Magnesium, Zinc, Iron and Sodium.

10.8.3 Rinse Blank:

10.8.3.1 A rinse blank is utilized by the ICP to cleanse the system following the intake of each digestate analyzed. No data is obtained during this rinse and no applicable controls are required for this type of blank. This is merely cleansing the lines throughout the analytical system.

10.9 Matrix Spike/Matrix Spike Duplicate (MS/MSD) - A matrix/matrix spike duplicate must be prepared for each matrix for each batch of 10 samples for method 200.7 or 20 samples for method 6010B/C/D, where sufficient sample volume was submitted by the client. Matrix spike and matrix spike duplicate are prepared from a sample aliquot spiked with the known concentration of analytes.

The matrix spike recoveries must meet the criteria in the table below unless the analyte concentration in the sample is at least 4 times greater than the spike concentration.

Method	Acceptance Criteria	
	Water	Soil
6010B, C, and D	75 – 125%	75 – 125%
200.7	70-130%	NA

Assess that the matrix spike duplicate precision (%RPD) results meet project-established goals acceptance criteria. If no project goals are specified, then results for the RPD must be less than 20%.

10.9.1 For Method 6010D, if less than acceptable bias and precision data are generated for the matrix spike(s), the additional QC protocols in Sections 10.9.1.1 and/or 10.9.1.2 should be performed prior to reporting concentration data for the elements in this method. At a minimum these tests should be performed with each batch of samples prepared/analyzed with corresponding unacceptable data quality results. If matrix interference effects are confirmed, then an alternative test method should be considered or the current test method modified, so that the analysis is not affected by the same interference. The use of a standard-addition analysis procedure may also be used to compensate for this effect.

10.9.1.1 Dilution Test - If the analyte concentration is within the linear range of the instrument and sufficiently high (minimally, a factor of 25 times greater than the LLOQ), an analysis of a 1:5 dilution should agree to within ±20% of the original determination. If not, then a chemical or physical interference effect should be suspected. The matrix spike is often a good choice of sample for the dilution test, since reasonable concentrations of most analytes are present. Elements that fail the dilution test are reported as estimated values.

CAUTION: If spectral overlap is suspected, then the use of computerized compensation, an alternate wavelength, or comparison with an alternate method is recommended.

10.9.1.2 Post-Digestion MS - If a high concentration sample is not available for performing the dilution test, then a post-digestion MS should be performed. The test only needs to be performed for the specific elements that failed original matrix spike limits, and only if the spike concentration added was greater than the concentration determined in the unspiked sample. Following preparation, which may include, but is not limited to, pre-filtration, digestion, dilution and filtration, an aliquot, or dilution thereof, should be obtained from the final aqueous, unspiked-analytical sample, and spiked with a known quantity of target

elements. The spike addition should be based on the indigenous concentration of each element of interest in the sample. The recovery of the post-digestion MS should fall within a ±20% acceptance range, relative to the known true value, or otherwise within the laboratory-derived acceptance limits. If the post-digestion MS recovery fails to meet the acceptance criteria, the sample results must be reported as estimated values.

10.10 Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD) - An LCS/LCSD pair must be digested and analyzed with each batch of 20 samples.

10.10.1 **For SW-846 Method 6010B, 6010C, and 6010D** – The LCS recovery must be 80-120%. The RPD must be less than 20%. When using a certified solid reference material for soils, the manufacturer's established limits are used for control limits

10.10.2 **For EPA Method 200.7** – The LCS recovery must be 85-115%. The RPD must be less than 20%.

10.11 Interference Check Standards (ICSA/ICSAB) – The ICSA and ICSAB must be analyzed at the beginning and ending of each sequence or twice within each 8 hour shift, whichever is more frequent. The recovery of the ICSA and ICSAB elements must be 80-120%. If the results are unsatisfactory, see section 11.10 for further guidance. Do not proceed until this criterion is met.

NOTE: The unspiked elements in the ICSA are not evaluated by the data capture software. The instrument analyst evaluates whether the unspiked elements are <2 times the LLOQ for the ICSA.

10.11.1 For Method 6010D two types of SIC checks are used. Individual element SIC checks are performed when the instrument is initially setup, and periodically (at least once every 6 months) thereafter. The mixed element SIC solution is used daily to check that the instrument is free from interference from elements typically observed in high concentration and to check that and interference corrections applied are still valid.

10.11.1.1 Single element interference checks - At a minimum, single element SIC checks must be performed for the following elements: Aluminum 500mg/L; Boron 50mg/L, Barium, 50mg/L, Calcium 500mg/L; Copper 20mg/L; Iron 200mg/L; Magnesium 500mg/L; Manganese 10mg/L; Molybdenum 20mg/L; Sodium 1000mg/L; Nickel 20mg/L; Selenium 20mg/L; Silicon 100mg/L; Tin 20mg/L; Vanadium 20mg/L; Zinc 10mg/L.

The absolute value of the concentration observed for any unspiked analyte in the single element SIC checks must be less than two times the analytes LLOQ. The concentration of the SIC checks are suggested, but become the highest concentration allowed in a

sample analysis, and cannot be higher than the highest established linear range. Samples with concentrations of elements higher than the SIC check must be diluted until the concentration is less than the SIC check solution. Note that reanalysis of a diluted sample is required even if the high concentration element is not required to be reported for the specific sample, since the function of the SIC check is to evaluate spectral interferences on other elements.

The single element SIC checks are performed when the instrument is setup and periodically (at least once every 6 months) thereafter.

10.11.1.2 Mixed element interference check - The mixed element SIC solution (see section 7.10.3.2) is analyzed at least once per day, immediately after the initial calibration. The concentration measured for any target analytes must be less than +/- two times the LLOQ. If this criterion is not met then sample analysis may not proceed until the problem is corrected, or alternatively the LLOQ may be raised to twice the concentration observed in the SIC solution. The only exceptions are those elements that have been demonstrated to be contaminants in the SIC solutions (see Section 7.10.3.1). These may be present up to the concentration documented plus the LLOQ.

State Note: For Wisconsin samples, the ICS is evaluated to the LOQ.

10.12 Serial Dilution (SD) - If the analyte concentration is sufficiently high (minimally 10X the IDL), an analysis of a 1:4 dilution must agree within 10% of the original determination. If not, see section 11.11 for further guidance.

10.13 Post digestion Spike (PS) - An analyte spike added to a portion of a prepared sample, or its dilution and must be recovered to within 75% to 125% of the known value. The spike addition should produce a minimum level of 10 times and a maximum of 100 times the IDL. If the spike is not recovered within the specified limits, see section 11.11 for further guidance.

For SW-846 Method 6010C – The Post Digestion Spike must recover within ±20% of the known value.

10.14 Internal Standard (ISTD) – Verify the internal standard responses. The intensity of the internal standard response in a sample is monitored and compared to the intensity of the response for that internal standard in the calibration blank. The Percent Relative Intensity (%RI) in the sample must fall within 60-140% of the response in the calibration blank. If the %RI of the response in the sample falls outside of these limits, see sections 9.15 & 11.9 for further guidance.

10.15 Sample Dilution - If a sample analyte concentration is quantitated within 90% or greater of the upper limit of the analyte Linear Dynamic Range (LDR), the sample must be diluted with acidified reagent water and re-analyzed.

10.16 Lower Limit of Quantitation (LLOQ) – When analyzing samples according to Method 6010D, the LLOQ is initially verified by the analysis of at least 7 replicate samples, spiked at the LLOQ and processed through all preparation and analysis steps of the method. The mean recovery and relative standard deviation of these samples provide an initial statement of precision and accuracy at the LLOQ. In most cases the mean recovery should be +/- 35% of the true value and RSD should be < 20%. In-house limits may be calculated when sufficient data points exist. Monitoring recovery of LLOQ over time is useful for assessing precision and bias.

10.16.1 Ongoing LLOQ verification, at a minimum, is on a quarterly basis to validate quantitation capability at low analyte concentration levels. This verification may be accomplished either with clean control material (e.g., reagent water, method blanks, Ottawa sand, diatomaceous earth, etc.) or a representative sample matrix (free of target compounds). Optimally, the LLOQ should be less than the desired regulatory action levels based on the stated project-specific requirements.

11.0 DATA VALIDATION AND CORRECTIVE ACTION

11.1 All data must undergo a primary review by the analyst. The analyst must check the performance of the initial calibration, mid-point check standard, and continuing calibrations to ensure that they meet the criteria of the method. The analyst should review any sample that has quantifiable compounds and make sure that they have been confirmed, if needed. The analyst must also verify that reported results are derived from quantitation between the RL and the highest standard of the initial calibration curve. All calculations must be checked (any dilutions, %solids, etc.). Data must be checked for the presence or absence of appropriate flags. Comments should be noted when data is flagged.

11.2 All data must then undergo a second analyst review. This review must be performed according to Pace National SOPs #030201, *Data Handling and Reporting* and #030227*, Data Review*.

11.3 Initial Calibration – After analyzing the calibration standards, the curve is reviewed to ensure the acceptance criteria described in section 10.5 are met. If analytes do not meet this requirement, corrective action must be taken. Corrective actions may include re-calibrating the instrument, replacing the tubing on the peristaltic pump, examining blanks and standards for degradation/contamination, or performing instrument maintenance. If the internal standard responses in the calibration standards do not meet the criteria in section 10.14, re-calibrate the instrument.

11.4 Initial Calibration Verification (ICV) – If the criteria described in section 10.6 are not met for a target analyte, re-analyze the ICV/ICVLL. If this fails a second time, corrective action must be taken. Re-calibrate and re-analyze the ICV/ICVLL using the same standard. If acceptance criteria are still not met, re-check standard curve and ICV/ICVLL preparation and/or perform routine instrument maintenance. If still not acceptable, refer to manufacturer's instruction or call service representative.

11.5 Continuing Calibration Verification (CCV) – The continuing calibration verification standard must agree with the criteria in section 10.7 or the CCV must be re-analyzed. If the recovery fails a second time, corrective action must be taken. The corrective action may require re-calibrate the instrument and re-analyze the last 10 samples, using the same CCV standard. If acceptance criteria are still not met, re-check the standard curve and CCV preparation and/or perform instrument maintenance. If the CCV still does not pass, refer to the manufacturer's instruction or call a service representative.

11.6 Blanks – Evaluate the blanks. The analyst must confirm that both the method blanks and the continuing calibration blanks were analyzed at the required frequency. Other items to check are as follows:

11.6.1 The instrument blank or continuing calibration blank (ICB/CCB) must meet the criteria in section 10.8. Corrective actions for method blank contamination include re-prepping the entire batch of samples, or if the site-specific requirements can be met, an elevated detection limit may be used, or the sample data qualified with a “B” qualifier and footnoted.

NOTE: Method 6010D - If the method blank fails to meet the necessary acceptance criteria, it should be reanalyzed once. If still unacceptable, then all samples associated with the method blank must be re-prepared and re-analyzed along with all other appropriate analysis batch QC samples. If the method blank results do not meet the acceptance criteria and reanalysis is not practical, then the laboratory should report the sample results along with the method blank results and provide a discussion of the potential impact of the contamination on the sample results. However, if an analyte of interest is found in a sample in the batch near its concentration confirmed in the blank, the presence and/or concentration of that analyte should be considered suspect and may require qualification.

11.7 Laboratory Control Sample (LCS)/Laboratory Control Sample Duplicate (LCSD) – Assess that LCS pairs were prepared at the required frequency. If all target analyte recoveries are not within the criteria described in section 10.10, rinse the instrument and re-analyze. If the LCS/LCSD fails for a second time, re-prepared all samples prepared in conjunction with the failing LCS. The affected samples must be re-digested and re-analyzed along with a new LCS. If there is insufficient volume submitted to re-prepare the field samples, notify the project manager to contact the client for further instruction. Reporting with a qualifier may be performed if acceptable to the client.

11.8 Matrix Spike (MS)/Matrix Spike Duplicate (MSD) – Assess that MS pairs were prepared at the required frequency. If all target analyte recoveries are not within the criteria described in section 10.9, review the post digestion spike results for similar failures. If the post spike confirms the matrix interferent, qualify the data using an O1 and J4. If the post spike does not confirm the interferent, rinse the instrument and re-analyze. If the MS/MSD fails for a second time, review the data to see if similar results are also present in the LCS/LCSD. If the LCS/LCSD are acceptable, the MS/MSD failures can be

attributed to matrix interferences and the data can be qualified with a J4 and reported. If similar results are seen in the LCS, then re-prepared all samples prepared in conjunction with the failing MS/MSD. In this case, the affected samples must be re-digested and re-analyzed along with a new MS/MSD pair. If there is insufficient volume submitted to re-prepare the field samples, notify the project manager to contact the client for further instruction. Reporting with a qualifier may be performed if acceptable to the client. If insufficient field sample remains for re-analysis, report results with a J3 and an L3.

NOTE: If the sample concentration for an analyte is greater than 4 times the spike concentration, a "V" qualifier is used. The "V" qualifier indicates that the high concentration of analyte in the sample interfered with the ability to make an accurate spike recovery determination.

11.9 ISTD – The intensity of the Yttrium internal standard response in each sample is monitored and compared to the intensity of the response for that internal standard in the calibration blank. The Percent Relative Intensity (%RI) in each sample must meet the criteria in section 10.14. If the %RI of the response in the sample falls outside of these limits, the laboratory must immediately re-analyze the calibration blank and monitor the internal standard intensities. If the %RI for that calibration blank is within the limits, the laboratory must re-analyze the original sample at a two-fold dilution due to a possible interference from the matrix on the ISTD. If the %RI for the re-analyzed calibration blank is outside the limits, the analysis must be terminated, the problem corrected, the instrument recalibrated, the new calibration verified, and the samples reanalyzed.

11.10 Interference Check Standards (ICSA/ICSAB) - Evaluate the ICSA and ICSAB. The analyst must verify that the ICS and ICSAB have been analyzed at the required frequency. If the criteria in section 10.11 are not met, check the background correction protocols currently in place for appropriateness. If this is the initial ICS and/or ICSAB run after daily calibration, re-analyze the CALBLANK and re-calibrate the instrument. If the ICSA and/or ICSAB did not agree at the end of an 8-hour shift, re-analyze the ICSA and ICSAB. If failure persists, perform instrument maintenance as needed, recalibrate and re-analyze any samples in the previous run that may have been affected.

11.11 Serial Dilution/Post-digestion Spike – The analyst must verify that the SD and PS have been analyzed at the required frequency. If either of these tests fails to meet the required criteria in sections 10.12 & 10.13, the possibility of a matrix interferent should be suspected. An O1 qualifier is used when either sample type fails due to matrix interferences.

11.11.1 Serial Dilution - An analysis of a 1:4 dilution must agree within 10% of the original determination. If not, a chemical or physical interference effect is suspected.

11.11.2 Post-digestion Spike - The spike addition should produce a minimum level of 10 times and a maximum of 100 times the instrumental detection limit. If the spike is not recovered within the specified limits, a matrix effect is suspected.

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CAUTION: If spectral overlap is suspected, use of computerized compensation, an alternate wavelength, or comparison with an alternate method is recommended.

11.12 Data that does not meet acceptable QC criteria may be acceptable for use in certain circumstances.

11.12.1 If a method blank contains an amount of target analyte, but all samples are non-detected, the data may be reported with a “B3” flag. If a method blank contains an amount of target analyte, but the samples contain analyte at a level that is 10 times the level present in the method blanks, the data may be reported with a “B” flag.

11.12.2 If the MS/MSD fails (recovery less than 30% or greater than 150% and/or RPD greater than 30%) in an initial analysis and again upon re-analysis, the data is released with an appropriate qualifier as the failure is accepted as matrix related.

11.12.3 If a calibration verification standard is above the acceptable QC criteria and all samples being bracketed are below the reporting limit, the data is acceptable based on a high calibration bias with undetectable levels in the field samples. Any positive samples require re-analysis.

11.12.4 If the target analyte spiked in the quality control samples (LCS, LCSD, MS, MSD) exhibits high recovery and the target analytes in the field samples are below the reporting limit, the data may be released with a J+ qualifier indicating the high bias with no impact on the field sample analysis due to the bias present.

11.12.5 If the target analyte spiked into the QC pair (LCS/LCSD, MS/MSD) exhibit acceptable recoveries, but high calculated RPD values for precision, and the target analytes in the field sample are flagged with a J3 for the precision beyond acceptable quality control limits.

11.12.6 Sample results can be qualified and possible bias is narrated per the Pace National SOP #030201, *Data Handling and Reporting*.

STATE NOTE: Drinking water samples analyzed using this procedure for compliance cannot be qualified.

12.0 POLLUTION PREVENTION AND WASTE MANAGEMENT

12.1 The EPA requires that laboratory waste management practice to be conducted consistent with all applicable federal and state laws and regulations. Excess reagents, samples and method process wastes must be characterized and disposed of in an acceptable manner. See *Pace National Waste Management Plan.*

12.2 See SOP #030302, *Environmental Sustainability & Pollution Prevention*.

13.0 METHOD MODIFICATIONS/CLARIFICATIONS

13.1 Adjustments to the concentrations of standards/spiking solutions, standards providers, and quality control are subject to change to better meet client/project/regulatory needs or to improve laboratory method performance.

13.2 Modifications to this method are noted in the body of the text as state notes. Compliance analyses performed in conjunction with specific state requirements must be performed as noted within the specific state(s) note listed.

13.3 Superscripts are provided where necessary to indicate the reference in Section 14.0 where the requirement/information can be found. Subscripts noted identify the most frequent/restrictive cases, but requirements may also be included at different frequencies/conditions in other references noted in section 14.0.

13.4 In the May 2012 Methods Update Rule, the EPA revised the previous interpretation of EPA 200.7 to include the use of axial torch orientation in the published method. Either axial or radial orientation is acceptable.

14.0 REFERENCES

14.1 *Inductively Coupled Plasma-Atomic Emission Spectrometry*, SW-846 Method 6010B, Revision 2, December 1996.

14.2 *Determination of Metals and Trace Elements in Water and Wastes by Inductively Coupled Plasma-Atomic Emission Spectrometry*, EPA Method 200.7, Revision 4.4, May 1994

14.3 *Identification of Test Procedures*, 40 CFR §136.3

14.4 *Inorganic Chemical Sampling and Analytical Requirements*, 40 CFR §141.23

14.5 *Inductively Coupled Plasma-Atomic Emission Spectrometry*, SW-846 Method 6010C, Revision 3, February, 2007.

14.6 *Hardness by Calculation*, Standard Methods (SM) 2340B, 20th Edition.

14.7 *Hardness by Calculation*, SM 2340B-2011.

14.8 *Hardness by Calculation*, SM 2340B-1997.

14.9 *Inorganic Analytes*, SW-846 Chapter 3, Revision 4, February, 2007.

Standard Operating Procedure

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TITLE: DETERMINATION OF METALS AND TRACE ELEMENTS IN VARIOUS MATRICES BY ICP-AES (EPA METHODS 6010B, 6010C,6010D [ICP-OES], AND 200.7) INCLUDING HARDNESS (EPA METHODS 200.7 AND 6010B/C/D AND SM 2340B)

Attachment I: Revision History

Current Version:

Version	Date	Description of Revisions
21	9/10/18	Update in response AZ audit finding CAR3296. Revised Post-Spike acceptance criteria to ±20% in Section 10.9.1.2

Superseded Versions:

This document supersedes the following:

Version	Date	Description of Revisions
0	5/1/95	Origination
1	7/25/95	
2	3/11/97	
3	8/18/99	
4	2/11/00	
5	8/21/00	
6	3/28/01	
7	12/14/01	
8	4/11/03	
9	1/26/04	
10	8/2/04	
11	10/15/05	Corrected CCV criteria for EPA 200.7
12	10/29/08	Technical and Quality Review and update. Corrected acceptance criteria in Section 10.6. Updated format and re-organized sections 8.0, 10.0 and 11.0 based on new format.
13	1/23/09	Technical and Quality Review and update.
14	2/2/09	Technical and Quality Review and update. Clarification of holding times, Inclusion of cross-references. Inclusion of section 13.1 and section 7.1.
15	4/15/11	Technical and Quality Review and update. Added state notes where applicable; Added Tables 1.2b & 1.2c; Revised Table 1.2a and Sections 1.1, 1.3, 1.6, 1.11, 2.18, 2.22, 5.6, 7.1, 7.6.2, 7.9, 8.1.3, 8.1.5, through 8.1.10, 9.1, 9.7 through 9.12, 10.3, 10.0 & 11.0, 12.1; Added Sections 2.13.1, 2.14.1, 2.31 through 2.35, 3.1.1, 4.1, 4.7, 7.17, 13.2, 13.3, 14.5 through 14.10.
16	6/27/14	Complete Rewrite and update.
17	12/7/2015	Technical and quality review and update. Header and signature block re-formatting. Revised Sections 1.13.1, 2.13.1, 2.23, 5.1.3, 6.1.1, 6.1.2, 7.1, 7.6, 7.7, 7.8, 7.9, 7.10.1, 7.10.2, 7.11, 7.12, 7.13, 7.14, 7.16, 8.1.3, 8.1.5, 8.1.11, 9.4, 10.2, 10.3.1, 10.3.2, 10.4.2, 10.4.4, 10.9, 10.10, 10.14, 11.12.6, and 12.2. Revised Tables 1.2a, and 1.10. Deleted Sections 2.22 and 7.12. Added Attachment III.

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Version	Date	Description of Revisions
18	10/28/2016	Technical and quality review and update. Update per South Carolina DHEC correspondence of 6/24/16. Header and signature block re-formatting. Revised SOP title. Revised Sections 1.1, Table 1.2a, 1.3, 1.6, 1.10, 2.12, 2.15, 5.6, 7.5.2, 7.10.1, 9.1, 10.2, 10.3.1, 10.4.2, 10.4.3, 10.4.5, 10.5, 10.6.1, 10.6.2, 10.7.1, 10.8.1.2, 10.8.2.2, 10.10.1, 10.16, and Attachment III Table 2. Deleted Table 1.2b. Deleted Sections 2.2, 2.12, 2.13, 2.14, 2.15, 2.17, 2.20, through 2.33, 3.5, 4.8, 7.14, 7.16, 8.1.3, 9.7 through 9.10, 9.13, 10.4.5.1, 10.4.5.2, 10.4.5.3, 10.10.3, 13.5, 14.7, 14.8, 14.9, and 14.10. Added Sections 2.14, 7.10.3 and all subsections, 9.11, 9.12, 10.1.1, 10.6.4, 10.6.5, 10.8.1.2, 10.9.1 and all subsections, 10.11.1 and all subsections, and 11.6.1.
19	11/30/2017	Update in response to A2LA audit finding CAR2872. Changed ESC logo. Updated Sections 1.5, 3.1, 7.9, 10.11, 14.1, 14.2, 14.3, 14.4, 14.5, 14.6, 14.7, 14.8, 14.9, and Attachment III Table 5.
20	7/27/18	Update in response to WI and AZ audit findings. Changed logo and references to “ESC” to “Pace National”. Revised Section 7.14, 10.4.4, and 10.7.3. Added State Note to Sections 10.8.1.2 and 10.11. Also added 6010C note to Section 10.13

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Attachment II: Potential ICP interferences arising from analytes present in field samples at concentrations of 100mg/L

Analyte	Wavelength (nm)	Interferant[a,b] Al	Ca	Cr	Cu	Fe	Mg	Mn	Ni	Ti	V
Aluminum	308.215	--	--	--	--	--	--	0.21	--	--	1.4
Antimony	206.833	0.47	--	2.9	--	0.08	--	--	--	0.25	0.45
Arsenic	193.696	1.3	--	0.44	--	--	--	--	--	--	1.1
Barium	455.403	--	--	--	--	--	--	--	--	--	--
Beryllium	313.042	--	--	--	--	--	--	--	--	0.04	0.05
Cadmium	226.502	--	--	--	--	0.03	--	--	0.02	--	--
Calcium	317.933	--	--	0.08	--	0.01	0.01	0.04	--	0.03	0.03
Chromium	267.716	--	--	--	--	0.003	--	0.04	--	--	0.04
Cobalt	228.616	--	--	0.03	--	0.005	--	--	0.03	0.15	--
Copper	324.754	--	--	--	--	0.003	--	--	--	0.05	0.02
Iron	259.940	--	--	--	--	--	--	0.12	--	--	--
Lead	220.353	0.17	--	--	--	--	--	--	--	--	--
Magnesium	279.079	--	0.02	0.11	--	0.13	--	0.25	--	0.07	0.12
Manganese	257.610	0.005	--	0.01	--	0.002	0.002	--	--	--	--
Molybdenum	202.030	0.05	--	--	--	0.03	--	--	--	--	--
Nickel	231.604	--	--	--	--	--	--	--	--	--	--
Selenium	196.026	0.23	--	--	--	0.09	--	--	--	--	--
Sodium	588.995	--	--	--	--	--	--	--	--	0.08	--
Thallium	190.864	0.30	--	--	--	--	--	--	--	--	--
Vanadium	292.402	--	--	0.05	--	0.005	--	--	--	0.02	--
Zinc	213.856	--	--	--	0.14	--	--	--	0.29	--	--

[a] Dashes indicate that no interference was observed even when interferents were introduced at the following levels:

Al -	1000 mg/L	Mg -	1000 mg/L
Ca -	1000 mg/L	Mn -	200 mg/L
Cr -	200 mg/L	Tl -	200 mg/L
Cu -	200 mg/L	V -	200 mg/L
Fe -	1000 mg/L		

[b] The figures recorded as analyte concentrations are not the actual observed concentrations; to obtain those figures, add the listed concentration to the interferant figure.

[c] Interferences will be affected by background choice and other interferences may be present.

NOTE: Using the above table, if analyzing for Lead in a sample containing 1000mg/L Aluminum, the lead results could demonstrate a high bias of 0.17mg/L. (If the sample contained 10000mg/L of Al, the bias in lead could be 1.7mg/L), if background corrections are not accurately applied by the instrument.

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Attachment III: DoD Requirements

1.0 Equipment/Instrument Maintenance

Instrument maintenance must be performed routinely to optimize instrument performance and improve chromatography. Commonly performed maintenance includes changing pump tubing, replacing the torch, cleaning the nebulizer, etc. A new calibration curve must be analyzed following any major maintenance performed on the analytical system.

2.0 Computer Hardware and Software

QTegra, Version 2.4

3.0 Troubleshooting

Table 1. GC Troubleshooting Guide

Problem	Cause	Treatment
Poor Precision	Nebulizer Pressure	Pressure should be about 0.15 mPa for aqueous solutions. If pressure is substantially higher, clean the nebulizer orifice or replace it entirely.
	Pooling in Spray Chamber	Usually caused by an oily film in the spray chamber. Aspirate 0.1% HF solution for about 20 seconds or 0.01% Triton X-100 solution.
	Center Tube	Replace the tube.
	Capillary Tubing	Air bubble migration through tubing should be smooth and consistent. Replace kinked/ pinched tubing.
	Peristaltic Pump	Adjust platen pressure. Check for leaks. Replace damaged pump.
Poor Accuracy	Pump Rate	Ensure the flush pump rate is the same as the analysis pump rate.
	Flush Time	Ensure proper time set for adequate rinse (typically 30 seconds).
Poor Detection Limits	Dirty Window or Mirror	Clean or replace dirty components.

4.0 Other Requirements

4.1 All hardcopy laboratory notebooks must be reviewed by the Supervisor, or their designee, on a monthly basis.

4.2 If not self-explanatory (e.g., a typo or transposed number), corrections to technical and quality records shall also include a justification for the change.

4.3 A person performing a manual integration must sign and date each manually integrated chromatogram and record the rationale for performing manual integration. Electronic signatures are acceptable.

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4.4 The results of calibration and verification of support equipment must be within the specifications required of the application for which this equipment is used or the equipment must be removed from service until repaired. Calibration and verification records, including those of established correction factors, must be maintained. In the absence of method-specific requirements, the minimum requirements are as follows:

Table 2. Support Equipment Checks

Performance Check	Frequency	Acceptance Criteria
Balance calibration check [Using two standard weights that bracket the expected mass]	Daily prior to use	Top-loading balance: ±2% or ±0.02g, whichever is greater Analytical balance: ±0.1% or ±0.5 mg, whichever is greater
Verification of standard mass [Using weights traceable to the International System of Units (SI) through a NMI	Every 5 years	Certificate of Calibration from ISO/IEC 17025 accredited calibration laboratory
Monitoring of refrigerator/freezer temperatures	Daily (i.e. 7 days per week) [use MIN/MAX thermometers or data loggers equipped with notification of out of control event capabilities i personnel not available to record daily]	Refrigerators: 0˚C to 6˚C Freezers: ≤-10˚C
Thermometer verification check [Using a thermometer traceable to the SI through an NMI] [Performed at two temperatures that bracket the target temperature(s). Assume linearity between the two bracketing temperatures.] [If only a single temperature is used, at the temperature of use]	Liquid in glass: Before first use and annually Electronic: Before first use and quarterly	Apply correction factors or replace thermometer
Volumetric labware	Class B: By lot before first use Class A and B: Upon evidence of deterioration	Bias: Mean within ±2% of nominal volume Precision: RSD ≤1% of nominal volume (based on 10 replicate measurements)
Non-volumetric labware [Applicable only when used for measuring initial sample volume and final extract/ digestates volume]	By lot before first use or upon evidence of deterioration	Bias: Mean within ±3% of nominal volume Precision: RSD ≤3% of nominal volume (based on 10 replicate measurements)

Standard Operating Procedure

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TITLE: DETERMINATION OF METALS AND TRACE ELEMENTS IN VARIOUS MATRICES BY ICP-AES (EPA METHODS 6010B, 6010C,6010D [ICP-OES], AND 200.7) INCLUDING HARDNESS (EPA METHODS 200.7 AND 6010B/C/D AND SM 2340B)

Table 2. Support Equipment Checks

Performance Check	Frequency	Acceptance Criteria
Mechanical volumetric pipette	Quarterly	Bias: Mean within ±2% of nominal volume Precision: RSD ≤1% of nominal volume (based on minimum of 3 replicate measurements) [Note: for variable volume pipettes, the nominal volume is the volume of use]
Glass microliter syringe	Upon receipt and upon evidence of deterioration	General Certificate of Bias & Precision upon receipt Replace if deterioration is evident
Drying oven temperature check	Daily prior to and after use	Within ±5% of set temperature
Water purification system	Daily prior to use	See method blank criteria given in Section 4.20 of this addendum

4.5 The expiration date of the prepared standard shall not exceed the expiration date of the primary standard. All containers must bear a preparation date.

4.6 To avoid preparing non-representative samples, the laboratory shall not "target" within a relatively small mass range (e.g., 1.00 ± 0.01g) because such targeting will produce non-representative subsamples if the sample has high heterogeneity. The laboratory shall not manipulate the sample material so the sample aliquot weighs exactly 1.00g ± 0.01g, as an example.

4.7 In the absence of project-specific requirements, the minimum standard data qualifiers to be used are:

U Analyte was not detected and is reported as less than the LOD or as defined by the customer. The LOD has been adjusted for any dilution or concentration of the sample.

J The reported result is an estimated value (e.g., matrix interference was observed or the analyte was detected at a concentration outside the quantitation range).

B Blank contamination. The recorded result is associated with a contaminated blank.

N Non-target analyte. The analyte is a tentatively identified compound using mass spectrometry or any non-customer requested compounds that are tentatively identified.

Q One or more quality control criteria failed (e.g., LCS recovery, surrogate spike recovery, or CCV recovery).

Additional data qualifiers may be used, or different letters or symbols to denote the qualifiers listed above, as long as they are appropriately defined and their use is consistent with project-specific requirements (e.g., QSM 5.0, the contract, and project-planning documents).

4.8 If the time of the sample collection is not provided, assume the most conservative time of day. For the purpose of batch processing, the start and stop dates and times of the batch preparation shall be recorded.

4.9 Each preparation method listed on the scope of accreditation must have quarterly LOD/LOQ verifications. However, not all possible combinations of preparation and cleanup techniques are required to have LOD/LOQ verifications. If LOD/LOQ verifications are not performed on all combinations, the laboratory must base the LOD/LOQ verifications on the worst case basis (preparation method with all applicable cleanup steps).

4.10 After each MDL determination, the laboratory must establish the LOD by spiking a quality system matrix at a concentration of at least 2 times but no greater than four times the MDL. This spike concentration establishes the LOD and the concentration at which the LOD shall be verified. It is specific to each suite of analyte, matrix, and method (including sample preparation). The following requirements apply to the initial LOD establishment and to the LOD verifications:

- The apparent signal to noise (S/N) ratio at the LOD must be at least three and the results must meet all method requirements for analyte identification (e.g., ion abundance, second column confirmation, or pattern recognition). For data systems that do not provide a measure of noise, the signal produced by the verification sample must produce a result that is at least three standard deviations greater than the mean method blank concentration. This is initially estimated based on a minimum of four method blank analyses and later established with a minimum of 20 method blank results.
- If the LOD verification fails, then the laboratory must repeat the MDL determination and LOD verification or perform and pass two consecutive LOD verifications at a higher spike concentration and set the LOD at the higher concentration.
- The laboratory shall maintain documentation for all MDL determinations and LOD verifications.
- The DL and LOD must be reported for all analyte-matrix-methods suites, unless it is not applicable to the test or specifically excluded by project requirements.

4.11 The LOD shall be verified quarterly. In situations where methods are setup and used on an infrequent basis, the laboratory may choose to perform LOD verifications on a one per batch basis. All verification data will be in compliance, reported, and available for review.

4.12 For DoD, at a minimum, the LOQ shall be verified quarterly. In situations where methods are setup and used on an infrequent basis, the laboratory may choose to perform LOQ verifications on a one per batch basis.

4.13 All initial instrument calibrations must be verified with a standard obtained from a second manufacturer prior to analyzing any samples. The use of a standard from a second lot obtained from the same manufacturer (independently prepared from different source materials) is acceptable for use as a second source standard. The concentration of the second source standard shall be at or near the midpoint of the calibration range. The acceptance criteria for the initial calibration verification must be at least as stringent as those for the continuing calibration verification.

4.14 Exclusion of calibration points without documented scientifically valid technical justification is not permitted.

4.15 The concentration of the CCV standard shall be greater than the low calibration standard and less than or equal to the midpoint of the calibration range.

4.16 All CCVs analyzed must be evaluated and reported. If a CCV fails, reanalysis or corrective actions must be taken.

- If a CCV fails, the laboratory can immediately analyze two additional consecutive CCVs (immediately is defined as starting a consecutive pair within one hour; no samples can be run between the failed CCV and the two additional CCVs). This approach allows for spurious failures of analytes to be reported without reanalysis of samples. Any corrective actions that change the dynamics of the system (e.g., clip column, clean injection port, run blanks) requires that all samples since the last acceptable CCV be reanalyzed.
- Both of these CCVs must meet acceptance criteria in order for the samples to be reported without reanalysis.
- If either of these two CCVs fail or if the laboratory cannot immediately analyze two CCVs, the associated samples cannot be reported and must be reanalyzed.
- Corrective action(s) and recalibration must occur if the above scenario fails. All affected samples since the last acceptable CCV must be reanalyzed.
- Flagging of data for a failed CCV is only appropriate when the affected samples cannot be reanalyzed. The laboratory must notify the client prior to reporting data associated with a failed CCV.

4.17 The results of all MS/MSDs must be evaluated using the same acceptance criteria used for the DoD LCS limits (see Addendum Tables 3 and 4) or project limits, if specified. If the specific analyte(s) are not available in the Addendum Tables 3 and 4, the laboratory shall use their LCS in-house limits (see the LIMS) as a means of evaluating MS/MSDs. The MS and MSD must be spiked with all reported analytes.

4.18 Surrogate spike results shall be compared with DoD LCS limits (see Addendum Tables 3 and 4) or acceptance criteria specified by the client. If these criteria are not available, the laboratory shall compare the results with its in-house statistically established LCS criteria (see the LIMS).

4.19 The method blank shall be considered to be contaminated if:

- The concentration of any target analyte (chemical of concern) in the blank exceeds 1/2 the LOQ and is greater than 1/10th the amount measured in any associated sample, or 1/0th the regulatory limit, whichever is greater;
- The concentration of any common laboratory contaminant in the blank exceeds the LOQ;
- If a method blank is contaminated as described above, then the laboratory shall reprocess affected samples in a subsequent preparation batch, except when sample results are below

the LOD. If insufficient sample volume remains for reprocessing, the results shall be reported with appropriate data qualifiers.

4.20 Sporadic Marginal Exceedances are not allowed for target analytes (chemicals of concern as identified by a project) without project-specific approval. Target analytes are considered those few analytes that are critical for the success of a project (such as risk drivers) where sporadic marginal exceedances cannot be allowed. Laboratories should consult with clients whenever long lists of analytes are requested for analysis to determine if marginal exceedances will not be allowed.

4.21 DoD considers the same analyte exceeding the LCS control limit two (2) out of three (3) consecutive LCS to be indicative of non-random behavior, which requires corrective action and reanalysis of the LCS.

Standard Operating Procedure

TITLE: DETERMINATION OF METALS AND TRACE ELEMENTS IN VARIOUS MATRICES BY ICP-AES (EPA METHODS 6010B, 6010C,6010D [ICP-OES], AND 200.7) INCLUDING HARDNESS (EPA METHODS 200.7 AND 6010B/C/D AND SM 2340B)

Table 3. LCS Control Limits – Method 6010 Solid Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
7429-90-5	Aluminum	6258	96.7	7.5	74	119
7440-36-0	Antimony	5997	96.4	5.7	79	114
7440-38-2	Arsenic	9530	96.2	4.9	82	111
7440-39-3	Barium	9236	98.3	5	83	113
7440-41-7	Beryllium	6799	97.8	5.1	83	113
7440-42-8	Boron	2312	93	7.1	72	114
7440-43-9	Cadmium	9466	97.5	5.3	82	113
7440-70-2	Calcium	6347	98.1	5.8	81	116
7440-47-3	Chromium	9598	98.9	4.6	85	113
7440-48-4	Cobalt	6725	98.7	4.5	85	112
7440-50-8	Copper	7839	99.1	6	81	117
7439-89-6	Iron	5746	99.7	6.1	81	118
7439-92-1	Lead	10160	96.8	5.1	81	112
7439-93-2	Lithium	551	98.8	4.5	85	112
7439-95-4	Magnesium	6283	96.1	6.1	78	115
7439-96-5	Manganese	6732	99.1	4.9	84	114
7439-98-7	Molybdenum	4424	98.7	5.7	82	116
7440-02-0	Nickel	7412	98.1	4.9	83	113
7723-14-0	Phosphorus	189	103.1	3.8	92	114
7440-09-7	Potassium	6574	98.3	5.8	81	116
7782-49-2	Selenium	8862	94.5	5.6	78	111
7440-22-4	Silver	9105	97.3	5	82	112
7440-23-5	Sodium	5825	100.1	5.8	83	118
7440-24-6	Strontium	2573	98.5	5	83	114
7440-28-0	Thallium	6416	96.8	4.6	83	111
7440-31-5	Tin	2780	100.1	6.6	80	120
7440-32-6	Titanium	2107	98.2	5.2	83	114
7440-61-1	Uranium	109	97.4	5.2	82	113
7440-62-2	Vanadium	6934	98.3	5.4	82	114
7440-66-6	Zinc	7882	97.4	5	82	113

Standard Operating Procedure

TITLE: DETERMINATION OF METALS AND TRACE ELEMENTS IN VARIOUS MATRICES BY ICP-AES (EPA METHODS 6010B, 6010C,6010D [ICP-OES], AND 200.7) INCLUDING HARDNESS (EPA METHODS 200.7 AND 6010B/C/D AND SM 2340B)

Table 4. LCS Control Limits – Method 6010 Water Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
7429-90-5	Aluminum	11532	100	4.8	86	115
7440-36-0	Antimony	10737	100.2	4.2	88	113
7440-38-2	Arsenic	14123	99.9	4.3	87	113
7440-39-3	Barium	14476	100.3	4.1	88	113
7440-41-7	Beryllium	11552	100.4	4	89	112
7440-69-9	Bismuth	147	95.8	3.2	86	105
7440-42-8	Boron	3871	98.8	4.8	85	113
7440-43-9	Cadmium	13922	100.8	4.1	88	113
7440-70-2	Calcium	11382	100	4.2	87	113
7440-47-3	Chromium	15027	101.1	3.9	90	113
7440-48-4	Cobalt	11824	101.2	4.2	89	114
7440-50-8	Copper	12910	100.2	4.6	86	114
7439-89-6	Iron	13797	100.7	4.7	87	115
7439-92-1	Lead	14391	99.3	4.4	86	113
7439-93-2	Lithium	938	100.7	5.3	85	117
7439-95-4	Magnesium	11423	98.8	4.8	85	113
7439-96-5	Manganese	12767	101.9	4.1	90	114
7439-98-7	Molybdenum	8251	101.1	4	89	113
7440-02-0	Nickel	12699	100.5	4.1	88	113
7440-05-3	Palladium	492	99.8	4	88	112
7723-14-0	Phosphorus	203	100.5	4.2	88	113
7440-09-7	Potassium	11006	99.9	4.7	86	114
7782-49-2	Selenium	13264	98.5	5.2	83	114
7440-21-3	Silicon	1525	100.6	6.1	82	119
7440-22-4	Silver	13770	99.1	5.1	84	115
7440-23-5	Sodium	10893	100.9	4.7	87	115
7440-24-6	Strontium	3782	101.3	3.8	90	113
7704-34-9	Sulfur	145	100.7	3.9	89	112
7440-28-0	Thallium	10063	99.5	4.7	85	114
7440-31-5	Tin	4502	101.3	4.4	88	115
7440-32-6	Titanium	5625	101.1	3.4	91	111
7440-61-1	Uranium	223	101.3	5.8	84	119
7440-62-2	Vanadium	12032	100.2	3.6	90	111
7440-66-6	Zinc	13549	100.6	4.6	87	115

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Standard Operating Procedure

TITLE: **DETERMINATION OF METALS AND TRACE ELEMENTS IN VARIOUS MATRICES BY ICP-AES (EPA METHODS 6010B, 6010C,6010D [ICP-OES], AND 200.7) INCLUDING HARDNESS (EPA METHODS 200.7 AND 6010B/C/D AND SM 2340B)**

Table 5. Quality Control Requirements – Inorganic Analysis by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP/AES)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Linear Dynamic Range (LDR) or high-level check standard	At initial set up and checked every 6 months with a high standard at the upper limit of the range.	Within ± 10% of true value.	Dilute samples within the calibration range, or re-establish/ verify the LDR.	Flagging is not appropriate.	Data cannot be reported above the high calibration range without an established/passing high-level check standard.
Initial Calibration (ICAL) for all analytes	Daily ICAL prior to sample analysis.	If more than one calibration standard is used, r2 ≥ 0.99.	Correct problem, then repeat ICAL.	Flagging is not appropriate.	Minimum one high standard and a calibration blank. No samples shall be analyzed until ICAL has passed.
Initial Calibration Verification (ICV)	Once after each ICAL, analysis of a second source standard prior to sample analysis.	All reported analytes within ± 10% of true value.	Correct problem. Rerun ICV. If that fails, repeat ICAL.	Flagging is not appropriate.	No samples shall be analyzed until calibration has been verified with a second source.

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TITLE: **DETERMINATION OF METALS AND TRACE ELEMENTS IN VARIOUS MATRICES BY ICP-AES (EPA METHODS 6010B, 6010C,6010D [ICP-OES], AND 200.7) INCLUDING HARDNESS (EPA METHODS 200.7 AND 6010B/C/D AND SM 2340B)**

Table 5. Quality Control Requirements – Inorganic Analysis by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP/AES)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Continuing Calibration Verification (CCV)	After every 10 field samples, and at the end of the analysis sequence.	All reported analytes within ± 10% of the true value.	Immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails or if two consecutive CCVs cannot be run, perform corrective action(s) and repeat CCV and all associated samples since the last successful CCV. Alternately, recalibrate if necessary; then reanalyze all associated samples since the last acceptable CCV	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification.	Results may not be reported without a valid CCV. Flagging is only appropriate in cases where the samples cannot be reanalyzed.

Standard Operating Procedure

TITLE: DETERMINATION OF METALS AND TRACE ELEMENTS IN VARIOUS MATRICES BY ICP-AES (EPA METHODS 6010B, 6010C,6010D [ICP-OES], AND 200.7) INCLUDING HARDNESS (EPA METHODS 200.7 AND 6010B/C/D AND SM 2340B)

Table 5. Quality Control Requirements – Inorganic Analysis by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP/AES)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Low-Level Calibration Check Standard (LLCCV)	Daily	All reported analytes within ± 20% of true value.	Correct problem and repeat ICAL.	Flagging is not appropriate.	No samples shall be analyzed without a valid low-level calibration check standard (LLCCV). Low-level calibration check standard should be less than or equal to the LOQ. If the concentration of the lowest calibration standard is less than or equal to the LOQ, the lowest standard may be re-quantified against the calibration curve as a LLCCV. Otherwise, a separate standard must be analyzed as LLCCV prior to the analysis of any samples.

Standard Operating Procedure

TITLE: DETERMINATION OF METALS AND TRACE ELEMENTS IN VARIOUS MATRICES BY ICP-AES (EPA METHODS 6010B, 6010C,6010D [ICP-OES], AND 200.7) INCLUDING HARDNESS (EPA METHODS 200.7 AND 6010B/C/D AND SM 2340B)

Table 5. Quality Control Requirements – Inorganic Analysis by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP/AES)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Method Blank (MB)	One per preparatory batch.	The absolute values of all analytes must be < ½ LOQ or < 1/10th the amount measured in any sample or 1/10 the regulatory limit, whichever is greater.	Correct problem. If required, reprep and reanalyze MB and all QC and field samples processed with the contaminated blank.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch.	Results may not be reported without a valid method blank. Non-detects associated with positive blank infractions may be reported. Sample results >10X the LOQ associated with negative blanks may be reported. Flagging is only appropriate in cases where the samples cannot be reanalyzed.

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Standard Operating Procedure

TITLE: DETERMINATION OF METALS AND TRACE ELEMENTS IN VARIOUS MATRICES BY ICP-AES (EPA METHODS 6010B, 6010C,6010D [ICP-OES], AND 200.7) INCLUDING HARDNESS (EPA METHODS 200.7 AND 6010B/C/D AND SM 2340B)

Table 5. Quality Control Requirements – Inorganic Analysis by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP/AES)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Initial and Continuing Calibration Blank (ICB/CCB)	Immediately after the ICV and immediately after every CCV.	The absolute values of all analytes must be < ½ LOQ or < 1/10th the amount measured in any sample.	ICB: Correct problem and repeat ICV/ICB analysis. If that fails, rerun ICAL. All samples following the last acceptable Calibration Blank must be reanalyzed. CCBs may not be reanalyzed without reanalysis of the associated samples and CCV(s).	Flagging is not appropriate.	Results may not be reported without a valid calibration blank. Non-detects associated with positive blank infractions may be reported. Sample results >10X the LOQ associated with negative blanks may be reported. For CCB, failures due to carryover may not require an ICAL.
Interference Check Solutions (ICS) (also called Spectral Interference Checks)	After ICAL and prior to sample analysis.	ICS-A: Absolute value of concentration for all non-spiked project analytes <1/2 LOQ (unless they are a verified trace impurity from one of the spiked analytes); ICS-AB: Within ± 20% of true value.	Terminate analysis; locate and correct problem; reanalyze ICS, reanalyze all samples.	If corrective action fails, apply Q-flag to all results for specific analyte(s) in all samples associated with the failed ICS.	All analytes must be within the LDR. ICS-AB is not needed if instrument can read negative responses.

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TITLE: **DETERMINATION OF METALS AND TRACE ELEMENTS IN VARIOUS MATRICES BY ICP-AES (EPA METHODS 6010B, 6010C,6010D [ICP-OES], AND 200.7) INCLUDING HARDNESS (EPA METHODS 200.7 AND 6010B/C/D AND SM 2340B)**

Table 5. Quality Control Requirements – Inorganic Analysis by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP/AES)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Laboratory Control Sample (LCS)	One per preparatory batch.	A laboratory must use Table 3 and 4 limits for batch control if project limits are not specified. If the analyte(s) are not listed, use in-house LCS limits if project limits are not specified.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Must contain all reported analytes. Results may not be reported without a valid LCS. Flagging is only appropriate in cases where the samples cannot be reanalyzed.
Matrix Spike (MS)	One per preparatory batch.	A laboratory must use Table 3 and 4 limits for batch control if project limits are not specified. If the analyte(s) are not listed, use in-house LCS limits if project limits are not specified.	Examine the project-specific requirements. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J flag if acceptance criteria are not met and explain in the case narrative.	For matrix evaluation only. If MS results are outside the limits, the data shall be evaluated to the source(s) of difference (i.e., matrix effect or analytical error).

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TITLE: DETERMINATION OF METALS AND TRACE ELEMENTS IN VARIOUS MATRICES BY ICP-AES (EPA METHODS 6010B, 6010C,6010D [ICP-OES], AND 200.7) INCLUDING HARDNESS (EPA METHODS 200.7 AND 6010B/C/D AND SM 2340B)

Table 5. Quality Control Requirements – Inorganic Analysis by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP/AES)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Matrix Spike Duplicate (MSD) or Matrix Duplicate (MD)	One per preparatory batch.	A laboratory must use Table 3 and 4 limits for batch control if project limits are not specified. If the analyte(s) are not listed, use in-house LCS limits if project limits are not specified. MSD or MD: RPD of all analytes ≤ 20% (between MS and MSD or sample and MD).	Examine the project-specific requirements. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J flag if acceptance criteria are not met and explain in the case narrative.	The data shall be evaluated to determine the source of difference. For Sample/MD: RPD criteria only apply to analytes whose concentration in the sample is greater than or equal to the LOQ.
Dilution Test	One per preparatory batch if MS or MSD fails.	Five-fold dilution must agree within ± 10% of the original measurement.	No specific CA, unless required by the project.	For the specific analyte(s) in the parent sample, apply J flag if acceptance criteria are not met and explain in the case narrative.	Only applicable for samples with concentrations > 50 x LOQ (prior to dilution). Use along with MS/MSD and PDS data to confirm matrix effects.

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TITLE: **DETERMINATION OF METALS AND TRACE ELEMENTS IN VARIOUS MATRICES BY ICP-AES (EPA METHODS 6010B, 6010C,6010D [ICP-OES], AND 200.7) INCLUDING HARDNESS (EPA METHODS 200.7 AND 6010B/C/D AND SM 2340B)**

Table 5. Quality Control Requirements – Inorganic Analysis by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP/AES)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Post-Digestion Spike (PDS) Addition (ICP only)	Perform if MS/MSD fails. One per preparatory batch (using the same sample as used for the MS/MSD if possible).	Recovery within 80-120%.	No specific CA, unless required by the project.	For the specific analyte(s) in the parent sample, apply J flag if acceptance criteria are not met and explain in the case narrative.	Criteria applies for samples with concentrations <50 X LOQ prior to dilution.
Method of Standard Additions (MSA)	When dilution test or post digestion spike fails and if required by project.	NA	NA	NA	Document use of MSA in the case narrative.

Appendix C: Field Sampling SOPs

TTI ENVIRONMENTAL INC.1253 N. Church Street, Moorestown, New Jersey 08057

STANDARD OPERATING PROCEDURES

Soil Sampling

January 3, 2019

Prepared by:

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Renee Michalak
Environmental Associate 2

Reviewed by:

Andrew Basehoar, PG
Project Manager

TTI ENVIRONMENTAL, INC. LABORATORY CERTIFICATION PROGRAM			
Program Name	Soil Sampling		
Regulatory Reference	Field Sampling Procedures Manual (2005)		
Date Created	January 2019	**Latest Revision**	
Program Supervisor	Kristin Heimburger		
Field Sampling Officer			

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Program Name	Soil Sampling		
Regulatory Reference	Field Sampling Procedures Manual (2005)		
Date Created	January 2019	**Latest Revision**	
Program Supervisor	Kristin Heimburger		
Field Sampling Officer			

1.0 PURPOSE AND OBJECTIVE

TTI Environmental, Inc. (TTI) has prepared this standard operating procedure (SOP) for soil sampling activities in order to establish a company standard for its employees to follow when investigating environmental issues related to soil. This SOP will ensure that soil samples are collected using the most current, appropriate methods and techniques. Soil sampling can generally be divided into surficial sampling, and subsurface sampling procedures. The sampling methods described within this SOP were developed with the assistance of the New Jersey Department of Environmental Protection (NJDEP) Field Sampling Procedures Manual (FSPM) (2005).

2.0 QUALIFICATIONS

A copy of this SOP shall be available to employees at the main office at all times. TTI personnel performing groundwater gauging and sampling activities shall be deemed qualified by the Program Coordinator by completing the following training:

- 40 hour HAZWOPER Training and Refresher courses
- TTI Health and Safety Training
- Data Acquisition Program training for this specific SOP

3.0 HEALTH & SAFETY

TTI personnel will abide by the TTI Health and Safety Program Guidelines while performing activities described in this SOP. Personal protective equipment (PPE) typically appropriate for these tasks include hard hat, nitrile gloves, hearing protection, safety glasses, long pants and steel toe boots. Additional PPE requirements and safety precautions may be required based on site-specific conditions and contaminants. Discuss potential safety scenarios and/or contaminant levels or exposure with project team or manager prior to arriving onsite to conduct soil sampling activities. Always have a charged cell phone, drinking water, and hospital directions onsite in case of emergencies.

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Field Sampling Officer			

4.0 PREPATORY TASKS

TTI shall allot preparatory time prior to each gauging and/or sampling event in order to ensure all necessary information, equipment, and items are accounted for before traveling to the job site to complete the work. The following is a general checklist of preparation activities and items:

- Kick-Off Meeting: discuss scope of work with project team or manager; sample locations, alternate sample locations, laboratory analysis required, type of sampling method(s) to perform, soil disposal plan, and site-specific safety concerns, etc. Complete Field-Work Kick-Off Checklist (**Appendix A**) and Health & Saftey Plan
- Utility Mark-Out: mark-out (One-Call) must be called in (by TTI or by driller subcontractor) at least 4 business days prior to breaking ground (account for weekends/holidays*), obtain confirmation ticket and review approved start date
- Schedule Subcontractors: if utilizing a geogrobe, contact subcontractor to schedule and review scope with drillers
- Site Access: calling/emailing to confirm with site/client/tenant contacts, ensuring sampling locations are readily accessible, obtaining site/fence keys etc.
- Paperwork: site maps, boring location maps, health and safety plan, boring logs, field book.
- Health and Safety Items: PPE; this may include nitrile gloves, hi-vis vest, hardhat, hearing protection, safety glasses, steel toe boots, drum labels, traffic cones, rain gear, etc.
- Other Equipment/Items: PID, hand auger, trowel, stainless steel bowl/spoons, core drill, jack hammer, pens/sharpies, paper towels, garbage bags, clipboard, tools (tape measure, screwdrivers, hammers), 5-gallon buckets, drums, asphalt patch, decon items, Alconox etc.
- Bottle Order: place bottle order with designated lab for the project, if sampling VOCs; specify Terra Cores or Encores
- Sign Out TTI Owned Equipment and/or Truck/Car
- Place Equipment Orders (if necessary)

Specific equipment needed to perform soil sampling varies depending on the methods used. TTI utilizes both in-house owned equipment, and equipment from subcontractors/vendors. Specific (typical) equipment needs for each type of activity are summarized in each method section below, and include complete printable checklists of equipment needs.

5.0 SOIL SAMPLING METHODS

TTI may utilize any of the following methods in order to collect soil data and samples. These methods and techniques have been generated in accordance with the FSPM (2005). All equipment shall be maintained and operated in accordance with the manufacturer's instructions. Any equipment malfunctions should follow troubleshooting procedures outlined within the manufacturer's instructions.

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5.1 General Soil Sampling

Any time soil samples are collected, the following procedures should be executed regardless of which sampling method is being implemented.

1. Choose and mark locations to sample with stakes/flags/marking paint
2. Confirm utilities are marked and not in immediate vicinity of location
3. Calibrate PID per manufacturers instruction prior to start of daily activities
4. Clear location of vegetation, asphalt or concrete (if necessary)
5. Decon equipment and/or ensure dedicated liners in place to prevent cross contamination
6. Ensure clean work area (i.e tailgate of truck, folding table, or polyethylene sheeting on ground if necessary)
7. Follow either surficial sampling (**Section 5.2**), direct push sampling (**Section 5.3**), or test pit/excavation sampling (**Section 5.4**) procedures.
8. Log soil information such as geology, visual contamination, odors, and PID readings, sleeve recovery, saturation, and depths in fieldbook or on boring log printouts. Soil boring logs should be recorded in 6-inch increments.
9. Collect soil sample from 6-inch interval at desired depth
    - VOC samples shall be collected first, directly from source (undisturbed soil; not composited) utilizing either TerraCore® or EnCore® kits.
        - TerraCore requires filling 3-40mL vials with approximately 5 grams of soil, and a soil jar. The 5 grams of soil will be inserted into each vial via the provided plunger (corer).
        - EnCore® require filling 3 plastic plungers with sealing caps, also approximately 5 grams each.
    - Remaining soil from the sample interval shall be homogenized with stainless steel spoons in a stainless steel mixing bowl. The soil then can be divided to fill any remaining Non-VOC sample jars needed. Remove all gravel/rocks from soils.
10. Complete sample label on jar(s) with sample ID, sample depth, time, and analysis
11. Place jars back into the cooler
12. Backfill excess soil into boring location/test pit, unless project specific plans to drum or dispose of waste.
13. Draw map with scale (measurements) to document location of borings/samples.
14. Decon equipment (if necessary as per Section 5.2, 5.3, or 5.4) prior to sampling next location.

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5.2 Surficial Soil Sampling

5.2.1 Objective

Surface soils include the zone from ground surface to a depth of 24 inches below ground surface. Due to the shallower depths required for surficial sampling, generally manual equipment is used to obtain sample data in this zone. Such equipment includes hand augers, shovels and/or trowels. A complete list of equipment utilized for surficial soil sampling is included in **Appendix B**.

5.2.2 Surficial Soil Sampling Procedures

1. Follow procedures 1 through 6 as described above in General Soil Sampling (**Section 5.1**)
2. Place auger bucket on sample location and turn (twist) in a downward forcing motion, until bucket is advanced into ground. Pull auger back up to surface and empty soil contents contained. Log lithology and observations as mentioned in Step 8 of **Section 5.1**.
3. Insert tape measure into open hole to determine depth of borehole.
4. Repeat Steps 2 and 3 until desired sampling depth is reached. If using shovel/trowel; dig hole to expose desired depth to be sampled.
5. Complete Steps 9 through 13 as described in **Section 5.1**.
6. Equipment which has come into contact with soils shall be deconned prior to sampling the next location in order to eliminate potential cross contamination.
    - Rinse auger bucket (or shovel/trowel) and stainless-steel bowl/spoons with a DI water/Alconox mixture. Scrub with brushes. Repeat if necessary.
    - Rinse with DI water, and pat dry with clean paper towels.
7. Move to next sampling location.

5.3 Subsurface Soil Sampling – Direct Push Geoprobe

5.3.1 Objective

Subsurface soils generally consist of soils located 24 inches or deeper. Hand augering can be utilized for subsurface sampling. However, due to difficulty in manually advancing borings to greater depths, this method is not preferred for depths greater than five feet. Should scope of work require hand augering, follow procedures outlined in Section 5.2 until desired depth is reached.

Due to the deeper depths required for subsurface sampling, generally hydraulic direct push (Geoprobe) equipment is utilized. This equipment is operated by licensed drillers (subcontractors), who utilize their own specific SOPs and manuals for retrieving samples. Direct push methods are beneficial as it allows collection of soil samples from discrete subsurface intervals, at deep depths, in a short amount of time without utilizing intensive manual labor. In New Jersey, soil borings may not exceed 50 feet bgs without obtaining a permit. A complete list of equipment utilized for subsurface direct push soil sampling is included in **Appendix C**.

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5.3.2 Direct Push Soil Sampling Procedures

1. Follow procedures 1 through 6 as described above in General Soil Sampling (**Section 5.1**)
2. Instruct driller to mobilize rig to sample location. Driller will advance, via direct push, one macrocore sampler with a dedicated acetate liner into the ground. Core will be filled with soils as its advanced into the ground. Sample tube will be extracted with the Geoprobe upon reaching interval.
    - Cores are generally 2 inches in diameter, and 4 or 5 foot long.
3. Remove liner from sample tube, and cut open. Immediately scan the PID along entire core recording results. Record amount of soils recovered. Log lithology and observations as mentioned in Step 8 of **Section 5.1**.
4. Have driller repeat Steps 2 and 3 until desired sampling depth is reached. Keep track of intervals and depths.
5. Complete Steps 9 through 13 as described in **Section 5.1**.
6. Direct push sampling utilizes individual dedicated liners for each interval of sampling, therefore decon is not necessary. However mixing spoon and bowls which have come into contact with soils shall be deconned prior to sampling the next location in order to eliminate potential cross contamination.
    - Rinse stainless steel bowl/spoons with a DI water/Alconox mixture. Scrub with brushes. Repeat if necessary.
    - Rinse with DI water, and pat dry with clean paper towels.
7. Move to next sampling location.

5.4 Subsurface Soil Sampling - Test Pits

5.4.1 Objective

Test pits may be warranted to expose subsurface soils adjacent to unknown metallic anomalies, USTs, historic fill, or to provide detailed observations in areas of concern at a site. Test pits will allow the collection of soil samples adjacent to specific areas of interest. Due to safety concerns, these samples will generally be collected via a backhoe to avoid entering the pits. The backhoe equipment will be operated by licensed machine operators (subcontractors), who utilize their own specific SOPs and manuals for performing test pits. A complete list of equipment utilized for subsurface test pit soil sampling is included in **Appendix D**.

5.4.2 Test Pit Soil Sampling Procedures

1. Follow procedures 1 through 6 as described above in General Soil Sampling (**Section 5.1**)
2. Backhoe operator shall expose subsurface area to be investigated in increments.
3. Instruct specific areas for operator to scoop with the bucket from sidewalls or bottom of pit.
4. Collect sample from central portion of bucket in order to avoid potential cross contamination on the sides of the bucket. Scrap top loose soil off

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top to expose undisturbed soils. Log lithology and observations as mentioned in Step 8 of **Section 5.1**.

5. Have operator repeat Steps 2, 3 and 4 until desired amount of samples are collected.
6. Complete Steps 9 through 13 as described in **Section 5.1**.
7. Test pit sampling utilizes backhoe/excavators to obtain samples in the pits. Soils in contact with the walls of the bucket are not collected for samples, therefore decon is not necessary. However mixing spoon and bowls which have come into contact with soils shall be deconned prior to sampling the next location in order to eliminate potential cross contamination.
    - Rinse stainless steel bowl/spoons with a DI water/Alconox mixture. Scrub with brushes. Repeat if necessary.
    - Rinse with DI water, and pat dry with clean paper towels.
8. Move to next sampling location or begin a new test pit.

6.0 QUALITY CONTROL/QUALITY ASSURANCE

QA/QC samples generally include the collection of a sufficient amount of blind duplicates, equipment blanks, and field blanks. Requirements for these samples will be determined on an as needed basis, per the project scope, and should be discussed during project Kick-Off Meeting.

7.0 SOIL MANAGEMENT

Upon completion of soil sampling methods described above, excess soils shall be backfilled into their parent borings or placed back into appropriate test pit/excavation locations unless otherwise determined for project specific needs. Should disposal be required, soils shall be containerized in 55-gallon drums, or rolloff containers, and staged on an approved area of the site. If drums/roll offs are staged onsite, they shall be labeled appropriately, and tops closed prior to leaving the site.

TTI shall follow site and/or client specific waste management protocols for soils accumulated from soil sampling activities. When project is complete, or drum(s)/roll offs are ready for disposal, TTI shall utilize a legitimate waste disposal company to dispose of the waste appropriately, and in accordance with all applicable local, state, and federal regulations.

8.0 RECORD KEEPING

Upon returning from a soil sampling field event, TTI shall scan copies of all field documents and save them to their appropriate project folder on the network as PDF. Such paperwork from soil sampling events may include the following:

- Field book notes
- Boring Logs
- Site/Sample Maps
- Site Photographs
- Chain of Custody (COC)

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After all documents have been saved to the network as PDF, the original hard copies of the documents may be kept in the client project folder. Records and documents shall be maintained for the duration of site investigations, and for a minimums of five years after a site case is closed.

9.0 PROGRAM AUDIT

Audit compliance with this Program will be conducted on an ongoing basis and any deficiencies should be reported to the Program Coordinator. Biennially, the Program Coordinator or his/her designee, shall conduct a formal audit.

10.0 REVISIONS

This SOP shall be updated whenever necessary to reflect any changes in the procedures used. All revisions require the signature of the Coordinator or designated employees. Each revision shall be designated by number and effective date on the cover of the SOP. Revisions shall be tracked in the table below.

Revision Number	Date of Last Revision	Reviewer	Revision

11.0 TRAINING

The Program Coordinator or his/her designee will provide training on this SOP to all TTI Environmental employees that may conduct soil sampling activities. All new employees will receive training prior to their initial assignment. Employees shall sign and date the **Training Log** below indicating they have completed the initial training session for this SOP. Additional training will be provided for employees whenever a new soil sampling technique/method is introduced. Refresher training will be provided annually (and more frequently, if needed). The Program Coordinator will monitor training scheduling and implementation, and Human Resources will maintain the records of completed training.

Employee Name (Printed)	Employee Signature (Signed)	Date Training Completed

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12.0 REFERENCES

NJDEP Field Sampling Procedures Manual (2005)

Appendix A: Field Work Kick-Off Checklist

Complete During Kickoff Meeting

Item #	Item	Yes/No/NA (Drop-down)	Notes	Date	Initial
	Project Task Review and Instruction				
1	Has a fully executed Project Award or Change Order, been received for this work? If not, do you have client written (e.g. email) or verbal authorization to proceed with this work?				
2	Has the field team been briefed of the site background, history, and chemicals of concern for the site?				
3	Has the field team been explained the mission/goal of the project?				
4	Have all printed figures/maps been reviewed (i.e., well locations, sample locations, etc.).				
5	Has the field team been briefed on the fieldwork scope of work, schedule, and budgeted hours?				
6	Have work days/hours been confirmed with project team and subcontractors?				
7	If weekend or off-hours work is to be performed, do you have you confirmed availability of field staff and subcontractors?				
8	Does the field team understand to contact the PL when anything changes onsite or is of importance to the project?				
9	Explain to each team member their specific project roles.				
	Health and Safety				
1	Has the Site Specific Health and Safety Plan (HASP) been prepared, reviewed, approved, and SAVED IN THE FIELD FOLDER ready for implementation?				
2	Are there any unusual or extreme hazards associated with this project that have not been addressed in the Health and Safety Plan (traffic, utilities, etc.)?				
3	Will the team be prepared for a pop-up H&S audit scheduled for this project? Has the HASP been printed and signed by the field team?				
4	Designate who will give the Tailgate Safety Meeting at the beginning of each field day and what topics will be discussed with team members and subconsultants				
5	Has a 3rd party utility locating service completed and cleared each individual location for the invasive task?				
6	Has a local One Call service been called? When? _____What is the phone number? _____ What is the ticket number? _____ Has the confirmation been included in the project folder?				
7	Does the facility have as-built drawings showing underground utilities?				
8	Discuss any potential problems in the field and any mitigation efforts; what can go wrong and how do we problem solve? (e.g. What if I have a One Call ticket, but the markout wasn't performed? What if there's a major rain event and the site is flooded? What if the rig the driller brought won't fit in the space we picked for the well/borings?)				

Complete During Kickoff Meeting

Item #	Item	Yes/No/NA (Drop-down)	Notes	Date	Initial
	Waste				
1	Will there be waste generated during this project? If no, select N/A and skip this section.				
2	Has a waste staging area been identified and approved by the client?				
3	Who will be responsible for:				
4	Profiling, handling, labeling, preparing manifests, etc.?				
5	Tracking the waste with accumulation time limits?				
	Property Where Work Will Be Performed and Notifications				
1	Client, property owners, tenants, etc been notified AND GAVE CONSENT of impending field work? Who was called/emailed? _____ When were they called/emailed? _____ Contact info? _____ _____				
2	Is an access agreement required? If so, has the access agreement been signed by the appropriate persons?				
3	If applicable, will a copy of the access agreement be taken to the site?				
4	Are there any special conditions in the access agreement that the field team need to be aware of?				
	Subcontracting and Procurement				
1	Is there a subcontractor for this project? If no, check N/A and skip this section.				
2	Has the lab order been placed? Has the equipment been ordered?				
3	Have all subcontractor PO's been taken out and forwarded appropriately (e.g. Lab, driller, equipment rental, etc.).				
4	Is this a new subcontractor? Have they been entered into TTI's approved vendor list?				
5	Discuss any potential changes to subcontracts that should be closely watched in the field (e.g. additional rentals, adding additional borings, wells, etc.).				

Appendix B: Surficial Soil Sampling Equipment Checklist

Appendix D

TTI Equipment Checklist – Test Pits

- Field note book and pen
- Proposed sample location map(s)
- Health and Safety Plan/appropriate PPE
- Excavator – provided by TMS or subcontractor, see SOW
- Stainless steel spoons
- Nitrile gloves
- Ice packed coolers with sample vials/jars and chain of custody
- Sample labels and permanent marker
- NO_x and de-ionized water
- Stainless steel bowls
- Calibrated PID
- Tape Measure
- Stakes/flags/marking paint
- Hammer

Appendix B

TTI Equipment Checklist – Surficial Soil Sampling

- Field note book and pen
- Proposed sample location map(s)
- Health and Safety Plan/appropriate PPE (see SOW)
- Hand auger/shovel/stainless steel trowel (per SOW)
- Stainless steel spoons
- Nitrile gloves
- Ice packed coolers with sample vials/jars and chain of custody
- Sample labels and permanent marker
- NO_x and de-ionized water
- Stainless steel bowls
- Generator and concrete core drill (if going through cement)
- Generator and hammer drill (if going through asphalt)
- Calibrated PID
- Tape Measure
- Stakes/flags/marking paint
- Hammer
- Asphalt patch/concrete (as needed – see SOW)

Appendix C: Subsurface Soil Sampling – Direct Push Equipment Checklist

Appendix C

TTI Equipment Checklist – Direct Push

- Field note book and pen
- Proposed sample location map(s)
- Health and Safety Plan/appropriate PPE
- Geoprobe – provided by subcontractor
- Stainless steel spoons
- Nitrile gloves
- Ice packed coolers with sample vials/jars and chain of custody
- Sample labels and permanent marker
- NO_x and de-ionized water
- Stainless steel bowls
- Calibrated PID
- Tape Measure
- Stakes/flags/marking paint
- Hammer

Appendix D: Subsurface Soil Sampling – Test Pits Equipment Checklist

Appendix D: Pace Analytical Laboratory Report

ANALYTICAL REPORT

April 16, 2019

TTI Environmental, Inc. - NJ

Sample Delivery Group:	L1083840
Samples Received:	03/29/2019
Project Number:	19-408
Description:	CRA

Report To: Mr. Andy Basehoar
1253 North Church Street
Moorestown, NJ 08057

Entire Report Reviewed By:

T. Alan Harvill
Project Manager

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by Pace National is performed per guidance provided in laboratory standard operating procedures: 060302, 060303, and 060304.

TP2@2-2.5 L1083840-01 Solid

Collected by: Dave DiPascale | Collected date/time: 03/27/19 09:25 | Received date/time: 03/29/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Total Solids by Method 2540 G-2011	WG1260177	1	04/04/19 10:26	04/04/19 10:39	JD	Mt. Juliet, TN
Mercury by Method 7471B	WG1260270	1	04/03/19 14:39	04/04/19 10:07	ABL	Mt. Juliet, TN
Metals (ICP) by Method 6010D	WG1260035	1	04/03/19 11:51	04/04/19 13:50	TRB	Mt. Juliet, TN
Semi Volatile Organic Compounds (GC/MS) by Method 8270D	WG1259754	10	04/04/19 08:57	04/05/19 01:34	DMG	Mt. Juliet, TN

TP3@3.5-4.0 L1083840-02 Solid

Collected by: Dave DiPascale | Collected date/time: 03/27/19 10:00 | Received date/time: 03/29/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Calculated Results	WG1260035	1	04/03/19 11:51	04/11/19 16:07	JZW	Mt. Juliet, TN
Total Solids by Method 2540 G-2011	WG1260177	1	04/04/19 10:26	04/04/19 10:39	JD	Mt. Juliet, TN
Wet Chemistry by Method 3060A/7196A	WG1263590	1	04/11/19 12:00	04/11/19 16:07	JZW	Mt. Juliet, TN
Wet Chemistry by Method 9012B	WG1259874	1	04/04/19 08:48	04/04/19 13:16	SDL	Mt. Juliet, TN
Mercury by Method 7471B	WG1260270	1	04/03/19 14:39	04/04/19 10:10	ABL	Mt. Juliet, TN
Metals (ICP) by Method 6010D	WG1260035	1	04/03/19 11:51	04/04/19 13:52	TRB	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260C	WG1258825	1	03/27/19 10:00	04/01/19 17:30	JHH	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260C	WG1260000	1.21	03/27/19 10:00	04/03/19 13:14	ACG	Mt. Juliet, TN
Semi-Volatile Organic Compounds (GC) by Method NJDEP EPH	WG1258997	1	04/01/19 13:44	04/03/19 00:05	CLG	Mt. Juliet, TN
Semi-Volatile Organic Compounds (GC) by Method NJDEP EPH	WG1258997	1	04/01/19 13:44	04/03/19 04:05	CLG	Mt. Juliet, TN
Pesticides (GC) by Method 8081B	WG1260104	1	04/03/19 12:28	04/04/19 09:18	LEL	Mt. Juliet, TN
Polychlorinated Biphenyls (GC) by Method 8082 A	WG1260104	1	04/03/19 12:28	04/05/19 01:08	MTJ	Mt. Juliet, TN
Semi Volatile Organic Compounds (GC/MS) by Method 8270D	WG1262278	10	04/08/19 08:18	04/09/19 14:48	AO	Mt. Juliet, TN

SB1@9-9.5 L1083840-03 Solid

Collected by: Dave DiPascale | Collected date/time: 03/27/19 10:35 | Received date/time: 03/29/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Total Solids by Method 2540 G-2011	WG1260177	1	04/04/19 10:26	04/04/19 10:39	JD	Mt. Juliet, TN
Semi-Volatile Organic Compounds (GC) by Method NJDEP EPH	WG1257869	15	04/01/19 13:47	04/02/19 15:13	AAT	Mt. Juliet, TN

TP5@6.5-7 L1083840-04 Solid

Collected by: Dave DiPascale | Collected date/time: 03/27/19 11:30 | Received date/time: 03/29/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Total Solids by Method 2540 G-2011	WG1260177	1	04/04/19 10:26	04/04/19 10:39	JD	Mt. Juliet, TN
Wet Chemistry by Method 9012B	WG1260642	1	04/05/19 10:04	04/05/19 14:10	JER	Mt. Juliet, TN
Mercury by Method 7471B	WG1260270	1	04/03/19 14:39	04/04/19 10:12	ABL	Mt. Juliet, TN
Metals (ICP) by Method 6010D	WG1260035	1	04/03/19 11:51	04/04/19 13:55	TRB	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260C	WG1258825	1	03/27/19 11:30	04/01/19 17:50	JHH	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260C	WG1260000	1.41	03/27/19 11:30	04/03/19 13:35	ACG	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260C	WG1261044	25.5	03/27/19 11:30	04/04/19 17:20	JHH	Mt. Juliet, TN
Semi-Volatile Organic Compounds (GC) by Method NJDEP EPH	WG1258997	1	04/01/19 13:44	04/03/19 00:27	CLG	Mt. Juliet, TN
Semi-Volatile Organic Compounds (GC) by Method NJDEP EPH	WG1258997	1	04/01/19 13:44	04/03/19 03:43	CLG	Mt. Juliet, TN
Pesticides (GC) by Method 8081B	WG1260104	1	04/03/19 12:28	04/04/19 09:30	LEL	Mt. Juliet, TN
Polychlorinated Biphenyls (GC) by Method 8082 A	WG1260104	1	04/03/19 12:28	04/04/19 12:57	NFN	Mt. Juliet, TN
Semi Volatile Organic Compounds (GC/MS) by Method 8270D	WG1262278	2	04/08/19 08:18	04/09/19 14:28	JF	Mt. Juliet, TN

TP6@0.5-1.0 L1083840-05 Solid

Collected by: Dave DiPascale | Collected date/time: 03/27/19 12:00 | Received date/time: 03/29/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Calculated Results	WG1260035	1	04/03/19 11:51	04/11/19 16:26	JZW	Mt. Juliet, TN
Total Solids by Method 2540 G-2011	WG1260177	1	04/04/19 10:26	04/04/19 10:39	JD	Mt. Juliet, TN
Wet Chemistry by Method 3060A/7196A	WG1263590	1	04/11/19 12:00	04/11/19 16:26	JZW	Mt. Juliet, TN
Mercury by Method 7471B	WG1260270	1	04/03/19 14:39	04/04/19 09:52	ABL	Mt. Juliet, TN
Metals (ICP) by Method 6010D	WG1260035	1	04/03/19 11:51	04/04/19 13:58	TRB	Mt. Juliet, TN
Semi Volatile Organic Compounds (GC/MS) by Method 8270D	WG1259754	10	04/04/19 08:57	04/05/19 11:07	DMG	Mt. Juliet, TN

SB5@9.0-9.5 L1083840-06 Solid

Collected by: Dave DiPascale | Collected date/time: 03/27/19 12:25 | Received date/time: 03/29/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Total Solids by Method 2540 G-2011	WG1260177	1	04/04/19 10:26	04/04/19 10:39	JD	Mt. Juliet, TN
Semi-Volatile Organic Compounds (GC) by Method NJDEP EPH	WG1257869	5	04/01/19 13:47	04/01/19 20:01	AAT	Mt. Juliet, TN

TB7@8.0-8.5 L1083840-07 Solid

Collected by: Dave DiPascale | Collected date/time: 03/27/19 12:30 | Received date/time: 03/29/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Total Solids by Method 2540 G-2011	WG1260177	1	04/04/19 10:26	04/04/19 10:39	JD	Mt. Juliet, TN
Semi-Volatile Organic Compounds (GC) by Method NJDEP EPH	WG1259119	125	04/03/19 10:16	04/06/19 04:35	AAT	Mt. Juliet, TN

TP8@8.0-8.5 L1083840-08 Solid

Collected by: Dave DiPascale | Collected date/time: 03/27/19 12:45 | Received date/time: 03/29/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Total Solids by Method 2540 G-2011	WG1260340	1	04/04/19 13:47	04/04/19 13:59	KBC	Mt. Juliet, TN
Semi-Volatile Organic Compounds (GC) by Method NJDEP EPH	WG1259119	125	04/03/19 10:16	04/06/19 04:51	AAT	Mt. Juliet, TN

TP9@8.0-8.5 L1083840-09 Solid

Collected by: Dave DiPascale | Collected date/time: 03/27/19 13:00 | Received date/time: 03/29/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Total Solids by Method 2540 G-2011	WG1260340	1	04/04/19 13:47	04/04/19 13:59	KBC	Mt. Juliet, TN
Semi-Volatile Organic Compounds (GC) by Method NJDEP EPH	WG1259119	125	04/03/19 10:16	04/06/19 05:07	AAT	Mt. Juliet, TN

SB6@4.5-5.0 L1083840-10 Solid

Collected by: Dave DiPascale | Collected date/time: 03/27/19 13:10 | Received date/time: 03/29/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Total Solids by Method 2540 G-2011	WG1260340	1	04/04/19 13:47	04/04/19 13:59	KBC	Mt. Juliet, TN
Wet Chemistry by Method 9012B	WG1260642	1	04/05/19 10:04	04/05/19 14:11	JER	Mt. Juliet, TN
Mercury by Method 7471B	WG1260270	1	04/03/19 14:39	04/04/19 10:15	ABL	Mt. Juliet, TN
Metals (ICP) by Method 6010D	WG1260035	1	04/03/19 11:51	04/04/19 14:00	TRB	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260C	WG1258825	1	03/27/19 13:10	04/01/19 18:30	JHH	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260C	WG1260000	1	03/27/19 13:10	04/03/19 13:55	ACG	Mt. Juliet, TN
Pesticides (GC) by Method 8081B	WG1260104	1	04/03/19 12:28	04/04/19 10:07	LEL	Mt. Juliet, TN
Polychlorinated Biphenyls (GC) by Method 8082 A	WG1260104	1	04/03/19 12:28	04/04/19 13:55	NFN	Mt. Juliet, TN
Semi Volatile Organic Compounds (GC/MS) by Method 8270D	WG1262278	2	04/08/19 08:18	04/09/19 14:09	JF	Mt. Juliet, TN

SB7@7.5-8.0 L1083840-11 Solid

Collected by: Dave DiPascale | Collected date/time: 03/27/19 13:30 | Received date/time: 03/29/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Total Solids by Method 2540 G-2011	WG1260340	1	04/04/19 13:47	04/04/19 13:59	KBC	Mt. Juliet, TN
Wet Chemistry by Method 9012B	WG1260642	1	04/05/19 10:04	04/05/19 14:12	JER	Mt. Juliet, TN
Mercury by Method 7471B	WG1260270	1	04/03/19 14:39	04/04/19 10:17	ABL	Mt. Juliet, TN
Metals (ICP) by Method 6010D	WG1260035	1	04/03/19 11:51	04/04/19 14:03	TRB	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260C	WG1258825	1	03/27/19 13:30	04/01/19 18:10	JHH	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260C	WG1260000	1	03/27/19 13:30	04/03/19 14:15	ACG	Mt. Juliet, TN
Pesticides (GC) by Method 8081B	WG1260104	1	04/03/19 12:28	04/04/19 10:20	LEL	Mt. Juliet, TN
Polychlorinated Biphenyls (GC) by Method 8082 A	WG1260104	1	04/03/19 12:28	04/04/19 14:09	NFN	Mt. Juliet, TN
Semi Volatile Organic Compounds (GC/MS) by Method 8270D	WG1262278	1	04/08/19 08:18	04/09/19 10:33	JNJ	Mt. Juliet, TN

BD032T19B L1083840-12 Solid

Collected by: Dave DiPascale | Collected date/time: 03/27/19 12:00 | Received date/time: 03/29/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Total Solids by Method 2540 G-2011	WG1260340	1	04/04/19 13:47	04/04/19 13:59	KBC	Mt. Juliet, TN
Wet Chemistry by Method 9012B	WG1260642	1	04/05/19 10:04	04/05/19 14:13	JER	Mt. Juliet, TN
Mercury by Method 7471B	WG1260270	1	04/03/19 14:39	04/04/19 10:20	ABL	Mt. Juliet, TN
Metals (ICP) by Method 6010D	WG1260035	1	04/03/19 11:51	04/04/19 16:25	TRB	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260C	WG1258825	1	03/27/19 12:00	04/01/19 18:50	JHH	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260C	WG1260000	1.04	03/27/19 12:00	04/03/19 14:35	ACG	Mt. Juliet, TN
Pesticides (GC) by Method 8081B	WG1260104	1	04/03/19 12:28	04/04/19 10:32	LEL	Mt. Juliet, TN
Polychlorinated Biphenyls (GC) by Method 8082 A	WG1260104	1	04/03/19 12:28	04/04/19 14:24	NFN	Mt. Juliet, TN
Semi Volatile Organic Compounds (GC/MS) by Method 8270D	WG1262278	1	04/08/19 08:18	04/09/19 11:51	JF	Mt. Juliet, TN

TP10@8.0-8.5 L1083840-13 Solid

Collected by: Dave DiPascale | Collected date/time: 03/27/19 13:30 | Received date/time: 03/29/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Total Solids by Method 2540 G-2011	WG1260340	1	04/04/19 13:47	04/04/19 13:59	KBC	Mt. Juliet, TN
Semi-Volatile Organic Compounds (GC) by Method NJDEP EPH	WG1259119	125	04/03/19 10:16	04/06/19 05:23	AAT	Mt. Juliet, TN

BD032719A L1083840-14 Solid

Collected by: Dave DiPascale | Collected date/time: 03/27/19 12:00 | Received date/time: 03/29/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Total Solids by Method 2540 G-2011	WG1260340	1	04/04/19 13:47	04/04/19 13:59	KBC	Mt. Juliet, TN
Semi-Volatile Organic Compounds (GC) by Method NJDEP EPH	WG1259119	125	04/03/19 10:16	04/06/19 05:40	AAT	Mt. Juliet, TN

SB8@7.5-8.0 L1083840-15 Solid

Collected by: Dave DiPascale | Collected date/time: 03/27/19 14:00 | Received date/time: 03/29/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Total Solids by Method 2540 G-2011	WG1260340	1	04/04/19 13:47	04/04/19 13:59	KBC	Mt. Juliet, TN
Wet Chemistry by Method 9012B	WG1260642	1	04/05/19 10:04	04/05/19 14:15	JER	Mt. Juliet, TN
Mercury by Method 7471B	WG1260270	1	04/03/19 14:39	04/04/19 10:22	ABL	Mt. Juliet, TN
Metals (ICP) by Method 6010D	WG1260035	1	04/03/19 11:51	04/04/19 16:28	TRB	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260C	WG1258825	1.04	03/27/19 14:00	04/01/19 19:10	JHH	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260C	WG1260000	1	03/27/19 14:00	04/03/19 14:56	ACG	Mt. Juliet, TN
Pesticides (GC) by Method 8081B	WG1260104	1	04/03/19 12:28	04/04/19 10:45	LEL	Mt. Juliet, TN
Polychlorinated Biphenyls (GC) by Method 8082 A	WG1260104	1	04/03/19 12:28	04/04/19 14:38	NFN	Mt. Juliet, TN
Semi Volatile Organic Compounds (GC/MS) by Method 8270D	WG1262278	1	04/08/19 08:18	04/09/19 10:14	JF	Mt. Juliet, TN

SB9@3-3.5 L1083840-16 Solid

Collected by: Dave DiPascale | Collected date/time: 03/27/19 14:15 | Received date/time: 03/29/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Calculated Results	WG1260035	1	04/03/19 11:51	04/12/19 17:59	TH	Mt. Juliet, TN
Total Solids by Method 2540 G-2011	WG1260340	1	04/04/19 13:47	04/04/19 13:59	KBC	Mt. Juliet, TN
Wet Chemistry by Method 3060A/7196A	WG1264834	1	04/12/19 14:15	04/12/19 17:59	TH	Mt. Juliet, TN
Wet Chemistry by Method 9012B	WG1260642	1	04/05/19 10:04	04/05/19 14:20	JER	Mt. Juliet, TN
Mercury by Method 7471B	WG1260270	1	04/03/19 14:39	04/04/19 10:25	ABL	Mt. Juliet, TN
Metals (ICP) by Method 6010D	WG1260035	1	04/03/19 11:51	04/04/19 16:31	TRB	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260C	WG1258825	1	03/27/19 14:15	04/01/19 19:30	JHH	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260C	WG1260000	1	03/27/19 14:15	04/03/19 15:16	ACG	Mt. Juliet, TN
Pesticides (GC) by Method 8081B	WG1260104	1	04/03/19 12:28	04/04/19 10:57	LEL	Mt. Juliet, TN
Polychlorinated Biphenyls (GC) by Method 8082 A	WG1260104	1	04/03/19 12:28	04/04/19 14:52	NFN	Mt. Juliet, TN
Semi Volatile Organic Compounds (GC/MS) by Method 8270D	WG1262278	20	04/08/19 08:18	04/09/19 15:27	JNJ	Mt. Juliet, TN

SB10@3-3.5 L1083840-17 Solid

Collected by: Dave DiPascale | Collected date/time: 03/27/19 14:35 | Received date/time: 03/29/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Total Solids by Method 2540 G-2011	WG1260340	1	04/04/19 13:47	04/04/19 13:59	KBC	Mt. Juliet, TN
Wet Chemistry by Method 9012B	WG1260642	1	04/05/19 10:04	04/05/19 14:21	JER	Mt. Juliet, TN
Mercury by Method 7471B	WG1260270	1	04/03/19 14:39	04/04/19 10:28	ABL	Mt. Juliet, TN
Metals (ICP) by Method 6010D	WG1260035	1	04/03/19 11:51	04/04/19 16:34	TRB	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260C	WG1258825	1	03/27/19 14:35	04/01/19 19:49	JHH	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260C	WG1260000	1	03/27/19 14:35	04/03/19 15:36	ACG	Mt. Juliet, TN
Pesticides (GC) by Method 8081B	WG1260104	1	04/03/19 12:28	04/04/19 11:09	LEL	Mt. Juliet, TN
Polychlorinated Biphenyls (GC) by Method 8082 A	WG1260104	1	04/03/19 12:28	04/04/19 15:07	NFN	Mt. Juliet, TN
Semi Volatile Organic Compounds (GC/MS) by Method 8270D	WG1262278	1	04/08/19 08:18	04/09/19 12:50	JF	Mt. Juliet, TN

SB11@4-4.5 L1083840-18 Solid

Collected by: Dave DiPascale | Collected date/time: 03/27/19 15:15 | Received date/time: 03/29/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Calculated Results	WG1260035	1	04/03/19 11:51	04/11/19 16:31	JZW	Mt. Juliet, TN
Total Solids by Method 2540 G-2011	WG1260343	1	04/04/19 10:56	04/04/19 11:06	JD	Mt. Juliet, TN
Wet Chemistry by Method 3060A/7196A	WG1263590	1	04/11/19 12:00	04/11/19 16:31	JZW	Mt. Juliet, TN
Wet Chemistry by Method 9012B	WG1260642	1	04/05/19 10:04	04/05/19 14:22	JER	Mt. Juliet, TN
Mercury by Method 7471B	WG1260270	1	04/03/19 14:39	04/04/19 10:35	ABL	Mt. Juliet, TN
Metals (ICP) by Method 6010D	WG1260035	1	04/03/19 11:51	04/04/19 16:36	TRB	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260C	WG1258825	1	03/27/19 15:15	04/01/19 20:09	JHH	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260C	WG1260000	1	03/27/19 15:15	04/03/19 15:56	ACG	Mt. Juliet, TN
Pesticides (GC) by Method 8081B	WG1260104	1	04/03/19 12:28	04/04/19 11:22	LEL	Mt. Juliet, TN
Polychlorinated Biphenyls (GC) by Method 8082 A	WG1260104	1	04/03/19 12:28	04/04/19 15:21	NFN	Mt. Juliet, TN
Semi Volatile Organic Compounds (GC/MS) by Method 8270D	WG1262278	2	04/08/19 08:18	04/09/19 13:29	JF	Mt. Juliet, TN

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Collected by: Dave DiPascale | Collected date/time: 03/27/19 15:00 | Received date/time: 03/29/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Wet Chemistry by Method 4500CN E-2011	WG1260640	1	04/04/19 14:24	04/04/19 17:41	JER	Mt. Juliet, TN
Mercury by Method 7470A	WG1258686	1	04/02/19 10:07	04/03/19 11:55	ABL	Mt. Juliet, TN
Metals (ICP) by Method 6010D	WG1259748	1	04/04/19 13:38	04/05/19 20:48	WBD	Mt. Juliet, TN
Metals (ICPMS) by Method 6020B	WG1259747	1	04/05/19 10:11	04/06/19 13:59	JPD	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260C	WG1258768	1	04/01/19 18:32	04/01/19 18:32	BMB	Mt. Juliet, TN
Pesticides (GC) by Method 8081B	WG1258609	1	04/01/19 16:43	04/02/19 11:47	LEL	Mt. Juliet, TN
Polychlorinated Biphenyls (GC) by Method 8082 A	WG1258609	1	04/01/19 16:43	04/02/19 12:52	MTJ	Mt. Juliet, TN

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Collected by: Dave DiPascale | Collected date/time: 03/27/19 15:00 | Received date/time: 03/29/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Semi Volatile Organic Compounds (GC/MS) by Method 8270 D	WG1258603	1	04/02/19 07:32	04/02/19 18:01	AO	Mt. Juliet, TN
Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM	WG1260608	1	04/03/19 11:03	04/04/19 11:19	LEA	Mt. Juliet, TN

EQUIPMENT BLANK L1083840-20 GW

Collected by: Dave DiPascale | Collected date/time: 03/27/19 15:30 | Received date/time: 03/29/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Wet Chemistry by Method 4500CN E-2011	WG1260640	1	04/04/19 14:24	04/04/19 19:42	JER	Mt. Juliet, TN
Mercury by Method 7470A	WG1258686	1	04/02/19 10:07	04/03/19 11:58	ABL	Mt. Juliet, TN
Metals (ICP) by Method 6010D	WG1259748	1	04/04/19 13:38	04/05/19 20:51	WBD	Mt. Juliet, TN
Metals (ICPMS) by Method 6020B	WG1259747	1	04/05/19 10:11	04/06/19 14:04	JPD	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260C	WG1258768	1	04/01/19 18:53	04/01/19 18:53	BMB	Mt. Juliet, TN
Pesticides (GC) by Method 8081B	WG1259577	1.03	04/02/19 16:45	04/03/19 11:25	LEL	Mt. Juliet, TN
Polychlorinated Biphenyls (GC) by Method 8082 A	WG1259577	1.03	04/02/19 16:45	04/03/19 14:07	RP	Mt. Juliet, TN
Semi Volatile Organic Compounds (GC/MS) by Method 8270 D	WG1258603	1	04/02/19 07:32	04/02/19 18:48	AO	Mt. Juliet, TN
Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM	WG1260608	1	04/03/19 11:03	04/04/19 11:41	LEA	Mt. Juliet, TN

TRIP BLANK L1083840-21 GW

Collected by: Dave DiPascale | Collected date/time: 03/27/19 00:00 | Received date/time: 03/29/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Organic Compounds (GC/MS) by Method 8260C	WG1258768	1	04/01/19 19:15	04/01/19 19:15	BMB	Mt. Juliet, TN

SB12@9.5-10 L1083840-22 Solid

Collected by: Dave DiPascale | Collected date/time: 03/28/19 08:30 | Received date/time: 03/29/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Total Solids by Method 2540 G-2011	WG1260343	1	04/04/19 10:56	04/04/19 11:06	JD	Mt. Juliet, TN
Wet Chemistry by Method 9012B	WG1260642	1	04/05/19 10:04	04/05/19 14:23	JER	Mt. Juliet, TN
Mercury by Method 7471B	WG1260270	1	04/03/19 14:39	04/04/19 10:38	ABL	Mt. Juliet, TN
Metals (ICP) by Method 6010D	WG1260035	1	04/03/19 11:51	04/04/19 16:39	TRB	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260C	WG1258825	500	03/28/19 08:30	04/01/19 21:28	JHH	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260C	WG1260000	500	03/28/19 08:30	04/03/19 16:58	ACG	Mt. Juliet, TN
Pesticides (GC) by Method 8081B	WG1260104	20	04/03/19 12:28	04/04/19 11:59	LEL	Mt. Juliet, TN
Polychlorinated Biphenyls (GC) by Method 8082 A	WG1260104	1	04/03/19 12:28	04/05/19 14:26	MTJ	Mt. Juliet, TN
Semi Volatile Organic Compounds (GC/MS) by Method 8270D	WG1262278	100	04/08/19 08:18	04/10/19 22:31	JNJ	Mt. Juliet, TN
Semi Volatile Organic Compounds (GC/MS) by Method 8270D	WG1262278	50	04/08/19 08:18	04/09/19 16:06	JNJ	Mt. Juliet, TN

FIELD BLANK L1083840-23 GW

Collected by: Dave DiPascale | Collected date/time: 03/28/19 10:45 | Received date/time: 03/29/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Wet Chemistry by Method 4500CN E-2011	WG1260640	1	04/04/19 14:24	04/04/19 19:45	JER	Mt. Juliet, TN
Mercury by Method 7470A	WG1258686	1	04/02/19 10:07	04/03/19 12:00	ABL	Mt. Juliet, TN
Metals (ICP) by Method 6010D	WG1259748	1	04/04/19 13:38	04/05/19 20:53	WBD	Mt. Juliet, TN
Metals (ICPMS) by Method 6020B	WG1259747	1	04/05/19 10:11	04/06/19 14:08	JPD	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260C	WG1258768	1	04/01/19 19:36	04/01/19 19:36	BMB	Mt. Juliet, TN
Pesticides (GC) by Method 8081B	WG1259577	1	04/02/19 16:45	04/03/19 11:37	LEL	Mt. Juliet, TN
Polychlorinated Biphenyls (GC) by Method 8082 A	WG1259577	1	04/02/19 16:45	04/03/19 14:21	RP	Mt. Juliet, TN
Semi Volatile Organic Compounds (GC/MS) by Method 8270 D	WG1259548	1	04/02/19 23:10	04/03/19 21:07	ADF	Mt. Juliet, TN
Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM	WG1260608	1	04/03/19 11:03	04/04/19 12:03	LEA	Mt. Juliet, TN

EQUIPMENT BLANK L1083840-24 GW

Collected by: Dave DiPascale | Collected date/time: 03/28/19 11:00 | Received date/time: 03/29/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Wet Chemistry by Method 4500CN E-2011	WG1260640	1	04/04/19 14:24	04/04/19 19:46	JER	Mt. Juliet, TN
Mercury by Method 7470A	WG1258686	1	04/02/19 10:07	04/03/19 12:03	ABL	Mt. Juliet, TN
Metals (ICP) by Method 6010D	WG1259748	1	04/04/19 13:38	04/05/19 21:02	WBD	Mt. Juliet, TN
Metals (ICPMS) by Method 6020B	WG1259747	1	04/05/19 10:11	04/06/19 14:29	JPD	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260C	WG1258768	1	04/01/19 19:58	04/01/19 19:58	BMB	Mt. Juliet, TN
Pesticides (GC) by Method 8081B	WG1259577	1	04/02/19 16:45	04/03/19 11:50	LEL	Mt. Juliet, TN
Polychlorinated Biphenyls (GC) by Method 8082 A	WG1259577	1	04/02/19 16:45	04/03/19 14:35	RP	Mt. Juliet, TN
Semi Volatile Organic Compounds (GC/MS) by Method 8270 D	WG1259548	1	04/02/19 23:10	04/03/19 21:27	ADF	Mt. Juliet, TN
Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM	WG1260608	1	04/03/19 11:03	04/04/19 12:25	DMG	Mt. Juliet, TN

SB16@8.5-9.0 L1083840-25 Solid

Collected by: Dave DiPascale | Collected date/time: 03/28/19 12:10 | Received date/time: 03/29/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Total Solids by Method 2540 G-2011	WG1260343	1	04/04/19 10:56	04/04/19 11:06	JD	Mt. Juliet, TN
Wet Chemistry by Method 9012B	WG1260642	1	04/05/19 10:04	04/05/19 14:24	JER	Mt. Juliet, TN
Mercury by Method 7471B	WG1260270	1	04/03/19 14:39	04/04/19 10:40	ABL	Mt. Juliet, TN
Metals (ICP) by Method 6010D	WG1260035	1	04/03/19 11:51	04/04/19 16:42	TRB	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260C	WG1258825	1	03/28/19 12:10	04/01/19 20:29	JHH	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260C	WG1260000	1	03/28/19 12:10	04/03/19 16:17	ACG	Mt. Juliet, TN
Semi-Volatile Organic Compounds (GC) by Method NJDEP EPH	WG1260316	1	04/03/19 10:19	04/05/19 18:02	SHG	Mt. Juliet, TN
Semi-Volatile Organic Compounds (GC) by Method NJDEP EPH	WG1260316	1	04/03/19 10:19	04/08/19 12:16	SHG	Mt. Juliet, TN
Pesticides (GC) by Method 8081B	WG1260104	1	04/03/19 12:28	04/04/19 11:34	LEL	Mt. Juliet, TN
Polychlorinated Biphenyls (GC) by Method 8082 A	WG1260104	1	04/03/19 12:28	04/04/19 15:35	NFN	Mt. Juliet, TN
Semi Volatile Organic Compounds (GC/MS) by Method 8270D	WG1262278	1	04/08/19 08:18	04/09/19 12:11	JF	Mt. Juliet, TN

SB17@8.5-9.0 L1083840-26 Solid

Collected by: Dave DiPascale | Collected date/time: 03/28/19 12:25 | Received date/time: 03/29/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Total Solids by Method 2540 G-2011	WG1260343	1	04/04/19 10:56	04/04/19 11:06	JD	Mt. Juliet, TN
Semi-Volatile Organic Compounds (GC) by Method NJDEP EPH	WG1258997	1	04/01/19 13:44	04/03/19 01:32	CLG	Mt. Juliet, TN
Semi-Volatile Organic Compounds (GC) by Method NJDEP EPH	WG1258997	1	04/01/19 13:44	04/03/19 02:38	CLG	Mt. Juliet, TN

BD032819 L1083840-27 Solid

Collected by: Dave DiPascale | Collected date/time: 03/28/19 12:00 | Received date/time: 03/29/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Total Solids by Method 2540 G-2011	WG1260343	1	04/04/19 10:56	04/04/19 11:06	JD	Mt. Juliet, TN
Semi-Volatile Organic Compounds (GC) by Method NJDEP EPH	WG1258997	1	04/01/19 13:44	04/03/19 01:54	CLG	Mt. Juliet, TN
Semi-Volatile Organic Compounds (GC) by Method NJDEP EPH	WG1258997	1	04/01/19 13:44	04/03/19 02:16	CLG	Mt. Juliet, TN

SB19@8.5-9 L1083840-28 Solid

Collected by: Dave DiPascale | Collected date/time: 03/28/19 13:00 | Received date/time: 03/29/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Total Solids by Method 2540 G-2011	WG1260343	1	04/04/19 10:56	04/04/19 11:06	JD	Mt. Juliet, TN
Wet Chemistry by Method 9012B	WG1260642	1	04/05/19 10:04	04/05/19 14:25	JER	Mt. Juliet, TN
Mercury by Method 7471B	WG1260270	1	04/03/19 14:39	04/04/19 10:43	ABL	Mt. Juliet, TN
Metals (ICP) by Method 6010D	WG1260035	1	04/03/19 11:51	04/04/19 16:45	TRB	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260C	WG1258825	1	03/28/19 13:00	04/01/19 20:48	JHH	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260C	WG1260000	1	03/28/19 13:00	04/03/19 16:37	ACG	Mt. Juliet, TN

SB19@8.5-9 L1083840-28 Solid

Collected by: Dave DiPascale | Collected date/time: 03/28/19 13:00 | Received date/time: 03/29/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Semi-Volatile Organic Compounds (GC) by Method NJDEP EPH	WG1260316	1	04/03/19 10:19	04/05/19 18:24	SHG	Mt. Juliet, TN
Semi-Volatile Organic Compounds (GC) by Method NJDEP EPH	WG1260316	1	04/03/19 10:19	04/08/19 12:40	SHG	Mt. Juliet, TN
Pesticides (GC) by Method 8081B	WG1260104	1	04/03/19 12:28	04/04/19 11:47	LEL	Mt. Juliet, TN
Polychlorinated Biphenyls (GC) by Method 8082 A	WG1260104	1	04/03/19 12:28	04/04/19 15:50	NFN	Mt. Juliet, TN
Semi Volatile Organic Compounds (GC/MS) by Method 8270D	WG1262278	1	04/08/19 08:18	04/09/19 12:31	JF	Mt. Juliet, TN

SB20@2.0-2.5 L1083840-29 Solid

Collected by: Dave DiPascale | Collected date/time: 03/28/19 13:15 | Received date/time: 03/29/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Total Solids by Method 2540 G-2011	WG1260343	1	04/04/19 10:56	04/04/19 11:06	JD	Mt. Juliet, TN
Semi-Volatile Organic Compounds (GC) by Method NJDEP EPH	WG1259119	1	04/03/19 10:16	04/06/19 04:18	AAT	Mt. Juliet, TN

TRIP BLANK L1083840-30 GW

Collected by: Dave DiPascale | Collected date/time: 03/28/19 08:30 | Received date/time: 03/29/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Organic Compounds (GC/MS) by Method 8260C	WG1258768	1	04/01/19 11:47	04/01/19 11:47	JAH	Mt. Juliet, TN

SB13 @ 5.5-6 L1083840-31 Solid

Collected by: Dave DiPascale | Collected date/time: 03/28/19 10:00 | Received date/time: 03/29/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Total Solids by Method 2540 G-2011	WG1260343	1	04/04/19 10:56	04/04/19 11:06	JD	Mt. Juliet, TN
Wet Chemistry by Method 9012B	WG1260642	1	04/05/19 10:04	04/05/19 14:51	JER	Mt. Juliet, TN
Mercury by Method 7471B	WG1259467	1	04/03/19 08:30	04/03/19 16:33	TCT	Mt. Juliet, TN
Metals (ICP) by Method 6010D	WG1260035	1	04/03/19 11:51	04/04/19 16:01	TRB	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260C	WG1260321	1	03/28/19 10:00	04/03/19 16:31	BMB	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260C	WG1261228	1	03/28/19 10:00	04/05/19 11:56	JAH	Mt. Juliet, TN
Semi-Volatile Organic Compounds (GC) by Method NJDEP EPH	WG1260316	1	04/03/19 10:19	04/05/19 18:46	SHG	Mt. Juliet, TN
Semi-Volatile Organic Compounds (GC) by Method NJDEP EPH	WG1260316	1	04/03/19 10:19	04/08/19 13:04	SHG	Mt. Juliet, TN
Pesticides (GC) by Method 8081B	WG1259761	1	04/03/19 07:21	04/03/19 12:46	LEL	Mt. Juliet, TN
Polychlorinated Biphenyls (GC) by Method 8082 A	WG1259761	1	04/03/19 07:21	04/03/19 13:22	NFN	Mt. Juliet, TN
Semi Volatile Organic Compounds (GC/MS) by Method 8270D	WG1262278	1	04/08/19 08:18	04/09/19 10:53	JNJ	Mt. Juliet, TN

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Unless qualified or notated within the narrative below, all sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.

T. Alan Harvill
Project Manager

Wet Chemistry by Method 3060A/7196A

The sample matrix interfered with the ability to make any accurate determination; spike value is low.

Batch	Lab Sample ID	Analytes
WG1263590	(MS) R3400864-5, (MSD) R3400864-6	Chromium,Hexavalent
WG1264834	(MS) R3401368-4	Chromium,Hexavalent

The associated batch QC was outside the established quality control range for precision.

Batch	Lab Sample ID	Analytes
WG1264834	(MSD) R3401368-5	Chromium,Hexavalent

Wet Chemistry by Method 9012B

RPD value not applicable for sample concentrations less than 5 times the reporting limit.

Batch	Lab Sample ID	Analytes
WG1260642	(DUP) R3398962-3, (DUP) R3398962-6, L1083840-12, 28	Cyanide

The sample matrix interfered with the ability to make any accurate determination; spike value is low.

Batch	Lab Sample ID	Analytes
WG1260642	(MS) R3398962-4, (MS) R3398962-7, (MSD) R3398962-8, L1083840-15, 31	Cyanide

Mercury by Method 7470A

The same analyte is found in the associated blank.

Batch	Analyte	Lab Sample ID
WG1258686	Mercury	L1083840-19, 20, 23, 24

Mercury by Method 7471B

The same analyte is found in the associated blank.

Batch	Analyte	Lab Sample ID
WG1259467	Mercury	L1083840-31

Mercury by Method 7471B

The sample matrix interfered with the ability to make any accurate determination; spike value is low.

Batch	Lab Sample ID	Analytes
WG1260270	(MS) R3398450-4, (MSD) R3398450-5, L1083840-05	Mercury

Metals (ICP) by Method 6010D

The same analyte is found in the associated blank.

Batch	Analyte	Lab Sample ID
WG1260035	Sodium	L1083840-01, 02, 04, 05, 10, 11, 12, 15, 16, 17, 18, 22, 25, 28, 31

The sample matrix interfered with the ability to make any accurate determination; spike value is high.

Batch	Lab Sample ID	Analytes
WG1260035	(MS) R3398704-6, (MSD) R3398704-7, L1083840-31	Aluminum

The sample matrix interfered with the ability to make any accurate determination; spike value is low.

Batch	Lab Sample ID	Analytes
WG1260035	(MS) R3398704-6, (MSD) R3398704-7, L1083840-31	Antimony

The sample concentration is too high to evaluate accurate spike recoveries.

Batch	Lab Sample ID	Analytes
WG1260035	(MS) R3398704-6, (MSD) R3398704-7, L1083840-31	Iron

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

The associated batch QC was above the established quality control range for accuracy.

Batch	Lab Sample ID	Analytes
WG1260000	(LCS) R3398545-1, (LCSD) R3398545-2, L1083840-02, 10, 11, 12, 15, 16, 17, 18, 22, 25, 28	Methyl Acetate
WG1261228	(LCS) R3398954-1, (LCSD) R3398954-2, L1083840-31	Methyl Acetate

The associated batch QC was outside the established quality control range for precision.

Batch	Lab Sample ID	Analytes
WG1258768	(LCSD) R3397246-2, L1083840-19, 20, 21, 23, 24, 30	Chloromethane

The sample matrix interfered with the ability to make any accurate determination; spike value is low.

Batch	Lab Sample ID	Analytes
WG1260321	(MS) R3398643-6, (MSD) R3398643-7, L1083840-31	38 analytes

The associated batch QC was outside the established quality control range for precision.

Batch	Lab Sample ID	Analytes
WG1260321	(MSD) R3398643-7, L1083840-31	36 analytes

Semi-Volatile Organic Compounds (GC) by Method NJDEP EPH

Surrogate recovery limits have been exceeded; values are outside lower control limits.

Batch	Analyte	Lab Sample ID
WG1257869	o-Terphenyl	L1083840-03

Surrogate recovery cannot be used for control limit evaluation due to dilution.

Batch	Analyte	Lab Sample ID
WG1259119	o-Terphenyl	L1083840-07, 08, 09, 13, 14

Pesticides (GC) by Method 8081B

RPD between the primary and confirmatory analysis exceeded 40%

Batch	Lab Sample ID	Analytes
WG1259577	(LCSD) R3397890-2	Heptachlor
WG1260104	(MSD) R3398435-5	Beta BHC

Surrogate recovery limits have been exceeded; values are outside upper control limits.

Batch	Analyte	Lab Sample ID
WG1260104	Decachlorobiphenyl	L1083840-17
WG1260104	Tetrachloro-m-xylene	L1083840-17

Surrogate recovery limits have been exceeded; values are outside lower control limits.

Batch	Analyte	Lab Sample ID
WG1259577	Decachlorobiphenyl	L1083840-23

Surrogate recovery cannot be used for control limit evaluation due to dilution.

Batch	Analyte	Lab Sample ID
WG1260104	Decachlorobiphenyl	L1083840-22
WG1260104	Tetrachloro-m-xylene	L1083840-22

The associated batch QC was above the established quality control range for accuracy.

Batch	Lab Sample ID	Analytes
WG1259577	(LCSD) R3397890-2, L1083840-20, 23, 24	Heptachlor

The associated batch QC was outside the established quality control range for precision.

Batch	Lab Sample ID	Analytes
WG1259577	(LCSD) R3397890-2, L1083840-20, 23, 24	Heptachlor

The sample matrix interfered with the ability to make any accurate determination; spike value is high.

Batch	Lab Sample ID	Analytes
WG1260104	(MS) R3398435-4, (MSD) R3398435-5, L1083840-04	4,4-DDD, 4,4-DDE and Dieldrin

The sample concentration is too high to evaluate accurate spike recoveries.

Batch	Lab Sample ID	Analytes
WG1260104	(MS) R3398435-4, (MSD) R3398435-5, L1083840-04	4,4-DDT

The associated batch QC was outside the established quality control range for precision.

Batch	Lab Sample ID	Analytes
WG1260104	(MSD) R3398435-5, L1083840-04	4,4-DDD, 4,4-DDE, 4,4-DDT, alpha-Chlordane, Dieldrin, Endosulfan I, Endrin ketone and gamma-Chlordane

Polychlorinated Biphenyls (GC) by Method 8082 A

RPD between the primary and confirmatory analysis exceeded 40%

Batch	Lab Sample ID	Analytes
WG1259577	(LCS) R3398326-2	PCB 1016 and PCB 1260
WG1259577	(LCSD) R3398326-3	PCB 1260
WG1259761	(LCS) R3398407-2	PCB 1016
WG1259761	(LCSD) R3398407-3	PCB 1016
WG1259761	(MS) R3398407-4	PCB 1016 and PCB 1260
WG1259761	(MSD) R3398407-5	PCB 1016 and PCB 1260

Surrogate recovery limits have been exceeded; values are outside upper control limits.

Batch	Analyte	Lab Sample ID
WG1260104	Decachlorobiphenyl	L1083840-17
WG1260104	Tetrachloro-m-xylene	L1083840-17, 22

Polychlorinated Biphenyls (GC) by Method 8082 A

The associated batch QC was outside the established quality control range for precision.

Batch	Lab Sample ID	Analytes
WG1259761	(LCSD) R3398407-3, L1083840-31	PCB 1016 and PCB 1260

The sample matrix interfered with the ability to make any accurate determination; spike value is high.

Batch	Lab Sample ID	Analytes
WG1260104	(MS) R3398916-4, (MSD) R3398916-5, L1083840-04	PCB 1260

The associated batch QC was outside the established quality control range for precision.

Batch	Lab Sample ID	Analytes
WG1260104	(MSD) R3398916-5, L1083840-04	PCB 1260

Semi Volatile Organic Compounds (GC/MS) by Method 8270 D

Surrogate recovery limits have been exceeded; values are outside lower control limits.

Batch	Analyte	Lab Sample ID
WG1259548	2-Fluorobiphenyl	L1083840-24
WG1259548	Nitrobenzene-d5	(BLANK) R3398228-3, L1083840-23, 24
WG1259548	Phenol-d5	L1083840-23, 24

The associated batch QC was below the established quality control range for accuracy.

Batch	Lab Sample ID	Analytes
WG1258603	(LCS) R3397719-1, (LCSD) R3397719-2, L1083840-19, 20	21 analytes
WG1259548	(LCS) R3398228-1, (LCSD) R3398228-2, L1083840-23, 24	23 analytes

The sample matrix interfered with the ability to make any accurate determination; spike value is low.

Batch	Lab Sample ID	Analytes
WG1258603	(MS) R3397719-4, (MSD) R3397719-5	19 analytes
WG1259548	(MS) R3398228-4, (MSD) R3398228-5	28 analytes

Semi Volatile Organic Compounds (GC/MS) by Method 8270D

Surrogate recovery limits have been exceeded; values are outside lower control limits.

Batch	Analyte	Lab Sample ID
WG1262278	2,4,6-Tribromophenol	L1083840-25

Surrogate recovery cannot be used for control limit evaluation due to dilution.

Batch	Analyte	Lab Sample ID
WG1262278	2,4,6-Tribromophenol	L1083840-16, 22
WG1262278	2-Fluorobiphenyl	L1083840-16, 22
WG1262278	2-Fluorophenol	L1083840-16, 22
WG1262278	Nitrobenzene-d5	L1083840-16, 22
WG1262278	Phenol-d5	L1083840-16, 22
WG1262278	p-Terphenyl-d14	L1083840-16, 22

The associated batch QC was below the established quality control range for accuracy.

Batch	Lab Sample ID	Analytes
WG1262278	(LCS) R3399893-1, (LCSD) R3399893-2, L1083840-02, 04, 10, 11, 12, 15, 16, 17, 18, 22, 25, 28, 31	40 analytes

The associated batch QC was outside the established quality control range for precision.

Batch	Lab Sample ID	Analytes
WG1262278	(LCSD) R3399893-2, L1083840-02, 04, 10, 11, 12, 15, 16, 17, 18, 22, 25, 28, 31	29 analytes

Semi Volatile Organic Compounds (GC/MS) by Method 8270D

The sample matrix interfered with the ability to make any accurate determination; spike value is low.

Batch	Lab Sample ID	Analytes
WG1262278	(MS) R3399893-4, (MSD) R3399893-5, L1083840-31	56 analytes

The associated batch QC was outside the established quality control range for precision.

Batch	Lab Sample ID	Analytes
WG1262278	(MSD) R3399893-5, L1083840-31	22 analytes

Total Solids by Method 2540 G-2011

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	%			date / time	
Total Solids	85.8		1	04/04/2019 10:39	WG1260177

Mercury by Method 7471B

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
Mercury	0.328		0.00326	0.0233	1	04/04/2019 10:07	WG1260270

Metals (ICP) by Method 6010D

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
Aluminum	6910		4.08	11.7	1	04/04/2019 13:50	WG1260035
Antimony	1.55	J	0.874	2.33	1	04/04/2019 13:50	WG1260035
Arsenic	6.53		0.536	2.33	1	04/04/2019 13:50	WG1260035
Barium	95.2		0.198	0.583	1	04/04/2019 13:50	WG1260035
Beryllium	0.413		0.0816	0.233	1	04/04/2019 13:50	WG1260035
Cadmium	1.83		0.0816	0.583	1	04/04/2019 13:50	WG1260035
Calcium	24400		5.40	117	1	04/04/2019 13:50	WG1260035
Chromium	95.8		0.163	1.17	1	04/04/2019 13:50	WG1260035
Cobalt	3.91		0.268	1.17	1	04/04/2019 13:50	WG1260035
Copper	42.6		0.618	2.33	1	04/04/2019 13:50	WG1260035
Iron	13200		1.64	11.7	1	04/04/2019 13:50	WG1260035
Lead	257		0.221	0.583	1	04/04/2019 13:50	WG1260035
Magnesium	1870		1.29	117	1	04/04/2019 13:50	WG1260035
Manganese	191		0.140	1.17	1	04/04/2019 13:50	WG1260035
Nickel	10.9		0.571	2.33	1	04/04/2019 13:50	WG1260035
Potassium	869		11.9	117	1	04/04/2019 13:50	WG1260035
Selenium	0.786	J	0.723	2.33	1	04/04/2019 13:50	WG1260035
Silver	U		0.140	1.17	1	04/04/2019 13:50	WG1260035
Sodium	159	B	11.5	117	1	04/04/2019 13:50	WG1260035
Thallium	U		0.758	2.33	1	04/04/2019 13:50	WG1260035
Vanadium	19.6		0.280	2.33	1	04/04/2019 13:50	WG1260035
Zinc	259		0.688	5.83	1	04/04/2019 13:50	WG1260035

Semi Volatile Organic Compounds (GC/MS) by Method 8270D

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
Anthracene	0.515		0.0849	0.385	10	04/05/2019 01:34	WG1259754
Acenaphthene	0.128	J	0.0859	0.385	10	04/05/2019 01:34	WG1259754
Acenaphthylene	0.555		0.0875	0.385	10	04/05/2019 01:34	WG1259754
Benzo(a)anthracene	1.89		0.0499	0.385	10	04/05/2019 01:34	WG1259754
Benzo(a)pyrene	1.60		0.0585	0.385	10	04/05/2019 01:34	WG1259754
Benzo(b)fluoranthene	2.19		0.0810	0.385	10	04/05/2019 01:34	WG1259754
Benzo(g,h,i)perylene	1.45		0.0840	0.385	10	04/05/2019 01:34	WG1259754
Benzo(k)fluoranthene	0.655		0.0590	0.385	10	04/05/2019 01:34	WG1259754
Chrysene	1.78		0.0915	0.385	10	04/05/2019 01:34	WG1259754
Dibenz(a,h)anthracene	0.446		0.0689	0.385	10	04/05/2019 01:34	WG1259754
Fluoranthene	3.64		0.0825	0.385	10	04/05/2019 01:34	WG1259754
Fluorene	0.333	J	0.0838	0.385	10	04/05/2019 01:34	WG1259754
Indeno(1,2,3-cd)pyrene	1.01		0.0654	0.385	10	04/05/2019 01:34	WG1259754
Naphthalene	0.148	J	0.0598	0.385	10	04/05/2019 01:34	WG1259754
Phenanthrene	2.48		0.0828	0.385	10	04/05/2019 01:34	WG1259754
Pyrene	2.65		0.0905	0.385	10	04/05/2019 01:34	WG1259754
(S) Nitrobenzene-d5	*73.7*			*31.0-146*		*04/05/2019 01:34*	WG1259754
(S) 2-Fluorobiphenyl	*89.4*			*31.0-130*		*04/05/2019 01:34*	WG1259754

Semi Volatile Organic Compounds (GC/MS) by Method 8270D

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
(S) p-Terphenyl-d14	*103*			*20.0-127*		*04/05/2019 01:34*	WG1259754

Semi Volatile Organic Compounds (GC/MS) by Method 8270D - TENTATIVELY IDENTIFIED COMPOUNDS

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch	CAS #
Total Tic	14300	J N	0.000	0.000	10	04/05/2019 01:34	WG1259754	
Unknown-01	2700	J N	0.000	0.000	10	04/05/2019 01:34	WG1259754	000556-67-2
Benzene-1,2,3,4-D4-, 5,6-Dichloro-	2560	J N	0.000	0.000	10	04/05/2019 01:34	WG1259754	002199-69-1
Benzo[E]Pyrene	2450	J N	0.000	0.000	10	04/05/2019 01:34	WG1259754	000192-97-2
Benzo[B]Naphtho[2,1-D]Thiophene	936	J N	0.000	0.000	10	04/05/2019 01:34	WG1259754	000239-35-0
Unknown-05	843	J N	0.000	0.000	10	04/05/2019 01:34	WG1259754	000203-64-5
Pyrene, 1-Methyl-	749	J N	0.000	0.000	10	04/05/2019 01:34	WG1259754	002381-21-7
Benzoic Acid	580	J N	0.000	0.000	10	04/05/2019 01:34	WG1259754	000065-85-0
Fluoranthene	525	J N	0.000	0.000	10	04/05/2019 01:34	WG1259754	000206-44-0
Unknown-07	471	J N	0.000	0.000	10	04/05/2019 01:34	WG1259754	000084-15-1
Anthracene, 2-Methyl-	469	J N	0.000	0.000	10	04/05/2019 01:34	WG1259754	000613-12-7
Unknown-04	457	J N	0.000	0.000	10	04/05/2019 01:34	WG1259754	000883-20-5
Carbazole	436	J N	0.000	0.000	10	04/05/2019 01:34	WG1259754	000086-74-8
9,10-Anthracenedione	407	J N	0.000	0.000	10	04/05/2019 01:34	WG1259754	000084-65-1
Phenanthrene, 2,5-Dimethyl-	360	J N	0.000	0.000	10	04/05/2019 01:34	WG1259754	003674-66-6
Unknown-06	338	J N	0.000	0.000	10	04/05/2019 01:34	WG1259754	000473-16-5

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Calculated Results

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Chromium,Trivalent	209		0.163	1.17	1	04/11/2019 16:07	WG1260035

Total Solids by Method 2540 G-2011

Analyte	Result %	Qualifier	Dilution	Analysis date / time	Batch
Total Solids	85.7		1	04/04/2019 10:39	WG1260177

Wet Chemistry by Method 3060A/7196A

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Chromium,Hexavalent	4.90		0.747	2.34	1	04/11/2019 16:07	WG1263590

Wet Chemistry by Method 9012B

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Cyanide	0.182	J	0.0455	0.292	1	04/04/2019 13:16	WG1259874

Mercury by Method 7471B

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Mercury	0.201		0.00327	0.0234	1	04/04/2019 10:10	WG1260270

Metals (ICP) by Method 6010D

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Aluminum	6180		4.09	11.7	1	04/04/2019 13:52	WG1260035
Antimony	2.72		0.876	2.34	1	04/04/2019 13:52	WG1260035
Arsenic	31.3		0.537	2.34	1	04/04/2019 13:52	WG1260035
Barium	121		0.198	0.584	1	04/04/2019 13:52	WG1260035
Beryllium	0.564		0.0817	0.234	1	04/04/2019 13:52	WG1260035
Cadmium	1.96		0.0817	0.584	1	04/04/2019 13:52	WG1260035
Calcium	4520		5.41	117	1	04/04/2019 13:52	WG1260035
Chromium	214		0.163	1.17	1	04/04/2019 13:52	WG1260035
Cobalt	9.02		0.269	1.17	1	04/04/2019 13:52	WG1260035
Copper	170		0.619	2.34	1	04/04/2019 13:52	WG1260035
Iron	31000		1.65	11.7	1	04/04/2019 13:52	WG1260035
Lead	358		0.222	0.584	1	04/04/2019 13:52	WG1260035
Magnesium	1840		1.30	117	1	04/04/2019 13:52	WG1260035
Manganese	113		0.140	1.17	1	04/04/2019 13:52	WG1260035
Nickel	17.4		0.572	2.34	1	04/04/2019 13:52	WG1260035
Potassium	1570		11.9	117	1	04/04/2019 13:52	WG1260035
Selenium	1.18	J	0.724	2.34	1	04/04/2019 13:52	WG1260035
Silver	U		0.140	1.17	1	04/04/2019 13:52	WG1260035
Sodium	254	B	11.5	117	1	04/04/2019 13:52	WG1260035
Thallium	U		0.759	2.34	1	04/04/2019 13:52	WG1260035
Vanadium	25.9		0.280	2.34	1	04/04/2019 13:52	WG1260035
Zinc	172		0.689	5.84	1	04/04/2019 13:52	WG1260035

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

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Acetone	0.0393	J	0.0141	0.0706	1.21	04/03/2019 13:14	WG1260000
Benzene	U		0.000315	0.00117	1	04/01/2019 17:30	WG1258825
Bromochloromethane	U		0.000455	0.00117	1	04/01/2019 17:30	WG1258825
Bromodichloromethane	U		0.000297	0.00117	1	04/01/2019 17:30	WG1258825
Bromoform	U		0.000495	0.00117	1	04/01/2019 17:30	WG1258825
Bromomethane	U		0.00156	0.00584	1	04/01/2019 17:30	WG1258825
Carbon disulfide	U		0.000258	0.00117	1	04/01/2019 17:30	WG1258825
Carbon tetrachloride	U		0.000383	0.00117	1	04/01/2019 17:30	WG1258825
Chlorobenzene	U		0.000248	0.00117	1	04/01/2019 17:30	WG1258825
Chlorodibromomethane	U		0.000435	0.00117	1	04/01/2019 17:30	WG1258825
Chloroethane	U		0.00110	0.00584	1	04/01/2019 17:30	WG1258825
Chloroform	U		0.000267	0.00584	1	04/01/2019 17:30	WG1258825
Chloromethane	U		0.000438	0.00292	1	04/01/2019 17:30	WG1258825
Cyclohexane	U		0.000409	0.00117	1	04/01/2019 17:30	WG1258825
1,2-Dibromo-3-Chloropropane	U		0.00123	0.00350	1	04/01/2019 17:30	WG1258825
1,2-Dibromoethane	U		0.000400	0.00117	1	04/01/2019 17:30	WG1258825
Dichlorodifluoromethane	U		0.000832	0.00584	1	04/01/2019 17:30	WG1258825
1,1-Dichloroethane	U		0.000232	0.00117	1	04/01/2019 17:30	WG1258825
1,2-Dichloroethane	U		0.000309	0.00117	1	04/01/2019 17:30	WG1258825
1,2-Dichlorobenzene	U		0.000356	0.00117	1	04/01/2019 17:30	WG1258825
1,3-Dichlorobenzene	U		0.000279	0.00117	1	04/01/2019 17:30	WG1258825
1,4-Dichlorobenzene	U		0.000264	0.00117	1	04/01/2019 17:30	WG1258825
1,1-Dichloroethene	U		0.000354	0.00117	1	04/01/2019 17:30	WG1258825
cis-1,2-Dichloroethene	U		0.000274	0.00117	1	04/01/2019 17:30	WG1258825
trans-1,2-Dichloroethene	U		0.000308	0.00117	1	04/01/2019 17:30	WG1258825
1,2-Dichloropropane	U		0.000418	0.00117	1	04/01/2019 17:30	WG1258825
cis-1,3-Dichloropropene	U		0.000306	0.00117	1	04/01/2019 17:30	WG1258825
trans-1,3-Dichloropropene	U		0.000312	0.00117	1	04/01/2019 17:30	WG1258825
Ethylbenzene	U		0.000347	0.00117	1	04/01/2019 17:30	WG1258825
2-Hexanone	U		0.00160	0.0117	1	04/01/2019 17:30	WG1258825
Isopropylbenzene	U		0.000284	0.0117	1	04/01/2019 17:30	WG1258825
2-Butanone (MEK)	U		0.00546	0.0117	1	04/01/2019 17:30	WG1258825
Methyl Acetate	0.0174	J J0 J4	0.00862	0.0283	1.21	04/03/2019 13:14	WG1260000
Methyl Cyclohexane	U		0.000444	0.00117	1	04/01/2019 17:30	WG1258825
Methylene Chloride	U		0.00117	0.00584	1	04/01/2019 17:30	WG1258825
4-Methyl-2-pentanone (MIBK)	U		0.00219	0.0117	1	04/01/2019 17:30	WG1258825
Methyl tert-butyl ether	U		0.000248	0.00117	1	04/01/2019 17:30	WG1258825
Styrene	U		0.000273	0.00117	1	04/01/2019 17:30	WG1258825
1,1,2,2-Tetrachloroethane	U		0.000426	0.00117	1	04/01/2019 17:30	WG1258825
Tetrachloroethene	U		0.000322	0.00117	1	04/01/2019 17:30	WG1258825
Toluene	0.000723	J	0.000507	0.00584	1	04/01/2019 17:30	WG1258825
1,2,3-Trichlorobenzene	U		0.000357	0.00117	1	04/01/2019 17:30	WG1258825
1,2,4-Trichlorobenzene	U		0.000453	0.00117	1	04/01/2019 17:30	WG1258825
1,1,1-Trichloroethane	U		0.000334	0.00117	1	04/01/2019 17:30	WG1258825
1,1,2-Trichloroethane	U		0.000323	0.00117	1	04/01/2019 17:30	WG1258825
Trichloroethene	U		0.000326	0.00117	1	04/01/2019 17:30	WG1258825
Trichlorofluoromethane	U		0.000446	0.00584	1	04/01/2019 17:30	WG1258825
1,1,2-Trichlorotrifluoroethane	U		0.000426	0.00117	1	04/01/2019 17:30	WG1258825
Vinyl chloride	U		0.000340	0.00117	1	04/01/2019 17:30	WG1258825
Xylenes, Total	U		0.000815	0.00350	1	04/01/2019 17:30	WG1258825
(S) Toluene-d8	*102*			*75.0-131*		*04/01/2019 17:30*	WG1258825
(S) Toluene-d8	*119*			*75.0-131*		*04/03/2019 13:14*	WG1260000
(S) a,a,a-Trifluorotoluene	*99.3*			*80.0-120*		*04/01/2019 17:30*	WG1258825
(S) a,a,a-Trifluorotoluene	*103*			*80.0-120*		*04/03/2019 13:14*	WG1260000
(S) 4-Bromofluorobenzene	*95.3*			*67.0-138*		*04/01/2019 17:30*	WG1258825
(S) 4-Bromofluorobenzene	*97.9*			*67.0-138*		*04/03/2019 13:14*	WG1260000

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

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

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
(S) 1,2-Dichloroethane-d4	*103*			*70.0-130*		*04/01/2019 17:30*	WG1258825
(S) 1,2-Dichloroethane-d4	*105*			*70.0-130*		*04/03/2019 13:14*	WG1260000

Volatile Organic Compounds (GC/MS) by Method 8260C - TENTATIVELY IDENTIFIED COMPOUNDS

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch	CAS #
Total Tic	0.000		0.000	0.000	1	04/01/2019 17:30	WG1258825	
Total Tic	0.0226	J N	0.000	0.000	1.21	04/03/2019 13:14	WG1260000	
Unknown-01	0.0226	J N	0.000	0.000	1.21	04/03/2019 13:14	WG1260000	000075-21-8

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Semi-Volatile Organic Compounds (GC) by Method NJDEP EPH

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
C9-C12 Aliphatics	U		3.85	11.7	1	04/03/2019 00:05	WG1258997
C12-C16 Aliphatics	U		3.85	11.7	1	04/03/2019 00:05	WG1258997
C16-C21 Aliphatics	U		3.85	11.7	1	04/03/2019 00:05	WG1258997
C21-C40 Aliphatics	32.6		3.85	11.7	1	04/03/2019 00:05	WG1258997
C10 - C12 Aromatics	U		3.85	11.7	1	04/03/2019 04:05	WG1258997
C12-C16 Aromatics	U		3.85	11.7	1	04/03/2019 04:05	WG1258997
C16-C21 Aromatics	27.1		3.85	11.7	1	04/03/2019 04:05	WG1258997
C21-C36 Aromatics	83.9		3.85	11.7	1	04/03/2019 04:05	WG1258997
Total EPH	144		0.000	11.7	1	04/03/2019 04:05	WG1258997
(S) 1-Chloro-octadecane	*70.7*			*40.0-140*		*04/03/2019 00:05*	WG1258997
(S) 2-Fluorobiphenyl	*85.7*			*40.0-140*		*04/03/2019 04:05*	WG1258997
(S) 2-Bromonaphthalene	*81.8*			*40.0-140*		*04/03/2019 04:05*	WG1258997
(S) o-Terphenyl	*72.4*			*40.0-140*		*04/03/2019 04:05*	WG1258997

Pesticides (GC) by Method 8081B

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Aldrin	U		0.00158	0.0234	1	04/04/2019 09:18	WG1260104
Alpha BHC	U		0.00159	0.00292	1	04/04/2019 09:18	WG1260104
Beta BHC	U		0.00187	0.00292	1	04/04/2019 09:18	WG1260104
Delta BHC	U		0.00167	0.0234	1	04/04/2019 09:18	WG1260104
Gamma BHC	U		0.00169	0.00292	1	04/04/2019 09:18	WG1260104
Chlordane	U		0.0455	0.234	1	04/04/2019 09:18	WG1260104
alpha-Chlordane	U		0.00165	0.0234	1	04/04/2019 09:18	WG1260104
gamma-Chlordane	U		0.00229	0.0234	1	04/04/2019 09:18	WG1260104
4,4-DDD	U		0.00182	0.0234	1	04/04/2019 09:18	WG1260104
4,4-DDE	U		0.00180	0.0234	1	04/04/2019 09:18	WG1260104
4,4-DDT	U		0.00234	0.0234	1	04/04/2019 09:18	WG1260104
Dieldrin	U		0.00177	0.00350	1	04/04/2019 09:18	WG1260104
Endosulfan I	U		0.00174	0.0234	1	04/04/2019 09:18	WG1260104
Endosulfan II	U		0.00187	0.0234	1	04/04/2019 09:18	WG1260104
Endosulfan sulfate	U		0.00176	0.0234	1	04/04/2019 09:18	WG1260104
Endrin	U		0.00183	0.0234	1	04/04/2019 09:18	WG1260104
Endrin aldehyde	U		0.00151	0.0234	1	04/04/2019 09:18	WG1260104
Endrin ketone	U		0.00193	0.0234	1	04/04/2019 09:18	WG1260104
Hexachlorobenzene	U		0.00145	0.0234	1	04/04/2019 09:18	WG1260104
Heptachlor	U		0.00180	0.0234	1	04/04/2019 09:18	WG1260104
Heptachlor epoxide	U		0.00188	0.0117	1	04/04/2019 09:18	WG1260104
Methoxychlor	U		0.00208	0.0234	1	04/04/2019 09:18	WG1260104

Pesticides (GC) by Method 8081B

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Toxaphene	U		0.0420	0.467	1	04/04/2019 09:18	WG1260104
(S) Decachlorobiphenyl	*116*			*30.0-150*		*04/04/2019 09:18*	WG1260104
(S) Tetrachloro-m-xylene	*79.8*			*30.0-150*		*04/04/2019 09:18*	WG1260104

Polychlorinated Biphenyls (GC) by Method 8082 A

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
PCB 1016	U		0.00409	0.0198	1	04/05/2019 01:08	WG1260104
PCB 1221	U		0.00627	0.0198	1	04/05/2019 01:08	WG1260104
PCB 1232	U		0.00487	0.0198	1	04/05/2019 01:08	WG1260104
PCB 1242	U		0.00371	0.0198	1	04/05/2019 01:08	WG1260104
PCB 1248	U		0.00368	0.0198	1	04/05/2019 01:08	WG1260104
PCB 1254	0.243		0.00551	0.0198	1	04/05/2019 01:08	WG1260104
PCB 1260	U		0.00577	0.0198	1	04/05/2019 01:08	WG1260104
(S) Decachlorobiphenyl	*71.6*			*30.0-150*		*04/05/2019 01:08*	WG1260104
(S) Tetrachloro-m-xylene	*80.1*			*30.0-150*		*04/05/2019 01:08*	WG1260104

Semi Volatile Organic Compounds (GC/MS) by Method 8270D

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Acenaphthene	0.281	J J3 J4	0.0750	0.385	10	04/09/2019 14:48	WG1262278
Acenaphthylene	0.292	J J3 J4	0.0783	0.385	10	04/09/2019 14:48	WG1262278
Acetophenone	U	J3 J4	0.878	1.75	10	04/09/2019 14:48	WG1262278
Anthracene	0.653	J4	0.0738	0.385	10	04/09/2019 14:48	WG1262278
Atrazine	U		1.10	1.75	10	04/09/2019 14:48	WG1262278
Benzaldehyde	U	J3	0.621	1.75	10	04/09/2019 14:48	WG1262278
Benzo(a)anthracene	2.50		0.0500	0.385	10	04/09/2019 14:48	WG1262278
Benzo(b)fluoranthene	3.16		0.0811	0.385	10	04/09/2019 14:48	WG1262278
Benzo(k)fluoranthene	0.973		0.0680	0.385	10	04/09/2019 14:48	WG1262278
Benzo(g,h,i)perylene	1.31		0.0842	0.385	10	04/09/2019 14:48	WG1262278
Benzo(a)pyrene	2.16		0.0640	0.385	10	04/09/2019 14:48	WG1262278
Biphenyl	U	J3 J4	0.0687	1.75	10	04/09/2019 14:48	WG1262278
Bis(2-chlorethoxy)methane	U	J3 J4	0.0899	1.75	10	04/09/2019 14:48	WG1262278
Bis(2-chloroethyl)ether	U	J3 J4	0.105	1.75	10	04/09/2019 14:48	WG1262278
Bis(2-chloroisopropyl)ether	U	J3 J4	0.0887	1.75	10	04/09/2019 14:48	WG1262278
4-Bromophenyl-phenylether	U	J4	0.133	1.75	10	04/09/2019 14:48	WG1262278
Caprolactam	U		1.21	1.75	10	04/09/2019 14:48	WG1262278
Carbazole	0.386	J	0.0612	1.75	10	04/09/2019 14:48	WG1262278
4-Chloroaniline	U	J3 J4	0.411	1.75	10	04/09/2019 14:48	WG1262278
2-Chloronaphthalene	U	J3 J4	0.0746	0.385	10	04/09/2019 14:48	WG1262278
4-Chlorophenyl-phenylether	U	J4	0.0732	1.75	10	04/09/2019 14:48	WG1262278
Chrysene	2.65	J4	0.0648	0.385	10	04/09/2019 14:48	WG1262278
Dibenz(a,h)anthracene	0.390		0.0959	0.385	10	04/09/2019 14:48	WG1262278
Dibenzofuran	0.205	J J3 J4	0.0605	1.75	10	04/09/2019 14:48	WG1262278
3,3-Dichlorobenzidine	U		0.927	1.75	10	04/09/2019 14:48	WG1262278
2,4-Dinitrotoluene	U	J4	0.0709	1.75	10	04/09/2019 14:48	WG1262278
2,6-Dinitrotoluene	U	J4	0.0860	1.75	10	04/09/2019 14:48	WG1262278
Fluoranthene	5.08		0.0579	0.385	10	04/09/2019 14:48	WG1262278
Fluorene	0.274	J J4	0.0796	0.385	10	04/09/2019 14:48	WG1262278
Hexachlorobenzene	U	J4	0.0999	1.75	10	04/09/2019 14:48	WG1262278
Hexachloro-1,3-butadiene	U	J3 J4	0.117	1.75	10	04/09/2019 14:48	WG1262278
Hexachlorocyclopentadiene	U	J0 J3	0.685	1.75	10	04/09/2019 14:48	WG1262278
Hexachloroethane	U	J3	0.156	1.75	10	04/09/2019 14:48	WG1262278
Indeno(1,2,3-cd)pyrene	1.52		0.0901	0.385	10	04/09/2019 14:48	WG1262278
Isophorone	0.0898	J J3 J4	0.0609	1.75	10	04/09/2019 14:48	WG1262278

Semi Volatile Organic Compounds (GC/MS) by Method 8270D

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
2-Methylnaphthalene	0.128	J J3 J4	0.101	0.385	10	04/09/2019 14:48	WG1262278
Naphthalene	0.371	J J3 J4	0.104	0.385	10	04/09/2019 14:48	WG1262278
2-Nitroaniline	U	J4	0.0881	1.75	10	04/09/2019 14:48	WG1262278
3-Nitroaniline	U	J4	0.0992	1.75	10	04/09/2019 14:48	WG1262278
4-Nitroaniline	U	J4	0.0746	1.75	10	04/09/2019 14:48	WG1262278
Nitrobenzene	U	J3 J4	0.0811	1.75	10	04/09/2019 14:48	WG1262278
n-Nitrosodiphenylamine	U		0.0694	1.75	10	04/09/2019 14:48	WG1262278
n-Nitrosodi-n-propylamine	U	J3 J4	0.106	1.75	10	04/09/2019 14:48	WG1262278
Phenanthrene	3.44	J4	0.0616	0.385	10	04/09/2019 14:48	WG1262278
Benzylbutyl phthalate	U		0.120	1.75	10	04/09/2019 14:48	WG1262278
Bis(2-ethylhexyl)phthalate	0.815	J	0.140	1.75	10	04/09/2019 14:48	WG1262278
Di-n-butyl phthalate	U		0.127	1.75	10	04/09/2019 14:48	WG1262278
Diethyl phthalate	U	J4	0.0807	1.75	10	04/09/2019 14:48	WG1262278
Dimethyl phthalate	U	J4	0.0630	1.75	10	04/09/2019 14:48	WG1262278
Di-n-octyl phthalate	U		0.106	1.75	10	04/09/2019 14:48	WG1262278
Pyrene	4.49		0.144	0.385	10	04/09/2019 14:48	WG1262278
1,2,4,5-Tetrachlorobenzene	U	J3 J4	0.890	1.75	10	04/09/2019 14:48	WG1262278
4-Chloro-3-methylphenol	U	J4	0.0557	1.75	10	04/09/2019 14:48	WG1262278
2-Chlorophenol	U	J3 J4	0.0970	1.75	10	04/09/2019 14:48	WG1262278
2-Methylphenol	U	J3 J4	0.115	1.75	10	04/09/2019 14:48	WG1262278
3&4-Methyl Phenol	U	J3	0.0914	1.75	10	04/09/2019 14:48	WG1262278
2,4-Dichlorophenol	U	J3 J4	0.0871	1.75	10	04/09/2019 14:48	WG1262278
2,4-Dimethylphenol	U	J3 J4	0.550	1.75	10	04/09/2019 14:48	WG1262278
4,6-Dinitro-2-methylphenol	U	J4	1.45	2.34	10	04/09/2019 14:48	WG1262278
2,4-Dinitrophenol	U	J3	1.14	2.34	10	04/09/2019 14:48	WG1262278
2-Nitrophenol	U	J3 J4	0.152	1.75	10	04/09/2019 14:48	WG1262278
4-Nitrophenol	U		0.613	1.75	10	04/09/2019 14:48	WG1262278
Pentachlorophenol	U		0.560	1.75	10	04/09/2019 14:48	WG1262278
Phenol	U	J3	0.0811	1.75	10	04/09/2019 14:48	WG1262278
2,4,5-Trichlorophenol	U	J4	0.121	1.75	10	04/09/2019 14:48	WG1262278
2,4,6-Trichlorophenol	U	J3 J4	0.0910	1.75	10	04/09/2019 14:48	WG1262278
(S) 2-Fluorophenol	*80.8*			*30.0-130*		*04/09/2019 14:48*	WG1262278
(S) Phenol-d5	*67.9*			*30.0-130*		*04/09/2019 14:48*	WG1262278
(S) Nitrobenzene-d5	*85.3*			*30.0-130*		*04/09/2019 14:48*	WG1262278
(S) 2-Fluorobiphenyl	*67.3*			*30.0-130*		*04/09/2019 14:48*	WG1262278
(S) 2,4,6-Tribromophenol	*75.2*			*30.0-130*		*04/09/2019 14:48*	WG1262278
(S) p-Terphenyl-d14	*76.3*			*30.0-130*		*04/09/2019 14:48*	WG1262278

Sample Narrative:

L1083840-02 WG1262278: Dilution due to matrix impact during extract concentration procedure

Semi Volatile Organic Compounds (GC/MS) by Method 8270D - TENTATIVELY IDENTIFIED COMPOUNDS

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch	CAS #
Total Tic	11.2	J N	0.000	0.000	10	04/09/2019 14:48	WG1262278	
Unknown-02	2.42	J N	0.000	0.000	10	04/09/2019 14:48	WG1262278	000123-42-2
Benzo[E]Pyrene	1.74	J N	0.000	0.000	10	04/09/2019 14:48	WG1262278	000192-97-2
Unknown-04	1.32	J N	0.000	0.000	10	04/09/2019 14:48	WG1262278	000203-64-5
Anthracene, 2-Methyl-	0.922	J N	0.000	0.000	10	04/09/2019 14:48	WG1262278	000613-12-7
Phenanthrene, 4-Methyl-	0.879	J N	0.000	0.000	10	04/09/2019 14:48	WG1262278	000832-64-4
Unknown-01	0.609	J N	0.000	0.000	10	04/09/2019 14:48	WG1262278	000108-10-1
2-Phenylnaphthalene	0.497	J N	0.000	0.000	10	04/09/2019 14:48	WG1262278	035465-71-5
9,10-Anthracenedione	0.462	J N	0.000	0.000	10	04/09/2019 14:48	WG1262278	000084-65-1
Eicosane	0.412	J N	0.000	0.000	10	04/09/2019 14:48	WG1262278	000112-95-8
9H-Fluoren-9-One	0.369	J N	0.000	0.000	10	04/09/2019 14:48	WG1262278	000486-25-9
Pyrene, 1-Methyl-	0.339	J N	0.000	0.000	10	04/09/2019 14:48	WG1262278	002381-21-7

Semi Volatile Organic Compounds (GC/MS) by Method 8270D - TENTATIVELY IDENTIFIED COMPOUNDS

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch	CAS #
Unknown-03	0.329	J N	0.000	0.000	10	04/09/2019 14:48	WG1262278	072182-11-7
Unknown-05	0.325	J N	0.000	0.000	10	04/09/2019 14:48	WG1262278	000238-84-6
Unknown-06	0.311	J N	0.000	0.000	10	04/09/2019 14:48	WG1262278	000239-35-0
2-Methylchrysene	0.306	J N	0.000	0.000	10	04/09/2019 14:48	WG1262278	003351-32-4

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Total Solids by Method 2540 G-2011

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	%			date / time	
Total Solids	91.5		1	04/04/2019 10:39	WG1260177

Semi-Volatile Organic Compounds (GC) by Method NJDEP EPH

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
EPH Screen	5740	J	117	8200	15	04/02/2019 15:13	WG1257869
(S) o-Terphenyl	*28.6*	J2	*100*	*40.0-140*		*04/02/2019 15:13*	WG1257869

Sample Narrative:

L1083840-03 WG1257869: Surrogate failure due to matrix interference Cannot run at lower dilution due to extract viscosity

Total Solids by Method 2540 G-2011

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	%			date / time	
Total Solids	91.2		1	04/04/2019 10:39	WG1260177

Wet Chemistry by Method 9012B

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
Cyanide	0.201	J	0.0427	0.274	1	04/05/2019 14:10	WG1260642

Mercury by Method 7471B

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
Mercury	0.528		0.00307	0.0219	1	04/04/2019 10:12	WG1260270

Metals (ICP) by Method 6010D

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
Aluminum	4890		3.84	11.0	1	04/04/2019 13:55	WG1260035
Antimony	5.90		0.822	2.19	1	04/04/2019 13:55	WG1260035
Arsenic	9.58		0.504	2.19	1	04/04/2019 13:55	WG1260035
Barium	146		0.186	0.548	1	04/04/2019 13:55	WG1260035
Beryllium	0.312		0.0767	0.219	1	04/04/2019 13:55	WG1260035
Cadmium	0.603		0.0767	0.548	1	04/04/2019 13:55	WG1260035
Calcium	6030		5.08	110	1	04/04/2019 13:55	WG1260035
Chromium	17.0		0.153	1.10	1	04/04/2019 13:55	WG1260035
Cobalt	4.07		0.252	1.10	1	04/04/2019 13:55	WG1260035
Copper	44.8		0.581	2.19	1	04/04/2019 13:55	WG1260035
Iron	11100		1.55	11.0	1	04/04/2019 13:55	WG1260035
Lead	334		0.208	0.548	1	04/04/2019 13:55	WG1260035
Magnesium	1590		1.22	110	1	04/04/2019 13:55	WG1260035
Manganese	169		0.132	1.10	1	04/04/2019 13:55	WG1260035
Nickel	8.08		0.537	2.19	1	04/04/2019 13:55	WG1260035
Potassium	810		11.2	110	1	04/04/2019 13:55	WG1260035
Selenium	U		0.680	2.19	1	04/04/2019 13:55	WG1260035
Silver	1.72		0.132	1.10	1	04/04/2019 13:55	WG1260035
Sodium	120	B	10.8	110	1	04/04/2019 13:55	WG1260035
Thallium	U		0.712	2.19	1	04/04/2019 13:55	WG1260035
Vanadium	13.2		0.263	2.19	1	04/04/2019 13:55	WG1260035
Zinc	215		0.647	5.48	1	04/04/2019 13:55	WG1260035

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

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
Acetone	0.115		0.0155	0.0773	1.41	04/03/2019 13:35	WG1260000
Benzene	0.000590	J	0.000296	0.00110	1	04/01/2019 17:50	WG1258825
Bromochloromethane	U		0.000427	0.00110	1	04/01/2019 17:50	WG1258825
Bromodichloromethane	U		0.000278	0.00110	1	04/01/2019 17:50	WG1258825
Bromoform	U		0.000465	0.00110	1	04/01/2019 17:50	WG1258825
Bromomethane	U		0.00147	0.00548	1	04/01/2019 17:50	WG1258825
Carbon disulfide	0.000477	J	0.000242	0.00110	1	04/01/2019 17:50	WG1258825
Carbon tetrachloride	U		0.000360	0.00110	1	04/01/2019 17:50	WG1258825
Chlorobenzene	U		0.000232	0.00110	1	04/01/2019 17:50	WG1258825
Chlorodibromomethane	U		0.000409	0.00110	1	04/01/2019 17:50	WG1258825
Chloroethane	U		0.00104	0.00548	1	04/01/2019 17:50	WG1258825
Chloroform	U		0.000251	0.00548	1	04/01/2019 17:50	WG1258825
Chloromethane	U		0.000411	0.00274	1	04/01/2019 17:50	WG1258825

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

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Cyclohexane	U		0.000384	0.00110	1	04/01/2019 17:50	WG1258825
1,2-Dibromo-3-Chloropropane	U		0.00115	0.00329	1	04/01/2019 17:50	WG1258825
1,2-Dibromoethane	U		0.000376	0.00110	1	04/01/2019 17:50	WG1258825
Dichlorodifluoromethane	U		0.000782	0.00548	1	04/01/2019 17:50	WG1258825
1,1-Dichloroethane	U		0.000218	0.00110	1	04/01/2019 17:50	WG1258825
1,2-Dichloroethane	U		0.000290	0.00110	1	04/01/2019 17:50	WG1258825
1,2-Dichlorobenzene	U		0.000334	0.00110	1	04/01/2019 17:50	WG1258825
1,3-Dichlorobenzene	U		0.000262	0.00110	1	04/01/2019 17:50	WG1258825
1,4-Dichlorobenzene	U		0.000248	0.00110	1	04/01/2019 17:50	WG1258825
1,1-Dichloroethene	U		0.000332	0.00110	1	04/01/2019 17:50	WG1258825
cis-1,2-Dichloroethene	U		0.000258	0.00110	1	04/01/2019 17:50	WG1258825
trans-1,2-Dichloroethene	U		0.000289	0.00110	1	04/01/2019 17:50	WG1258825
1,2-Dichloropropane	U		0.000392	0.00110	1	04/01/2019 17:50	WG1258825
cis-1,3-Dichloropropene	U		0.000287	0.00110	1	04/01/2019 17:50	WG1258825
trans-1,3-Dichloropropene	U		0.000293	0.00110	1	04/01/2019 17:50	WG1258825
Ethylbenzene	U		0.000326	0.00110	1	04/01/2019 17:50	WG1258825
2-Hexanone	U		0.00150	0.0110	1	04/01/2019 17:50	WG1258825
Isopropylbenzene	U		0.000266	0.0110	1	04/01/2019 17:50	WG1258825
2-Butanone (MEK)	U		0.00513	0.0110	1	04/01/2019 17:50	WG1258825
Methyl Acetate	U		0.171	0.559	25.5	04/04/2019 17:20	WG1261044
Methyl Cyclohexane	U		0.000417	0.00110	1	04/01/2019 17:50	WG1258825
Methylene Chloride	U		0.00110	0.00548	1	04/01/2019 17:50	WG1258825
4-Methyl-2-pentanone (MIBK)	U		0.00206	0.0110	1	04/01/2019 17:50	WG1258825
Methyl tert-butyl ether	U		0.000232	0.00110	1	04/01/2019 17:50	WG1258825
Styrene	U		0.000256	0.00110	1	04/01/2019 17:50	WG1258825
1,1,2,2-Tetrachloroethane	U		0.000400	0.00110	1	04/01/2019 17:50	WG1258825
Tetrachloroethene	0.00218		0.000303	0.00110	1	04/01/2019 17:50	WG1258825
Toluene	0.00721		0.000476	0.00548	1	04/01/2019 17:50	WG1258825
1,2,3-Trichlorobenzene	U		0.000335	0.00110	1	04/01/2019 17:50	WG1258825
1,2,4-Trichlorobenzene	U		0.000425	0.00110	1	04/01/2019 17:50	WG1258825
1,1,1-Trichloroethane	U		0.000313	0.00110	1	04/01/2019 17:50	WG1258825
1,1,2-Trichloroethane	U		0.000304	0.00110	1	04/01/2019 17:50	WG1258825
Trichloroethene	U		0.000306	0.00110	1	04/01/2019 17:50	WG1258825
Trichlorofluoromethane	U		0.000419	0.00548	1	04/01/2019 17:50	WG1258825
1,1,2-Trichlorotrifluoroethane	U		0.000400	0.00110	1	04/01/2019 17:50	WG1258825
Vinyl chloride	U		0.000319	0.00110	1	04/01/2019 17:50	WG1258825
Xylenes, Total	U		0.000765	0.00329	1	04/01/2019 17:50	WG1258825
(S) Toluene-d8	*99.5*			*75.0-131*		*04/01/2019 17:50*	WG1258825
(S) Toluene-d8	*123*			*75.0-131*		*04/03/2019 13:35*	WG1260000
(S) Toluene-d8	*101*			*75.0-131*		*04/04/2019 17:20*	WG1261044
(S) a,a,a-Trifluorotoluene	*102*			*80.0-120*		*04/01/2019 17:50*	WG1258825
(S) a,a,a-Trifluorotoluene	*107*			*80.0-120*		*04/03/2019 13:35*	WG1260000
(S) a,a,a-Trifluorotoluene	*96.3*			*80.0-120*		*04/04/2019 17:20*	WG1261044
(S) 4-Bromofluorobenzene	*99.9*			*67.0-138*		*04/01/2019 17:50*	WG1258825
(S) 4-Bromofluorobenzene	*117*			*67.0-138*		*04/03/2019 13:35*	WG1260000
(S) 4-Bromofluorobenzene	*98.3*			*67.0-138*		*04/04/2019 17:20*	WG1261044
(S) 1,2-Dichloroethane-d4	*103*			*70.0-130*		*04/01/2019 17:50*	WG1258825
(S) 1,2-Dichloroethane-d4	*113*			*70.0-130*		*04/03/2019 13:35*	WG1260000
(S) 1,2-Dichloroethane-d4	*113*			*70.0-130*		*04/04/2019 17:20*	WG1261044

Sample Narrative:

L1083840-04 WG1261044: No stir bars remain for analysis.

Volatile Organic Compounds (GC/MS) by Method 8260C - TENTATIVELY IDENTIFIED COMPOUNDS

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch	CAS #
Total Tic	0.000		0.000	0.000	1	04/01/2019 17:50	WG1258825	
Total Tic	0.0247	J N	0.000	0.000	1.41	04/03/2019 13:35	WG1260000	
Unknown-01	0.0247	J N	0.000	0.000	1.41	04/03/2019 13:35	WG1260000	000075-21-8

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Semi-Volatile Organic Compounds (GC) by Method NJDEP EPH

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
C9-C12 Aliphatics	U		3.62	11.0	1	04/03/2019 00:27	WG1258997
C12-C16 Aliphatics	U		3.62	11.0	1	04/03/2019 00:27	WG1258997
C16-C21 Aliphatics	U		3.62	11.0	1	04/03/2019 00:27	WG1258997
C21-C40 Aliphatics	22.3		3.62	11.0	1	04/03/2019 00:27	WG1258997
C10 - C12 Aromatics	U		3.62	11.0	1	04/03/2019 03:43	WG1258997
C12-C16 Aromatics	U		3.62	11.0	1	04/03/2019 03:43	WG1258997
C16-C21 Aromatics	6.96	J	3.62	11.0	1	04/03/2019 03:43	WG1258997
C21-C36 Aromatics	36.2		3.62	11.0	1	04/03/2019 03:43	WG1258997
Total EPH	65.4		0.000	11.0	1	04/03/2019 03:43	WG1258997
(S) 1-Chloro-octadecane	*76.3*			*40.0-140*		*04/03/2019 00:27*	WG1258997
(S) 2-Fluorobiphenyl	*83.5*			*40.0-140*		*04/03/2019 03:43*	WG1258997
(S) 2-Bromonaphthalene	*81.8*			*40.0-140*		*04/03/2019 03:43*	WG1258997
(S) o-Terphenyl	*72.2*			*40.0-140*		*04/03/2019 03:43*	WG1258997

Pesticides (GC) by Method 8081B

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Aldrin	U		0.00148	0.0219	1	04/04/2019 09:30	WG1260104
Alpha BHC	U		0.00149	0.00274	1	04/04/2019 09:30	WG1260104
Beta BHC	U		0.00175	0.00274	1	04/04/2019 09:30	WG1260104
Delta BHC	U		0.00157	0.0219	1	04/04/2019 09:30	WG1260104
Gamma BHC	U		0.00159	0.00274	1	04/04/2019 09:30	WG1260104
Chlordane	U		0.0427	0.219	1	04/04/2019 09:30	WG1260104
alpha-Chlordane	U	J3	0.00155	0.0219	1	04/04/2019 09:30	WG1260104
gamma-Chlordane	U	J3	0.00215	0.0219	1	04/04/2019 09:30	WG1260104
4,4-DDD	U	J3 J5	0.00171	0.0219	1	04/04/2019 09:30	WG1260104
4,4-DDE	0.0624	J3 J5	0.00169	0.0219	1	04/04/2019 09:30	WG1260104
4,4-DDT	0.386	J3 V	0.00219	0.0219	1	04/04/2019 09:30	WG1260104
Dieldrin	0.0156	J3 J5	0.00167	0.00329	1	04/04/2019 09:30	WG1260104
Endosulfan I	U	J3	0.00163	0.0219	1	04/04/2019 09:30	WG1260104
Endosulfan II	U		0.00175	0.0219	1	04/04/2019 09:30	WG1260104
Endosulfan sulfate	U		0.00166	0.0219	1	04/04/2019 09:30	WG1260104
Endrin	U		0.00172	0.0219	1	04/04/2019 09:30	WG1260104
Endrin aldehyde	U		0.00141	0.0219	1	04/04/2019 09:30	WG1260104
Endrin ketone	U	J3	0.00181	0.0219	1	04/04/2019 09:30	WG1260104
Hexachlorobenzene	U		0.00136	0.0219	1	04/04/2019 09:30	WG1260104
Heptachlor	U		0.00169	0.0219	1	04/04/2019 09:30	WG1260104
Heptachlor epoxide	U		0.00176	0.0110	1	04/04/2019 09:30	WG1260104
Methoxychlor	U		0.00195	0.0219	1	04/04/2019 09:30	WG1260104
Toxaphene	U		0.0395	0.438	1	04/04/2019 09:30	WG1260104
(S) Decachlorobiphenyl	*98.0*			*30.0-150*		*04/04/2019 09:30*	WG1260104
(S) Tetrachloro-m-xylene	*86.7*			*30.0-150*		*04/04/2019 09:30*	WG1260104

Polychlorinated Biphenyls (GC) by Method 8082 A

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
PCB 1016	U		0.00384	0.0186	1	04/04/2019 12:57	WG1260104
PCB 1221	U		0.00589	0.0186	1	04/04/2019 12:57	WG1260104
PCB 1232	U		0.00457	0.0186	1	04/04/2019 12:57	WG1260104
PCB 1242	U		0.00349	0.0186	1	04/04/2019 12:57	WG1260104
PCB 1248	U		0.00345	0.0186	1	04/04/2019 12:57	WG1260104
PCB 1254	U		0.00517	0.0186	1	04/04/2019 12:57	WG1260104
PCB 1260	U	J3 J5	0.00541	0.0186	1	04/04/2019 12:57	WG1260104
(S) Decachlorobiphenyl	*82.3*			*30.0-150*		*04/04/2019 12:57*	WG1260104
(S) Tetrachloro-m-xylene	*74.7*			*30.0-150*		*04/04/2019 12:57*	WG1260104

Semi Volatile Organic Compounds (GC/MS) by Method 8270D

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Acenaphthene	0.0503	J J3 J4	0.0140	0.0723	2	04/09/2019 14:28	WG1262278
Acenaphthylene	0.0794	J3 J4	0.0147	0.0723	2	04/09/2019 14:28	WG1262278
Acetophenone	U	J3 J4	0.164	0.329	2	04/09/2019 14:28	WG1262278
Anthracene	0.132	J4	0.0138	0.0723	2	04/09/2019 14:28	WG1262278
Atrazine	U		0.206	0.329	2	04/09/2019 14:28	WG1262278
Benzaldehyde	0.226	J J3	0.116	0.329	2	04/09/2019 14:28	WG1262278
Benzo(a)anthracene	0.272		0.00938	0.0723	2	04/09/2019 14:28	WG1262278
Benzo(b)fluoranthene	0.401		0.0152	0.0723	2	04/09/2019 14:28	WG1262278
Benzo(k)fluoranthene	0.137		0.0127	0.0723	2	04/09/2019 14:28	WG1262278
Benzo(g,h,i)perylene	0.214		0.0158	0.0723	2	04/09/2019 14:28	WG1262278
Benzo(a)pyrene	0.258		0.0121	0.0723	2	04/09/2019 14:28	WG1262278
Biphenyl	0.0568	J J3 J4	0.0129	0.329	2	04/09/2019 14:28	WG1262278
Bis(2-chlorethoxy)methane	U	J3 J4	0.0169	0.329	2	04/09/2019 14:28	WG1262278
Bis(2-chloroethyl)ether	U	J3 J4	0.0196	0.329	2	04/09/2019 14:28	WG1262278
Bis(2-chloroisopropyl)ether	U	J3 J4	0.0167	0.329	2	04/09/2019 14:28	WG1262278
4-Bromophenyl-phenylether	U	J4	0.0250	0.329	2	04/09/2019 14:28	WG1262278
Caprolactam	U		0.228	0.329	2	04/09/2019 14:28	WG1262278
Carbazole	0.0504	J	0.0115	0.329	2	04/09/2019 14:28	WG1262278
4-Chloroaniline	U	J3 J4	0.0772	0.329	2	04/09/2019 14:28	WG1262278
2-Chloronaphthalene	U	J3 J4	0.0140	0.0723	2	04/09/2019 14:28	WG1262278
4-Chlorophenyl-phenylether	U	J4	0.0137	0.329	2	04/09/2019 14:28	WG1262278
Chrysene	0.333	J4	0.0122	0.0723	2	04/09/2019 14:28	WG1262278
Dibenz(a,h)anthracene	0.0575	J	0.0180	0.0723	2	04/09/2019 14:28	WG1262278
Dibenzofuran	0.135	J J3 J4	0.0114	0.329	2	04/09/2019 14:28	WG1262278
3,3-Dichlorobenzidine	U		0.174	0.329	2	04/09/2019 14:28	WG1262278
2,4-Dinitrotoluene	U	J4	0.0133	0.329	2	04/09/2019 14:28	WG1262278
2,6-Dinitrotoluene	U	J4	0.0161	0.329	2	04/09/2019 14:28	WG1262278
Fluoranthene	0.595		0.0109	0.0723	2	04/09/2019 14:28	WG1262278
Fluorene	0.0517	J J4	0.0149	0.0723	2	04/09/2019 14:28	WG1262278
Hexachlorobenzene	U	J4	0.0187	0.329	2	04/09/2019 14:28	WG1262278
Hexachloro-1,3-butadiene	U	J3 J4	0.0219	0.329	2	04/09/2019 14:28	WG1262278
Hexachlorocyclopentadiene	U	J0 J3	0.128	0.329	2	04/09/2019 14:28	WG1262278
Hexachloroethane	U	J3	0.0294	0.329	2	04/09/2019 14:28	WG1262278
Indeno(1,2,3-cd)pyrene	0.227		0.0169	0.0723	2	04/09/2019 14:28	WG1262278
Isophorone	U	J3 J4	0.0114	0.329	2	04/09/2019 14:28	WG1262278
2-Methylnaphthalene	0.258	J3 J4	0.0189	0.0723	2	04/09/2019 14:28	WG1262278
Naphthalene	0.607	J3 J4	0.0195	0.0723	2	04/09/2019 14:28	WG1262278
2-Nitroaniline	U	J4	0.0166	0.329	2	04/09/2019 14:28	WG1262278
3-Nitroaniline	U	J4	0.0186	0.329	2	04/09/2019 14:28	WG1262278
4-Nitroaniline	U	J4	0.0140	0.329	2	04/09/2019 14:28	WG1262278
Nitrobenzene	U	J3 J4	0.0152	0.329	2	04/09/2019 14:28	WG1262278
n-Nitrosodiphenylamine	U		0.0130	0.329	2	04/09/2019 14:28	WG1262278
n-Nitrosodi-n-propylamine	U	J3 J4	0.0198	0.329	2	04/09/2019 14:28	WG1262278

Semi Volatile Organic Compounds (GC/MS) by Method 8270D

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Phenanthrene	0.543	J4	0.0116	0.0723	2	04/09/2019 14:28	WG1262278
Benzylbutyl phthalate	0.0244	J	0.0226	0.329	2	04/09/2019 14:28	WG1262278
Bis(2-ethylhexyl)phthalate	0.216	J	0.0263	0.329	2	04/09/2019 14:28	WG1262278
Di-n-butyl phthalate	0.152	J	0.0239	0.329	2	04/09/2019 14:28	WG1262278
Diethyl phthalate	U	J4	0.0151	0.329	2	04/09/2019 14:28	WG1262278
Dimethyl phthalate	U	J4	0.0118	0.329	2	04/09/2019 14:28	WG1262278
Di-n-octyl phthalate	U		0.0198	0.329	2	04/09/2019 14:28	WG1262278
Pyrene	0.544		0.0270	0.0723	2	04/09/2019 14:28	WG1262278
1,2,4,5-Tetrachlorobenzene	U	J3 J4	0.167	0.329	2	04/09/2019 14:28	WG1262278
4-Chloro-3-methylphenol	U	J4	0.0105	0.329	2	04/09/2019 14:28	WG1262278
2-Chlorophenol	U	J3 J4	0.0182	0.329	2	04/09/2019 14:28	WG1262278
2-Methylphenol	U	J3 J4	0.0216	0.329	2	04/09/2019 14:28	WG1262278
3&4-Methyl Phenol	0.0350	J J3	0.0172	0.329	2	04/09/2019 14:28	WG1262278
2,4-Dichlorophenol	U	J3 J4	0.0163	0.329	2	04/09/2019 14:28	WG1262278
2,4-Dimethylphenol	U	J3 J4	0.103	0.329	2	04/09/2019 14:28	WG1262278
4,6-Dinitro-2-methylphenol	U	J4	0.272	0.438	2	04/09/2019 14:28	WG1262278
2,4-Dinitrophenol	U	J3	0.215	0.438	2	04/09/2019 14:28	WG1262278
2-Nitrophenol	U	J3 J4	0.0285	0.329	2	04/09/2019 14:28	WG1262278
4-Nitrophenol	U		0.115	0.329	2	04/09/2019 14:28	WG1262278
Pentachlorophenol	U		0.105	0.329	2	04/09/2019 14:28	WG1262278
Phenol	U	J3	0.0152	0.329	2	04/09/2019 14:28	WG1262278
2,4,5-Trichlorophenol	U	J4	0.0228	0.329	2	04/09/2019 14:28	WG1262278
2,4,6-Trichlorophenol	U	J3 J4	0.0171	0.329	2	04/09/2019 14:28	WG1262278
(S) 2-Fluorophenol	*60.4*			*30.0-130*		*04/09/2019 14:28*	WG1262278
(S) Phenol-d5	*62.7*			*30.0-130*		*04/09/2019 14:28*	WG1262278
(S) Nitrobenzene-d5	*67.0*			*30.0-130*		*04/09/2019 14:28*	WG1262278
(S) 2-Fluorobiphenyl	*61.9*			*30.0-130*		*04/09/2019 14:28*	WG1262278
(S) 2,4,6-Tribromophenol	*55.0*			*30.0-130*		*04/09/2019 14:28*	WG1262278
(S) p-Terphenyl-d14	*65.5*			*30.0-130*		*04/09/2019 14:28*	WG1262278

Sample Narrative:

L1083840-04 WG1262278: Dilution due to matrix impact during extract concentration procedure

Calculated Results

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Chromium,Trivalent	109		0.176	1.26	1	04/11/2019 16:26	WG1260035

Total Solids by Method 2540 G-2011

Analyte	Result %	Qualifier	Dilution	Analysis date / time	Batch
Total Solids	79.5		1	04/04/2019 10:39	WG1260177

Wet Chemistry by Method 3060A/7196A

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Chromium,Hexavalent	0.805	J	0.805	2.51	1	04/11/2019 16:26	WG1263590

Mercury by Method 7471B

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Mercury	0.508	J6	0.00352	0.0251	1	04/04/2019 09:52	WG1260270

Metals (ICP) by Method 6010D

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Aluminum	8100		4.40	12.6	1	04/04/2019 13:58	WG1260035
Antimony	2.63		0.943	2.51	1	04/04/2019 13:58	WG1260035
Arsenic	11.5		0.578	2.51	1	04/04/2019 13:58	WG1260035
Barium	176		0.214	0.629	1	04/04/2019 13:58	WG1260035
Beryllium	0.646		0.0880	0.251	1	04/04/2019 13:58	WG1260035
Cadmium	6.02		0.0880	0.629	1	04/04/2019 13:58	WG1260035
Calcium	25300		5.82	126	1	04/04/2019 13:58	WG1260035
Chromium	109		0.176	1.26	1	04/04/2019 13:58	WG1260035
Cobalt	8.98		0.289	1.26	1	04/04/2019 13:58	WG1260035
Copper	93.1		0.666	2.51	1	04/04/2019 13:58	WG1260035
Iron	36700		1.77	12.6	1	04/04/2019 13:58	WG1260035
Lead	552		0.239	0.629	1	04/04/2019 13:58	WG1260035
Magnesium	4580		1.40	126	1	04/04/2019 13:58	WG1260035
Manganese	461		0.151	1.26	1	04/04/2019 13:58	WG1260035
Nickel	28.5		0.616	2.51	1	04/04/2019 13:58	WG1260035
Potassium	976		12.8	126	1	04/04/2019 13:58	WG1260035
Selenium	U		0.780	2.51	1	04/04/2019 13:58	WG1260035
Silver	U		0.151	1.26	1	04/04/2019 13:58	WG1260035
Sodium	208	B	12.4	126	1	04/04/2019 13:58	WG1260035
Thallium	U		0.817	2.51	1	04/04/2019 13:58	WG1260035
Vanadium	35.6		0.302	2.51	1	04/04/2019 13:58	WG1260035
Zinc	557		0.742	6.29	1	04/04/2019 13:58	WG1260035

Semi Volatile Organic Compounds (GC/MS) by Method 8270D

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Anthracene	0.719		0.0915	0.415	10	04/05/2019 11:07	WG1259754
Acenaphthene	0.196	J	0.0927	0.415	10	04/05/2019 11:07	WG1259754
Acenaphthylene	0.686		0.0944	0.415	10	04/05/2019 11:07	WG1259754
Benzo(a)anthracene	3.18		0.0538	0.415	10	04/05/2019 11:07	WG1259754
Benzo(a)pyrene	3.02		0.0631	0.415	10	04/05/2019 11:07	WG1259754
Benzo(b)fluoranthene	4.83		0.0874	0.415	10	04/05/2019 11:07	WG1259754
Benzo(g,h,i)perylene	2.24		0.0906	0.415	10	04/05/2019 11:07	WG1259754

Semi Volatile Organic Compounds (GC/MS) by Method 8270D

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Benzo(k)fluoranthene	1.57		0.0636	0.415	10	04/05/2019 11:07	WG1259754
Chrysene	4.11		0.0987	0.415	10	04/05/2019 11:07	WG1259754
Dibenz(a,h)anthracene	0.684		0.0743	0.415	10	04/05/2019 11:07	WG1259754
Fluoranthene	9.24		0.0890	0.415	10	04/05/2019 11:07	WG1259754
Fluorene	0.360	J	0.0904	0.415	10	04/05/2019 11:07	WG1259754
Indeno(1,2,3-cd)pyrene	2.07		0.0705	0.415	10	04/05/2019 11:07	WG1259754
Naphthalene	0.319	J	0.0645	0.415	10	04/05/2019 11:07	WG1259754
Phenanthrene	6.70		0.0893	0.415	10	04/05/2019 11:07	WG1259754
Pyrene	6.93		0.0976	0.415	10	04/05/2019 11:07	WG1259754
(S) Nitrobenzene-d5	*72.0*			*31.0-146*		*04/05/2019 11:07*	WG1259754
(S) 2-Fluorobiphenyl	*90.4*			*31.0-130*		*04/05/2019 11:07*	WG1259754
(S) p-Terphenyl-d14	*97.9*			*20.0-127*		*04/05/2019 11:07*	WG1259754

Semi Volatile Organic Compounds (GC/MS) by Method 8270D - TENTATIVELY IDENTIFIED COMPOUNDS

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch	CAS #
Total Tic	24200	J N	0.000	0.000	10	04/05/2019 11:07	WG1259754	
Unknown-01	7000	J N	0.000	0.000	10	04/05/2019 11:07	WG1259754	000556-67-2
Benzo[J]Fluoranthene	2800	J N	0.000	0.000	10	04/05/2019 11:07	WG1259754	000205-82-3
1,4-Dichlorobenzene-D4	2640	J N	0.000	0.000	10	04/05/2019 11:07	WG1259754	003855-82-1
Cyclopentasiloxane, Decamethyl-	1500	J N	0.000	0.000	10	04/05/2019 11:07	WG1259754	000541-02-6
9,10-Anthracenedione	1480	J N	0.000	0.000	10	04/05/2019 11:07	WG1259754	000084-65-1
Unknown-04	1270	J N	0.000	0.000	10	04/05/2019 11:07	WG1259754	000779-02-2
Anthracene, 2-Methyl-	1210	J N	0.000	0.000	10	04/05/2019 11:07	WG1259754	000613-12-7
Unknown-03	1050	J N	0.000	0.000	10	04/05/2019 11:07	WG1259754	002531-84-2
Carbazole	847	J N	0.000	0.000	10	04/05/2019 11:07	WG1259754	000086-74-8
9H-Fluoren-9-One	835	J N	0.000	0.000	10	04/05/2019 11:07	WG1259754	000486-25-9
Phenanthrene, 2,5-Dimethyl-	803	J N	0.000	0.000	10	04/05/2019 11:07	WG1259754	003674-66-6
11H-Benzo[B]Fluorene	733	J N	0.000	0.000	10	04/05/2019 11:07	WG1259754	000243-17-4
7H-Benz[De]Anthracen-7-One	720	J N	0.000	0.000	10	04/05/2019 11:07	WG1259754	000082-05-3
Benzo[K]Fluoranthene	702	J N	0.000	0.000	10	04/05/2019 11:07	WG1259754	000207-08-9
Naphthalene, 2-Phenyl-	632	J N	0.000	0.000	10	04/05/2019 11:07	WG1259754	000612-94-2

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Total Solids by Method 2540 G-2011

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	%			date / time	
Total Solids	91.7		1	04/04/2019 10:39	WG1260177

Semi-Volatile Organic Compounds (GC) by Method NJDEP EPH

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
EPH Screen	6090		38.7	2730	5	04/01/2019 20:01	WG1257869
(S) o-Terphenyl	*102*		*33.3*	*40.0-140*		*04/01/2019 20:01*	WG1257869

Total Solids by Method 2540 G-2011

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	%			date / time	
Total Solids	91.5		1	04/04/2019 10:39	WG1260177

Semi-Volatile Organic Compounds (GC) by Method NJDEP EPH

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
EPH Screen	18400	J	970	68300	125	04/06/2019 04:35	WG1259119
(S) o-Terphenyl	*0.000*	*J7*	*833*	*40.0-140*		*04/06/2019 04:35*	*WG1259119*

Sample Narrative:

L1083840-07 WG1259119: Cannot run at lower dilution due to viscosity of extract

Total Solids by Method 2540 G-2011

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	%			date / time	
Total Solids	93.0		1	04/04/2019 13:59	WG1260340

Semi-Volatile Organic Compounds (GC) by Method NJDEP EPH

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
EPH Screen	28700	J	954	67200	125	04/06/2019 04:51	WG1259119
(S) o-Terphenyl	*0.000*	*J7*	*833*	*40.0-140*		*04/06/2019 04:51*	WG1259119

Sample Narrative:

L1083840-08 WG1259119: Cannot run at lower dilution due to viscosity of extract

Total Solids by Method 2540 G-2011

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	%			date / time	
Total Solids	90.3		1	04/04/2019 13:59	WG1260340

Semi-Volatile Organic Compounds (GC) by Method NJDEP EPH

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
EPH Screen	22500	J	984	69200	125	04/06/2019 05:07	WG1259119
(S) o-Terphenyl	*0.000*	*J7*	*833*	*40.0-140*		*04/06/2019 05:07*	WG1259119

Sample Narrative:

L1083840-09 WG1259119: Cannot run at lower dilution due to viscosity of extract

Total Solids by Method 2540 G-2011

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	%			date / time	
Total Solids	92.5		1	04/04/2019 13:59	WG1260340

Wet Chemistry by Method 9012B

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
Cyanide	0.0992	J	0.0422	0.270	1	04/05/2019 14:11	WG1260642

Mercury by Method 7471B

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
Mercury	0.0744		0.00303	0.0216	1	04/04/2019 10:15	WG1260270

Metals (ICP) by Method 6010D

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
Aluminum	4980		3.78	10.8	1	04/04/2019 14:00	WG1260035
Antimony	U		0.811	2.16	1	04/04/2019 14:00	WG1260035
Arsenic	2.52		0.497	2.16	1	04/04/2019 14:00	WG1260035
Barium	29.1		0.184	0.540	1	04/04/2019 14:00	WG1260035
Beryllium	0.273		0.0757	0.216	1	04/04/2019 14:00	WG1260035
Cadmium	0.118	J	0.0757	0.540	1	04/04/2019 14:00	WG1260035
Calcium	23400		5.00	108	1	04/04/2019 14:00	WG1260035
Chromium	23.7		0.151	1.08	1	04/04/2019 14:00	WG1260035
Cobalt	2.62		0.249	1.08	1	04/04/2019 14:00	WG1260035
Copper	11.1		0.573	2.16	1	04/04/2019 14:00	WG1260035
Iron	10600		1.52	10.8	1	04/04/2019 14:00	WG1260035
Lead	46.9		0.205	0.540	1	04/04/2019 14:00	WG1260035
Magnesium	5800		1.20	108	1	04/04/2019 14:00	WG1260035
Manganese	129		0.130	1.08	1	04/04/2019 14:00	WG1260035
Nickel	6.87		0.530	2.16	1	04/04/2019 14:00	WG1260035
Potassium	1190		11.0	108	1	04/04/2019 14:00	WG1260035
Selenium	0.762	J	0.670	2.16	1	04/04/2019 14:00	WG1260035
Silver	U		0.130	1.08	1	04/04/2019 14:00	WG1260035
Sodium	162	B	10.6	108	1	04/04/2019 14:00	WG1260035
Thallium	U		0.703	2.16	1	04/04/2019 14:00	WG1260035
Vanadium	14.3		0.259	2.16	1	04/04/2019 14:00	WG1260035
Zinc	26.3		0.638	5.40	1	04/04/2019 14:00	WG1260035

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

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
Acetone	0.0244	J	0.0108	0.0540	1	04/03/2019 13:55	WG1260000
Benzene	U		0.000292	0.00108	1	04/01/2019 18:30	WG1258825
Bromochloromethane	U		0.000422	0.00108	1	04/01/2019 18:30	WG1258825
Bromodichloromethane	U		0.000275	0.00108	1	04/01/2019 18:30	WG1258825
Bromoform	U		0.000458	0.00108	1	04/01/2019 18:30	WG1258825
Bromomethane	U		0.00145	0.00540	1	04/01/2019 18:30	WG1258825
Carbon disulfide	0.000431	J	0.000239	0.00108	1	04/01/2019 18:30	WG1258825
Carbon tetrachloride	U		0.000355	0.00108	1	04/01/2019 18:30	WG1258825
Chlorobenzene	U		0.000229	0.00108	1	04/01/2019 18:30	WG1258825
Chlorodibromomethane	U		0.000403	0.00108	1	04/01/2019 18:30	WG1258825
Chloroethane	U		0.00102	0.00540	1	04/01/2019 18:30	WG1258825
Chloroform	U		0.000248	0.00540	1	04/01/2019 18:30	WG1258825
Chloromethane	U		0.000405	0.00270	1	04/01/2019 18:30	WG1258825

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

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Cyclohexane	U		0.000378	0.00108	1	04/01/2019 18:30	WG1258825
1,2-Dibromo-3-Chloropropane	U		0.00113	0.00324	1	04/01/2019 18:30	WG1258825
1,2-Dibromoethane	U		0.000371	0.00108	1	04/01/2019 18:30	WG1258825
Dichlorodifluoromethane	U		0.000771	0.00540	1	04/01/2019 18:30	WG1258825
1,1-Dichloroethane	U		0.000215	0.00108	1	04/01/2019 18:30	WG1258825
1,2-Dichloroethane	U		0.000286	0.00108	1	04/01/2019 18:30	WG1258825
1,2-Dichlorobenzene	U		0.000330	0.00108	1	04/01/2019 18:30	WG1258825
1,3-Dichlorobenzene	U		0.000258	0.00108	1	04/01/2019 18:30	WG1258825
1,4-Dichlorobenzene	U		0.000244	0.00108	1	04/01/2019 18:30	WG1258825
1,1-Dichloroethene	U		0.000328	0.00108	1	04/01/2019 18:30	WG1258825
cis-1,2-Dichloroethene	U		0.000254	0.00108	1	04/01/2019 18:30	WG1258825
trans-1,2-Dichloroethene	U		0.000285	0.00108	1	04/01/2019 18:30	WG1258825
1,2-Dichloropropane	U		0.000387	0.00108	1	04/01/2019 18:30	WG1258825
cis-1,3-Dichloropropene	U		0.000283	0.00108	1	04/01/2019 18:30	WG1258825
trans-1,3-Dichloropropene	U		0.000289	0.00108	1	04/01/2019 18:30	WG1258825
Ethylbenzene	U		0.000321	0.00108	1	04/01/2019 18:30	WG1258825
2-Hexanone	U		0.00148	0.0108	1	04/01/2019 18:30	WG1258825
Isopropylbenzene	U		0.000263	0.0108	1	04/01/2019 18:30	WG1258825
2-Butanone (MEK)	U		0.00506	0.0108	1	04/01/2019 18:30	WG1258825
Methyl Acetate	U	J4	0.00659	0.0216	1	04/03/2019 13:55	WG1260000
Methyl Cyclohexane	0.000425	J	0.000411	0.00108	1	04/01/2019 18:30	WG1258825
Methylene Chloride	U		0.00108	0.00540	1	04/01/2019 18:30	WG1258825
4-Methyl-2-pentanone (MIBK)	U		0.00203	0.0108	1	04/01/2019 18:30	WG1258825
Methyl tert-butyl ether	U		0.000229	0.00108	1	04/01/2019 18:30	WG1258825
Styrene	U		0.000253	0.00108	1	04/01/2019 18:30	WG1258825
1,1,2,2-Tetrachloroethane	U		0.000395	0.00108	1	04/01/2019 18:30	WG1258825
Tetrachloroethene	U		0.000298	0.00108	1	04/01/2019 18:30	WG1258825
Toluene	0.000607	J	0.000469	0.00540	1	04/01/2019 18:30	WG1258825
1,2,3-Trichlorobenzene	U		0.000331	0.00108	1	04/01/2019 18:30	WG1258825
1,2,4-Trichlorobenzene	U		0.000419	0.00108	1	04/01/2019 18:30	WG1258825
1,1,1-Trichloroethane	U		0.000309	0.00108	1	04/01/2019 18:30	WG1258825
1,1,2-Trichloroethane	U		0.000299	0.00108	1	04/01/2019 18:30	WG1258825
Trichloroethene	U		0.000302	0.00108	1	04/01/2019 18:30	WG1258825
Trichlorofluoromethane	U		0.000413	0.00540	1	04/01/2019 18:30	WG1258825
1,1,2-Trichlorotrifluoroethane	U		0.000395	0.00108	1	04/01/2019 18:30	WG1258825
Vinyl chloride	U		0.000315	0.00108	1	04/01/2019 18:30	WG1258825
Xylenes, Total	U		0.000754	0.00324	1	04/01/2019 18:30	WG1258825
(S) Toluene-d8	*101*			*75.0-131*		*04/01/2019 18:30*	WG1258825
(S) Toluene-d8	*107*			*75.0-131*		*04/03/2019 13:55*	WG1260000
(S) a,a,a-Trifluorotoluene	*99.8*			*80.0-120*		*04/01/2019 18:30*	WG1258825
(S) a,a,a-Trifluorotoluene	*102*			*80.0-120*		*04/03/2019 13:55*	WG1260000
(S) 4-Bromofluorobenzene	*97.7*			*67.0-138*		*04/01/2019 18:30*	WG1258825
(S) 4-Bromofluorobenzene	*112*			*67.0-138*		*04/03/2019 13:55*	WG1260000
(S) 1,2-Dichloroethane-d4	*107*			*70.0-130*		*04/01/2019 18:30*	WG1258825
(S) 1,2-Dichloroethane-d4	*102*			*70.0-130*		*04/03/2019 13:55*	WG1260000

Volatile Organic Compounds (GC/MS) by Method 8260C - TENTATIVELY IDENTIFIED COMPOUNDS

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch	CAS #
Total Tic	0.000		0.000	0.000	1	04/01/2019 18:30	WG1258825	
Total Tic	0.0150	J N	0.000	0.000	1	04/03/2019 13:55	WG1260000	
Unknown-01	0.0150	J N	0.000	0.000	1	04/03/2019 13:55	WG1260000	000075-21-8

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Pesticides (GC) by Method 8081B

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Aldrin	U		0.00146	0.0216	1	04/04/2019 10:07	WG1260104
Alpha BHC	U		0.00147	0.00270	1	04/04/2019 10:07	WG1260104
Beta BHC	U		0.00173	0.00270	1	04/04/2019 10:07	WG1260104
Delta BHC	U		0.00155	0.0216	1	04/04/2019 10:07	WG1260104
Gamma BHC	U		0.00157	0.00270	1	04/04/2019 10:07	WG1260104
Chlordane	U		0.0422	0.216	1	04/04/2019 10:07	WG1260104
alpha-Chlordane	U		0.00152	0.0216	1	04/04/2019 10:07	WG1260104
gamma-Chlordane	U		0.00212	0.0216	1	04/04/2019 10:07	WG1260104
4,4-DDD	U		0.00169	0.0216	1	04/04/2019 10:07	WG1260104
4,4-DDE	U		0.00166	0.0216	1	04/04/2019 10:07	WG1260104
4,4-DDT	0.00353	J	0.00216	0.0216	1	04/04/2019 10:07	WG1260104
Dieldrin	U		0.00164	0.00324	1	04/04/2019 10:07	WG1260104
Endosulfan I	U		0.00161	0.0216	1	04/04/2019 10:07	WG1260104
Endosulfan II	U		0.00173	0.0216	1	04/04/2019 10:07	WG1260104
Endosulfan sulfate	U		0.00163	0.0216	1	04/04/2019 10:07	WG1260104
Endrin	U		0.00170	0.0216	1	04/04/2019 10:07	WG1260104
Endrin aldehyde	U		0.00139	0.0216	1	04/04/2019 10:07	WG1260104
Endrin ketone	U		0.00178	0.0216	1	04/04/2019 10:07	WG1260104
Hexachlorobenzene	U		0.00134	0.0216	1	04/04/2019 10:07	WG1260104
Heptachlor	U		0.00166	0.0216	1	04/04/2019 10:07	WG1260104
Heptachlor epoxide	U		0.00174	0.0108	1	04/04/2019 10:07	WG1260104
Methoxychlor	U		0.00192	0.0216	1	04/04/2019 10:07	WG1260104
Toxaphene	U		0.0389	0.432	1	04/04/2019 10:07	WG1260104
(S) Decachlorobiphenyl	*70.0*			*30.0-150*		*04/04/2019 10:07*	WG1260104
(S) Tetrachloro-m-xylene	*75.0*			*30.0-150*		*04/04/2019 10:07*	WG1260104

Polychlorinated Biphenyls (GC) by Method 8082 A

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
PCB 1016	U		0.00378	0.0184	1	04/04/2019 13:55	WG1260104
PCB 1221	U		0.00580	0.0184	1	04/04/2019 13:55	WG1260104
PCB 1232	U		0.00451	0.0184	1	04/04/2019 13:55	WG1260104
PCB 1242	U		0.00344	0.0184	1	04/04/2019 13:55	WG1260104
PCB 1248	U		0.00340	0.0184	1	04/04/2019 13:55	WG1260104
PCB 1254	U		0.00510	0.0184	1	04/04/2019 13:55	WG1260104
PCB 1260	U		0.00534	0.0184	1	04/04/2019 13:55	WG1260104
(S) Decachlorobiphenyl	*68.3*			*30.0-150*		*04/04/2019 13:55*	WG1260104
(S) Tetrachloro-m-xylene	*64.3*			*30.0-150*		*04/04/2019 13:55*	WG1260104

Semi Volatile Organic Compounds (GC/MS) by Method 8270D

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Acenaphthene	0.136	J3 J4	0.0138	0.0713	2	04/09/2019 14:09	WG1262278
Acenaphthylene	0.125	J3 J4	0.0145	0.0713	2	04/09/2019 14:09	WG1262278
Acetophenone	U	J3 J4	0.162	0.324	2	04/09/2019 14:09	WG1262278
Anthracene	0.506	J4	0.0136	0.0713	2	04/09/2019 14:09	WG1262278
Atrazine	U		0.203	0.324	2	04/09/2019 14:09	WG1262278
Benzaldehyde	U	J3	0.115	0.324	2	04/09/2019 14:09	WG1262278
Benzo(a)anthracene	1.32		0.00925	0.0713	2	04/09/2019 14:09	WG1262278
Benzo(b)fluoranthene	1.36		0.0150	0.0713	2	04/09/2019 14:09	WG1262278
Benzo(k)fluoranthene	0.484		0.0125	0.0713	2	04/09/2019 14:09	WG1262278
Benzo(g,h,i)perylene	0.570		0.0156	0.0713	2	04/09/2019 14:09	WG1262278
Benzo(a)pyrene	0.958		0.0119	0.0713	2	04/09/2019 14:09	WG1262278
Biphenyl	0.0252	J J3 J4	0.0128	0.324	2	04/09/2019 14:09	WG1262278
Bis(2-chlorethoxy)methane	U	J3 J4	0.0166	0.324	2	04/09/2019 14:09	WG1262278

Semi Volatile Organic Compounds (GC/MS) by Method 8270D

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Bis(2-chloroethyl)ether	U	J3 J4	0.0193	0.324	2	04/09/2019 14:09	WG1262278
Bis(2-chloroisopropyl)ether	U	J3 J4	0.0164	0.324	2	04/09/2019 14:09	WG1262278
4-Bromophenyl-phenylether	U	J4	0.0246	0.324	2	04/09/2019 14:09	WG1262278
Caprolactam	U		0.225	0.324	2	04/09/2019 14:09	WG1262278
Carbazole	0.384		0.0113	0.324	2	04/09/2019 14:09	WG1262278
4-Chloroaniline	U	J3 J4	0.0761	0.324	2	04/09/2019 14:09	WG1262278
2-Chloronaphthalene	U	J3 J4	0.0138	0.0713	2	04/09/2019 14:09	WG1262278
4-Chlorophenyl-phenylether	U	J4	0.0135	0.324	2	04/09/2019 14:09	WG1262278
Chrysene	1.05	J4	0.0120	0.0713	2	04/09/2019 14:09	WG1262278
Dibenz(a,h)anthracene	0.185		0.0177	0.0713	2	04/09/2019 14:09	WG1262278
Dibenzofuran	0.218	J J3 J4	0.0112	0.324	2	04/09/2019 14:09	WG1262278
3,3-Dichlorobenzidine	U		0.172	0.324	2	04/09/2019 14:09	WG1262278
2,4-Dinitrotoluene	U	J4	0.0131	0.324	2	04/09/2019 14:09	WG1262278
2,6-Dinitrotoluene	U	J4	0.0159	0.324	2	04/09/2019 14:09	WG1262278
Fluoranthene	2.90		0.0107	0.0713	2	04/09/2019 14:09	WG1262278
Fluorene	0.214	J4	0.0147	0.0713	2	04/09/2019 14:09	WG1262278
Hexachlorobenzene	U	J4	0.0185	0.324	2	04/09/2019 14:09	WG1262278
Hexachloro-1,3-butadiene	U	J3 J4	0.0216	0.324	2	04/09/2019 14:09	WG1262278
Hexachlorocyclopentadiene	U	J0 J3	0.126	0.324	2	04/09/2019 14:09	WG1262278
Hexachloroethane	U	J3	0.0290	0.324	2	04/09/2019 14:09	WG1262278
Indeno(1,2,3-cd)pyrene	0.692		0.0166	0.0713	2	04/09/2019 14:09	WG1262278
Isophorone	U	J3 J4	0.0112	0.324	2	04/09/2019 14:09	WG1262278
2-Methylnaphthalene	0.0800	J3 J4	0.0186	0.0713	2	04/09/2019 14:09	WG1262278
Naphthalene	0.188	J3 J4	0.0192	0.0713	2	04/09/2019 14:09	WG1262278
2-Nitroaniline	U	J4	0.0163	0.324	2	04/09/2019 14:09	WG1262278
3-Nitroaniline	U	J4	0.0184	0.324	2	04/09/2019 14:09	WG1262278
4-Nitroaniline	U	J4	0.0138	0.324	2	04/09/2019 14:09	WG1262278
Nitrobenzene	U	J3 J4	0.0150	0.324	2	04/09/2019 14:09	WG1262278
n-Nitrosodiphenylamine	U		0.0129	0.324	2	04/09/2019 14:09	WG1262278
n-Nitrosodi-n-propylamine	U	J3 J4	0.0196	0.324	2	04/09/2019 14:09	WG1262278
Phenanthrene	2.71	J4	0.0115	0.0713	2	04/09/2019 14:09	WG1262278
Benzylbutyl phthalate	U		0.0223	0.324	2	04/09/2019 14:09	WG1262278
Bis(2-ethylhexyl)phthalate	0.0826	J	0.0259	0.324	2	04/09/2019 14:09	WG1262278
Di-n-butyl phthalate	0.0334	J	0.0236	0.324	2	04/09/2019 14:09	WG1262278
Diethyl phthalate	U	J4	0.0149	0.324	2	04/09/2019 14:09	WG1262278
Dimethyl phthalate	U	J4	0.0117	0.324	2	04/09/2019 14:09	WG1262278
Di-n-octyl phthalate	U		0.0196	0.324	2	04/09/2019 14:09	WG1262278
Pyrene	2.30		0.0266	0.0713	2	04/09/2019 14:09	WG1262278
1,2,4,5-Tetrachlorobenzene	U	J3 J4	0.164	0.324	2	04/09/2019 14:09	WG1262278
4-Chloro-3-methylphenol	U	J4	0.0103	0.324	2	04/09/2019 14:09	WG1262278
2-Chlorophenol	U	J3 J4	0.0179	0.324	2	04/09/2019 14:09	WG1262278
2-Methylphenol	U	J3 J4	0.0213	0.324	2	04/09/2019 14:09	WG1262278
3&4-Methyl Phenol	U	J3	0.0170	0.324	2	04/09/2019 14:09	WG1262278
2,4-Dichlorophenol	U	J3 J4	0.0161	0.324	2	04/09/2019 14:09	WG1262278
2,4-Dimethylphenol	U	J3 J4	0.102	0.324	2	04/09/2019 14:09	WG1262278
4,6-Dinitro-2-methylphenol	U	J4	0.268	0.432	2	04/09/2019 14:09	WG1262278
2,4-Dinitrophenol	U	J3	0.212	0.432	2	04/09/2019 14:09	WG1262278
2-Nitrophenol	U	J3 J4	0.0281	0.324	2	04/09/2019 14:09	WG1262278
4-Nitrophenol	U		0.113	0.324	2	04/09/2019 14:09	WG1262278
Pentachlorophenol	U		0.104	0.324	2	04/09/2019 14:09	WG1262278
Phenol	U	J3	0.0150	0.324	2	04/09/2019 14:09	WG1262278
2,4,5-Trichlorophenol	U	J4	0.0225	0.324	2	04/09/2019 14:09	WG1262278
2,4,6-Trichlorophenol	U	J3 J4	0.0169	0.324	2	04/09/2019 14:09	WG1262278
(S) 2-Fluorophenol	*61.6*			*30.0-130*		*04/09/2019 14:09*	WG1262278
(S) Phenol-d5	*57.3*			*30.0-130*		*04/09/2019 14:09*	WG1262278
(S) Nitrobenzene-d5	*52.6*			*30.0-130*		*04/09/2019 14:09*	WG1262278

Semi Volatile Organic Compounds (GC/MS) by Method 8270D

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
(S) 2-Fluorobiphenyl	*51.1*			*30.0-130*		*04/09/2019 14:09*	WG1262278
(S) 2,4,6-Tribromophenol	*68.8*			*30.0-130*		*04/09/2019 14:09*	WG1262278
(S) p-Terphenyl-d14	*76.3*			*30.0-130*		*04/09/2019 14:09*	WG1262278

Sample Narrative:

L1083840-10 WG1262278: Dilution due to matrix impact during extract concentration procedure

Semi Volatile Organic Compounds (GC/MS) by Method 8270D - TENTATIVELY IDENTIFIED COMPOUNDS

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch	CAS #
Total Tic	4.80	J N	0.000	0.000	2	04/09/2019 14:09	WG1262278	
Unknown-01	0.921	J N	0.000	0.000	2	04/09/2019 14:09	WG1262278	000123-42-2
Perylene	0.799	J N	0.000	0.000	2	04/09/2019 14:09	WG1262278	000198-55-0
Unknown-07	0.588	J N	0.000	0.000	2	04/09/2019 14:09	WG1262278	000203-64-5
Phenanthrene, 2,5-Dimethyl-	0.304	J N	0.000	0.000	2	04/09/2019 14:09	WG1262278	003674-66-6
Cyclopenta(Def)Phenanthrenone	0.255	J N	0.000	0.000	2	04/09/2019 14:09	WG1262278	005737-13-3
9,10-Anthracenedione	0.251	J N	0.000	0.000	2	04/09/2019 14:09	WG1262278	000084-65-1
Unknown-09	0.249	J N	0.000	0.000	2	04/09/2019 14:09	WG1262278	000214-17-5
9H-Fluoren-9-One	0.240	J N	0.000	0.000	2	04/09/2019 14:09	WG1262278	000486-25-9
Benzo[E]Pyrene	0.223	J N	0.000	0.000	2	04/09/2019 14:09	WG1262278	000192-97-2
Unknown-02	0.210	J N	0.000	0.000	2	04/09/2019 14:09	WG1262278	043183-55-7
Unknown-03	0.185	J N	0.000	0.000	2	04/09/2019 14:09	WG1262278	002216-34-4
Dibenzothiophene	0.160	J N	0.000	0.000	2	04/09/2019 14:09	WG1262278	000132-65-0
Unknown-08	0.155	J N	0.000	0.000	2	04/09/2019 14:09	WG1262278	000000-00-0
1,2:7,8-Dibenzphenanthrene	0.145	J N	0.000	0.000	2	04/09/2019 14:09	WG1262278	000000-00-0
Unknown-05	0.118	J N	0.000	0.000	2	04/09/2019 14:09	WG1262278	001430-97-3

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Total Solids by Method 2540 G-2011

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	%			date / time	
Total Solids	89.2		1	04/04/2019 13:59	WG1260340

Wet Chemistry by Method 9012B

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
Cyanide	0.0850	J	0.0437	0.280	1	04/05/2019 14:12	WG1260642

Mercury by Method 7471B

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
Mercury	0.00618	J	0.00314	0.0224	1	04/04/2019 10:17	WG1260270

Metals (ICP) by Method 6010D

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
Aluminum	6810		3.92	11.2	1	04/04/2019 14:03	WG1260035
Antimony	U		0.841	2.24	1	04/04/2019 14:03	WG1260035
Arsenic	2.05	J	0.516	2.24	1	04/04/2019 14:03	WG1260035
Barium	21.4		0.191	0.561	1	04/04/2019 14:03	WG1260035
Beryllium	0.500		0.0785	0.224	1	04/04/2019 14:03	WG1260035
Cadmium	0.0848	J	0.0785	0.561	1	04/04/2019 14:03	WG1260035
Calcium	441		5.19	112	1	04/04/2019 14:03	WG1260035
Chromium	19.2		0.157	1.12	1	04/04/2019 14:03	WG1260035
Cobalt	4.97		0.258	1.12	1	04/04/2019 14:03	WG1260035
Copper	6.19		0.594	2.24	1	04/04/2019 14:03	WG1260035
Iron	14500		1.58	11.2	1	04/04/2019 14:03	WG1260035
Lead	4.11		0.213	0.561	1	04/04/2019 14:03	WG1260035
Magnesium	1590		1.24	112	1	04/04/2019 14:03	WG1260035
Manganese	152		0.135	1.12	1	04/04/2019 14:03	WG1260035
Nickel	11.6		0.549	2.24	1	04/04/2019 14:03	WG1260035
Potassium	1370		11.4	112	1	04/04/2019 14:03	WG1260035
Selenium	U		0.695	2.24	1	04/04/2019 14:03	WG1260035
Silver	U		0.135	1.12	1	04/04/2019 14:03	WG1260035
Sodium	90.8	B J	11.0	112	1	04/04/2019 14:03	WG1260035
Thallium	U		0.729	2.24	1	04/04/2019 14:03	WG1260035
Vanadium	16.1		0.269	2.24	1	04/04/2019 14:03	WG1260035
Zinc	24.3		0.662	5.61	1	04/04/2019 14:03	WG1260035

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

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
Acetone	U		0.0112	0.0561	1	04/03/2019 14:15	WG1260000
Benzene	U		0.000303	0.00112	1	04/01/2019 18:10	WG1258825
Bromochloromethane	U		0.000437	0.00112	1	04/01/2019 18:10	WG1258825
Bromodichloromethane	U		0.000285	0.00112	1	04/01/2019 18:10	WG1258825
Bromoform	U		0.000475	0.00112	1	04/01/2019 18:10	WG1258825
Bromomethane	U		0.00150	0.00561	1	04/01/2019 18:10	WG1258825
Carbon disulfide	U		0.000248	0.00112	1	04/01/2019 18:10	WG1258825
Carbon tetrachloride	U		0.000368	0.00112	1	04/01/2019 18:10	WG1258825
Chlorobenzene	U		0.000238	0.00112	1	04/01/2019 18:10	WG1258825
Chlorodibromomethane	U		0.000418	0.00112	1	04/01/2019 18:10	WG1258825
Chloroethane	U		0.00106	0.00561	1	04/01/2019 18:10	WG1258825
Chloroform	U		0.000257	0.00561	1	04/01/2019 18:10	WG1258825
Chloromethane	U		0.000421	0.00280	1	04/01/2019 18:10	WG1258825

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

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Cyclohexane	U		0.000392	0.00112	1	04/01/2019 18:10	WG1258825
1,2-Dibromo-3-Chloropropane	U		0.00118	0.00336	1	04/01/2019 18:10	WG1258825
1,2-Dibromoethane	U		0.000385	0.00112	1	04/01/2019 18:10	WG1258825
Dichlorodifluoromethane	U		0.000800	0.00561	1	04/01/2019 18:10	WG1258825
1,1-Dichloroethane	U		0.000223	0.00112	1	04/01/2019 18:10	WG1258825
1,2-Dichloroethane	U		0.000297	0.00112	1	04/01/2019 18:10	WG1258825
1,2-Dichlorobenzene	U		0.000342	0.00112	1	04/01/2019 18:10	WG1258825
1,3-Dichlorobenzene	U		0.000268	0.00112	1	04/01/2019 18:10	WG1258825
1,4-Dichlorobenzene	U		0.000253	0.00112	1	04/01/2019 18:10	WG1258825
1,1-Dichloroethene	U		0.000340	0.00112	1	04/01/2019 18:10	WG1258825
cis-1,2-Dichloroethene	U		0.000264	0.00112	1	04/01/2019 18:10	WG1258825
trans-1,2-Dichloroethene	U		0.000296	0.00112	1	04/01/2019 18:10	WG1258825
1,2-Dichloropropane	U		0.000401	0.00112	1	04/01/2019 18:10	WG1258825
cis-1,3-Dichloropropene	U		0.000294	0.00112	1	04/01/2019 18:10	WG1258825
trans-1,3-Dichloropropene	U		0.000299	0.00112	1	04/01/2019 18:10	WG1258825
Ethylbenzene	U		0.000333	0.00112	1	04/01/2019 18:10	WG1258825
2-Hexanone	U		0.00154	0.0112	1	04/01/2019 18:10	WG1258825
Isopropylbenzene	U		0.000272	0.0112	1	04/01/2019 18:10	WG1258825
2-Butanone (MEK)	U		0.00525	0.0112	1	04/01/2019 18:10	WG1258825
Methyl Acetate	U	J4	0.00684	0.0224	1	04/03/2019 14:15	WG1260000
Methyl Cyclohexane	U		0.000426	0.00112	1	04/01/2019 18:10	WG1258825
Methylene Chloride	U		0.00112	0.00561	1	04/01/2019 18:10	WG1258825
4-Methyl-2-pentanone (MIBK)	U		0.00211	0.0112	1	04/01/2019 18:10	WG1258825
Methyl tert-butyl ether	U		0.000238	0.00112	1	04/01/2019 18:10	WG1258825
Styrene	U		0.000262	0.00112	1	04/01/2019 18:10	WG1258825
1,1,2,2-Tetrachloroethane	U		0.000409	0.00112	1	04/01/2019 18:10	WG1258825
Tetrachloroethene	U		0.000309	0.00112	1	04/01/2019 18:10	WG1258825
Toluene	U		0.000487	0.00561	1	04/01/2019 18:10	WG1258825
1,2,3-Trichlorobenzene	U		0.000343	0.00112	1	04/01/2019 18:10	WG1258825
1,2,4-Trichlorobenzene	U		0.000435	0.00112	1	04/01/2019 18:10	WG1258825
1,1,1-Trichloroethane	U		0.000321	0.00112	1	04/01/2019 18:10	WG1258825
1,1,2-Trichloroethane	U		0.000311	0.00112	1	04/01/2019 18:10	WG1258825
Trichloroethene	U		0.000313	0.00112	1	04/01/2019 18:10	WG1258825
Trichlorofluoromethane	U		0.000428	0.00561	1	04/01/2019 18:10	WG1258825
1,1,2-Trichlorotrifluoroethane	U		0.000409	0.00112	1	04/01/2019 18:10	WG1258825
Vinyl chloride	U		0.000326	0.00112	1	04/01/2019 18:10	WG1258825
Xylenes, Total	U		0.000783	0.00336	1	04/01/2019 18:10	WG1258825
(S) Toluene-d8	*101*			*75.0-131*		*04/01/2019 18:10*	WG1258825
(S) Toluene-d8	*111*			*75.0-131*		*04/03/2019 14:15*	WG1260000
(S) a,a,a-Trifluorotoluene	*102*			*80.0-120*		*04/01/2019 18:10*	WG1258825
(S) a,a,a-Trifluorotoluene	*105*			*80.0-120*		*04/03/2019 14:15*	WG1260000
(S) 4-Bromofluorobenzene	*105*			*67.0-138*		*04/01/2019 18:10*	WG1258825
(S) 4-Bromofluorobenzene	*117*			*67.0-138*		*04/03/2019 14:15*	WG1260000
(S) 1,2-Dichloroethane-d4	*103*			*70.0-130*		*04/01/2019 18:10*	WG1258825
(S) 1,2-Dichloroethane-d4	*105*			*70.0-130*		*04/03/2019 14:15*	WG1260000

Volatile Organic Compounds (GC/MS) by Method 8260C - TENTATIVELY IDENTIFIED COMPOUNDS

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch	CAS #
Total Tic	0.000		0.000	0.000	1	04/01/2019 18:10	WG1258825	
Total Tic	1.43	J N	0.000	0.000	1	04/03/2019 14:15	WG1260000	
Unknown-01	1.43	J N	0.000	0.000	1	04/03/2019 14:15	WG1260000	000075-21-8

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Pesticides (GC) by Method 8081B

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Aldrin	U		0.00151	0.0224	1	04/04/2019 10:20	WG1260104
Alpha BHC	U		0.00153	0.00280	1	04/04/2019 10:20	WG1260104
Beta BHC	U		0.00179	0.00280	1	04/04/2019 10:20	WG1260104
Delta BHC	U		0.00160	0.0224	1	04/04/2019 10:20	WG1260104
Gamma BHC	U		0.00163	0.00280	1	04/04/2019 10:20	WG1260104
Chlordane	U		0.0437	0.224	1	04/04/2019 10:20	WG1260104
alpha-Chlordane	U		0.00158	0.0224	1	04/04/2019 10:20	WG1260104
gamma-Chlordane	U		0.00220	0.0224	1	04/04/2019 10:20	WG1260104
4,4-DDD	U		0.00175	0.0224	1	04/04/2019 10:20	WG1260104
4,4-DDE	U		0.00173	0.0224	1	04/04/2019 10:20	WG1260104
4,4-DDT	U		0.00224	0.0224	1	04/04/2019 10:20	WG1260104
Dieldrin	U		0.00170	0.00336	1	04/04/2019 10:20	WG1260104
Endosulfan I	U		0.00167	0.0224	1	04/04/2019 10:20	WG1260104
Endosulfan II	U		0.00179	0.0224	1	04/04/2019 10:20	WG1260104
Endosulfan sulfate	U		0.00169	0.0224	1	04/04/2019 10:20	WG1260104
Endrin	U		0.00176	0.0224	1	04/04/2019 10:20	WG1260104
Endrin aldehyde	U		0.00145	0.0224	1	04/04/2019 10:20	WG1260104
Endrin ketone	U		0.00185	0.0224	1	04/04/2019 10:20	WG1260104
Hexachlorobenzene	U		0.00139	0.0224	1	04/04/2019 10:20	WG1260104
Heptachlor	U		0.00173	0.0224	1	04/04/2019 10:20	WG1260104
Heptachlor epoxide	U		0.00181	0.0112	1	04/04/2019 10:20	WG1260104
Methoxychlor	U		0.00200	0.0224	1	04/04/2019 10:20	WG1260104
Toxaphene	U		0.0404	0.449	1	04/04/2019 10:20	WG1260104
(S) Decachlorobiphenyl	*73.2*			*30.0-150*		*04/04/2019 10:20*	WG1260104
(S) Tetrachloro-m-xylene	*89.0*			*30.0-150*		*04/04/2019 10:20*	WG1260104

Polychlorinated Biphenyls (GC) by Method 8082 A

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
PCB 1016	U		0.00392	0.0191	1	04/04/2019 14:09	WG1260104
PCB 1221	U		0.00602	0.0191	1	04/04/2019 14:09	WG1260104
PCB 1232	U		0.00468	0.0191	1	04/04/2019 14:09	WG1260104
PCB 1242	U		0.00357	0.0191	1	04/04/2019 14:09	WG1260104
PCB 1248	U		0.00353	0.0191	1	04/04/2019 14:09	WG1260104
PCB 1254	U		0.00529	0.0191	1	04/04/2019 14:09	WG1260104
PCB 1260	U		0.00554	0.0191	1	04/04/2019 14:09	WG1260104
(S) Decachlorobiphenyl	*79.0*			*30.0-150*		*04/04/2019 14:09*	WG1260104
(S) Tetrachloro-m-xylene	*75.3*			*30.0-150*		*04/04/2019 14:09*	WG1260104

Semi Volatile Organic Compounds (GC/MS) by Method 8270D

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Acenaphthene	U	J3 J4	0.00720	0.0370	1	04/09/2019 10:33	WG1262278
Acenaphthylene	U	J3 J4	0.00752	0.0370	1	04/09/2019 10:33	WG1262278
Acetophenone	U	J3 J4	0.0843	0.168	1	04/09/2019 10:33	WG1262278
Anthracene	U	J4	0.00709	0.0370	1	04/09/2019 10:33	WG1262278
Atrazine	U		0.105	0.168	1	04/09/2019 10:33	WG1262278
Benzaldehyde	U	J3	0.0597	0.168	1	04/09/2019 10:33	WG1262278
Benzo(a)anthracene	U		0.00480	0.0370	1	04/09/2019 10:33	WG1262278
Benzo(b)fluoranthene	U		0.00779	0.0370	1	04/09/2019 10:33	WG1262278
Benzo(k)fluoranthene	U		0.00653	0.0370	1	04/09/2019 10:33	WG1262278
Benzo(g,h,i)perylene	U		0.00808	0.0370	1	04/09/2019 10:33	WG1262278
Benzo(a)pyrene	U		0.00614	0.0370	1	04/09/2019 10:33	WG1262278
Biphenyl	U	J3 J4	0.00659	0.168	1	04/09/2019 10:33	WG1262278
Bis(2-chlorethoxy)methane	U	J3 J4	0.00863	0.168	1	04/09/2019 10:33	WG1262278

Semi Volatile Organic Compounds (GC/MS) by Method 8270D

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Bis(2-chloroethyl)ether	U	J3 J4	0.0100	0.168	1	04/09/2019 10:33	WG1262278
Bis(2-chloroisopropyl)ether	U	J3 J4	0.00852	0.168	1	04/09/2019 10:33	WG1262278
4-Bromophenyl-phenylether	U	J4	0.0128	0.168	1	04/09/2019 10:33	WG1262278
Caprolactam	U		0.117	0.168	1	04/09/2019 10:33	WG1262278
Carbazole	U		0.00588	0.168	1	04/09/2019 10:33	WG1262278
4-Chloroaniline	U	J3 J4	0.0395	0.168	1	04/09/2019 10:33	WG1262278
2-Chloronaphthalene	U	J3 J4	0.00717	0.0370	1	04/09/2019 10:33	WG1262278
4-Chlorophenyl-phenylether	U	J4	0.00703	0.168	1	04/09/2019 10:33	WG1262278
Chrysene	U	J4	0.00622	0.0370	1	04/09/2019 10:33	WG1262278
Dibenz(a,h)anthracene	U		0.00921	0.0370	1	04/09/2019 10:33	WG1262278
Dibenzofuran	U	J3 J4	0.00581	0.168	1	04/09/2019 10:33	WG1262278
3,3-Dichlorobenzidine	U		0.0890	0.168	1	04/09/2019 10:33	WG1262278
2,4-Dinitrotoluene	U	J4	0.00681	0.168	1	04/09/2019 10:33	WG1262278
2,6-Dinitrotoluene	U	J4	0.00826	0.168	1	04/09/2019 10:33	WG1262278
Fluoranthene	U		0.00556	0.0370	1	04/09/2019 10:33	WG1262278
Fluorene	U	J4	0.00765	0.0370	1	04/09/2019 10:33	WG1262278
Hexachlorobenzene	U	J4	0.00960	0.168	1	04/09/2019 10:33	WG1262278
Hexachloro-1,3-butadiene	U	J3 J4	0.0112	0.168	1	04/09/2019 10:33	WG1262278
Hexachlorocyclopentadiene	U	J0 J3	0.0658	0.168	1	04/09/2019 10:33	WG1262278
Hexachloroethane	U	J3	0.0150	0.168	1	04/09/2019 10:33	WG1262278
Indeno(1,2,3-cd)pyrene	U		0.00866	0.0370	1	04/09/2019 10:33	WG1262278
Isophorone	U	J3 J4	0.00585	0.168	1	04/09/2019 10:33	WG1262278
2-Methylnaphthalene	U	J3 J4	0.00965	0.0370	1	04/09/2019 10:33	WG1262278
Naphthalene	U	J3 J4	0.00997	0.0370	1	04/09/2019 10:33	WG1262278
2-Nitroaniline	U	J4	0.00847	0.168	1	04/09/2019 10:33	WG1262278
3-Nitroaniline	U	J4	0.00953	0.168	1	04/09/2019 10:33	WG1262278
4-Nitroaniline	U	J4	0.00717	0.168	1	04/09/2019 10:33	WG1262278
Nitrobenzene	U	J3 J4	0.00779	0.168	1	04/09/2019 10:33	WG1262278
n-Nitrosodiphenylamine	U		0.00666	0.168	1	04/09/2019 10:33	WG1262278
n-Nitrosodi-n-propylamine	U	J3 J4	0.0102	0.168	1	04/09/2019 10:33	WG1262278
Phenanthrene	U	J4	0.00592	0.0370	1	04/09/2019 10:33	WG1262278
Benzylbutyl phthalate	U		0.0115	0.168	1	04/09/2019 10:33	WG1262278
Bis(2-ethylhexyl)phthalate	U		0.0135	0.168	1	04/09/2019 10:33	WG1262278
Di-n-butyl phthalate	U		0.0122	0.168	1	04/09/2019 10:33	WG1262278
Diethyl phthalate	U	J4	0.00775	0.168	1	04/09/2019 10:33	WG1262278
Dimethyl phthalate	U	J4	0.00606	0.168	1	04/09/2019 10:33	WG1262278
Di-n-octyl phthalate	U		0.0102	0.168	1	04/09/2019 10:33	WG1262278
Pyrene	U		0.0138	0.0370	1	04/09/2019 10:33	WG1262278
1,2,4,5-Tetrachlorobenzene	U	J3 J4	0.0854	0.168	1	04/09/2019 10:33	WG1262278
4-Chloro-3-methylphenol	U	J4	0.00535	0.168	1	04/09/2019 10:33	WG1262278
2-Chlorophenol	U	J3 J4	0.00932	0.168	1	04/09/2019 10:33	WG1262278
2-Methylphenol	U	J3 J4	0.0111	0.168	1	04/09/2019 10:33	WG1262278
3&4-Methyl Phenol	U	J3	0.00878	0.168	1	04/09/2019 10:33	WG1262278
2,4-Dichlorophenol	U	J3 J4	0.00837	0.168	1	04/09/2019 10:33	WG1262278
2,4-Dimethylphenol	U	J3 J4	0.0528	0.168	1	04/09/2019 10:33	WG1262278
4,6-Dinitro-2-methylphenol	U	J4	0.139	0.224	1	04/09/2019 10:33	WG1262278
2,4-Dinitrophenol	U	J3	0.110	0.224	1	04/09/2019 10:33	WG1262278
2-Nitrophenol	U	J3 J4	0.0146	0.168	1	04/09/2019 10:33	WG1262278
4-Nitrophenol	U		0.0589	0.168	1	04/09/2019 10:33	WG1262278
Pentachlorophenol	U		0.0538	0.168	1	04/09/2019 10:33	WG1262278
Phenol	U	J3	0.00779	0.168	1	04/09/2019 10:33	WG1262278
2,4,5-Trichlorophenol	U	J4	0.0117	0.168	1	04/09/2019 10:33	WG1262278
2,4,6-Trichlorophenol	U	J3 J4	0.00874	0.168	1	04/09/2019 10:33	WG1262278
(S) 2-Fluorophenol	*51.2*			*30.0-130*		*04/09/2019 10:33*	WG1262278
(S) Phenol-d5	*51.8*			*30.0-130*		*04/09/2019 10:33*	WG1262278
(S) Nitrobenzene-d5	*40.2*			*30.0-130*		*04/09/2019 10:33*	WG1262278

Semi Volatile Organic Compounds (GC/MS) by Method 8270D

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
(S) 2-Fluorobiphenyl	*40.2*			*30.0-130*		*04/09/2019 10:33*	WG1262278
(S) 2,4,6-Tribromophenol	*51.8*			*30.0-130*		*04/09/2019 10:33*	WG1262278
(S) p-Terphenyl-d14	*64.0*			*30.0-130*		*04/09/2019 10:33*	WG1262278

Semi Volatile Organic Compounds (GC/MS) by Method 8270D - TENTATIVELY IDENTIFIED COMPOUNDS

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch	CAS #
Total Tic	0.0648	J N	0.000	0.000	1	04/09/2019 10:33	WG1262278	
Unknown-01	0.0648	J N	0.000	0.000	1	04/09/2019 10:33	WG1262278	043183-55-7

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Total Solids by Method 2540 G-2011

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	%			date / time	
Total Solids	89.1		1	04/04/2019 13:59	WG1260340

Wet Chemistry by Method 9012B

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
Cyanide	0.116	J P1	0.0438	0.281	1	04/05/2019 14:13	WG1260642

Mercury by Method 7471B

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
Mercury	0.0109	J	0.00314	0.0224	1	04/04/2019 10:20	WG1260270

Metals (ICP) by Method 6010D

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
Aluminum	3970		3.93	11.2	1	04/04/2019 16:25	WG1260035
Antimony	U		0.842	2.24	1	04/04/2019 16:25	WG1260035
Arsenic	2.28		0.516	2.24	1	04/04/2019 16:25	WG1260035
Barium	16.4		0.191	0.561	1	04/04/2019 16:25	WG1260035
Beryllium	0.332		0.0786	0.224	1	04/04/2019 16:25	WG1260035
Cadmium	U		0.0786	0.561	1	04/04/2019 16:25	WG1260035
Calcium	314		5.20	112	1	04/04/2019 16:25	WG1260035
Chromium	13.4		0.157	1.12	1	04/04/2019 16:25	WG1260035
Cobalt	2.76		0.258	1.12	1	04/04/2019 16:25	WG1260035
Copper	4.38		0.595	2.24	1	04/04/2019 16:25	WG1260035
Iron	10300		1.58	11.2	1	04/04/2019 16:25	WG1260035
Lead	2.75		0.213	0.561	1	04/04/2019 16:25	WG1260035
Magnesium	818		1.25	112	1	04/04/2019 16:25	WG1260035
Manganese	79.9		0.135	1.12	1	04/04/2019 16:25	WG1260035
Nickel	5.38		0.550	2.24	1	04/04/2019 16:25	WG1260035
Potassium	989		11.4	112	1	04/04/2019 16:25	WG1260035
Selenium	U		0.696	2.24	1	04/04/2019 16:25	WG1260035
Silver	U		0.135	1.12	1	04/04/2019 16:25	WG1260035
Sodium	70.6	B J	11.1	112	1	04/04/2019 16:25	WG1260035
Thallium	U		0.730	2.24	1	04/04/2019 16:25	WG1260035
Vanadium	12.1		0.269	2.24	1	04/04/2019 16:25	WG1260035
Zinc	16.8		0.662	5.61	1	04/04/2019 16:25	WG1260035

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

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
Acetone	U		0.0117	0.0584	1.04	04/03/2019 14:35	WG1260000
Benzene	U		0.000303	0.00112	1	04/01/2019 18:50	WG1258825
Bromochloromethane	U		0.000438	0.00112	1	04/01/2019 18:50	WG1258825
Bromodichloromethane	U		0.000285	0.00112	1	04/01/2019 18:50	WG1258825
Bromoform	U		0.000476	0.00112	1	04/01/2019 18:50	WG1258825
Bromomethane	U		0.00150	0.00561	1	04/01/2019 18:50	WG1258825
Carbon disulfide	U		0.000248	0.00112	1	04/01/2019 18:50	WG1258825
Carbon tetrachloride	U		0.000368	0.00112	1	04/01/2019 18:50	WG1258825
Chlorobenzene	U		0.000238	0.00112	1	04/01/2019 18:50	WG1258825
Chlorodibromomethane	U		0.000419	0.00112	1	04/01/2019 18:50	WG1258825
Chloroethane	U		0.00106	0.00561	1	04/01/2019 18:50	WG1258825
Chloroform	U		0.000257	0.00561	1	04/01/2019 18:50	WG1258825
Chloromethane	U		0.000421	0.00281	1	04/01/2019 18:50	WG1258825

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

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Cyclohexane	U		0.000393	0.00112	1	04/01/2019 18:50	WG1258825
1,2-Dibromo-3-Chloropropane	U		0.00118	0.00337	1	04/01/2019 18:50	WG1258825
1,2-Dibromoethane	U		0.000385	0.00112	1	04/01/2019 18:50	WG1258825
Dichlorodifluoromethane	U		0.000800	0.00561	1	04/01/2019 18:50	WG1258825
1,1-Dichloroethane	U		0.000223	0.00112	1	04/01/2019 18:50	WG1258825
1,2-Dichloroethane	U		0.000297	0.00112	1	04/01/2019 18:50	WG1258825
1,2-Dichlorobenzene	U		0.000342	0.00112	1	04/01/2019 18:50	WG1258825
1,3-Dichlorobenzene	U		0.000268	0.00112	1	04/01/2019 18:50	WG1258825
1,4-Dichlorobenzene	U		0.000254	0.00112	1	04/01/2019 18:50	WG1258825
1,1-Dichloroethene	U		0.000340	0.00112	1	04/01/2019 18:50	WG1258825
cis-1,2-Dichloroethene	U		0.000264	0.00112	1	04/01/2019 18:50	WG1258825
trans-1,2-Dichloroethene	U		0.000296	0.00112	1	04/01/2019 18:50	WG1258825
1,2-Dichloropropane	U		0.000402	0.00112	1	04/01/2019 18:50	WG1258825
cis-1,3-Dichloropropene	U		0.000294	0.00112	1	04/01/2019 18:50	WG1258825
trans-1,3-Dichloropropene	U		0.000300	0.00112	1	04/01/2019 18:50	WG1258825
Ethylbenzene	U		0.000333	0.00112	1	04/01/2019 18:50	WG1258825
2-Hexanone	U		0.00154	0.0112	1	04/01/2019 18:50	WG1258825
Isopropylbenzene	U		0.000273	0.0112	1	04/01/2019 18:50	WG1258825
2-Butanone (MEK)	U		0.00525	0.0112	1	04/01/2019 18:50	WG1258825
Methyl Acetate	U	J4	0.00712	0.0233	1.04	04/03/2019 14:35	WG1260000
Methyl Cyclohexane	U		0.000426	0.00112	1	04/01/2019 18:50	WG1258825
Methylene Chloride	U		0.00112	0.00561	1	04/01/2019 18:50	WG1258825
4-Methyl-2-pentanone (MIBK)	U		0.00211	0.0112	1	04/01/2019 18:50	WG1258825
Methyl tert-butyl ether	U		0.000238	0.00112	1	04/01/2019 18:50	WG1258825
Styrene	U		0.000263	0.00112	1	04/01/2019 18:50	WG1258825
1,1,2,2-Tetrachloroethane	U		0.000410	0.00112	1	04/01/2019 18:50	WG1258825
Tetrachloroethene	U		0.000310	0.00112	1	04/01/2019 18:50	WG1258825
Toluene	U		0.000487	0.00561	1	04/01/2019 18:50	WG1258825
1,2,3-Trichlorobenzene	U		0.000343	0.00112	1	04/01/2019 18:50	WG1258825
1,2,4-Trichlorobenzene	U		0.000435	0.00112	1	04/01/2019 18:50	WG1258825
1,1,1-Trichloroethane	U		0.000321	0.00112	1	04/01/2019 18:50	WG1258825
1,1,2-Trichloroethane	U		0.000311	0.00112	1	04/01/2019 18:50	WG1258825
Trichloroethene	U		0.000313	0.00112	1	04/01/2019 18:50	WG1258825
Trichlorofluoromethane	U		0.000429	0.00561	1	04/01/2019 18:50	WG1258825
1,1,2-Trichlorotrifluoroethane	U		0.000410	0.00112	1	04/01/2019 18:50	WG1258825
Vinyl chloride	U		0.000327	0.00112	1	04/01/2019 18:50	WG1258825
Xylenes, Total	U		0.000783	0.00337	1	04/01/2019 18:50	WG1258825
(S) Toluene-d8	*102*			*75.0-131*		*04/01/2019 18:50*	WG1258825
(S) Toluene-d8	*114*			*75.0-131*		*04/03/2019 14:35*	WG1260000
(S) a,a,a-Trifluorotoluene	*101*			*80.0-120*		*04/01/2019 18:50*	WG1258825
(S) a,a,a-Trifluorotoluene	*103*			*80.0-120*		*04/03/2019 14:35*	WG1260000
(S) 4-Bromofluorobenzene	*106*			*67.0-138*		*04/01/2019 18:50*	WG1258825
(S) 4-Bromofluorobenzene	*109*			*67.0-138*		*04/03/2019 14:35*	WG1260000
(S) 1,2-Dichloroethane-d4	*104*			*70.0-130*		*04/01/2019 18:50*	WG1258825
(S) 1,2-Dichloroethane-d4	*106*			*70.0-130*		*04/03/2019 14:35*	WG1260000

Volatile Organic Compounds (GC/MS) by Method 8260C - TENTATIVELY IDENTIFIED COMPOUNDS

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch	CAS #
Total Tic	0.000		0.000	0.000	1	04/01/2019 18:50	WG1258825	
Total Tic	0.000		0.000	0.000	1.04	04/03/2019 14:35	WG1260000	

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Pesticides (GC) by Method 8081B

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Aldrin	U		0.00152	0.0224	1	04/04/2019 10:32	WG1260104
Alpha BHC	U		0.00153	0.00281	1	04/04/2019 10:32	WG1260104
Beta BHC	U		0.00180	0.00281	1	04/04/2019 10:32	WG1260104
Delta BHC	U		0.00160	0.0224	1	04/04/2019 10:32	WG1260104
Gamma BHC	U		0.00163	0.00281	1	04/04/2019 10:32	WG1260104
Chlordane	U		0.0438	0.224	1	04/04/2019 10:32	WG1260104
alpha-Chlordane	U		0.00158	0.0224	1	04/04/2019 10:32	WG1260104
gamma-Chlordane	U		0.00220	0.0224	1	04/04/2019 10:32	WG1260104
4,4-DDD	U		0.00175	0.0224	1	04/04/2019 10:32	WG1260104
4,4-DDE	U		0.00173	0.0224	1	04/04/2019 10:32	WG1260104
4,4-DDT	U		0.00224	0.0224	1	04/04/2019 10:32	WG1260104
Dieldrin	U		0.00171	0.00337	1	04/04/2019 10:32	WG1260104
Endosulfan I	U		0.00167	0.0224	1	04/04/2019 10:32	WG1260104
Endosulfan II	U		0.00180	0.0224	1	04/04/2019 10:32	WG1260104
Endosulfan sulfate	U		0.00169	0.0224	1	04/04/2019 10:32	WG1260104
Endrin	U		0.00176	0.0224	1	04/04/2019 10:32	WG1260104
Endrin aldehyde	U		0.00145	0.0224	1	04/04/2019 10:32	WG1260104
Endrin ketone	U		0.00185	0.0224	1	04/04/2019 10:32	WG1260104
Hexachlorobenzene	U		0.00139	0.0224	1	04/04/2019 10:32	WG1260104
Heptachlor	U		0.00173	0.0224	1	04/04/2019 10:32	WG1260104
Heptachlor epoxide	U		0.00181	0.0112	1	04/04/2019 10:32	WG1260104
Methoxychlor	U		0.00200	0.0224	1	04/04/2019 10:32	WG1260104
Toxaphene	U		0.0404	0.449	1	04/04/2019 10:32	WG1260104
(S) Decachlorobiphenyl	*70.4*			*30.0-150*		*04/04/2019 10:32*	WG1260104
(S) Tetrachloro-m-xylene	*85.5*			*30.0-150*		*04/04/2019 10:32*	WG1260104

Polychlorinated Biphenyls (GC) by Method 8082 A

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
PCB 1016	U		0.00393	0.0191	1	04/04/2019 14:24	WG1260104
PCB 1221	U		0.00603	0.0191	1	04/04/2019 14:24	WG1260104
PCB 1232	U		0.00468	0.0191	1	04/04/2019 14:24	WG1260104
PCB 1242	U		0.00357	0.0191	1	04/04/2019 14:24	WG1260104
PCB 1248	U		0.00354	0.0191	1	04/04/2019 14:24	WG1260104
PCB 1254	U		0.00530	0.0191	1	04/04/2019 14:24	WG1260104
PCB 1260	U		0.00554	0.0191	1	04/04/2019 14:24	WG1260104
(S) Decachlorobiphenyl	*76.4*			*30.0-150*		*04/04/2019 14:24*	WG1260104
(S) Tetrachloro-m-xylene	*72.5*			*30.0-150*		*04/04/2019 14:24*	WG1260104

Semi Volatile Organic Compounds (GC/MS) by Method 8270D

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Acenaphthene	U	J3 J4	0.00721	0.0370	1	04/09/2019 11:51	WG1262278
Acenaphthylene	U	J3 J4	0.00753	0.0370	1	04/09/2019 11:51	WG1262278
Acetophenone	U	J3 J4	0.0844	0.168	1	04/09/2019 11:51	WG1262278
Anthracene	U	J4	0.00709	0.0370	1	04/09/2019 11:51	WG1262278
Atrazine	U		0.105	0.168	1	04/09/2019 11:51	WG1262278
Benzaldehyde	U	J3	0.0597	0.168	1	04/09/2019 11:51	WG1262278
Benzo(a)anthracene	0.00579	J	0.00480	0.0370	1	04/09/2019 11:51	WG1262278
Benzo(b)fluoranthene	U		0.00780	0.0370	1	04/09/2019 11:51	WG1262278
Benzo(k)fluoranthene	U		0.00653	0.0370	1	04/09/2019 11:51	WG1262278
Benzo(g,h,i)perylene	U		0.00809	0.0370	1	04/09/2019 11:51	WG1262278
Benzo(a)pyrene	U		0.00615	0.0370	1	04/09/2019 11:51	WG1262278
Biphenyl	U	J3 J4	0.00660	0.168	1	04/09/2019 11:51	WG1262278
Bis(2-chlorethoxy)methane	U	J3 J4	0.00864	0.168	1	04/09/2019 11:51	WG1262278

Semi Volatile Organic Compounds (GC/MS) by Method 8270D

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Bis(2-chloroethyl)ether	U	J3 J4	0.0101	0.168	1	04/09/2019 11:51	WG1262278
Bis(2-chloroisopropyl)ether	U	J3 J4	0.00853	0.168	1	04/09/2019 11:51	WG1262278
4-Bromophenyl-phenylether	U	J4	0.0128	0.168	1	04/09/2019 11:51	WG1262278
Caprolactam	U		0.117	0.168	1	04/09/2019 11:51	WG1262278
Carbazole	U		0.00588	0.168	1	04/09/2019 11:51	WG1262278
4-Chloroaniline	U	J3 J4	0.0395	0.168	1	04/09/2019 11:51	WG1262278
2-Chloronaphthalene	U	J3 J4	0.00717	0.0370	1	04/09/2019 11:51	WG1262278
4-Chlorophenyl-phenylether	U	J4	0.00704	0.168	1	04/09/2019 11:51	WG1262278
Chrysene	U	J4	0.00623	0.0370	1	04/09/2019 11:51	WG1262278
Dibenz(a,h)anthracene	U		0.00921	0.0370	1	04/09/2019 11:51	WG1262278
Dibenzofuran	U	J3 J4	0.00581	0.168	1	04/09/2019 11:51	WG1262278
3,3-Dichlorobenzidine	U		0.0891	0.168	1	04/09/2019 11:51	WG1262278
2,4-Dinitrotoluene	U	J4	0.00681	0.168	1	04/09/2019 11:51	WG1262278
2,6-Dinitrotoluene	U	J4	0.00827	0.168	1	04/09/2019 11:51	WG1262278
Fluoranthene	0.00788	J	0.00557	0.0370	1	04/09/2019 11:51	WG1262278
Fluorene	U	J4	0.00765	0.0370	1	04/09/2019 11:51	WG1262278
Hexachlorobenzene	U	J4	0.00961	0.168	1	04/09/2019 11:51	WG1262278
Hexachloro-1,3-butadiene	U	J3 J4	0.0112	0.168	1	04/09/2019 11:51	WG1262278
Hexachlorocyclopentadiene	U	J0 J3	0.0659	0.168	1	04/09/2019 11:51	WG1262278
Hexachloroethane	U	J3	0.0150	0.168	1	04/09/2019 11:51	WG1262278
Indeno(1,2,3-cd)pyrene	U		0.00866	0.0370	1	04/09/2019 11:51	WG1262278
Isophorone	U	J3 J4	0.00586	0.168	1	04/09/2019 11:51	WG1262278
2-Methylnaphthalene	U	J3 J4	0.00966	0.0370	1	04/09/2019 11:51	WG1262278
Naphthalene	U	J3 J4	0.00998	0.0370	1	04/09/2019 11:51	WG1262278
2-Nitroaniline	U	J4	0.00847	0.168	1	04/09/2019 11:51	WG1262278
3-Nitroaniline	U	J4	0.00954	0.168	1	04/09/2019 11:51	WG1262278
4-Nitroaniline	U	J4	0.00717	0.168	1	04/09/2019 11:51	WG1262278
Nitrobenzene	U	J3 J4	0.00780	0.168	1	04/09/2019 11:51	WG1262278
n-Nitrosodiphenylamine	U		0.00667	0.168	1	04/09/2019 11:51	WG1262278
n-Nitrosodi-n-propylamine	U	J3 J4	0.0102	0.168	1	04/09/2019 11:51	WG1262278
Phenanthrene	U	J4	0.00593	0.0370	1	04/09/2019 11:51	WG1262278
Benzylbutyl phthalate	U		0.0116	0.168	1	04/09/2019 11:51	WG1262278
Bis(2-ethylhexyl)phthalate	U		0.0135	0.168	1	04/09/2019 11:51	WG1262278
Di-n-butyl phthalate	U		0.0122	0.168	1	04/09/2019 11:51	WG1262278
Diethyl phthalate	U	J4	0.00776	0.168	1	04/09/2019 11:51	WG1262278
Dimethyl phthalate	U	J4	0.00606	0.168	1	04/09/2019 11:51	WG1262278
Di-n-octyl phthalate	U		0.0102	0.168	1	04/09/2019 11:51	WG1262278
Pyrene	U		0.0138	0.0370	1	04/09/2019 11:51	WG1262278
1,2,4,5-Tetrachlorobenzene	U	J3 J4	0.0855	0.168	1	04/09/2019 11:51	WG1262278
4-Chloro-3-methylphenol	U	J4	0.00535	0.168	1	04/09/2019 11:51	WG1262278
2-Chlorophenol	U	J3 J4	0.00933	0.168	1	04/09/2019 11:51	WG1262278
2-Methylphenol	U	J3 J4	0.0111	0.168	1	04/09/2019 11:51	WG1262278
3&4-Methyl Phenol	U	J3	0.00879	0.168	1	04/09/2019 11:51	WG1262278
2,4-Dichlorophenol	U	J3 J4	0.00837	0.168	1	04/09/2019 11:51	WG1262278
2,4-Dimethylphenol	U	J3 J4	0.0529	0.168	1	04/09/2019 11:51	WG1262278
4,6-Dinitro-2-methylphenol	U	J4	0.139	0.224	1	04/09/2019 11:51	WG1262278
2,4-Dinitrophenol	U	J3	0.110	0.224	1	04/09/2019 11:51	WG1262278
2-Nitrophenol	U	J3 J4	0.0146	0.168	1	04/09/2019 11:51	WG1262278
4-Nitrophenol	U		0.0589	0.168	1	04/09/2019 11:51	WG1262278
Pentachlorophenol	U		0.0539	0.168	1	04/09/2019 11:51	WG1262278
Phenol	U	J3	0.00780	0.168	1	04/09/2019 11:51	WG1262278
2,4,5-Trichlorophenol	U	J4	0.0117	0.168	1	04/09/2019 11:51	WG1262278
2,4,6-Trichlorophenol	U	J3 J4	0.00874	0.168	1	04/09/2019 11:51	WG1262278
(S) 2-Fluorophenol	*62.5*			*30.0-130*		*04/09/2019 11:51*	WG1262278
(S) Phenol-d5	*57.5*			*30.0-130*		*04/09/2019 11:51*	WG1262278
(S) Nitrobenzene-d5	*51.4*			*30.0-130*		*04/09/2019 11:51*	WG1262278

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Semi Volatile Organic Compounds (GC/MS) by Method 8270D

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
(S) 2-Fluorobiphenyl	*52.9*			*30.0-130*		*04/09/2019 11:51*	WG1262278
(S) 2,4,6-Tribromophenol	*47.1*			*30.0-130*		*04/09/2019 11:51*	WG1262278
(S) p-Terphenyl-d14	*67.9*			*30.0-130*		*04/09/2019 11:51*	WG1262278

Semi Volatile Organic Compounds (GC/MS) by Method 8270D - TENTATIVELY IDENTIFIED COMPOUNDS

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch	CAS #
Total Tic	0.701	J N	0.000	0.000	1	04/09/2019 11:51	WG1262278	
Unknown-01	0.418	J N	0.000	0.000	1	04/09/2019 11:51	WG1262278	000123-42-2
Unknown-04	0.122	J N	0.000	0.000	1	04/09/2019 11:51	WG1262278	001069-53-0
Unknown-05	0.0863	J N	0.000	0.000	1	04/09/2019 11:51	WG1262278	004733-39-5
Unknown-03	0.0455	J N	0.000	0.000	1	04/09/2019 11:51	WG1262278	031230-17-8
Unknown-02	0.0296	J N	0.000	0.000	1	04/09/2019 11:51	WG1262278	000107-86-8

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Total Solids by Method 2540 G-2011

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	%			date / time	
Total Solids	92.2		1	04/04/2019 13:59	WG1260340

Semi-Volatile Organic Compounds (GC) by Method NJDEP EPH

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
EPH Screen	23700	J	963	67800	125	04/06/2019 05:23	WG1259119
(S) o-Terphenyl	*0.000*	J7	*833*	*40.0-140*		*04/06/2019 05:23*	WG1259119

Sample Narrative:

L1083840-13 WG1259119: Cannot run at lower dilution due to viscosity of extract

Total Solids by Method 2540 G-2011

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	%			date / time	
Total Solids	92.1		1	04/04/2019 13:59	WG1260340

Semi-Volatile Organic Compounds (GC) by Method NJDEP EPH

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
EPH Screen	26400	J	964	67800	125	04/06/2019 05:40	WG1259119
(S) o-Terphenyl	*0.000*	J7	*833*	*40.0-140*		*04/06/2019 05:40*	WG1259119

Sample Narrative:

L1083840-14 WG1259119: Cannot run at lower dilution due to viscosity of extract

Total Solids by Method 2540 G-2011

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	%			date / time	
Total Solids	91.1		1	04/04/2019 13:59	WG1260340

Wet Chemistry by Method 9012B

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
Cyanide	0.0449	J J6	0.0428	0.275	1	04/05/2019 14:15	WG1260642

Mercury by Method 7471B

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
Mercury	U		0.00307	0.0220	1	04/04/2019 10:22	WG1260270

Metals (ICP) by Method 6010D

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
Aluminum	2990		3.84	11.0	1	04/04/2019 16:28	WG1260035
Antimony	U		0.824	2.20	1	04/04/2019 16:28	WG1260035
Arsenic	0.966	J	0.505	2.20	1	04/04/2019 16:28	WG1260035
Barium	7.89		0.187	0.549	1	04/04/2019 16:28	WG1260035
Beryllium	0.257		0.0769	0.220	1	04/04/2019 16:28	WG1260035
Cadmium	U		0.0769	0.549	1	04/04/2019 16:28	WG1260035
Calcium	218		5.08	110	1	04/04/2019 16:28	WG1260035
Chromium	8.92		0.154	1.10	1	04/04/2019 16:28	WG1260035
Cobalt	2.31		0.253	1.10	1	04/04/2019 16:28	WG1260035
Copper	3.27		0.582	2.20	1	04/04/2019 16:28	WG1260035
Iron	7550		1.55	11.0	1	04/04/2019 16:28	WG1260035
Lead	1.95		0.209	0.549	1	04/04/2019 16:28	WG1260035
Magnesium	555		1.22	110	1	04/04/2019 16:28	WG1260035
Manganese	62.9		0.132	1.10	1	04/04/2019 16:28	WG1260035
Nickel	4.48		0.538	2.20	1	04/04/2019 16:28	WG1260035
Potassium	758		11.2	110	1	04/04/2019 16:28	WG1260035
Selenium	U		0.681	2.20	1	04/04/2019 16:28	WG1260035
Silver	U		0.132	1.10	1	04/04/2019 16:28	WG1260035
Sodium	77.7	B J	10.8	110	1	04/04/2019 16:28	WG1260035
Thallium	U		0.714	2.20	1	04/04/2019 16:28	WG1260035
Vanadium	7.93		0.264	2.20	1	04/04/2019 16:28	WG1260035
Zinc	11.0		0.648	5.49	1	04/04/2019 16:28	WG1260035

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

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
Acetone	U		0.0110	0.0549	1	04/03/2019 14:56	WG1260000
Benzene	U		0.000309	0.00114	1.04	04/01/2019 19:10	WG1258825
Bromochloromethane	U		0.000446	0.00114	1.04	04/01/2019 19:10	WG1258825
Bromodichloromethane	U		0.000290	0.00114	1.04	04/01/2019 19:10	WG1258825
Bromoform	U		0.000484	0.00114	1.04	04/01/2019 19:10	WG1258825
Bromomethane	U		0.00153	0.00571	1.04	04/01/2019 19:10	WG1258825
Carbon disulfide	U		0.000253	0.00114	1.04	04/01/2019 19:10	WG1258825
Carbon tetrachloride	U		0.000374	0.00114	1.04	04/01/2019 19:10	WG1258825
Chlorobenzene	U		0.000242	0.00114	1.04	04/01/2019 19:10	WG1258825
Chlorodibromomethane	U		0.000426	0.00114	1.04	04/01/2019 19:10	WG1258825
Chloroethane	U		0.00108	0.00571	1.04	04/01/2019 19:10	WG1258825
Chloroform	U		0.000261	0.00571	1.04	04/01/2019 19:10	WG1258825
Chloromethane	U		0.000428	0.00285	1.04	04/01/2019 19:10	WG1258825

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

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Cyclohexane	U		0.000400	0.00114	1.04	04/01/2019 19:10	WG1258825
1,2-Dibromo-3-Chloropropane	U		0.00120	0.00343	1.04	04/01/2019 19:10	WG1258825
1,2-Dibromoethane	U		0.000392	0.00114	1.04	04/01/2019 19:10	WG1258825
Dichlorodifluoromethane	U		0.000815	0.00571	1.04	04/01/2019 19:10	WG1258825
1,1-Dichloroethane	U		0.000227	0.00114	1.04	04/01/2019 19:10	WG1258825
1,2-Dichloroethane	U		0.000303	0.00114	1.04	04/01/2019 19:10	WG1258825
1,2-Dichlorobenzene	U		0.000348	0.00114	1.04	04/01/2019 19:10	WG1258825
1,3-Dichlorobenzene	U		0.000272	0.00114	1.04	04/01/2019 19:10	WG1258825
1,4-Dichlorobenzene	U		0.000258	0.00114	1.04	04/01/2019 19:10	WG1258825
1,1-Dichloroethene	U		0.000346	0.00114	1.04	04/01/2019 19:10	WG1258825
cis-1,2-Dichloroethene	U		0.000268	0.00114	1.04	04/01/2019 19:10	WG1258825
trans-1,2-Dichloroethene	U		0.000301	0.00114	1.04	04/01/2019 19:10	WG1258825
1,2-Dichloropropane	U		0.000408	0.00114	1.04	04/01/2019 19:10	WG1258825
cis-1,3-Dichloropropene	U		0.000299	0.00114	1.04	04/01/2019 19:10	WG1258825
trans-1,3-Dichloropropene	U		0.000305	0.00114	1.04	04/01/2019 19:10	WG1258825
Ethylbenzene	U		0.000339	0.00114	1.04	04/01/2019 19:10	WG1258825
2-Hexanone	U		0.00156	0.0114	1.04	04/01/2019 19:10	WG1258825
Isopropylbenzene	U		0.000278	0.0114	1.04	04/01/2019 19:10	WG1258825
2-Butanone (MEK)	U		0.00535	0.0114	1.04	04/01/2019 19:10	WG1258825
Methyl Acetate	U	J4	0.00670	0.0220	1	04/03/2019 14:56	WG1260000
Methyl Cyclohexane	U		0.000434	0.00114	1.04	04/01/2019 19:10	WG1258825
Methylene Chloride	U		0.00114	0.00571	1.04	04/01/2019 19:10	WG1258825
4-Methyl-2-pentanone (MIBK)	U		0.00215	0.0114	1.04	04/01/2019 19:10	WG1258825
Methyl tert-butyl ether	U		0.000242	0.00114	1.04	04/01/2019 19:10	WG1258825
Styrene	U		0.000267	0.00114	1.04	04/01/2019 19:10	WG1258825
1,1,2,2-Tetrachloroethane	U		0.000417	0.00114	1.04	04/01/2019 19:10	WG1258825
Tetrachloroethene	U		0.000315	0.00114	1.04	04/01/2019 19:10	WG1258825
Toluene	U		0.000495	0.00571	1.04	04/01/2019 19:10	WG1258825
1,2,3-Trichlorobenzene	U		0.000349	0.00114	1.04	04/01/2019 19:10	WG1258825
1,2,4-Trichlorobenzene	U		0.000444	0.00114	1.04	04/01/2019 19:10	WG1258825
1,1,1-Trichloroethane	U		0.000326	0.00114	1.04	04/01/2019 19:10	WG1258825
1,1,2-Trichloroethane	U		0.000316	0.00114	1.04	04/01/2019 19:10	WG1258825
Trichloroethene	U		0.000318	0.00114	1.04	04/01/2019 19:10	WG1258825
Trichlorofluoromethane	U		0.000436	0.00571	1.04	04/01/2019 19:10	WG1258825
1,1,2-Trichlorotrifluoroethane	U		0.000417	0.00114	1.04	04/01/2019 19:10	WG1258825
Vinyl chloride	U		0.000333	0.00114	1.04	04/01/2019 19:10	WG1258825
Xylenes, Total	U		0.000797	0.00343	1.04	04/01/2019 19:10	WG1258825
(S) Toluene-d8	*98.9*			*75.0-131*		*04/01/2019 19:10*	WG1258825
(S) Toluene-d8	*114*			*75.0-131*		*04/03/2019 14:56*	WG1260000
(S) a,a,a-Trifluorotoluene	*100*			*80.0-120*		*04/01/2019 19:10*	WG1258825
(S) a,a,a-Trifluorotoluene	*106*			*80.0-120*		*04/03/2019 14:56*	WG1260000
(S) 4-Bromofluorobenzene	*103*			*67.0-138*		*04/01/2019 19:10*	WG1258825
(S) 4-Bromofluorobenzene	*116*			*67.0-138*		*04/03/2019 14:56*	WG1260000
(S) 1,2-Dichloroethane-d4	*104*			*70.0-130*		*04/01/2019 19:10*	WG1258825
(S) 1,2-Dichloroethane-d4	*106*			*70.0-130*		*04/03/2019 14:56*	WG1260000

Volatile Organic Compounds (GC/MS) by Method 8260C - TENTATIVELY IDENTIFIED COMPOUNDS

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch	CAS #
Total Tic	0.000		0.000	0.000	1.04	04/01/2019 19:10	WG1258825	
Total Tic	0.704	J N	0.000	0.000	1	04/03/2019 14:56	WG1260000	
Unknown-01	0.691	J N	0.000	0.000	1	04/03/2019 14:56	WG1260000	
Benzene, 1,4-Difluoro-	0.0130	J N	0.000	0.000	1	04/03/2019 14:56	WG1260000	000540-36-3

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Pesticides (GC) by Method 8081B

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Aldrin	U		0.00148	0.0220	1	04/04/2019 10:45	WG1260104
Alpha BHC	U		0.00149	0.00275	1	04/04/2019 10:45	WG1260104
Beta BHC	U		0.00176	0.00275	1	04/04/2019 10:45	WG1260104
Delta BHC	U		0.00157	0.0220	1	04/04/2019 10:45	WG1260104
Gamma BHC	U		0.00159	0.00275	1	04/04/2019 10:45	WG1260104
Chlordane	U		0.0428	0.220	1	04/04/2019 10:45	WG1260104
alpha-Chlordane	U		0.00155	0.0220	1	04/04/2019 10:45	WG1260104
gamma-Chlordane	U		0.00215	0.0220	1	04/04/2019 10:45	WG1260104
4,4-DDD	U		0.00171	0.0220	1	04/04/2019 10:45	WG1260104
4,4-DDE	U		0.00169	0.0220	1	04/04/2019 10:45	WG1260104
4,4-DDT	U		0.00220	0.0220	1	04/04/2019 10:45	WG1260104
Dieldrin	U		0.00167	0.00329	1	04/04/2019 10:45	WG1260104
Endosulfan I	U		0.00164	0.0220	1	04/04/2019 10:45	WG1260104
Endosulfan II	U		0.00176	0.0220	1	04/04/2019 10:45	WG1260104
Endosulfan sulfate	U		0.00166	0.0220	1	04/04/2019 10:45	WG1260104
Endrin	U		0.00172	0.0220	1	04/04/2019 10:45	WG1260104
Endrin aldehyde	U		0.00142	0.0220	1	04/04/2019 10:45	WG1260104
Endrin ketone	U		0.00181	0.0220	1	04/04/2019 10:45	WG1260104
Hexachlorobenzene	U		0.00136	0.0220	1	04/04/2019 10:45	WG1260104
Heptachlor	U		0.00169	0.0220	1	04/04/2019 10:45	WG1260104
Heptachlor epoxide	U		0.00177	0.0110	1	04/04/2019 10:45	WG1260104
Methoxychlor	U		0.00195	0.0220	1	04/04/2019 10:45	WG1260104
Toxaphene	U		0.0395	0.439	1	04/04/2019 10:45	WG1260104
(S) Decachlorobiphenyl	*75.8*			*30.0-150*		*04/04/2019 10:45*	WG1260104
(S) Tetrachloro-m-xylene	*89.2*			*30.0-150*		*04/04/2019 10:45*	WG1260104

Polychlorinated Biphenyls (GC) by Method 8082 A

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
PCB 1016	U		0.00384	0.0187	1	04/04/2019 14:38	WG1260104
PCB 1221	U		0.00590	0.0187	1	04/04/2019 14:38	WG1260104
PCB 1232	U		0.00458	0.0187	1	04/04/2019 14:38	WG1260104
PCB 1242	U		0.00349	0.0187	1	04/04/2019 14:38	WG1260104
PCB 1248	U		0.00346	0.0187	1	04/04/2019 14:38	WG1260104
PCB 1254	U		0.00518	0.0187	1	04/04/2019 14:38	WG1260104
PCB 1260	U		0.00542	0.0187	1	04/04/2019 14:38	WG1260104
(S) Decachlorobiphenyl	*82.2*			*30.0-150*		*04/04/2019 14:38*	WG1260104
(S) Tetrachloro-m-xylene	*77.4*			*30.0-150*		*04/04/2019 14:38*	WG1260104

Semi Volatile Organic Compounds (GC/MS) by Method 8270D

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Acenaphthene	U	J3 J4	0.00705	0.0362	1	04/09/2019 10:14	WG1262278
Acenaphthylene	U	J3 J4	0.00737	0.0362	1	04/09/2019 10:14	WG1262278
Acetophenone	U	J3 J4	0.0826	0.165	1	04/09/2019 10:14	WG1262278
Anthracene	U	J4	0.00694	0.0362	1	04/09/2019 10:14	WG1262278
Atrazine	U		0.103	0.165	1	04/09/2019 10:14	WG1262278
Benzaldehyde	U	J3	0.0584	0.165	1	04/09/2019 10:14	WG1262278
Benzo(a)anthracene	U		0.00470	0.0362	1	04/09/2019 10:14	WG1262278
Benzo(b)fluoranthene	U		0.00763	0.0362	1	04/09/2019 10:14	WG1262278
Benzo(k)fluoranthene	U		0.00639	0.0362	1	04/09/2019 10:14	WG1262278
Benzo(g,h,i)perylene	U		0.00792	0.0362	1	04/09/2019 10:14	WG1262278
Benzo(a)pyrene	U		0.00602	0.0362	1	04/09/2019 10:14	WG1262278
Biphenyl	U	J3 J4	0.00646	0.165	1	04/09/2019 10:14	WG1262278
Bis(2-chlorethoxy)methane	U	J3 J4	0.00845	0.165	1	04/09/2019 10:14	WG1262278

Semi Volatile Organic Compounds (GC/MS) by Method 8270D

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Bis(2-chloroethyl)ether	U	J3 J4	0.00984	0.165	1	04/09/2019 10:14	WG1262278
Bis(2-chloroisopropyl)ether	U	J3 J4	0.00834	0.165	1	04/09/2019 10:14	WG1262278
4-Bromophenyl-phenylether	U	J4	0.0125	0.165	1	04/09/2019 10:14	WG1262278
Caprolactam	U		0.114	0.165	1	04/09/2019 10:14	WG1262278
Carbazole	U		0.00575	0.165	1	04/09/2019 10:14	WG1262278
4-Chloroaniline	U	J3 J4	0.0387	0.165	1	04/09/2019 10:14	WG1262278
2-Chloronaphthalene	U	J3 J4	0.00702	0.0362	1	04/09/2019 10:14	WG1262278
4-Chlorophenyl-phenylether	U	J4	0.00688	0.165	1	04/09/2019 10:14	WG1262278
Chrysene	U	J4	0.00609	0.0362	1	04/09/2019 10:14	WG1262278
Dibenz(a,h)anthracene	U		0.00901	0.0362	1	04/09/2019 10:14	WG1262278
Dibenzofuran	U	J3 J4	0.00569	0.165	1	04/09/2019 10:14	WG1262278
3,3-Dichlorobenzidine	U		0.0872	0.165	1	04/09/2019 10:14	WG1262278
2,4-Dinitrotoluene	U	J4	0.00666	0.165	1	04/09/2019 10:14	WG1262278
2,6-Dinitrotoluene	U	J4	0.00809	0.165	1	04/09/2019 10:14	WG1262278
Fluoranthene	U		0.00545	0.0362	1	04/09/2019 10:14	WG1262278
Fluorene	U	J4	0.00749	0.0362	1	04/09/2019 10:14	WG1262278
Hexachlorobenzene	U	J4	0.00940	0.165	1	04/09/2019 10:14	WG1262278
Hexachloro-1,3-butadiene	U	J3 J4	0.0110	0.165	1	04/09/2019 10:14	WG1262278
Hexachlorocyclopentadiene	U	J0 J3	0.0645	0.165	1	04/09/2019 10:14	WG1262278
Hexachloroethane	U	J3	0.0147	0.165	1	04/09/2019 10:14	WG1262278
Indeno(1,2,3-cd)pyrene	U		0.00848	0.0362	1	04/09/2019 10:14	WG1262278
Isophorone	U	J3 J4	0.00573	0.165	1	04/09/2019 10:14	WG1262278
2-Methylnaphthalene	U	J3 J4	0.00945	0.0362	1	04/09/2019 10:14	WG1262278
Naphthalene	U	J3 J4	0.00976	0.0362	1	04/09/2019 10:14	WG1262278
2-Nitroaniline	U	J4	0.00829	0.165	1	04/09/2019 10:14	WG1262278
3-Nitroaniline	U	J4	0.00933	0.165	1	04/09/2019 10:14	WG1262278
4-Nitroaniline	U	J4	0.00702	0.165	1	04/09/2019 10:14	WG1262278
Nitrobenzene	U	J3 J4	0.00763	0.165	1	04/09/2019 10:14	WG1262278
n-Nitrosodiphenylamine	U		0.00652	0.165	1	04/09/2019 10:14	WG1262278
n-Nitrosodi-n-propylamine	U	J3 J4	0.00995	0.165	1	04/09/2019 10:14	WG1262278
Phenanthrene	U	J4	0.00580	0.0362	1	04/09/2019 10:14	WG1262278
Benzylbutyl phthalate	U		0.0113	0.165	1	04/09/2019 10:14	WG1262278
Bis(2-ethylhexyl)phthalate	U		0.0132	0.165	1	04/09/2019 10:14	WG1262278
Di-n-butyl phthalate	U		0.0120	0.165	1	04/09/2019 10:14	WG1262278
Diethyl phthalate	U	J4	0.00759	0.165	1	04/09/2019 10:14	WG1262278
Dimethyl phthalate	U	J4	0.00593	0.165	1	04/09/2019 10:14	WG1262278
Di-n-octyl phthalate	U		0.00996	0.165	1	04/09/2019 10:14	WG1262278
Pyrene	U		0.0135	0.0362	1	04/09/2019 10:14	WG1262278
1,2,4,5-Tetrachlorobenzene	U	J3 J4	0.0837	0.165	1	04/09/2019 10:14	WG1262278
4-Chloro-3-methylphenol	U	J4	0.00524	0.165	1	04/09/2019 10:14	WG1262278
2-Chlorophenol	U	J3 J4	0.00912	0.165	1	04/09/2019 10:14	WG1262278
2-Methylphenol	U	J3 J4	0.0108	0.165	1	04/09/2019 10:14	WG1262278
3&4-Methyl Phenol	U	J3	0.00860	0.165	1	04/09/2019 10:14	WG1262278
2,4-Dichlorophenol	U	J3 J4	0.00819	0.165	1	04/09/2019 10:14	WG1262278
2,4-Dimethylphenol	U	J3 J4	0.0517	0.165	1	04/09/2019 10:14	WG1262278
4,6-Dinitro-2-methylphenol	U	J4	0.136	0.220	1	04/09/2019 10:14	WG1262278
2,4-Dinitrophenol	U	J3	0.108	0.220	1	04/09/2019 10:14	WG1262278
2-Nitrophenol	U	J3 J4	0.0143	0.165	1	04/09/2019 10:14	WG1262278
4-Nitrophenol	U		0.0576	0.165	1	04/09/2019 10:14	WG1262278
Pentachlorophenol	U		0.0527	0.165	1	04/09/2019 10:14	WG1262278
Phenol	U	J3	0.00763	0.165	1	04/09/2019 10:14	WG1262278
2,4,5-Trichlorophenol	U	J4	0.0114	0.165	1	04/09/2019 10:14	WG1262278
2,4,6-Trichlorophenol	U	J3 J4	0.00855	0.165	1	04/09/2019 10:14	WG1262278
(S) 2-Fluorophenol	*53.9*			*30.0-130*		*04/09/2019 10:14*	WG1262278
(S) Phenol-d5	*53.0*			*30.0-130*		*04/09/2019 10:14*	WG1262278
(S) Nitrobenzene-d5	*42.3*			*30.0-130*		*04/09/2019 10:14*	WG1262278

Semi Volatile Organic Compounds (GC/MS) by Method 8270D

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
(S) 2-Fluorobiphenyl	*39.3*			*30.0-130*		*04/09/2019 10:14*	WG1262278
(S) 2,4,6-Tribromophenol	*51.5*			*30.0-130*		*04/09/2019 10:14*	WG1262278
(S) p-Terphenyl-d14	*70.0*			*30.0-130*		*04/09/2019 10:14*	WG1262278

Semi Volatile Organic Compounds (GC/MS) by Method 8270D - TENTATIVELY IDENTIFIED COMPOUNDS

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch	CAS #
Total Tic	0.519	J N	0.000	0.000	1	04/09/2019 10:14	WG1262278	
Unknown-02	0.393	J N	0.000	0.000	1	04/09/2019 10:14	WG1262278	000123-42-2
Unknown-03	0.0651	J N	0.000	0.000	1	04/09/2019 10:14	WG1262278	043183-55-7
Unknown-04	0.0338	J N	0.000	0.000	1	04/09/2019 10:14	WG1262278	000591-78-6
Unknown-01	0.0269	J N	0.000	0.000	1	04/09/2019 10:14	WG1262278	000625-86-5

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Calculated Results

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Chromium,Trivalent	274		0.159	1.14	1	04/12/2019 17:59	WG1260035

Total Solids by Method 2540 G-2011

Analyte	Result %	Qualifier	Dilution	Analysis date / time	Batch
Total Solids	87.9		1	04/04/2019 13:59	WG1260340

Wet Chemistry by Method 3060A/7196A

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Chromium,Hexavalent	4.92		0.728	2.28	1	04/12/2019 17:59	WG1264834

Wet Chemistry by Method 9012B

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Cyanide	0.176	J	0.0444	0.284	1	04/05/2019 14:20	WG1260642

Mercury by Method 7471B

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Mercury	0.958		0.00319	0.0228	1	04/04/2019 10:25	WG1260270

Metals (ICP) by Method 6010D

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Aluminum	7890		3.98	11.4	1	04/04/2019 16:31	WG1260035
Antimony	U		0.853	2.28	1	04/04/2019 16:31	WG1260035
Arsenic	4.86		0.523	2.28	1	04/04/2019 16:31	WG1260035
Barium	183		0.193	0.569	1	04/04/2019 16:31	WG1260035
Beryllium	0.700		0.0797	0.228	1	04/04/2019 16:31	WG1260035
Cadmium	0.633		0.0797	0.569	1	04/04/2019 16:31	WG1260035
Calcium	2110		5.27	114	1	04/04/2019 16:31	WG1260035
Chromium	279		0.159	1.14	1	04/04/2019 16:31	WG1260035
Cobalt	15.9		0.262	1.14	1	04/04/2019 16:31	WG1260035
Copper	78.9		0.603	2.28	1	04/04/2019 16:31	WG1260035
Iron	18400		1.60	11.4	1	04/04/2019 16:31	WG1260035
Lead	545		0.216	0.569	1	04/04/2019 16:31	WG1260035
Magnesium	1150		1.26	114	1	04/04/2019 16:31	WG1260035
Manganese	705		0.137	1.14	1	04/04/2019 16:31	WG1260035
Nickel	12.0		0.558	2.28	1	04/04/2019 16:31	WG1260035
Potassium	1000		11.6	114	1	04/04/2019 16:31	WG1260035
Selenium	U		0.706	2.28	1	04/04/2019 16:31	WG1260035
Silver	U		0.137	1.14	1	04/04/2019 16:31	WG1260035
Sodium	119	B	11.2	114	1	04/04/2019 16:31	WG1260035
Thallium	U		0.740	2.28	1	04/04/2019 16:31	WG1260035
Vanadium	16.7		0.273	2.28	1	04/04/2019 16:31	WG1260035
Zinc	195		0.671	5.69	1	04/04/2019 16:31	WG1260035

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

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Acetone	0.184		0.0114	0.0569	1	04/03/2019 15:16	WG1260000
Benzene	U		0.000307	0.00114	1	04/01/2019 19:30	WG1258825
Bromochloromethane	U		0.000444	0.00114	1	04/01/2019 19:30	WG1258825
Bromodichloromethane	U		0.000289	0.00114	1	04/01/2019 19:30	WG1258825
Bromoform	U		0.000482	0.00114	1	04/01/2019 19:30	WG1258825
Bromomethane	U		0.00152	0.00569	1	04/01/2019 19:30	WG1258825
Carbon disulfide	U		0.000251	0.00114	1	04/01/2019 19:30	WG1258825
Carbon tetrachloride	U		0.000373	0.00114	1	04/01/2019 19:30	WG1258825
Chlorobenzene	U		0.000241	0.00114	1	04/01/2019 19:30	WG1258825
Chlorodibromomethane	U		0.000424	0.00114	1	04/01/2019 19:30	WG1258825
Chloroethane	U		0.00108	0.00569	1	04/01/2019 19:30	WG1258825
Chloroform	U		0.000261	0.00569	1	04/01/2019 19:30	WG1258825
Chloromethane	U		0.000427	0.00284	1	04/01/2019 19:30	WG1258825
Cyclohexane	U		0.000398	0.00114	1	04/01/2019 19:30	WG1258825
1,2-Dibromo-3-Chloropropane	U		0.00119	0.00341	1	04/01/2019 19:30	WG1258825
1,2-Dibromoethane	U		0.000390	0.00114	1	04/01/2019 19:30	WG1258825
Dichlorodifluoromethane	U		0.000811	0.00569	1	04/01/2019 19:30	WG1258825
1,1-Dichloroethane	U		0.000226	0.00114	1	04/01/2019 19:30	WG1258825
1,2-Dichloroethane	U		0.000302	0.00114	1	04/01/2019 19:30	WG1258825
1,2-Dichlorobenzene	U		0.000347	0.00114	1	04/01/2019 19:30	WG1258825
1,3-Dichlorobenzene	U		0.000272	0.00114	1	04/01/2019 19:30	WG1258825
1,4-Dichlorobenzene	U		0.000257	0.00114	1	04/01/2019 19:30	WG1258825
1,1-Dichloroethene	U		0.000345	0.00114	1	04/01/2019 19:30	WG1258825
cis-1,2-Dichloroethene	U		0.000267	0.00114	1	04/01/2019 19:30	WG1258825
trans-1,2-Dichloroethene	U		0.000300	0.00114	1	04/01/2019 19:30	WG1258825
1,2-Dichloropropane	U		0.000407	0.00114	1	04/01/2019 19:30	WG1258825
cis-1,3-Dichloropropene	U		0.000298	0.00114	1	04/01/2019 19:30	WG1258825
trans-1,3-Dichloropropene	U		0.000304	0.00114	1	04/01/2019 19:30	WG1258825
Ethylbenzene	U		0.000338	0.00114	1	04/01/2019 19:30	WG1258825
2-Hexanone	U		0.00156	0.0114	1	04/01/2019 19:30	WG1258825
Isopropylbenzene	U		0.000277	0.0114	1	04/01/2019 19:30	WG1258825
2-Butanone (MEK)	0.0295		0.00533	0.0114	1	04/01/2019 19:30	WG1258825
Methyl Acetate	U	J4	0.00694	0.0228	1	04/03/2019 15:16	WG1260000
Methyl Cyclohexane	U		0.000432	0.00114	1	04/01/2019 19:30	WG1258825
Methylene Chloride	U		0.00114	0.00569	1	04/01/2019 19:30	WG1258825
4-Methyl-2-pentanone (MIBK)	U		0.00214	0.0114	1	04/01/2019 19:30	WG1258825
Methyl tert-butyl ether	U		0.000241	0.00114	1	04/01/2019 19:30	WG1258825
Styrene	U		0.000266	0.00114	1	04/01/2019 19:30	WG1258825
1,1,2,2-Tetrachloroethane	U		0.000415	0.00114	1	04/01/2019 19:30	WG1258825
Tetrachloroethene	0.00165		0.000314	0.00114	1	04/01/2019 19:30	WG1258825
Toluene	U		0.000494	0.00569	1	04/01/2019 19:30	WG1258825
1,2,3-Trichlorobenzene	U		0.000348	0.00114	1	04/01/2019 19:30	WG1258825
1,2,4-Trichlorobenzene	U		0.000442	0.00114	1	04/01/2019 19:30	WG1258825
1,1,1-Trichloroethane	U		0.000325	0.00114	1	04/01/2019 19:30	WG1258825
1,1,2-Trichloroethane	U		0.000315	0.00114	1	04/01/2019 19:30	WG1258825
Trichloroethene	U		0.000317	0.00114	1	04/01/2019 19:30	WG1258825
Trichlorofluoromethane	U		0.000435	0.00569	1	04/01/2019 19:30	WG1258825
1,1,2-Trichlorotrifluoroethane	U		0.000415	0.00114	1	04/01/2019 19:30	WG1258825
Vinyl chloride	U		0.000331	0.00114	1	04/01/2019 19:30	WG1258825
Xylenes, Total	U		0.000794	0.00341	1	04/01/2019 19:30	WG1258825
(S) Toluene-d8	*103*			*75.0-131*		*04/01/2019 19:30*	WG1258825
(S) Toluene-d8	*116*			*75.0-131*		*04/03/2019 15:16*	WG1260000
(S) a,a,a-Trifluorotoluene	*100*			*80.0-120*		*04/01/2019 19:30*	WG1258825
(S) a,a,a-Trifluorotoluene	*104*			*80.0-120*		*04/03/2019 15:16*	WG1260000
(S) 4-Bromofluorobenzene	*99.9*			*67.0-138*		*04/01/2019 19:30*	WG1258825
(S) 4-Bromofluorobenzene	*109*			*67.0-138*		*04/03/2019 15:16*	WG1260000

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

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
(S) 1,2-Dichloroethane-d4	*103*			*70.0-130*		*04/01/2019 19:30*	WG1258825
(S) 1,2-Dichloroethane-d4	*106*			*70.0-130*		*04/03/2019 15:16*	WG1260000

Volatile Organic Compounds (GC/MS) by Method 8260C - TENTATIVELY IDENTIFIED COMPOUNDS

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch	CAS #
Total Tic	0.000		0.000	0.000	1	04/01/2019 19:30	WG1258825	
Total Tic	0.000		0.000	0.000	1	04/03/2019 15:16	WG1260000	

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Pesticides (GC) by Method 8081B

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Aldrin	U		0.00154	0.0228	1	04/04/2019 10:57	WG1260104
Alpha BHC	U		0.00155	0.00284	1	04/04/2019 10:57	WG1260104
Beta BHC	U		0.00182	0.00284	1	04/04/2019 10:57	WG1260104
Delta BHC	U		0.00163	0.0228	1	04/04/2019 10:57	WG1260104
Gamma BHC	U		0.00165	0.00284	1	04/04/2019 10:57	WG1260104
Chlordane	U		0.0444	0.228	1	04/04/2019 10:57	WG1260104
alpha-Chlordane	U		0.00160	0.0228	1	04/04/2019 10:57	WG1260104
gamma-Chlordane	U		0.00223	0.0228	1	04/04/2019 10:57	WG1260104
4,4-DDD	U		0.00178	0.0228	1	04/04/2019 10:57	WG1260104
4,4-DDE	U		0.00175	0.0228	1	04/04/2019 10:57	WG1260104
4,4-DDT	U		0.00228	0.0228	1	04/04/2019 10:57	WG1260104
Dieldrin	U		0.00173	0.00341	1	04/04/2019 10:57	WG1260104
Endosulfan I	U		0.00170	0.0228	1	04/04/2019 10:57	WG1260104
Endosulfan II	U		0.00182	0.0228	1	04/04/2019 10:57	WG1260104
Endosulfan sulfate	U		0.00172	0.0228	1	04/04/2019 10:57	WG1260104
Endrin	U		0.00179	0.0228	1	04/04/2019 10:57	WG1260104
Endrin aldehyde	U		0.00147	0.0228	1	04/04/2019 10:57	WG1260104
Endrin ketone	U		0.00188	0.0228	1	04/04/2019 10:57	WG1260104
Hexachlorobenzene	U		0.00141	0.0228	1	04/04/2019 10:57	WG1260104
Heptachlor	U		0.00175	0.0228	1	04/04/2019 10:57	WG1260104
Heptachlor epoxide	U		0.00183	0.0114	1	04/04/2019 10:57	WG1260104
Methoxychlor	U		0.00203	0.0228	1	04/04/2019 10:57	WG1260104
Toxaphene	U		0.0410	0.455	1	04/04/2019 10:57	WG1260104
(S) Decachlorobiphenyl	*91.4*			*30.0-150*		*04/04/2019 10:57*	WG1260104
(S) Tetrachloro-m-xylene	*80.8*			*30.0-150*		*04/04/2019 10:57*	WG1260104

Polychlorinated Biphenyls (GC) by Method 8082 A

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
PCB 1016	U		0.00398	0.0193	1	04/04/2019 14:52	WG1260104
PCB 1221	U		0.00611	0.0193	1	04/04/2019 14:52	WG1260104
PCB 1232	U		0.00475	0.0193	1	04/04/2019 14:52	WG1260104
PCB 1242	U		0.00362	0.0193	1	04/04/2019 14:52	WG1260104
PCB 1248	U		0.00358	0.0193	1	04/04/2019 14:52	WG1260104
PCB 1254	U		0.00537	0.0193	1	04/04/2019 14:52	WG1260104
PCB 1260	U		0.00562	0.0193	1	04/04/2019 14:52	WG1260104
(S) Decachlorobiphenyl	*76.9*			*30.0-150*		*04/04/2019 14:52*	WG1260104
(S) Tetrachloro-m-xylene	*73.9*			*30.0-150*		*04/04/2019 14:52*	WG1260104

Semi Volatile Organic Compounds (GC/MS) by Method 8270D

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Acenaphthene	U	J3 J4	0.146	0.751	20	04/09/2019 15:27	WG1262278
Acenaphthylene	U	J3 J4	0.152	0.751	20	04/09/2019 15:27	WG1262278
Acetophenone	U	J3 J4	1.71	3.41	20	04/09/2019 15:27	WG1262278
Anthracene	U	J4	0.143	0.751	20	04/09/2019 15:27	WG1262278
Atrazine	U		2.14	3.41	20	04/09/2019 15:27	WG1262278
Benzaldehyde	U	J3	1.21	3.41	20	04/09/2019 15:27	WG1262278
Benzo(a)anthracene	0.509	J	0.0974	0.751	20	04/09/2019 15:27	WG1262278
Benzo(b)fluoranthene	0.716	J	0.158	0.751	20	04/09/2019 15:27	WG1262278
Benzo(k)fluoranthene	0.229	J	0.132	0.751	20	04/09/2019 15:27	WG1262278
Benzo(g,h,i)perylene	0.311	J	0.164	0.751	20	04/09/2019 15:27	WG1262278
Benzo(a)pyrene	0.502	J	0.125	0.751	20	04/09/2019 15:27	WG1262278
Biphenyl	U	J3 J4	0.134	3.41	20	04/09/2019 15:27	WG1262278
Bis(2-chlorethoxy)methane	U	J3 J4	0.175	3.41	20	04/09/2019 15:27	WG1262278
Bis(2-chloroethyl)ether	U	J3 J4	0.204	3.41	20	04/09/2019 15:27	WG1262278
Bis(2-chloroisopropyl)ether	U	J3 J4	0.173	3.41	20	04/09/2019 15:27	WG1262278
4-Bromophenyl-phenylether	U	J4	0.259	3.41	20	04/09/2019 15:27	WG1262278
Caprolactam	U		2.37	3.41	20	04/09/2019 15:27	WG1262278
Carbazole	U		0.119	3.41	20	04/09/2019 15:27	WG1262278
4-Chloroaniline	U	J3 J4	0.801	3.41	20	04/09/2019 15:27	WG1262278
2-Chloronaphthalene	U	J3 J4	0.146	0.751	20	04/09/2019 15:27	WG1262278
4-Chlorophenyl-phenylether	U	J4	0.142	3.41	20	04/09/2019 15:27	WG1262278
Chrysene	0.583	J J4	0.126	0.751	20	04/09/2019 15:27	WG1262278
Dibenz(a,h)anthracene	U		0.187	0.751	20	04/09/2019 15:27	WG1262278
Dibenzofuran	U	J3 J4	0.118	3.41	20	04/09/2019 15:27	WG1262278
3,3-Dichlorobenzidine	U		1.81	3.41	20	04/09/2019 15:27	WG1262278
2,4-Dinitrotoluene	U	J4	0.138	3.41	20	04/09/2019 15:27	WG1262278
2,6-Dinitrotoluene	U	J4	0.167	3.41	20	04/09/2019 15:27	WG1262278
Fluoranthene	1.03		0.113	0.751	20	04/09/2019 15:27	WG1262278
Fluorene	U	J4	0.155	0.751	20	04/09/2019 15:27	WG1262278
Hexachlorobenzene	U	J4	0.195	3.41	20	04/09/2019 15:27	WG1262278
Hexachloro-1,3-butadiene	U	J3 J4	0.228	3.41	20	04/09/2019 15:27	WG1262278
Hexachlorocyclopentadiene	U	J0 J3	1.33	3.41	20	04/09/2019 15:27	WG1262278
Hexachloroethane	U	J3	0.305	3.41	20	04/09/2019 15:27	WG1262278
Indeno(1,2,3-cd)pyrene	0.355	J	0.175	0.751	20	04/09/2019 15:27	WG1262278
Isophorone	U	J3 J4	0.118	3.41	20	04/09/2019 15:27	WG1262278
2-Methylnaphthalene	U	J3 J4	0.196	0.751	20	04/09/2019 15:27	WG1262278
Naphthalene	U	J3 J4	0.203	0.751	20	04/09/2019 15:27	WG1262278
2-Nitroaniline	U	J4	0.172	3.41	20	04/09/2019 15:27	WG1262278
3-Nitroaniline	U	J4	0.193	3.41	20	04/09/2019 15:27	WG1262278
4-Nitroaniline	U	J4	0.146	3.41	20	04/09/2019 15:27	WG1262278
Nitrobenzene	U	J3 J4	0.158	3.41	20	04/09/2019 15:27	WG1262278
n-Nitrosodiphenylamine	U		0.135	3.41	20	04/09/2019 15:27	WG1262278
n-Nitrosodi-n-propylamine	U	J3 J4	0.206	3.41	20	04/09/2019 15:27	WG1262278
Phenanthrene	0.591	J J4	0.121	0.751	20	04/09/2019 15:27	WG1262278
Benzylbutyl phthalate	U		0.234	3.41	20	04/09/2019 15:27	WG1262278
Bis(2-ethylhexyl)phthalate	U		0.273	3.41	20	04/09/2019 15:27	WG1262278
Di-n-butyl phthalate	U		0.248	3.41	20	04/09/2019 15:27	WG1262278
Diethyl phthalate	U	J4	0.157	3.41	20	04/09/2019 15:27	WG1262278
Dimethyl phthalate	U	J4	0.123	3.41	20	04/09/2019 15:27	WG1262278
Di-n-octyl phthalate	U		0.206	3.41	20	04/09/2019 15:27	WG1262278
Pyrene	0.885		0.280	0.751	20	04/09/2019 15:27	WG1262278
1,2,4,5-Tetrachlorobenzene	U	J3 J4	1.73	3.41	20	04/09/2019 15:27	WG1262278
4-Chloro-3-methylphenol	U	J4	0.109	3.41	20	04/09/2019 15:27	WG1262278
2-Chlorophenol	U	J3 J4	0.189	3.41	20	04/09/2019 15:27	WG1262278
2-Methylphenol	U	J3 J4	0.224	3.41	20	04/09/2019 15:27	WG1262278
3&4-Methyl Phenol	U	J3	0.179	3.41	20	04/09/2019 15:27	WG1262278

Semi Volatile Organic Compounds (GC/MS) by Method 8270D

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
2,4-Dichlorophenol	U	J3 J4	0.170	3.41	20	04/09/2019 15:27	WG1262278
2,4-Dimethylphenol	U	J3 J4	1.07	3.41	20	04/09/2019 15:27	WG1262278
4,6-Dinitro-2-methylphenol	U	J4	2.82	4.55	20	04/09/2019 15:27	WG1262278
2,4-Dinitrophenol	U	J3	2.23	4.55	20	04/09/2019 15:27	WG1262278
2-Nitrophenol	U	J3 J4	0.296	3.41	20	04/09/2019 15:27	WG1262278
4-Nitrophenol	U		1.19	3.41	20	04/09/2019 15:27	WG1262278
Pentachlorophenol	U		1.09	3.41	20	04/09/2019 15:27	WG1262278
Phenol	U	J3	0.158	3.41	20	04/09/2019 15:27	WG1262278
2,4,5-Trichlorophenol	U	J4	0.237	3.41	20	04/09/2019 15:27	WG1262278
2,4,6-Trichlorophenol	U	J3 J4	0.178	3.41	20	04/09/2019 15:27	WG1262278
(S) 2-Fluorophenol	*54.2*	J7		*30.0-130*		*04/09/2019 15:27*	WG1262278
(S) Phenol-d5	*48.9*	J7		*30.0-130*		*04/09/2019 15:27*	WG1262278
(S) Nitrobenzene-d5	*58.9*	J7		*30.0-130*		*04/09/2019 15:27*	WG1262278
(S) 2-Fluorobiphenyl	*59.2*	J7		*30.0-130*		*04/09/2019 15:27*	WG1262278
(S) 2,4,6-Tribromophenol	*66.7*	J7		*30.0-130*		*04/09/2019 15:27*	WG1262278
(S) p-Terphenyl-d14	*73.0*	J7		*30.0-130*		*04/09/2019 15:27*	WG1262278

Sample Narrative:

L1083840-16 WG1262278: Dilution due to viscosity

Semi Volatile Organic Compounds (GC/MS) by Method 8270D - TENTATIVELY IDENTIFIED COMPOUNDS

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch	CAS #
Total Tic	1.00	J N	0.000	0.000	20	04/09/2019 15:27	WG1262278	
Unknown-01	1.00	J N	0.000	0.000	20	04/09/2019 15:27	WG1262278	000123-42-2

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Total Solids by Method 2540 G-2011

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	%			date / time	
Total Solids	92.5		1	04/04/2019 13:59	WG1260340

Wet Chemistry by Method 9012B

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
Cyanide	0.0587	J	0.0422	0.270	1	04/05/2019 14:21	WG1260642

Mercury by Method 7471B

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
Mercury	0.00349	J	0.00303	0.0216	1	04/04/2019 10:28	WG1260270

Metals (ICP) by Method 6010D

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
Aluminum	4830		3.78	10.8	1	04/04/2019 16:34	WG1260035
Antimony	1.01	J	0.811	2.16	1	04/04/2019 16:34	WG1260035
Arsenic	2.05	J	0.497	2.16	1	04/04/2019 16:34	WG1260035
Barium	26.8		0.184	0.541	1	04/04/2019 16:34	WG1260035
Beryllium	0.323		0.0757	0.216	1	04/04/2019 16:34	WG1260035
Cadmium	U		0.0757	0.541	1	04/04/2019 16:34	WG1260035
Calcium	677		5.01	108	1	04/04/2019 16:34	WG1260035
Chromium	14.3		0.151	1.08	1	04/04/2019 16:34	WG1260035
Cobalt	1.68		0.249	1.08	1	04/04/2019 16:34	WG1260035
Copper	3.53		0.573	2.16	1	04/04/2019 16:34	WG1260035
Iron	12300		1.52	10.8	1	04/04/2019 16:34	WG1260035
Lead	4.40		0.205	0.541	1	04/04/2019 16:34	WG1260035
Magnesium	1060		1.20	108	1	04/04/2019 16:34	WG1260035
Manganese	46.3		0.130	1.08	1	04/04/2019 16:34	WG1260035
Nickel	4.69		0.530	2.16	1	04/04/2019 16:34	WG1260035
Potassium	1210		11.0	108	1	04/04/2019 16:34	WG1260035
Selenium	U		0.670	2.16	1	04/04/2019 16:34	WG1260035
Silver	U		0.130	1.08	1	04/04/2019 16:34	WG1260035
Sodium	79.7	B J	10.6	108	1	04/04/2019 16:34	WG1260035
Thallium	U		0.703	2.16	1	04/04/2019 16:34	WG1260035
Vanadium	14.5		0.259	2.16	1	04/04/2019 16:34	WG1260035
Zinc	19.6		0.638	5.41	1	04/04/2019 16:34	WG1260035

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

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
Acetone	U		0.0108	0.0541	1	04/03/2019 15:36	WG1260000
Benzene	U		0.000292	0.00108	1	04/01/2019 19:49	WG1258825
Bromochloromethane	U		0.000422	0.00108	1	04/01/2019 19:49	WG1258825
Bromodichloromethane	U		0.000275	0.00108	1	04/01/2019 19:49	WG1258825
Bromoform	U		0.000458	0.00108	1	04/01/2019 19:49	WG1258825
Bromomethane	U		0.00145	0.00541	1	04/01/2019 19:49	WG1258825
Carbon disulfide	U		0.000239	0.00108	1	04/01/2019 19:49	WG1258825
Carbon tetrachloride	U		0.000355	0.00108	1	04/01/2019 19:49	WG1258825
Chlorobenzene	U		0.000229	0.00108	1	04/01/2019 19:49	WG1258825
Chlorodibromomethane	U		0.000403	0.00108	1	04/01/2019 19:49	WG1258825
Chloroethane	U		0.00102	0.00541	1	04/01/2019 19:49	WG1258825
Chloroform	U		0.000248	0.00541	1	04/01/2019 19:49	WG1258825
Chloromethane	U		0.000405	0.00270	1	04/01/2019 19:49	WG1258825

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

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Cyclohexane	U		0.000378	0.00108	1	04/01/2019 19:49	WG1258825
1,2-Dibromo-3-Chloropropane	U		0.00114	0.00324	1	04/01/2019 19:49	WG1258825
1,2-Dibromoethane	U		0.000371	0.00108	1	04/01/2019 19:49	WG1258825
Dichlorodifluoromethane	U		0.000771	0.00541	1	04/01/2019 19:49	WG1258825
1,1-Dichloroethane	U		0.000215	0.00108	1	04/01/2019 19:49	WG1258825
1,2-Dichloroethane	U		0.000287	0.00108	1	04/01/2019 19:49	WG1258825
1,2-Dichlorobenzene	U		0.000330	0.00108	1	04/01/2019 19:49	WG1258825
1,3-Dichlorobenzene	U		0.000258	0.00108	1	04/01/2019 19:49	WG1258825
1,4-Dichlorobenzene	U		0.000244	0.00108	1	04/01/2019 19:49	WG1258825
1,1-Dichloroethene	U		0.000328	0.00108	1	04/01/2019 19:49	WG1258825
cis-1,2-Dichloroethene	U		0.000254	0.00108	1	04/01/2019 19:49	WG1258825
trans-1,2-Dichloroethene	U		0.000285	0.00108	1	04/01/2019 19:49	WG1258825
1,2-Dichloropropane	U		0.000387	0.00108	1	04/01/2019 19:49	WG1258825
cis-1,3-Dichloropropene	U		0.000283	0.00108	1	04/01/2019 19:49	WG1258825
trans-1,3-Dichloropropene	U		0.000289	0.00108	1	04/01/2019 19:49	WG1258825
Ethylbenzene	U		0.000321	0.00108	1	04/01/2019 19:49	WG1258825
2-Hexanone	U		0.00148	0.0108	1	04/01/2019 19:49	WG1258825
Isopropylbenzene	U		0.000263	0.0108	1	04/01/2019 19:49	WG1258825
2-Butanone (MEK)	U		0.00506	0.0108	1	04/01/2019 19:49	WG1258825
Methyl Acetate	U	J4	0.00660	0.0216	1	04/03/2019 15:36	WG1260000
Methyl Cyclohexane	U		0.000411	0.00108	1	04/01/2019 19:49	WG1258825
Methylene Chloride	U		0.00108	0.00541	1	04/01/2019 19:49	WG1258825
4-Methyl-2-pentanone (MIBK)	U		0.00203	0.0108	1	04/01/2019 19:49	WG1258825
Methyl tert-butyl ether	U		0.000229	0.00108	1	04/01/2019 19:49	WG1258825
Styrene	U		0.000253	0.00108	1	04/01/2019 19:49	WG1258825
1,1,2,2-Tetrachloroethane	U		0.000395	0.00108	1	04/01/2019 19:49	WG1258825
Tetrachloroethene	U		0.000298	0.00108	1	04/01/2019 19:49	WG1258825
Toluene	U		0.000469	0.00541	1	04/01/2019 19:49	WG1258825
1,2,3-Trichlorobenzene	U		0.000331	0.00108	1	04/01/2019 19:49	WG1258825
1,2,4-Trichlorobenzene	U		0.000419	0.00108	1	04/01/2019 19:49	WG1258825
1,1,1-Trichloroethane	U		0.000309	0.00108	1	04/01/2019 19:49	WG1258825
1,1,2-Trichloroethane	U		0.000299	0.00108	1	04/01/2019 19:49	WG1258825
Trichloroethene	U		0.000302	0.00108	1	04/01/2019 19:49	WG1258825
Trichlorofluoromethane	U		0.000413	0.00541	1	04/01/2019 19:49	WG1258825
1,1,2-Trichlorotrifluoroethane	U		0.000395	0.00108	1	04/01/2019 19:49	WG1258825
Vinyl chloride	U		0.000315	0.00108	1	04/01/2019 19:49	WG1258825
Xylenes, Total	U		0.000755	0.00324	1	04/01/2019 19:49	WG1258825
(S) Toluene-d8	*98.4*			*75.0-131*		*04/01/2019 19:49*	WG1258825
(S) Toluene-d8	*115*			*75.0-131*		*04/03/2019 15:36*	WG1260000
(S) a,a,a-Trifluorotoluene	*101*			*80.0-120*		*04/01/2019 19:49*	WG1258825
(S) a,a,a-Trifluorotoluene	*101*			*80.0-120*		*04/03/2019 15:36*	WG1260000
(S) 4-Bromofluorobenzene	*102*			*67.0-138*		*04/01/2019 19:49*	WG1258825
(S) 4-Bromofluorobenzene	*109*			*67.0-138*		*04/03/2019 15:36*	WG1260000
(S) 1,2-Dichloroethane-d4	*103*			*70.0-130*		*04/01/2019 19:49*	WG1258825
(S) 1,2-Dichloroethane-d4	*103*			*70.0-130*		*04/03/2019 15:36*	WG1260000

Volatile Organic Compounds (GC/MS) by Method 8260C - TENTATIVELY IDENTIFIED COMPOUNDS

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch	CAS #
Total Tic	0.0127	J N	0.000	0.000	1	04/01/2019 19:49	WG1258825	
Total Tic	0.0122	J N	0.000	0.000	1	04/03/2019 15:36	WG1260000	
Benzene, 1,4-Difluoro-	0.0122	J N	0.000	0.000	1	04/03/2019 15:36	WG1260000	000540-36-3
Hexanal	0.0127	J N	0.000	0.000	1	04/01/2019 19:49	WG1258825	000066-25-1

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Pesticides (GC) by Method 8081B

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Aldrin	U		0.00146	0.0216	1	04/04/2019 11:09	WG1260104
Alpha BHC	U		0.00147	0.00270	1	04/04/2019 11:09	WG1260104
Beta BHC	U		0.00173	0.00270	1	04/04/2019 11:09	WG1260104
Delta BHC	U		0.00155	0.0216	1	04/04/2019 11:09	WG1260104
Gamma BHC	U		0.00157	0.00270	1	04/04/2019 11:09	WG1260104
Chlordane	U		0.0422	0.216	1	04/04/2019 11:09	WG1260104
alpha-Chlordane	U		0.00152	0.0216	1	04/04/2019 11:09	WG1260104
gamma-Chlordane	U		0.00212	0.0216	1	04/04/2019 11:09	WG1260104
4,4-DDD	U		0.00169	0.0216	1	04/04/2019 11:09	WG1260104
4,4-DDE	U		0.00166	0.0216	1	04/04/2019 11:09	WG1260104
4,4-DDT	U		0.00216	0.0216	1	04/04/2019 11:09	WG1260104
Dieldrin	U		0.00164	0.00324	1	04/04/2019 11:09	WG1260104
Endosulfan I	U		0.00161	0.0216	1	04/04/2019 11:09	WG1260104
Endosulfan II	U		0.00173	0.0216	1	04/04/2019 11:09	WG1260104
Endosulfan sulfate	U		0.00163	0.0216	1	04/04/2019 11:09	WG1260104
Endrin	U		0.00170	0.0216	1	04/04/2019 11:09	WG1260104
Endrin aldehyde	U		0.00139	0.0216	1	04/04/2019 11:09	WG1260104
Endrin ketone	U		0.00178	0.0216	1	04/04/2019 11:09	WG1260104
Hexachlorobenzene	U		0.00134	0.0216	1	04/04/2019 11:09	WG1260104
Heptachlor	U		0.00166	0.0216	1	04/04/2019 11:09	WG1260104
Heptachlor epoxide	U		0.00174	0.0108	1	04/04/2019 11:09	WG1260104
Methoxychlor	U		0.00192	0.0216	1	04/04/2019 11:09	WG1260104
Toxaphene	U		0.0389	0.432	1	04/04/2019 11:09	WG1260104
(S) Decachlorobiphenyl	*151*	J1		*30.0-150*		*04/04/2019 11:09*	WG1260104
(S) Tetrachloro-m-xylene	*180*	J1		*30.0-150*		*04/04/2019 11:09*	WG1260104

Polychlorinated Biphenyls (GC) by Method 8082 A

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
PCB 1016	U		0.00378	0.0184	1	04/04/2019 15:07	WG1260104
PCB 1221	U		0.00581	0.0184	1	04/04/2019 15:07	WG1260104
PCB 1232	U		0.00451	0.0184	1	04/04/2019 15:07	WG1260104
PCB 1242	U		0.00344	0.0184	1	04/04/2019 15:07	WG1260104
PCB 1248	U		0.00341	0.0184	1	04/04/2019 15:07	WG1260104
PCB 1254	U		0.00510	0.0184	1	04/04/2019 15:07	WG1260104
PCB 1260	U		0.00534	0.0184	1	04/04/2019 15:07	WG1260104
(S) Decachlorobiphenyl	*157*	J1		*30.0-150*		*04/04/2019 15:07*	WG1260104
(S) Tetrachloro-m-xylene	*157*	J1		*30.0-150*		*04/04/2019 15:07*	WG1260104

Semi Volatile Organic Compounds (GC/MS) by Method 8270D

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Acenaphthene	U	J3 J4	0.00694	0.0357	1	04/09/2019 12:50	WG1262278
Acenaphthylene	U	J3 J4	0.00725	0.0357	1	04/09/2019 12:50	WG1262278
Acetophenone	U	J3 J4	0.0813	0.162	1	04/09/2019 12:50	WG1262278
Anthracene	U	J4	0.00683	0.0357	1	04/09/2019 12:50	WG1262278
Atrazine	U		0.101	0.162	1	04/09/2019 12:50	WG1262278
Benzaldehyde	U	J3	0.0575	0.162	1	04/09/2019 12:50	WG1262278
Benzo(a)anthracene	0.0103	J	0.00463	0.0357	1	04/09/2019 12:50	WG1262278
Benzo(b)fluoranthene	0.0137	J	0.00751	0.0357	1	04/09/2019 12:50	WG1262278
Benzo(k)fluoranthene	U		0.00629	0.0357	1	04/09/2019 12:50	WG1262278
Benzo(g,h,i)perylene	U		0.00780	0.0357	1	04/09/2019 12:50	WG1262278
Benzo(a)pyrene	0.00804	J	0.00592	0.0357	1	04/09/2019 12:50	WG1262278
Biphenyl	U	J3 J4	0.00636	0.162	1	04/09/2019 12:50	WG1262278
Bis(2-chlorethoxy)methane	U	J3 J4	0.00832	0.162	1	04/09/2019 12:50	WG1262278

Semi Volatile Organic Compounds (GC/MS) by Method 8270D

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Bis(2-chloroethyl)ether	U	J3 J4	0.00969	0.162	1	04/09/2019 12:50	WG1262278
Bis(2-chloroisopropyl)ether	U	J3 J4	0.00822	0.162	1	04/09/2019 12:50	WG1262278
4-Bromophenyl-phenylether	U	J4	0.0123	0.162	1	04/09/2019 12:50	WG1262278
Caprolactam	U		0.112	0.162	1	04/09/2019 12:50	WG1262278
Carbazole	U		0.00567	0.162	1	04/09/2019 12:50	WG1262278
4-Chloroaniline	U	J3 J4	0.0381	0.162	1	04/09/2019 12:50	WG1262278
2-Chloronaphthalene	U	J3 J4	0.00691	0.0357	1	04/09/2019 12:50	WG1262278
4-Chlorophenyl-phenylether	U	J4	0.00678	0.162	1	04/09/2019 12:50	WG1262278
Chrysene	0.00911	J J4	0.00600	0.0357	1	04/09/2019 12:50	WG1262278
Dibenz(a,h)anthracene	U		0.00888	0.0357	1	04/09/2019 12:50	WG1262278
Dibenzofuran	U	J3 J4	0.00560	0.162	1	04/09/2019 12:50	WG1262278
3,3-Dichlorobenzidine	U		0.0858	0.162	1	04/09/2019 12:50	WG1262278
2,4-Dinitrotoluene	U	J4	0.00656	0.162	1	04/09/2019 12:50	WG1262278
2,6-Dinitrotoluene	U	J4	0.00797	0.162	1	04/09/2019 12:50	WG1262278
Fluoranthene	0.0198	J	0.00536	0.0357	1	04/09/2019 12:50	WG1262278
Fluorene	U	J4	0.00737	0.0357	1	04/09/2019 12:50	WG1262278
Hexachlorobenzene	U	J4	0.00925	0.162	1	04/09/2019 12:50	WG1262278
Hexachloro-1,3-butadiene	U	J3 J4	0.0108	0.162	1	04/09/2019 12:50	WG1262278
Hexachlorocyclopentadiene	U	J0 J3	0.0635	0.162	1	04/09/2019 12:50	WG1262278
Hexachloroethane	U	J3	0.0145	0.162	1	04/09/2019 12:50	WG1262278
Indeno(1,2,3-cd)pyrene	U		0.00835	0.0357	1	04/09/2019 12:50	WG1262278
Isophorone	U	J3 J4	0.00564	0.162	1	04/09/2019 12:50	WG1262278
2-Methylnaphthalene	U	J3 J4	0.00931	0.0357	1	04/09/2019 12:50	WG1262278
Naphthalene	U	J3 J4	0.00961	0.0357	1	04/09/2019 12:50	WG1262278
2-Nitroaniline	U	J4	0.00816	0.162	1	04/09/2019 12:50	WG1262278
3-Nitroaniline	U	J4	0.00919	0.162	1	04/09/2019 12:50	WG1262278
4-Nitroaniline	U	J4	0.00691	0.162	1	04/09/2019 12:50	WG1262278
Nitrobenzene	U	J3 J4	0.00751	0.162	1	04/09/2019 12:50	WG1262278
n-Nitrosodiphenylamine	U		0.00642	0.162	1	04/09/2019 12:50	WG1262278
n-Nitrosodi-n-propylamine	U	J3 J4	0.00980	0.162	1	04/09/2019 12:50	WG1262278
Phenanthrene	0.0103	J J4	0.00571	0.0357	1	04/09/2019 12:50	WG1262278
Benzylbutyl phthalate	U		0.0111	0.162	1	04/09/2019 12:50	WG1262278
Bis(2-ethylhexyl)phthalate	U		0.0130	0.162	1	04/09/2019 12:50	WG1262278
Di-n-butyl phthalate	U		0.0118	0.162	1	04/09/2019 12:50	WG1262278
Diethyl phthalate	U	J4	0.00747	0.162	1	04/09/2019 12:50	WG1262278
Dimethyl phthalate	U	J4	0.00584	0.162	1	04/09/2019 12:50	WG1262278
Di-n-octyl phthalate	U		0.00981	0.162	1	04/09/2019 12:50	WG1262278
Pyrene	0.0157	J	0.0133	0.0357	1	04/09/2019 12:50	WG1262278
1,2,4,5-Tetrachlorobenzene	U	J3 J4	0.0824	0.162	1	04/09/2019 12:50	WG1262278
4-Chloro-3-methylphenol	U	J4	0.00516	0.162	1	04/09/2019 12:50	WG1262278
2-Chlorophenol	U	J3 J4	0.00898	0.162	1	04/09/2019 12:50	WG1262278
2-Methylphenol	U	J3 J4	0.0107	0.162	1	04/09/2019 12:50	WG1262278
3&4-Methyl Phenol	U	J3	0.00847	0.162	1	04/09/2019 12:50	WG1262278
2,4-Dichlorophenol	U	J3 J4	0.00807	0.162	1	04/09/2019 12:50	WG1262278
2,4-Dimethylphenol	U	J3 J4	0.0509	0.162	1	04/09/2019 12:50	WG1262278
4,6-Dinitro-2-methylphenol	U	J4	0.134	0.216	1	04/09/2019 12:50	WG1262278
2,4-Dinitrophenol	U	J3	0.106	0.216	1	04/09/2019 12:50	WG1262278
2-Nitrophenol	U	J3 J4	0.0141	0.162	1	04/09/2019 12:50	WG1262278
4-Nitrophenol	U		0.0568	0.162	1	04/09/2019 12:50	WG1262278
Pentachlorophenol	U		0.0519	0.162	1	04/09/2019 12:50	WG1262278
Phenol	U	J3	0.00751	0.162	1	04/09/2019 12:50	WG1262278
2,4,5-Trichlorophenol	U	J4	0.0112	0.162	1	04/09/2019 12:50	WG1262278
2,4,6-Trichlorophenol	U	J3 J4	0.00842	0.162	1	04/09/2019 12:50	WG1262278
(S) 2-Fluorophenol	*65.3*			*30.0-130*		*04/09/2019 12:50*	WG1262278
(S) Phenol-d5	*58.7*			*30.0-130*		*04/09/2019 12:50*	WG1262278
(S) Nitrobenzene-d5	*51.4*			*30.0-130*		*04/09/2019 12:50*	WG1262278

Semi Volatile Organic Compounds (GC/MS) by Method 8270D

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
(S) 2-Fluorobiphenyl	*52.6*			*30.0-130*		*04/09/2019 12:50*	WG1262278
(S) 2,4,6-Tribromophenol	*47.9*			*30.0-130*		*04/09/2019 12:50*	WG1262278
(S) p-Terphenyl-d14	*64.6*			*30.0-130*		*04/09/2019 12:50*	WG1262278

Semi Volatile Organic Compounds (GC/MS) by Method 8270D - TENTATIVELY IDENTIFIED COMPOUNDS

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch	CAS #
Total Tic	0.994	J N	0.000	0.000	1	04/09/2019 12:50	WG1262278	
Unknown-02	0.727	J N	0.000	0.000	1	04/09/2019 12:50	WG1262278	000123-42-2
Unknown-06	0.136	J N	0.000	0.000	1	04/09/2019 12:50	WG1262278	000079-29-8
Unknown-04	0.0469	J N	0.000	0.000	1	04/09/2019 12:50	WG1262278	000109-49-9
Unknown-05	0.0376	J N	0.000	0.000	1	04/09/2019 12:50	WG1262278	000000-00-0
Unknown-03	0.0235	J N	0.000	0.000	1	04/09/2019 12:50	WG1262278	001576-87-0
Unknown-01	0.0235	J N	0.000	0.000	1	04/09/2019 12:50	WG1262278	000558-37-2

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Calculated Results

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Chromium,Trivalent	2200		0.156	1.11	1	04/11/2019 16:31	WG1260035

Total Solids by Method 2540 G-2011

Analyte	Result %	Qualifier	Dilution	Analysis date / time	Batch
Total Solids	89.8		1	04/04/2019 11:06	WG1260343

Wet Chemistry by Method 3060A/7196A

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Chromium,Hexavalent	28.4		0.713	2.23	1	04/11/2019 16:31	WG1263590

Wet Chemistry by Method 9012B

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Cyanide	0.112	J	0.0434	0.278	1	04/05/2019 14:22	WG1260642

Mercury by Method 7471B

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Mercury	0.0609		0.00312	0.0223	1	04/04/2019 10:35	WG1260270

Metals (ICP) by Method 6010D

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Aluminum	4320		3.90	11.1	1	04/04/2019 16:36	WG1260035
Antimony	U		0.835	2.23	1	04/04/2019 16:36	WG1260035
Arsenic	U		0.512	2.23	1	04/04/2019 16:36	WG1260035
Barium	60.7		0.189	0.557	1	04/04/2019 16:36	WG1260035
Beryllium	0.173	J	0.0779	0.223	1	04/04/2019 16:36	WG1260035
Cadmium	U		0.0779	0.557	1	04/04/2019 16:36	WG1260035
Calcium	1360		5.16	111	1	04/04/2019 16:36	WG1260035
Chromium	2230		0.156	1.11	1	04/04/2019 16:36	WG1260035
Cobalt	0.758	J	0.256	1.11	1	04/04/2019 16:36	WG1260035
Copper	9.91		0.590	2.23	1	04/04/2019 16:36	WG1260035
Iron	8840		1.57	11.1	1	04/04/2019 16:36	WG1260035
Lead	35.8		0.212	0.557	1	04/04/2019 16:36	WG1260035
Magnesium	810		1.24	111	1	04/04/2019 16:36	WG1260035
Manganese	22.7		0.134	1.11	1	04/04/2019 16:36	WG1260035
Nickel	3.43		0.546	2.23	1	04/04/2019 16:36	WG1260035
Potassium	776		11.4	111	1	04/04/2019 16:36	WG1260035
Selenium	1.05	J	0.690	2.23	1	04/04/2019 16:36	WG1260035
Silver	U		0.134	1.11	1	04/04/2019 16:36	WG1260035
Sodium	72.5	B J	11.0	111	1	04/04/2019 16:36	WG1260035
Thallium	1.13	J	0.724	2.23	1	04/04/2019 16:36	WG1260035
Vanadium	5.30		0.267	2.23	1	04/04/2019 16:36	WG1260035
Zinc	17.5		0.657	5.57	1	04/04/2019 16:36	WG1260035

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

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Acetone	U		0.0111	0.0557	1	04/03/2019 15:56	WG1260000
Benzene	U		0.000301	0.00111	1	04/01/2019 20:09	WG1258825
Bromochloromethane	U		0.000434	0.00111	1	04/01/2019 20:09	WG1258825
Bromodichloromethane	U		0.000283	0.00111	1	04/01/2019 20:09	WG1258825
Bromoform	U		0.000472	0.00111	1	04/01/2019 20:09	WG1258825
Bromomethane	U		0.00149	0.00557	1	04/01/2019 20:09	WG1258825
Carbon disulfide	U		0.000246	0.00111	1	04/01/2019 20:09	WG1258825
Carbon tetrachloride	U		0.000365	0.00111	1	04/01/2019 20:09	WG1258825
Chlorobenzene	U		0.000236	0.00111	1	04/01/2019 20:09	WG1258825
Chlorodibromomethane	U		0.000415	0.00111	1	04/01/2019 20:09	WG1258825
Chloroethane	U		0.00105	0.00557	1	04/01/2019 20:09	WG1258825
Chloroform	U		0.000255	0.00557	1	04/01/2019 20:09	WG1258825
Chloromethane	U		0.000418	0.00278	1	04/01/2019 20:09	WG1258825
Cyclohexane	U		0.000390	0.00111	1	04/01/2019 20:09	WG1258825
1,2-Dibromo-3-Chloropropane	U		0.00117	0.00334	1	04/01/2019 20:09	WG1258825
1,2-Dibromoethane	U		0.000382	0.00111	1	04/01/2019 20:09	WG1258825
Dichlorodifluoromethane	U		0.000794	0.00557	1	04/01/2019 20:09	WG1258825
1,1-Dichloroethane	U		0.000222	0.00111	1	04/01/2019 20:09	WG1258825
1,2-Dichloroethane	U		0.000295	0.00111	1	04/01/2019 20:09	WG1258825
1,2-Dichlorobenzene	U		0.000340	0.00111	1	04/01/2019 20:09	WG1258825
1,3-Dichlorobenzene	U		0.000266	0.00111	1	04/01/2019 20:09	WG1258825
1,4-Dichlorobenzene	U		0.000252	0.00111	1	04/01/2019 20:09	WG1258825
1,1-Dichloroethene	U		0.000337	0.00111	1	04/01/2019 20:09	WG1258825
cis-1,2-Dichloroethene	U		0.000262	0.00111	1	04/01/2019 20:09	WG1258825
trans-1,2-Dichloroethene	U		0.000294	0.00111	1	04/01/2019 20:09	WG1258825
1,2-Dichloropropane	U		0.000399	0.00111	1	04/01/2019 20:09	WG1258825
cis-1,3-Dichloropropene	U		0.000292	0.00111	1	04/01/2019 20:09	WG1258825
trans-1,3-Dichloropropene	U		0.000297	0.00111	1	04/01/2019 20:09	WG1258825
Ethylbenzene	U		0.000331	0.00111	1	04/01/2019 20:09	WG1258825
2-Hexanone	U		0.00153	0.0111	1	04/01/2019 20:09	WG1258825
Isopropylbenzene	U		0.000271	0.0111	1	04/01/2019 20:09	WG1258825
2-Butanone (MEK)	U		0.00521	0.0111	1	04/01/2019 20:09	WG1258825
Methyl Acetate	U	J4	0.00679	0.0223	1	04/03/2019 15:56	WG1260000
Methyl Cyclohexane	U		0.000423	0.00111	1	04/01/2019 20:09	WG1258825
Methylene Chloride	U		0.00111	0.00557	1	04/01/2019 20:09	WG1258825
4-Methyl-2-pentanone (MIBK)	U		0.00209	0.0111	1	04/01/2019 20:09	WG1258825
Methyl tert-butyl ether	U		0.000236	0.00111	1	04/01/2019 20:09	WG1258825
Styrene	U		0.000261	0.00111	1	04/01/2019 20:09	WG1258825
1,1,2,2-Tetrachloroethane	U		0.000406	0.00111	1	04/01/2019 20:09	WG1258825
Tetrachloroethene	U		0.000307	0.00111	1	04/01/2019 20:09	WG1258825
Toluene	U		0.000483	0.00557	1	04/01/2019 20:09	WG1258825
1,2,3-Trichlorobenzene	U		0.000341	0.00111	1	04/01/2019 20:09	WG1258825
1,2,4-Trichlorobenzene	U		0.000432	0.00111	1	04/01/2019 20:09	WG1258825
1,1,1-Trichloroethane	U		0.000318	0.00111	1	04/01/2019 20:09	WG1258825
1,1,2-Trichloroethane	U		0.000308	0.00111	1	04/01/2019 20:09	WG1258825
Trichloroethene	U		0.000311	0.00111	1	04/01/2019 20:09	WG1258825
Trichlorofluoromethane	U		0.000425	0.00557	1	04/01/2019 20:09	WG1258825
1,1,2-Trichlorotrifluoroethane	U		0.000406	0.00111	1	04/01/2019 20:09	WG1258825
Vinyl chloride	U		0.000324	0.00111	1	04/01/2019 20:09	WG1258825
Xylenes, Total	U		0.000777	0.00334	1	04/01/2019 20:09	WG1258825
(S) Toluene-d8	*101*			*75.0-131*		*04/01/2019 20:09*	WG1258825
(S) Toluene-d8	*116*			*75.0-131*		*04/03/2019 15:56*	WG1260000
(S) a,a,a-Trifluorotoluene	*99.6*			*80.0-120*		*04/01/2019 20:09*	WG1258825
(S) a,a,a-Trifluorotoluene	*99.8*			*80.0-120*		*04/03/2019 15:56*	WG1260000
(S) 4-Bromofluorobenzene	*100*			*67.0-138*		*04/01/2019 20:09*	WG1258825
(S) 4-Bromofluorobenzene	*112*			*67.0-138*		*04/03/2019 15:56*	WG1260000

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

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
(S) 1,2-Dichloroethane-d4	*103*			*70.0-130*		*04/01/2019 20:09*	WG1258825
(S) 1,2-Dichloroethane-d4	*101*			*70.0-130*		*04/03/2019 15:56*	WG1260000

Volatile Organic Compounds (GC/MS) by Method 8260C - TENTATIVELY IDENTIFIED COMPOUNDS

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch	CAS #
Total Tic	0.000		0.000	0.000	1	04/01/2019 20:09	WG1258825	
Total Tic	0.0121	J N	0.000	0.000	1	04/03/2019 15:56	WG1260000	
Benzene, 1,4-Difluoro-	0.0121	J N	0.000	0.000	1	04/03/2019 15:56	WG1260000	000540-36-3

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Pesticides (GC) by Method 8081B

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Aldrin	U		0.00150	0.0223	1	04/04/2019 11:22	WG1260104
Alpha BHC	U		0.00151	0.00278	1	04/04/2019 11:22	WG1260104
Beta BHC	U		0.00178	0.00278	1	04/04/2019 11:22	WG1260104
Delta BHC	U		0.00159	0.0223	1	04/04/2019 11:22	WG1260104
Gamma BHC	U		0.00161	0.00278	1	04/04/2019 11:22	WG1260104
Chlordane	U		0.0434	0.223	1	04/04/2019 11:22	WG1260104
alpha-Chlordane	U		0.00157	0.0223	1	04/04/2019 11:22	WG1260104
gamma-Chlordane	U		0.00218	0.0223	1	04/04/2019 11:22	WG1260104
4,4-DDD	U		0.00174	0.0223	1	04/04/2019 11:22	WG1260104
4,4-DDE	U		0.00171	0.0223	1	04/04/2019 11:22	WG1260104
4,4-DDT	U		0.00223	0.0223	1	04/04/2019 11:22	WG1260104
Dieldrin	U		0.00169	0.00334	1	04/04/2019 11:22	WG1260104
Endosulfan I	U		0.00166	0.0223	1	04/04/2019 11:22	WG1260104
Endosulfan II	U		0.00178	0.0223	1	04/04/2019 11:22	WG1260104
Endosulfan sulfate	U		0.00168	0.0223	1	04/04/2019 11:22	WG1260104
Endrin	U		0.00175	0.0223	1	04/04/2019 11:22	WG1260104
Endrin aldehyde	U		0.00144	0.0223	1	04/04/2019 11:22	WG1260104
Endrin ketone	U		0.00184	0.0223	1	04/04/2019 11:22	WG1260104
Hexachlorobenzene	U		0.00138	0.0223	1	04/04/2019 11:22	WG1260104
Heptachlor	U		0.00171	0.0223	1	04/04/2019 11:22	WG1260104
Heptachlor epoxide	U		0.00179	0.0111	1	04/04/2019 11:22	WG1260104
Methoxychlor	U		0.00198	0.0223	1	04/04/2019 11:22	WG1260104
Toxaphene	U		0.0401	0.445	1	04/04/2019 11:22	WG1260104
(S) Decachlorobiphenyl	*77.0*			*30.0-150*		*04/04/2019 11:22*	WG1260104
(S) Tetrachloro-m-xylene	*80.3*			*30.0-150*		*04/04/2019 11:22*	WG1260104

Polychlorinated Biphenyls (GC) by Method 8082 A

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
PCB 1016	U		0.00390	0.0189	1	04/04/2019 15:21	WG1260104
PCB 1221	U		0.00598	0.0189	1	04/04/2019 15:21	WG1260104
PCB 1232	U		0.00464	0.0189	1	04/04/2019 15:21	WG1260104
PCB 1242	U		0.00354	0.0189	1	04/04/2019 15:21	WG1260104
PCB 1248	U		0.00351	0.0189	1	04/04/2019 15:21	WG1260104
PCB 1254	U		0.00526	0.0189	1	04/04/2019 15:21	WG1260104
PCB 1260	U		0.00550	0.0189	1	04/04/2019 15:21	WG1260104
(S) Decachlorobiphenyl	*72.6*			*30.0-150*		*04/04/2019 15:21*	WG1260104
(S) Tetrachloro-m-xylene	*65.9*			*30.0-150*		*04/04/2019 15:21*	WG1260104

Semi Volatile Organic Compounds (GC/MS) by Method 8270D

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Acenaphthene	U	J3 J4	0.0143	0.0735	2	04/09/2019 13:29	WG1262278
Acenaphthylene	U	J3 J4	0.0149	0.0735	2	04/09/2019 13:29	WG1262278
Acetophenone	U	J3 J4	0.167	0.334	2	04/09/2019 13:29	WG1262278
Anthracene	0.0252	J J4	0.0140	0.0735	2	04/09/2019 13:29	WG1262278
Atrazine	U		0.209	0.334	2	04/09/2019 13:29	WG1262278
Benzaldehyde	U	J3	0.118	0.334	2	04/09/2019 13:29	WG1262278
Benzo(a)anthracene	0.0504	J	0.00953	0.0735	2	04/09/2019 13:29	WG1262278
Benzo(b)fluoranthene	0.0512	J	0.0155	0.0735	2	04/09/2019 13:29	WG1262278
Benzo(k)fluoranthene	0.0130	J	0.0129	0.0735	2	04/09/2019 13:29	WG1262278
Benzo(g,h,i)perylene	0.0210	J	0.0160	0.0735	2	04/09/2019 13:29	WG1262278
Benzo(a)pyrene	0.0403	J	0.0122	0.0735	2	04/09/2019 13:29	WG1262278
Biphenyl	U	J3 J4	0.0131	0.334	2	04/09/2019 13:29	WG1262278
Bis(2-chlorethoxy)methane	U	J3 J4	0.0171	0.334	2	04/09/2019 13:29	WG1262278
Bis(2-chloroethyl)ether	U	J3 J4	0.0199	0.334	2	04/09/2019 13:29	WG1262278
Bis(2-chloroisopropyl)ether	U	J3 J4	0.0169	0.334	2	04/09/2019 13:29	WG1262278
4-Bromophenyl-phenylether	U	J4	0.0254	0.334	2	04/09/2019 13:29	WG1262278
Caprolactam	U		0.232	0.334	2	04/09/2019 13:29	WG1262278
Carbazole	0.0151	J	0.0117	0.334	2	04/09/2019 13:29	WG1262278
4-Chloroaniline	U	J3 J4	0.0784	0.334	2	04/09/2019 13:29	WG1262278
2-Chloronaphthalene	U	J3 J4	0.0143	0.0735	2	04/09/2019 13:29	WG1262278
4-Chlorophenyl-phenylether	U	J4	0.0139	0.334	2	04/09/2019 13:29	WG1262278
Chrysene	0.0470	J J4	0.0124	0.0735	2	04/09/2019 13:29	WG1262278
Dibenz(a,h)anthracene	U		0.0183	0.0735	2	04/09/2019 13:29	WG1262278
Dibenzofuran	0.0122	J J3 J4	0.0116	0.334	2	04/09/2019 13:29	WG1262278
3,3-Dichlorobenzidine	U		0.177	0.334	2	04/09/2019 13:29	WG1262278
2,4-Dinitrotoluene	U	J4	0.0135	0.334	2	04/09/2019 13:29	WG1262278
2,6-Dinitrotoluene	U	J4	0.0164	0.334	2	04/09/2019 13:29	WG1262278
Fluoranthene	0.0960		0.0110	0.0735	2	04/09/2019 13:29	WG1262278
Fluorene	U	J4	0.0151	0.0735	2	04/09/2019 13:29	WG1262278
Hexachlorobenzene	U	J4	0.0190	0.334	2	04/09/2019 13:29	WG1262278
Hexachloro-1,3-butadiene	U	J3 J4	0.0223	0.334	2	04/09/2019 13:29	WG1262278
Hexachlorocyclopentadiene	U	J0 J3	0.130	0.334	2	04/09/2019 13:29	WG1262278
Hexachloroethane	U	J3	0.0298	0.334	2	04/09/2019 13:29	WG1262278
Indeno(1,2,3-cd)pyrene	0.0268	J	0.0171	0.0735	2	04/09/2019 13:29	WG1262278
Isophorone	U	J3 J4	0.0116	0.334	2	04/09/2019 13:29	WG1262278
2-Methylnaphthalene	U	J3 J4	0.0192	0.0735	2	04/09/2019 13:29	WG1262278
Naphthalene	U	J3 J4	0.0198	0.0735	2	04/09/2019 13:29	WG1262278
2-Nitroaniline	U	J4	0.0168	0.334	2	04/09/2019 13:29	WG1262278
3-Nitroaniline	U	J4	0.0189	0.334	2	04/09/2019 13:29	WG1262278
4-Nitroaniline	U	J4	0.0143	0.334	2	04/09/2019 13:29	WG1262278
Nitrobenzene	U	J3 J4	0.0155	0.334	2	04/09/2019 13:29	WG1262278
n-Nitrosodiphenylamine	U		0.0133	0.334	2	04/09/2019 13:29	WG1262278
n-Nitrosodi-n-propylamine	U	J3 J4	0.0202	0.334	2	04/09/2019 13:29	WG1262278
Phenanthrene	0.104	J4	0.0118	0.0735	2	04/09/2019 13:29	WG1262278
Benzylbutyl phthalate	U		0.0229	0.334	2	04/09/2019 13:29	WG1262278
Bis(2-ethylhexyl)phthalate	U		0.0267	0.334	2	04/09/2019 13:29	WG1262278
Di-n-butyl phthalate	U		0.0243	0.334	2	04/09/2019 13:29	WG1262278
Diethyl phthalate	U	J4	0.0154	0.334	2	04/09/2019 13:29	WG1262278
Dimethyl phthalate	U	J4	0.0120	0.334	2	04/09/2019 13:29	WG1262278
Di-n-octyl phthalate	U		0.0202	0.334	2	04/09/2019 13:29	WG1262278
Pyrene	0.0787		0.0274	0.0735	2	04/09/2019 13:29	WG1262278
1,2,4,5-Tetrachlorobenzene	U	J3 J4	0.169	0.334	2	04/09/2019 13:29	WG1262278
4-Chloro-3-methylphenol	U	J4	0.0106	0.334	2	04/09/2019 13:29	WG1262278
2-Chlorophenol	U	J3 J4	0.0185	0.334	2	04/09/2019 13:29	WG1262278
2-Methylphenol	U	J3 J4	0.0219	0.334	2	04/09/2019 13:29	WG1262278
3&4-Methyl Phenol	U	J3	0.0175	0.334	2	04/09/2019 13:29	WG1262278

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Semi Volatile Organic Compounds (GC/MS) by Method 8270D

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
2,4-Dichlorophenol	U	J3 J4	0.0166	0.334	2	04/09/2019 13:29	WG1262278
2,4-Dimethylphenol	U	J3 J4	0.105	0.334	2	04/09/2019 13:29	WG1262278
4,6-Dinitro-2-methylphenol	U	J4	0.276	0.445	2	04/09/2019 13:29	WG1262278
2,4-Dinitrophenol	U	J3	0.218	0.445	2	04/09/2019 13:29	WG1262278
2-Nitrophenol	U	J3 J4	0.0290	0.334	2	04/09/2019 13:29	WG1262278
4-Nitrophenol	U		0.117	0.334	2	04/09/2019 13:29	WG1262278
Pentachlorophenol	U		0.107	0.334	2	04/09/2019 13:29	WG1262278
Phenol	U	J3	0.0155	0.334	2	04/09/2019 13:29	WG1262278
2,4,5-Trichlorophenol	U	J4	0.0232	0.334	2	04/09/2019 13:29	WG1262278
2,4,6-Trichlorophenol	U	J3 J4	0.0174	0.334	2	04/09/2019 13:29	WG1262278
(S) 2-Fluorophenol	*73.5*			*30.0-130*		*04/09/2019 13:29*	WG1262278
(S) Phenol-d5	*68.2*			*30.0-130*		*04/09/2019 13:29*	WG1262278
(S) Nitrobenzene-d5	*59.8*			*30.0-130*		*04/09/2019 13:29*	WG1262278
(S) 2-Fluorobiphenyl	*64.6*			*30.0-130*		*04/09/2019 13:29*	WG1262278
(S) 2,4,6-Tribromophenol	*67.5*			*30.0-130*		*04/09/2019 13:29*	WG1262278
(S) p-Terphenyl-d14	*70.3*			*30.0-130*		*04/09/2019 13:29*	WG1262278

Sample Narrative:

L1083840-18 WG1262278: Dilution due to matrix impact during extract concentration procedure

Semi Volatile Organic Compounds (GC/MS) by Method 8270D - TENTATIVELY IDENTIFIED COMPOUNDS

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch	CAS #
Total Tic	2.84	J N	0.000	0.000	2	04/09/2019 13:29	WG1262278	
Unknown-03	1.53	J N	0.000	0.000	2	04/09/2019 13:29	WG1262278	000123-42-2
Unknown-06	0.235	J N	0.000	0.000	2	04/09/2019 13:29	WG1262278	072182-11-7
Unknown-05	0.216	J N	0.000	0.000	2	04/09/2019 13:29	WG1262278	004464-77-1
Unknown-02	0.215	J N	0.000	0.000	2	04/09/2019 13:29	WG1262278	058783-82-7
Unknown-01	0.184	J N	0.000	0.000	2	04/09/2019 13:29	WG1262278	003404-73-7
Unknown-07	0.157	J N	0.000	0.000	2	04/09/2019 13:29	WG1262278	000600-14-6
Unknown-04	0.114	J N	0.000	0.000	2	04/09/2019 13:29	WG1262278	054699-35-3
Unknown-08	0.0709	J N	0.000	0.000	2	04/09/2019 13:29	WG1262278	000192-97-2
Unknown-09	0.0649	J N	0.000	0.000	2	04/09/2019 13:29	WG1262278	000630-06-8
Unknown-10	0.0546	J N	0.000	0.000	2	04/09/2019 13:29	WG1262278	054823-99-3

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Wet Chemistry by Method 4500CN E-2011

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Cyanide	U		1.80	5.00	1	04/04/2019 17:41	WG1260640

Mercury by Method 7470A

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Mercury	0.0732	B J	0.0490	0.200	1	04/03/2019 11:55	WG1258686

Metals (ICP) by Method 6010D

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Aluminum	63.0	J	35.0	200	1	04/05/2019 20:48	WG1259748
Antimony	U		7.50	10.0	1	04/05/2019 20:48	WG1259748
Arsenic	U		6.50	10.0	1	04/05/2019 20:48	WG1259748
Barium	U		1.70	5.00	1	04/05/2019 20:48	WG1259748
Beryllium	U		0.700	2.00	1	04/05/2019 20:48	WG1259748
Cadmium	U		0.700	2.00	1	04/05/2019 20:48	WG1259748
Calcium	71.1	J	46.3	1000	1	04/05/2019 20:48	WG1259748
Chromium	U		1.40	10.0	1	04/05/2019 20:48	WG1259748
Cobalt	U		2.30	10.0	1	04/05/2019 20:48	WG1259748
Copper	U		5.30	10.0	1	04/05/2019 20:48	WG1259748
Iron	15.7	J	14.1	100	1	04/05/2019 20:48	WG1259748
Lead	U		1.90	5.00	1	04/05/2019 20:48	WG1259748
Magnesium	U		11.1	1000	1	04/05/2019 20:48	WG1259748
Manganese	U		1.20	10.0	1	04/05/2019 20:48	WG1259748
Nickel	U		4.90	10.0	1	04/05/2019 20:48	WG1259748
Potassium	105	J	102	1000	1	04/05/2019 20:48	WG1259748
Silver	U		2.80	5.00	1	04/05/2019 20:48	WG1259748
Sodium	267	J	98.5	1000	1	04/05/2019 20:48	WG1259748
Vanadium	U		2.40	20.0	1	04/05/2019 20:48	WG1259748
Zinc	U		5.90	50.0	1	04/05/2019 20:48	WG1259748

Metals (ICPMS) by Method 6020B

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Selenium	U		0.380	2.00	1	04/06/2019 13:59	WG1259747
Thallium	U		0.190	2.00	1	04/06/2019 13:59	WG1259747

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

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Acetone	U		10.0	50.0	1	04/01/2019 18:32	WG1258768
Benzene	U		0.331	1.00	1	04/01/2019 18:32	WG1258768
Bromochloromethane	U		0.520	1.00	1	04/01/2019 18:32	WG1258768
Bromodichloromethane	U		0.380	1.00	1	04/01/2019 18:32	WG1258768
Bromoform	U		0.469	1.00	1	04/01/2019 18:32	WG1258768
Bromomethane	U		0.866	5.00	1	04/01/2019 18:32	WG1258768
Carbon disulfide	U		0.275	1.00	1	04/01/2019 18:32	WG1258768
Carbon tetrachloride	U		0.379	1.00	1	04/01/2019 18:32	WG1258768
Chlorobenzene	U		0.348	1.00	1	04/01/2019 18:32	WG1258768
Chlorodibromomethane	U		0.327	1.00	1	04/01/2019 18:32	WG1258768
Chloroethane	U		0.453	5.00	1	04/01/2019 18:32	WG1258768
Chloroform	U		0.324	5.00	1	04/01/2019 18:32	WG1258768
Chloromethane	U	J3	0.276	2.50	1	04/01/2019 18:32	WG1258768
Cyclohexane	U		0.390	1.00	1	04/01/2019 18:32	WG1258768

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

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
1,2-Dibromo-3-Chloropropane	U		1.33	5.00	1	04/01/2019 18:32	WG1258768
1,2-Dibromoethane	U		0.381	1.00	1	04/01/2019 18:32	WG1258768
1,2-Dichlorobenzene	U		0.349	1.00	1	04/01/2019 18:32	WG1258768
1,3-Dichlorobenzene	U		0.220	1.00	1	04/01/2019 18:32	WG1258768
1,4-Dichlorobenzene	U		0.274	1.00	1	04/01/2019 18:32	WG1258768
Dichlorodifluoromethane	U		0.551	5.00	1	04/01/2019 18:32	WG1258768
1,1-Dichloroethane	U		0.259	1.00	1	04/01/2019 18:32	WG1258768
1,2-Dichloroethane	U		0.361	1.00	1	04/01/2019 18:32	WG1258768
1,1-Dichloroethene	U		0.398	1.00	1	04/01/2019 18:32	WG1258768
cis-1,2-Dichloroethene	U		0.260	1.00	1	04/01/2019 18:32	WG1258768
trans-1,2-Dichloroethene	U		0.396	1.00	1	04/01/2019 18:32	WG1258768
1,2-Dichloropropane	U		0.306	1.00	1	04/01/2019 18:32	WG1258768
cis-1,3-Dichloropropene	U		0.418	1.00	1	04/01/2019 18:32	WG1258768
trans-1,3-Dichloropropene	U		0.419	1.00	1	04/01/2019 18:32	WG1258768
Ethylbenzene	U		0.384	1.00	1	04/01/2019 18:32	WG1258768
2-Hexanone	U		3.82	10.0	1	04/01/2019 18:32	WG1258768
Isopropylbenzene	U		0.326	1.00	1	04/01/2019 18:32	WG1258768
2-Butanone (MEK)	U		3.93	10.0	1	04/01/2019 18:32	WG1258768
Methyl Acetate	U		4.30	20.0	1	04/01/2019 18:32	WG1258768
Methyl Cyclohexane	U		0.380	1.00	1	04/01/2019 18:32	WG1258768
Methylene Chloride	U		1.00	3.00	1	04/01/2019 18:32	WG1258768
4-Methyl-2-pentanone (MIBK)	U		2.14	10.0	1	04/01/2019 18:32	WG1258768
Methyl tert-butyl ether	U		0.367	1.00	1	04/01/2019 18:32	WG1258768
Naphthalene	U		1.00	5.00	1	04/01/2019 18:32	WG1258768
tert-Butyl alcohol	U		2.40	5.00	1	04/01/2019 18:32	WG1258768
Styrene	U		0.307	1.00	1	04/01/2019 18:32	WG1258768
1,1,2,2-Tetrachloroethane	U		0.130	1.00	1	04/01/2019 18:32	WG1258768
Tetrachloroethene	U		0.372	1.00	1	04/01/2019 18:32	WG1258768
Toluene	U		0.412	1.00	1	04/01/2019 18:32	WG1258768
1,2,3-Trichlorobenzene	U		0.230	1.00	1	04/01/2019 18:32	WG1258768
1,2,4-Trichlorobenzene	U		0.355	1.00	1	04/01/2019 18:32	WG1258768
1,1,1-Trichloroethane	U		0.319	1.00	1	04/01/2019 18:32	WG1258768
1,1,2-Trichloroethane	U		0.383	1.00	1	04/01/2019 18:32	WG1258768
Trichloroethene	U		0.398	1.00	1	04/01/2019 18:32	WG1258768
Trichlorofluoromethane	U		1.20	5.00	1	04/01/2019 18:32	WG1258768
1,1,2-Trichlorotrifluoroethane	U		0.303	1.00	1	04/01/2019 18:32	WG1258768
Vinyl chloride	U		0.259	1.00	1	04/01/2019 18:32	WG1258768
Xylenes, Total	U		1.06	3.00	1	04/01/2019 18:32	WG1258768
(S) Toluene-d8	*107*			*80.0-120*		*04/01/2019 18:32*	WG1258768
(S) a,a,a-Trifluorotoluene	*107*			*80.0-120*		*04/01/2019 18:32*	WG1258768
(S) 4-Bromofluorobenzene	*94.2*			*77.0-126*		*04/01/2019 18:32*	WG1258768
(S) 1,2-Dichloroethane-d4	*99.4*			*70.0-130*		*04/01/2019 18:32*	WG1258768

Volatile Organic Compounds (GC/MS) by Method 8260C - TENTATIVELY IDENTIFIED COMPOUNDS

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch	CAS #
Total Tic	0.000		0.000	0.000	1	04/01/2019 18:32	WG1258768	

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Pesticides (GC) by Method 8081B

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
Aldrin	U		0.00813	0.0400	1	04/02/2019 11:47	WG1258609
Alpha BHC	U		0.0166	0.0200	1	04/02/2019 11:47	WG1258609
Beta BHC	U		0.0184	0.0400	1	04/02/2019 11:47	WG1258609
Delta BHC	U		0.0197	0.0500	1	04/02/2019 11:47	WG1258609
Gamma BHC	U		0.0176	0.0300	1	04/02/2019 11:47	WG1258609
Chlordane	U		0.0977	0.500	1	04/02/2019 11:47	WG1258609
alpha-Chlordane	U		0.0149	0.0500	1	04/02/2019 11:47	WG1258609
gamma-Chlordane	U		0.0137	0.0500	1	04/02/2019 11:47	WG1258609
4,4-DDD	U		0.0170	0.0500	1	04/02/2019 11:47	WG1258609
4,4-DDE	U		0.0164	0.0500	1	04/02/2019 11:47	WG1258609
4,4-DDT	U		0.0177	0.0500	1	04/02/2019 11:47	WG1258609
Dieldrin	U		0.00751	0.0500	1	04/02/2019 11:47	WG1258609
Endosulfan I	U		0.0179	0.0500	1	04/02/2019 11:47	WG1258609
Endosulfan II	U		0.0176	0.0500	1	04/02/2019 11:47	WG1258609
Endosulfan sulfate	U		0.0196	0.0500	1	04/02/2019 11:47	WG1258609
Endrin	U		0.0189	0.0500	1	04/02/2019 11:47	WG1258609
Endrin aldehyde	U		0.0142	0.0500	1	04/02/2019 11:47	WG1258609
Endrin ketone	U		0.0170	0.0500	1	04/02/2019 11:47	WG1258609
Hexachlorobenzene	U		0.0134	0.0500	1	04/02/2019 11:47	WG1258609
Heptachlor	U		0.0108	0.0500	1	04/02/2019 11:47	WG1258609
Heptachlor epoxide	U		0.0175	0.0500	1	04/02/2019 11:47	WG1258609
Methoxychlor	U		0.0193	0.0500	1	04/02/2019 11:47	WG1258609
Toxaphene	U		0.168	0.500	1	04/02/2019 11:47	WG1258609
(S) Decachlorobiphenyl	*67.9*			*30.0-150*		*04/02/2019 11:47*	WG1258609
(S) Tetrachloro-m-xylene	*109*			*30.0-150*		*04/02/2019 11:47*	WG1258609

Polychlorinated Biphenyls (GC) by Method 8082 A

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
PCB 1016	U		0.100	0.500	1	04/02/2019 12:52	WG1258609
PCB 1221	U		0.0730	0.500	1	04/02/2019 12:52	WG1258609
PCB 1232	U		0.0420	0.500	1	04/02/2019 12:52	WG1258609
PCB 1242	U		0.0470	0.500	1	04/02/2019 12:52	WG1258609
PCB 1248	U		0.0860	0.500	1	04/02/2019 12:52	WG1258609
PCB 1254	U		0.0470	0.500	1	04/02/2019 12:52	WG1258609
PCB 1260	U		0.120	0.500	1	04/02/2019 12:52	WG1258609
(S) Decachlorobiphenyl	*59.6*			*30.0-150*		*04/02/2019 12:52*	WG1258609
(S) Tetrachloro-m-xylene	*84.7*			*30.0-150*		*04/02/2019 12:52*	WG1258609

Semi Volatile Organic Compounds (GC/MS) by Method 8270 D

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
Acetophenone	U	J4	2.71	10.0	1	04/02/2019 18:01	WG1258603
Atrazine	U		0.260	10.0	1	04/02/2019 18:01	WG1258603
Benzaldehyde	U		1.40	10.0	1	04/02/2019 18:01	WG1258603
Biphenyl	U	J4	0.325	10.0	1	04/02/2019 18:01	WG1258603
Bis(2-chlorethoxy)methane	U	J4	0.329	10.0	1	04/02/2019 18:01	WG1258603
Bis(2-chloroethyl)ether	U	J4	1.62	7.00	1	04/02/2019 18:01	WG1258603
Bis(2-chloroisopropyl)ether	U	J4	0.445	10.0	1	04/02/2019 18:01	WG1258603
4-Bromophenyl-phenylether	U		0.335	10.0	1	04/02/2019 18:01	WG1258603
Caprolactam	U		2.59	10.0	1	04/02/2019 18:01	WG1258603
Carbazole	U		0.260	10.0	1	04/02/2019 18:01	WG1258603
4-Chloroaniline	U	J4	0.382	10.0	1	04/02/2019 18:01	WG1258603
4-Chlorophenyl-phenylether	U	J4	0.303	10.0	1	04/02/2019 18:01	WG1258603
Dibenzofuran	U	J4	0.338	10.0	1	04/02/2019 18:01	WG1258603

Semi Volatile Organic Compounds (GC/MS) by Method 8270 D

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
3,3-Dichlorobenzidine	U	J4	2.02	10.0	1	04/02/2019 18:01	WG1258603
2,4-Dinitrotoluene	U		1.65	10.0	1	04/02/2019 18:01	WG1258603
2,6-Dinitrotoluene	U		0.279	10.0	1	04/02/2019 18:01	WG1258603
Hexachloro-1,3-butadiene	U	J4	0.329	10.0	1	04/02/2019 18:01	WG1258603
Hexachlorocyclopentadiene	U	J0	2.33	50.0	1	04/02/2019 18:01	WG1258603
Hexachloroethane	U		0.365	7.00	1	04/02/2019 18:01	WG1258603
Isophorone	U	J4	0.272	10.0	1	04/02/2019 18:01	WG1258603
2-Nitroaniline	U		1.90	10.0	1	04/02/2019 18:01	WG1258603
3-Nitroaniline	U		0.308	10.0	1	04/02/2019 18:01	WG1258603
4-Nitroaniline	U		0.349	10.0	1	04/02/2019 18:01	WG1258603
Nitrobenzene	U	J4	0.367	6.00	1	04/02/2019 18:01	WG1258603
n-Nitrosodiphenylamine	U		1.19	10.0	1	04/02/2019 18:01	WG1258603
n-Nitrosodi-n-propylamine	U		0.403	10.0	1	04/02/2019 18:01	WG1258603
Benzylbutyl phthalate	U		0.275	10.0	1	04/02/2019 18:01	WG1258603
Bis(2-ethylhexyl)phthalate	U		0.709	10.0	1	04/02/2019 18:01	WG1258603
Di-n-butyl phthalate	U		0.266	10.0	1	04/02/2019 18:01	WG1258603
Diethyl phthalate	U		0.282	10.0	1	04/02/2019 18:01	WG1258603
Dimethyl phthalate	U		0.283	10.0	1	04/02/2019 18:01	WG1258603
Di-n-octyl phthalate	U		0.278	10.0	1	04/02/2019 18:01	WG1258603
1,2,4,5-Tetrachlorobenzene	U	J4	2.41	10.0	1	04/02/2019 18:01	WG1258603
4-Chloro-3-methylphenol	U	J4	0.263	10.0	1	04/02/2019 18:01	WG1258603
2-Chlorophenol	U	J4	0.283	10.0	1	04/02/2019 18:01	WG1258603
2-Methylphenol	U	J4	0.312	10.0	1	04/02/2019 18:01	WG1258603
3&4-Methyl Phenol	U		0.266	10.0	1	04/02/2019 18:01	WG1258603
2,4-Dichlorophenol	U	J4	0.284	10.0	1	04/02/2019 18:01	WG1258603
2,4-Dimethylphenol	U	J4	0.264	10.0	1	04/02/2019 18:01	WG1258603
4,6-Dinitro-2-methylphenol	U		2.62	10.0	1	04/02/2019 18:01	WG1258603
2,4-Dinitrophenol	U		3.25	10.0	1	04/02/2019 18:01	WG1258603
2-Nitrophenol	U	J4	0.320	10.0	1	04/02/2019 18:01	WG1258603
4-Nitrophenol	U		2.01	10.0	1	04/02/2019 18:01	WG1258603
Pentachlorophenol	U		0.313	10.0	1	04/02/2019 18:01	WG1258603
Phenol	2.40	J	0.334	10.0	1	04/02/2019 18:01	WG1258603
2,4,5-Trichlorophenol	U	J4	0.236	10.0	1	04/02/2019 18:01	WG1258603
2,4,6-Trichlorophenol	U	J4	0.297	10.0	1	04/02/2019 18:01	WG1258603
(S) 2-Fluorophenol	*38.6*			*15.0-110*		*04/02/2019 18:01*	WG1258603
(S) Phenol-d5	*20.5*			*15.0-110*		*04/02/2019 18:01*	WG1258603
(S) Nitrobenzene-d5	*57.4*			*30.0-130*		*04/02/2019 18:01*	WG1258603
(S) 2-Fluorobiphenyl	*61.1*			*30.0-130*		*04/02/2019 18:01*	WG1258603
(S) 2,4,6-Tribromophenol	*55.5*			*15.0-110*		*04/02/2019 18:01*	WG1258603
(S) p-Terphenyl-d14	*75.0*			*30.0-130*		*04/02/2019 18:01*	WG1258603

Semi Volatile Organic Compounds (GC/MS) by Method 8270 D - TENTATIVELY IDENTIFIED COMPOUNDS

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch	CAS #
Total Tic	0.000		0.000	0.000	1	04/02/2019 18:01	WG1258603	

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Anthracene	U		0.00800	0.0500	1	04/04/2019 11:19	WG1260608
Acenaphthene	U		0.0100	0.0500	1	04/04/2019 11:19	WG1260608
Acenaphthylene	U		0.0120	0.0500	1	04/04/2019 11:19	WG1260608
Benzo(a)anthracene	U		0.00410	0.0500	1	04/04/2019 11:19	WG1260608
Benzo(a)pyrene	U		0.0116	0.0500	1	04/04/2019 11:19	WG1260608
Benzo(b)fluoranthene	U		0.00212	0.0500	1	04/04/2019 11:19	WG1260608
Benzo(g,h,i)perylene	U		0.00227	0.0500	1	04/04/2019 11:19	WG1260608
Benzo(k)fluoranthene	U		0.0136	0.0500	1	04/04/2019 11:19	WG1260608
Chrysene	U		0.0108	0.0500	1	04/04/2019 11:19	WG1260608
Dibenz(a,h)anthracene	U		0.00396	0.0500	1	04/04/2019 11:19	WG1260608
Fluoranthene	U		0.0157	0.0500	1	04/04/2019 11:19	WG1260608
Fluorene	U		0.00850	0.0500	1	04/04/2019 11:19	WG1260608
Hexachlorobenzene	U		0.00670	0.0200	1	04/04/2019 11:19	WG1260608
Indeno(1,2,3-cd)pyrene	U		0.0148	0.0500	1	04/04/2019 11:19	WG1260608
Naphthalene	U		0.0198	0.250	1	04/04/2019 11:19	WG1260608
Phenanthrene	U		0.00820	0.0500	1	04/04/2019 11:19	WG1260608
Pyrene	U		0.0117	0.0500	1	04/04/2019 11:19	WG1260608
1-Methylnaphthalene	U		0.00821	0.250	1	04/04/2019 11:19	WG1260608
2-Methylnaphthalene	U		0.00902	0.250	1	04/04/2019 11:19	WG1260608
2-Chloronaphthalene	U		0.00647	0.250	1	04/04/2019 11:19	WG1260608
(S) Nitrobenzene-d5	*107*			*31.0-160*		*04/04/2019 11:19*	WG1260608
(S) 2-Fluorobiphenyl	*85.8*			*48.0-148*		*04/04/2019 11:19*	WG1260608
(S) p-Terphenyl-d14	*88.4*			*37.0-146*		*04/04/2019 11:19*	WG1260608

Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM - TENTATIVELY IDENTIFIED COMPOUNDS

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch	CAS #
	ug/l		ug/l	ug/l		date / time		

Number of TICs found: 0

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Wet Chemistry by Method 4500CN E-2011

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Cyanide	U		1.80	5.00	1	04/04/2019 19:42	WG1260640

Mercury by Method 7470A

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Mercury	0.0705	B J	0.0490	0.200	1	04/03/2019 11:58	WG1258686

Metals (ICP) by Method 6010D

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Aluminum	71.4	J	35.0	200	1	04/05/2019 20:51	WG1259748
Antimony	U		7.50	10.0	1	04/05/2019 20:51	WG1259748
Arsenic	U		6.50	10.0	1	04/05/2019 20:51	WG1259748
Barium	U		1.70	5.00	1	04/05/2019 20:51	WG1259748
Beryllium	U		0.700	2.00	1	04/05/2019 20:51	WG1259748
Cadmium	U		0.700	2.00	1	04/05/2019 20:51	WG1259748
Calcium	189	J	46.3	1000	1	04/05/2019 20:51	WG1259748
Chromium	2.51	J	1.40	10.0	1	04/05/2019 20:51	WG1259748
Cobalt	U		2.30	10.0	1	04/05/2019 20:51	WG1259748
Copper	U		5.30	10.0	1	04/05/2019 20:51	WG1259748
Iron	150		14.1	100	1	04/05/2019 20:51	WG1259748
Lead	U		1.90	5.00	1	04/05/2019 20:51	WG1259748
Magnesium	U		11.1	1000	1	04/05/2019 20:51	WG1259748
Manganese	1.41	J	1.20	10.0	1	04/05/2019 20:51	WG1259748
Nickel	U		4.90	10.0	1	04/05/2019 20:51	WG1259748
Potassium	115	J	102	1000	1	04/05/2019 20:51	WG1259748
Silver	U		2.80	5.00	1	04/05/2019 20:51	WG1259748
Sodium	468	J	98.5	1000	1	04/05/2019 20:51	WG1259748
Vanadium	U		2.40	20.0	1	04/05/2019 20:51	WG1259748
Zinc	U		5.90	50.0	1	04/05/2019 20:51	WG1259748

Metals (ICPMS) by Method 6020B

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Selenium	U		0.380	2.00	1	04/06/2019 14:04	WG1259747
Thallium	U		0.190	2.00	1	04/06/2019 14:04	WG1259747

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

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Acetone	U		10.0	50.0	1	04/01/2019 18:53	WG1258768
Benzene	U		0.331	1.00	1	04/01/2019 18:53	WG1258768
Bromochloromethane	U		0.520	1.00	1	04/01/2019 18:53	WG1258768
Bromodichloromethane	U		0.380	1.00	1	04/01/2019 18:53	WG1258768
Bromoform	U		0.469	1.00	1	04/01/2019 18:53	WG1258768
Bromomethane	U		0.866	5.00	1	04/01/2019 18:53	WG1258768
Carbon disulfide	U		0.275	1.00	1	04/01/2019 18:53	WG1258768
Carbon tetrachloride	U		0.379	1.00	1	04/01/2019 18:53	WG1258768
Chlorobenzene	U		0.348	1.00	1	04/01/2019 18:53	WG1258768
Chlorodibromomethane	U		0.327	1.00	1	04/01/2019 18:53	WG1258768
Chloroethane	U		0.453	5.00	1	04/01/2019 18:53	WG1258768
Chloroform	U		0.324	5.00	1	04/01/2019 18:53	WG1258768
Chloromethane	U	J3	0.276	2.50	1	04/01/2019 18:53	WG1258768
Cyclohexane	U		0.390	1.00	1	04/01/2019 18:53	WG1258768

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

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
1,2-Dibromo-3-Chloropropane	U		1.33	5.00	1	04/01/2019 18:53	WG1258768
1,2-Dibromoethane	U		0.381	1.00	1	04/01/2019 18:53	WG1258768
1,2-Dichlorobenzene	U		0.349	1.00	1	04/01/2019 18:53	WG1258768
1,3-Dichlorobenzene	U		0.220	1.00	1	04/01/2019 18:53	WG1258768
1,4-Dichlorobenzene	U		0.274	1.00	1	04/01/2019 18:53	WG1258768
Dichlorodifluoromethane	U		0.551	5.00	1	04/01/2019 18:53	WG1258768
1,1-Dichloroethane	U		0.259	1.00	1	04/01/2019 18:53	WG1258768
1,2-Dichloroethane	U		0.361	1.00	1	04/01/2019 18:53	WG1258768
1,1-Dichloroethene	U		0.398	1.00	1	04/01/2019 18:53	WG1258768
cis-1,2-Dichloroethene	U		0.260	1.00	1	04/01/2019 18:53	WG1258768
trans-1,2-Dichloroethene	U		0.396	1.00	1	04/01/2019 18:53	WG1258768
1,2-Dichloropropane	U		0.306	1.00	1	04/01/2019 18:53	WG1258768
cis-1,3-Dichloropropene	U		0.418	1.00	1	04/01/2019 18:53	WG1258768
trans-1,3-Dichloropropene	U		0.419	1.00	1	04/01/2019 18:53	WG1258768
Ethylbenzene	U		0.384	1.00	1	04/01/2019 18:53	WG1258768
2-Hexanone	U		3.82	10.0	1	04/01/2019 18:53	WG1258768
Isopropylbenzene	U		0.326	1.00	1	04/01/2019 18:53	WG1258768
2-Butanone (MEK)	U		3.93	10.0	1	04/01/2019 18:53	WG1258768
Methyl Acetate	U		4.30	20.0	1	04/01/2019 18:53	WG1258768
Methyl Cyclohexane	U		0.380	1.00	1	04/01/2019 18:53	WG1258768
Methylene Chloride	U		1.00	3.00	1	04/01/2019 18:53	WG1258768
4-Methyl-2-pentanone (MIBK)	U		2.14	10.0	1	04/01/2019 18:53	WG1258768
Methyl tert-butyl ether	U		0.367	1.00	1	04/01/2019 18:53	WG1258768
Naphthalene	U		1.00	5.00	1	04/01/2019 18:53	WG1258768
tert-Butyl alcohol	U		2.40	5.00	1	04/01/2019 18:53	WG1258768
Styrene	U		0.307	1.00	1	04/01/2019 18:53	WG1258768
1,1,2,2-Tetrachloroethane	U		0.130	1.00	1	04/01/2019 18:53	WG1258768
Tetrachloroethene	U		0.372	1.00	1	04/01/2019 18:53	WG1258768
Toluene	U		0.412	1.00	1	04/01/2019 18:53	WG1258768
1,2,3-Trichlorobenzene	U		0.230	1.00	1	04/01/2019 18:53	WG1258768
1,2,4-Trichlorobenzene	U		0.355	1.00	1	04/01/2019 18:53	WG1258768
1,1,1-Trichloroethane	U		0.319	1.00	1	04/01/2019 18:53	WG1258768
1,1,2-Trichloroethane	U		0.383	1.00	1	04/01/2019 18:53	WG1258768
Trichloroethene	U		0.398	1.00	1	04/01/2019 18:53	WG1258768
Trichlorofluoromethane	U		1.20	5.00	1	04/01/2019 18:53	WG1258768
1,1,2-Trichlorotrifluoroethane	U		0.303	1.00	1	04/01/2019 18:53	WG1258768
Vinyl chloride	U		0.259	1.00	1	04/01/2019 18:53	WG1258768
Xylenes, Total	U		1.06	3.00	1	04/01/2019 18:53	WG1258768
(S) Toluene-d8	*99.2*			*80.0-120*		*04/01/2019 18:53*	WG1258768
(S) a,a,a-Trifluorotoluene	*107*			*80.0-120*		*04/01/2019 18:53*	WG1258768
(S) 4-Bromofluorobenzene	*98.2*			*77.0-126*		*04/01/2019 18:53*	WG1258768
(S) 1,2-Dichloroethane-d4	*97.5*			*70.0-130*		*04/01/2019 18:53*	WG1258768

Volatile Organic Compounds (GC/MS) by Method 8260C - TENTATIVELY IDENTIFIED COMPOUNDS

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch	CAS #
	ug/l		ug/l	ug/l		date / time		
Total Tic	0.000		0.000	0.000	1	04/01/2019 18:53	WG1258768	

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Pesticides (GC) by Method 8081B

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
Aldrin	U		0.00837	0.0412	1.03	04/03/2019 11:25	WG1259577
Alpha BHC	U		0.0171	0.0206	1.03	04/03/2019 11:25	WG1259577
Beta BHC	U		0.0190	0.0412	1.03	04/03/2019 11:25	WG1259577
Delta BHC	U		0.0203	0.0515	1.03	04/03/2019 11:25	WG1259577
Gamma BHC	U		0.0181	0.0309	1.03	04/03/2019 11:25	WG1259577
Chlordane	U		0.101	0.515	1.03	04/03/2019 11:25	WG1259577
alpha-Chlordane	U		0.0153	0.0515	1.03	04/03/2019 11:25	WG1259577
gamma-Chlordane	U		0.0141	0.0515	1.03	04/03/2019 11:25	WG1259577
4,4-DDD	U		0.0175	0.0515	1.03	04/03/2019 11:25	WG1259577
4,4-DDE	U		0.0169	0.0515	1.03	04/03/2019 11:25	WG1259577
4,4-DDT	U		0.0182	0.0515	1.03	04/03/2019 11:25	WG1259577
Dieldrin	U		0.00774	0.0515	1.03	04/03/2019 11:25	WG1259577
Endosulfan I	U		0.0184	0.0515	1.03	04/03/2019 11:25	WG1259577
Endosulfan II	U		0.0181	0.0515	1.03	04/03/2019 11:25	WG1259577
Endosulfan sulfate	U		0.0202	0.0515	1.03	04/03/2019 11:25	WG1259577
Endrin	U		0.0195	0.0515	1.03	04/03/2019 11:25	WG1259577
Endrin aldehyde	U		0.0146	0.0515	1.03	04/03/2019 11:25	WG1259577
Endrin ketone	U		0.0175	0.0515	1.03	04/03/2019 11:25	WG1259577
Hexachlorobenzene	U		0.0138	0.0515	1.03	04/03/2019 11:25	WG1259577
Heptachlor	U	J3 J4	0.0111	0.0515	1.03	04/03/2019 11:25	WG1259577
Heptachlor epoxide	U		0.0180	0.0515	1.03	04/03/2019 11:25	WG1259577
Methoxychlor	U		0.0199	0.0515	1.03	04/03/2019 11:25	WG1259577
Toxaphene	U		0.173	0.515	1.03	04/03/2019 11:25	WG1259577
(S) Decachlorobiphenyl	*76.3*			*30.0-150*		*04/03/2019 11:25*	WG1259577
(S) Tetrachloro-m-xylene	*96.9*			*30.0-150*		*04/03/2019 11:25*	WG1259577

Polychlorinated Biphenyls (GC) by Method 8082 A

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
PCB 1016	U		0.103	0.515	1.03	04/03/2019 14:07	WG1259577
PCB 1221	U		0.0752	0.515	1.03	04/03/2019 14:07	WG1259577
PCB 1232	U		0.0433	0.515	1.03	04/03/2019 14:07	WG1259577
PCB 1242	U		0.0484	0.515	1.03	04/03/2019 14:07	WG1259577
PCB 1248	U		0.0886	0.515	1.03	04/03/2019 14:07	WG1259577
PCB 1254	U		0.0484	0.515	1.03	04/03/2019 14:07	WG1259577
PCB 1260	U		0.124	0.515	1.03	04/03/2019 14:07	WG1259577
(S) Decachlorobiphenyl	*80.2*			*30.0-150*		*04/03/2019 14:07*	WG1259577
(S) Tetrachloro-m-xylene	*87.5*			*30.0-150*		*04/03/2019 14:07*	WG1259577

Semi Volatile Organic Compounds (GC/MS) by Method 8270 D

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
Acetophenone	U	J4	2.71	10.0	1	04/02/2019 18:48	WG1258603
Atrazine	U		0.260	10.0	1	04/02/2019 18:48	WG1258603
Benzaldehyde	U		1.40	10.0	1	04/02/2019 18:48	WG1258603
Biphenyl	U	J4	0.325	10.0	1	04/02/2019 18:48	WG1258603
Bis(2-chlorethoxy)methane	U	J4	0.329	10.0	1	04/02/2019 18:48	WG1258603
Bis(2-chloroethyl)ether	U	J4	1.62	7.00	1	04/02/2019 18:48	WG1258603
Bis(2-chloroisopropyl)ether	U	J4	0.445	10.0	1	04/02/2019 18:48	WG1258603
4-Bromophenyl-phenylether	U		0.335	10.0	1	04/02/2019 18:48	WG1258603
Caprolactam	U		2.59	10.0	1	04/02/2019 18:48	WG1258603
Carbazole	U		0.260	10.0	1	04/02/2019 18:48	WG1258603
4-Chloroaniline	U	J4	0.382	10.0	1	04/02/2019 18:48	WG1258603
4-Chlorophenyl-phenylether	U	J4	0.303	10.0	1	04/02/2019 18:48	WG1258603
Dibenzofuran	U	J4	0.338	10.0	1	04/02/2019 18:48	WG1258603

Semi Volatile Organic Compounds (GC/MS) by Method 8270 D

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
3,3-Dichlorobenzidine	U	J4	2.02	10.0	1	04/02/2019 18:48	WG1258603
2,4-Dinitrotoluene	U		1.65	10.0	1	04/02/2019 18:48	WG1258603
2,6-Dinitrotoluene	U		0.279	10.0	1	04/02/2019 18:48	WG1258603
Hexachloro-1,3-butadiene	U	J4	0.329	10.0	1	04/02/2019 18:48	WG1258603
Hexachlorocyclopentadiene	U	J0	2.33	50.0	1	04/02/2019 18:48	WG1258603
Hexachloroethane	U		0.365	7.00	1	04/02/2019 18:48	WG1258603
Isophorone	U	J4	0.272	10.0	1	04/02/2019 18:48	WG1258603
2-Nitroaniline	U		1.90	10.0	1	04/02/2019 18:48	WG1258603
3-Nitroaniline	U		0.308	10.0	1	04/02/2019 18:48	WG1258603
4-Nitroaniline	U		0.349	10.0	1	04/02/2019 18:48	WG1258603
Nitrobenzene	U	J4	0.367	6.00	1	04/02/2019 18:48	WG1258603
n-Nitrosodiphenylamine	U		1.19	10.0	1	04/02/2019 18:48	WG1258603
n-Nitrosodi-n-propylamine	U		0.403	10.0	1	04/02/2019 18:48	WG1258603
Benzylbutyl phthalate	U		0.275	10.0	1	04/02/2019 18:48	WG1258603
Bis(2-ethylhexyl)phthalate	U		0.709	10.0	1	04/02/2019 18:48	WG1258603
Di-n-butyl phthalate	1.76	J	0.266	10.0	1	04/02/2019 18:48	WG1258603
Diethyl phthalate	U		0.282	10.0	1	04/02/2019 18:48	WG1258603
Dimethyl phthalate	U		0.283	10.0	1	04/02/2019 18:48	WG1258603
Di-n-octyl phthalate	U		0.278	10.0	1	04/02/2019 18:48	WG1258603
1,2,4,5-Tetrachlorobenzene	U	J4	2.41	10.0	1	04/02/2019 18:48	WG1258603
4-Chloro-3-methylphenol	U	J4	0.263	10.0	1	04/02/2019 18:48	WG1258603
2-Chlorophenol	U	J4	0.283	10.0	1	04/02/2019 18:48	WG1258603
2-Methylphenol	U	J4	0.312	10.0	1	04/02/2019 18:48	WG1258603
3&4-Methyl Phenol	U		0.266	10.0	1	04/02/2019 18:48	WG1258603
2,4-Dichlorophenol	U	J4	0.284	10.0	1	04/02/2019 18:48	WG1258603
2,4-Dimethylphenol	U	J4	0.264	10.0	1	04/02/2019 18:48	WG1258603
4,6-Dinitro-2-methylphenol	U		2.62	10.0	1	04/02/2019 18:48	WG1258603
2,4-Dinitrophenol	U		3.25	10.0	1	04/02/2019 18:48	WG1258603
2-Nitrophenol	U	J4	0.320	10.0	1	04/02/2019 18:48	WG1258603
4-Nitrophenol	U		2.01	10.0	1	04/02/2019 18:48	WG1258603
Pentachlorophenol	U		0.313	10.0	1	04/02/2019 18:48	WG1258603
Phenol	1.52	J	0.334	10.0	1	04/02/2019 18:48	WG1258603
2,4,5-Trichlorophenol	U	J4	0.236	10.0	1	04/02/2019 18:48	WG1258603
2,4,6-Trichlorophenol	U	J4	0.297	10.0	1	04/02/2019 18:48	WG1258603
(S) 2-Fluorophenol	*42.4*			*15.0-110*		*04/02/2019 18:48*	WG1258603
(S) Phenol-d5	*23.0*			*15.0-110*		*04/02/2019 18:48*	WG1258603
(S) Nitrobenzene-d5	*58.0*			*30.0-130*		*04/02/2019 18:48*	WG1258603
(S) 2-Fluorobiphenyl	*62.3*			*30.0-130*		*04/02/2019 18:48*	WG1258603
(S) 2,4,6-Tribromophenol	*58.0*			*15.0-110*		*04/02/2019 18:48*	WG1258603
(S) p-Terphenyl-d14	*75.9*			*30.0-130*		*04/02/2019 18:48*	WG1258603

Semi Volatile Organic Compounds (GC/MS) by Method 8270 D - TENTATIVELY IDENTIFIED COMPOUNDS

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch	CAS #
	ug/l		ug/l	ug/l		date / time		
Total Tic	9.17	J N	0.000	0.000	1	04/02/2019 18:48	WG1258603	
Butyl Citrate	9.17	J N	0.000	0.000	1	04/02/2019 18:48	WG1258603	000077-94-1

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Anthracene	U		0.00800	0.0500	1	04/04/2019 11:41	WG1260608
Acenaphthene	U		0.0100	0.0500	1	04/04/2019 11:41	WG1260608
Acenaphthylene	U		0.0120	0.0500	1	04/04/2019 11:41	WG1260608
Benzo(a)anthracene	U		0.00410	0.0500	1	04/04/2019 11:41	WG1260608
Benzo(a)pyrene	U		0.0116	0.0500	1	04/04/2019 11:41	WG1260608
Benzo(b)fluoranthene	U		0.00212	0.0500	1	04/04/2019 11:41	WG1260608
Benzo(g,h,i)perylene	U		0.00227	0.0500	1	04/04/2019 11:41	WG1260608
Benzo(k)fluoranthene	U		0.0136	0.0500	1	04/04/2019 11:41	WG1260608
Chrysene	U		0.0108	0.0500	1	04/04/2019 11:41	WG1260608
Dibenz(a,h)anthracene	U		0.00396	0.0500	1	04/04/2019 11:41	WG1260608
Fluoranthene	U		0.0157	0.0500	1	04/04/2019 11:41	WG1260608
Fluorene	0.0100	J	0.00850	0.0500	1	04/04/2019 11:41	WG1260608
Hexachlorobenzene	U		0.00670	0.0200	1	04/04/2019 11:41	WG1260608
Indeno(1,2,3-cd)pyrene	U		0.0148	0.0500	1	04/04/2019 11:41	WG1260608
Naphthalene	0.0745	J	0.0198	0.250	1	04/04/2019 11:41	WG1260608
Phenanthrene	0.0380	J	0.00820	0.0500	1	04/04/2019 11:41	WG1260608
Pyrene	0.0147	J	0.0117	0.0500	1	04/04/2019 11:41	WG1260608
1-Methylnaphthalene	0.0225	J	0.00821	0.250	1	04/04/2019 11:41	WG1260608
2-Methylnaphthalene	0.0309	J	0.00902	0.250	1	04/04/2019 11:41	WG1260608
2-Chloronaphthalene	U		0.00647	0.250	1	04/04/2019 11:41	WG1260608
(S) Nitrobenzene-d5	*112*			*31.0-160*		*04/04/2019 11:41*	WG1260608
(S) 2-Fluorobiphenyl	*84.2*			*48.0-148*		*04/04/2019 11:41*	WG1260608
(S) p-Terphenyl-d14	*90.5*			*37.0-146*		*04/04/2019 11:41*	WG1260608

Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM - TENTATIVELY IDENTIFIED COMPOUNDS

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch	CAS #
	ug/l		ug/l	ug/l		date / time		

Number of TICs found: 0

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

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

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Acetone	U		10.0	50.0	1	04/01/2019 19:15	WG1258768
Benzene	U		0.331	1.00	1	04/01/2019 19:15	WG1258768
Bromochloromethane	U		0.520	1.00	1	04/01/2019 19:15	WG1258768
Bromodichloromethane	U		0.380	1.00	1	04/01/2019 19:15	WG1258768
Bromoform	U		0.469	1.00	1	04/01/2019 19:15	WG1258768
Bromomethane	U		0.866	5.00	1	04/01/2019 19:15	WG1258768
Carbon disulfide	U		0.275	1.00	1	04/01/2019 19:15	WG1258768
Carbon tetrachloride	U		0.379	1.00	1	04/01/2019 19:15	WG1258768
Chlorobenzene	U		0.348	1.00	1	04/01/2019 19:15	WG1258768
Chlorodibromomethane	U		0.327	1.00	1	04/01/2019 19:15	WG1258768
Chloroethane	U		0.453	5.00	1	04/01/2019 19:15	WG1258768
Chloroform	U		0.324	5.00	1	04/01/2019 19:15	WG1258768
Chloromethane	U	J3	0.276	2.50	1	04/01/2019 19:15	WG1258768
Cyclohexane	U		0.390	1.00	1	04/01/2019 19:15	WG1258768
1,2-Dibromo-3-Chloropropane	U		1.33	5.00	1	04/01/2019 19:15	WG1258768
1,2-Dibromoethane	U		0.381	1.00	1	04/01/2019 19:15	WG1258768
1,2-Dichlorobenzene	U		0.349	1.00	1	04/01/2019 19:15	WG1258768
1,3-Dichlorobenzene	U		0.220	1.00	1	04/01/2019 19:15	WG1258768
1,4-Dichlorobenzene	U		0.274	1.00	1	04/01/2019 19:15	WG1258768
Dichlorodifluoromethane	U		0.551	5.00	1	04/01/2019 19:15	WG1258768
1,1-Dichloroethane	U		0.259	1.00	1	04/01/2019 19:15	WG1258768
1,2-Dichloroethane	U		0.361	1.00	1	04/01/2019 19:15	WG1258768
1,1-Dichloroethene	U		0.398	1.00	1	04/01/2019 19:15	WG1258768
cis-1,2-Dichloroethene	U		0.260	1.00	1	04/01/2019 19:15	WG1258768
trans-1,2-Dichloroethene	U		0.396	1.00	1	04/01/2019 19:15	WG1258768
1,2-Dichloropropane	U		0.306	1.00	1	04/01/2019 19:15	WG1258768
cis-1,3-Dichloropropene	U		0.418	1.00	1	04/01/2019 19:15	WG1258768
trans-1,3-Dichloropropene	U		0.419	1.00	1	04/01/2019 19:15	WG1258768
Ethylbenzene	U		0.384	1.00	1	04/01/2019 19:15	WG1258768
2-Hexanone	U		3.82	10.0	1	04/01/2019 19:15	WG1258768
Isopropylbenzene	U		0.326	1.00	1	04/01/2019 19:15	WG1258768
2-Butanone (MEK)	U		3.93	10.0	1	04/01/2019 19:15	WG1258768
Methyl Acetate	U		4.30	20.0	1	04/01/2019 19:15	WG1258768
Methyl Cyclohexane	U		0.380	1.00	1	04/01/2019 19:15	WG1258768
Methylene Chloride	U		1.00	3.00	1	04/01/2019 19:15	WG1258768
4-Methyl-2-pentanone (MIBK)	U		2.14	10.0	1	04/01/2019 19:15	WG1258768
Methyl tert-butyl ether	U		0.367	1.00	1	04/01/2019 19:15	WG1258768
Naphthalene	U		1.00	5.00	1	04/01/2019 19:15	WG1258768
tert-Butyl alcohol	U		2.40	5.00	1	04/01/2019 19:15	WG1258768
Styrene	U		0.307	1.00	1	04/01/2019 19:15	WG1258768
1,1,2,2-Tetrachloroethane	U		0.130	1.00	1	04/01/2019 19:15	WG1258768
Tetrachloroethene	U		0.372	1.00	1	04/01/2019 19:15	WG1258768
Toluene	U		0.412	1.00	1	04/01/2019 19:15	WG1258768
1,2,3-Trichlorobenzene	U		0.230	1.00	1	04/01/2019 19:15	WG1258768
1,2,4-Trichlorobenzene	U		0.355	1.00	1	04/01/2019 19:15	WG1258768
1,1,1-Trichloroethane	U		0.319	1.00	1	04/01/2019 19:15	WG1258768
1,1,2-Trichloroethane	U		0.383	1.00	1	04/01/2019 19:15	WG1258768
Trichloroethene	U		0.398	1.00	1	04/01/2019 19:15	WG1258768
Trichlorofluoromethane	U		1.20	5.00	1	04/01/2019 19:15	WG1258768
1,1,2-Trichlorotrifluoroethane	U		0.303	1.00	1	04/01/2019 19:15	WG1258768
Vinyl chloride	U		0.259	1.00	1	04/01/2019 19:15	WG1258768
Xylenes, Total	U		1.06	3.00	1	04/01/2019 19:15	WG1258768
(S) Toluene-d8	*102*			*80.0-120*		*04/01/2019 19:15*	WG1258768
(S) a,a,a-Trifluorotoluene	*101*			*80.0-120*		*04/01/2019 19:15*	WG1258768
(S) 4-Bromofluorobenzene	*92.6*			*77.0-126*		*04/01/2019 19:15*	WG1258768
(S) 1,2-Dichloroethane-d4	*100*			*70.0-130*		*04/01/2019 19:15*	WG1258768

Volatile Organic Compounds (GC/MS) by Method 8260C - TENTATIVELY IDENTIFIED COMPOUNDS

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch	CAS #
	ug/l		ug/l	ug/l		date / time		
Total Tic	0.000		0.000	0.000	1	04/01/2019 19:15	WG1258768	

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Total Solids by Method 2540 G-2011

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	%			date / time	
Total Solids	92.0		1	04/04/2019 11:06	WG1260343

Wet Chemistry by Method 9012B

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
Cyanide	0.0763	J	0.0424	0.272	1	04/05/2019 14:23	WG1260642

Mercury by Method 7471B

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
Mercury	0.0201	J	0.00304	0.0217	1	04/04/2019 10:38	WG1260270

Metals (ICP) by Method 6010D

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
Aluminum	4080		3.80	10.9	1	04/04/2019 16:39	WG1260035
Antimony	U		0.815	2.17	1	04/04/2019 16:39	WG1260035
Arsenic	2.62		0.500	2.17	1	04/04/2019 16:39	WG1260035
Barium	7.99		0.185	0.543	1	04/04/2019 16:39	WG1260035
Beryllium	0.210	J	0.0761	0.217	1	04/04/2019 16:39	WG1260035
Cadmium	U		0.0761	0.543	1	04/04/2019 16:39	WG1260035
Calcium	479		5.03	109	1	04/04/2019 16:39	WG1260035
Chromium	19.1		0.152	1.09	1	04/04/2019 16:39	WG1260035
Cobalt	1.94		0.250	1.09	1	04/04/2019 16:39	WG1260035
Copper	6.28		0.576	2.17	1	04/04/2019 16:39	WG1260035
Iron	9960		1.53	10.9	1	04/04/2019 16:39	WG1260035
Lead	2.81		0.206	0.543	1	04/04/2019 16:39	WG1260035
Magnesium	863		1.21	109	1	04/04/2019 16:39	WG1260035
Manganese	35.9		0.130	1.09	1	04/04/2019 16:39	WG1260035
Nickel	6.96		0.532	2.17	1	04/04/2019 16:39	WG1260035
Potassium	799		11.1	109	1	04/04/2019 16:39	WG1260035
Selenium	U		0.674	2.17	1	04/04/2019 16:39	WG1260035
Silver	U		0.130	1.09	1	04/04/2019 16:39	WG1260035
Sodium	78.3	B J	10.7	109	1	04/04/2019 16:39	WG1260035
Thallium	U		0.706	2.17	1	04/04/2019 16:39	WG1260035
Vanadium	12.9		0.261	2.17	1	04/04/2019 16:39	WG1260035
Zinc	15.8		0.641	5.43	1	04/04/2019 16:39	WG1260035

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

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
Acetone	U		5.43	27.2	500	04/03/2019 16:58	WG1260000
Benzene	0.315	J	0.147	0.543	500	04/01/2019 21:28	WG1258825
Bromochloromethane	U		0.212	0.543	500	04/01/2019 21:28	WG1258825
Bromodichloromethane	U		0.138	0.543	500	04/01/2019 21:28	WG1258825
Bromoform	U		0.230	0.543	500	04/01/2019 21:28	WG1258825
Bromomethane	U		0.728	2.72	500	04/01/2019 21:28	WG1258825
Carbon disulfide	U		0.120	0.543	500	04/01/2019 21:28	WG1258825
Carbon tetrachloride	U		0.178	0.543	500	04/01/2019 21:28	WG1258825
Chlorobenzene	U		0.115	0.543	500	04/01/2019 21:28	WG1258825
Chlorodibromomethane	U		0.202	0.543	500	04/01/2019 21:28	WG1258825
Chloroethane	U		0.514	2.72	500	04/01/2019 21:28	WG1258825
Chloroform	U		0.124	2.72	500	04/01/2019 21:28	WG1258825
Chloromethane	U		0.204	1.36	500	04/01/2019 21:28	WG1258825

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

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Cyclohexane	0.543	J	0.190	0.543	500	04/01/2019 21:28	WG1258825
1,2-Dibromo-3-Chloropropane	U		0.570	1.63	500	04/01/2019 21:28	WG1258825
1,2-Dibromoethane	U		0.187	0.543	500	04/01/2019 21:28	WG1258825
Dichlorodifluoromethane	U		0.387	2.72	500	04/01/2019 21:28	WG1258825
1,1-Dichloroethane	U		0.108	0.543	500	04/01/2019 21:28	WG1258825
1,2-Dichloroethane	U		0.143	0.543	500	04/01/2019 21:28	WG1258825
1,2-Dichlorobenzene	U		0.165	0.543	500	04/01/2019 21:28	WG1258825
1,3-Dichlorobenzene	U		0.130	0.543	500	04/01/2019 21:28	WG1258825
1,4-Dichlorobenzene	U		0.123	0.543	500	04/01/2019 21:28	WG1258825
1,1-Dichloroethene	U		0.165	0.543	500	04/01/2019 21:28	WG1258825
cis-1,2-Dichloroethene	U		0.128	0.543	500	04/01/2019 21:28	WG1258825
trans-1,2-Dichloroethene	U		0.143	0.543	500	04/01/2019 21:28	WG1258825
1,2-Dichloropropane	U		0.194	0.543	500	04/01/2019 21:28	WG1258825
cis-1,3-Dichloropropene	U		0.142	0.543	500	04/01/2019 21:28	WG1258825
trans-1,3-Dichloropropene	U		0.146	0.543	500	04/01/2019 21:28	WG1258825
Ethylbenzene	0.211	J	0.161	0.543	500	04/01/2019 21:28	WG1258825
2-Hexanone	U		0.744	5.43	500	04/01/2019 21:28	WG1258825
Isopropylbenzene	0.899	J	0.133	5.43	500	04/01/2019 21:28	WG1258825
2-Butanone (MEK)	U		2.54	5.43	500	04/01/2019 21:28	WG1258825
Methyl Acetate	U	J4	3.31	10.9	500	04/03/2019 16:58	WG1260000
Methyl Cyclohexane	2.60		0.206	0.543	500	04/01/2019 21:28	WG1258825
Methylene Chloride	U		0.543	2.72	500	04/01/2019 21:28	WG1258825
4-Methyl-2-pentanone (MIBK)	U		1.02	5.43	500	04/01/2019 21:28	WG1258825
Methyl tert-butyl ether	U		0.115	0.543	500	04/01/2019 21:28	WG1258825
Styrene	U		0.127	0.543	500	04/01/2019 21:28	WG1258825
1,1,2,2-Tetrachloroethane	U		0.198	0.543	500	04/01/2019 21:28	WG1258825
Tetrachloroethene	U		0.150	0.543	500	04/01/2019 21:28	WG1258825
Toluene	U		0.236	2.72	500	04/01/2019 21:28	WG1258825
1,2,3-Trichlorobenzene	U		0.166	0.543	500	04/01/2019 21:28	WG1258825
1,2,4-Trichlorobenzene	U		0.211	0.543	500	04/01/2019 21:28	WG1258825
1,1,1-Trichloroethane	U		0.155	0.543	500	04/01/2019 21:28	WG1258825
1,1,2-Trichloroethane	U		0.150	0.543	500	04/01/2019 21:28	WG1258825
Trichloroethene	U		0.152	0.543	500	04/01/2019 21:28	WG1258825
Trichlorofluoromethane	U		0.208	2.72	500	04/01/2019 21:28	WG1258825
1,1,2-Trichlorotrifluoroethane	U		0.198	0.543	500	04/01/2019 21:28	WG1258825
Vinyl chloride	U		0.159	0.543	500	04/01/2019 21:28	WG1258825
Xylenes, Total	U		0.379	1.63	500	04/01/2019 21:28	WG1258825
(S) Toluene-d8	*101*			*75.0-131*		*04/01/2019 21:28*	WG1258825
(S) Toluene-d8	*109*			*75.0-131*		*04/03/2019 16:58*	WG1260000
(S) a,a,a-Trifluorotoluene	*104*			*80.0-120*		*04/01/2019 21:28*	WG1258825
(S) a,a,a-Trifluorotoluene	*105*			*80.0-120*		*04/03/2019 16:58*	WG1260000
(S) 4-Bromofluorobenzene	*99.8*			*67.0-138*		*04/01/2019 21:28*	WG1258825
(S) 4-Bromofluorobenzene	*118*			*67.0-138*		*04/03/2019 16:58*	WG1260000
(S) 1,2-Dichloroethane-d4	*88.8*			*70.0-130*		*04/01/2019 21:28*	WG1258825
(S) 1,2-Dichloroethane-d4	*93.0*			*70.0-130*		*04/03/2019 16:58*	WG1260000

Sample Narrative:

L1083840-22 WG1258825: Non-target compounds too high to run at a lower dilution.

Volatile Organic Compounds (GC/MS) by Method 8260C - TENTATIVELY IDENTIFIED COMPOUNDS

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch	CAS #
Total Tic	145	J N	0.000	0.000	500	04/01/2019 21:28	WG1258825	
Total Tic	200	J N	0.000	0.000	500	04/03/2019 16:58	WG1260000	
Naphthalene, 2-Methyl-	49.4	J N	0.000	0.000	500	04/03/2019 16:58	WG1260000	000091-57-6
Benzene, 2-Ethenyl-1,4-Dimethyl-	33.1	J N	0.000	0.000	500	04/03/2019 16:58	WG1260000	002039-89-6

Volatile Organic Compounds (GC/MS) by Method 8260C - TENTATIVELY IDENTIFIED COMPOUNDS

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch	CAS #
1H-Indene, 2,3-Dihydro-1,6-Dimethy	24.9	J N	0.000	0.000	500	04/01/2019 21:28	WG1258825	017059-48-2
Unknown-02	26.9	J N	0.000	0.000	500	04/03/2019 16:58	WG1260000	001559-81-5
Indan, 1-Methyl-	22.0	J N	0.000	0.000	500	04/03/2019 16:58	WG1260000	000767-58-8
Unknown-01	16.7	J N	0.000	0.000	500	04/01/2019 21:28	WG1258825	001680-51-9
1H-Indene, 2,3-Dihydro-1,2-Dimethy	15.8	J N	0.000	0.000	500	04/03/2019 16:58	WG1260000	017057-82-8
1H-Indene, 2,3-Dihydro-4-Methyl-	14.9	J N	0.000	0.000	500	04/01/2019 21:28	WG1258825	000824-22-6
1H-Indene, 2,3-Dihydro-5-Methyl-	14.9	J N	0.000	0.000	500	04/03/2019 16:58	WG1260000	000874-35-1
Benzene, 1-Ethyl-2,4-Dimethyl-	13.2	J N	0.000	0.000	500	04/01/2019 21:28	WG1258825	000874-41-9
1,4-Dimethyl-1,2,3,4-Tetrahydronap	12.2	J N	0.000	0.000	500	04/01/2019 21:28	WG1258825	000000-00-0
Benzene, 1-Methyl-2-(1-Methylethyl	14.4	J N	0.000	0.000	500	04/03/2019 16:58	WG1260000	000527-84-4
Benzene, 1,3-Diethyl-	10.6	J N	0.000	0.000	500	04/01/2019 21:28	WG1258825	000141-93-5
Unknown-01	12.1	J N	0.000	0.000	500	04/03/2019 16:58	WG1260000	004175-53-5
1H-Indene, 2,3-Dihydro-1,3-Dimethy	11.8	J N	0.000	0.000	500	04/03/2019 16:58	WG1260000	004175-53-5
1H-Indene, 2,3-Dihydro-1,5,7-Trime	10.6	J N	0.000	0.000	500	04/01/2019 21:28	WG1258825	054340-88-4
Benzene, 1,2,4,5-Tetramethyl-	9.13	J N	0.000	0.000	500	04/01/2019 21:28	WG1258825	000095-93-2
1H-Indene, 2,3-Dihydro-1,2-Dimethy	8.77	J N	0.000	0.000	500	04/01/2019 21:28	WG1258825	017057-82-8
1H-Indene, 2,3-Dihydro-1,1,5-Trime	8.55	J N	0.000	0.000	500	04/01/2019 21:28	WG1258825	040650-41-7
Indane	7.69	J N	0.000	0.000	500	04/01/2019 21:28	WG1258825	000496-11-7
Unknown-02	7.26	J N	0.000	0.000	500	04/01/2019 21:28	WG1258825	021564-91-0

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Pesticides (GC) by Method 8081B

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Aldrin	U		0.0293	0.435	20	04/04/2019 11:59	WG1260104
Alpha BHC	U		0.0296	0.0543	20	04/04/2019 11:59	WG1260104
Beta BHC	U		0.0348	0.0543	20	04/04/2019 11:59	WG1260104
Delta BHC	U		0.0311	0.435	20	04/04/2019 11:59	WG1260104
Gamma BHC	U		0.0315	0.0543	20	04/04/2019 11:59	WG1260104
Chlordane	U		0.847	4.35	20	04/04/2019 11:59	WG1260104
alpha-Chlordane	U		0.0306	0.435	20	04/04/2019 11:59	WG1260104
gamma-Chlordane	U		0.0426	0.435	20	04/04/2019 11:59	WG1260104
4,4-DDD	U		0.0339	0.435	20	04/04/2019 11:59	WG1260104
4,4-DDE	U		0.0335	0.435	20	04/04/2019 11:59	WG1260104
4,4-DDT	U		0.0435	0.435	20	04/04/2019 11:59	WG1260104
Dieldrin	U		0.0330	0.0652	20	04/04/2019 11:59	WG1260104
Endosulfan I	U		0.0324	0.435	20	04/04/2019 11:59	WG1260104
Endosulfan II	U		0.0348	0.435	20	04/04/2019 11:59	WG1260104
Endosulfan sulfate	U		0.0328	0.435	20	04/04/2019 11:59	WG1260104
Endrin	U		0.0341	0.435	20	04/04/2019 11:59	WG1260104
Endrin aldehyde	U		0.0280	0.435	20	04/04/2019 11:59	WG1260104
Endrin ketone	U		0.0359	0.435	20	04/04/2019 11:59	WG1260104
Hexachlorobenzene	U		0.0269	0.435	20	04/04/2019 11:59	WG1260104
Heptachlor	U		0.0335	0.435	20	04/04/2019 11:59	WG1260104
Heptachlor epoxide	U		0.0350	0.217	20	04/04/2019 11:59	WG1260104
Methoxychlor	U		0.0387	0.435	20	04/04/2019 11:59	WG1260104
Toxaphene	U		0.782	8.69	20	04/04/2019 11:59	WG1260104
(S) Decachlorobiphenyl	*94.5*	J7		*30.0-150*		*04/04/2019 11:59*	WG1260104
(S) Tetrachloro-m-xylene	*101*	J7		*30.0-150*		*04/04/2019 11:59*	WG1260104

Polychlorinated Biphenyls (GC) by Method 8082 A

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
PCB 1016	U		0.00380	0.0185	1	04/05/2019 14:26	WG1260104
PCB 1221	U		0.00583	0.0185	1	04/05/2019 14:26	WG1260104
PCB 1232	U		0.00453	0.0185	1	04/05/2019 14:26	WG1260104
PCB 1242	U		0.00346	0.0185	1	04/05/2019 14:26	WG1260104
PCB 1248	U		0.00342	0.0185	1	04/05/2019 14:26	WG1260104
PCB 1254	U		0.00513	0.0185	1	04/05/2019 14:26	WG1260104
PCB 1260	U		0.00537	0.0185	1	04/05/2019 14:26	WG1260104
(S) Decachlorobiphenyl	*62.7*			*30.0-150*		*04/05/2019 14:26*	WG1260104
(S) Tetrachloro-m-xylene	*468*	J1		*30.0-150*		*04/05/2019 14:26*	WG1260104

Semi Volatile Organic Compounds (GC/MS) by Method 8270D

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Acenaphthene	6.71	J3 J4	0.349	1.79	50	04/09/2019 16:06	WG1262278
Acenaphthylene	1.21	J J3 J4	0.364	1.79	50	04/09/2019 16:06	WG1262278
Acetophenone	U	J3 J4	4.09	8.15	50	04/09/2019 16:06	WG1262278
Anthracene	U	J4	0.343	1.79	50	04/09/2019 16:06	WG1262278
Atrazine	U		5.10	8.15	50	04/09/2019 16:06	WG1262278
Benzaldehyde	U	J3	2.89	8.15	50	04/09/2019 16:06	WG1262278
Benzo(a)anthracene	3.91		0.233	1.79	50	04/09/2019 16:06	WG1262278
Benzo(b)fluoranthene	1.24	J	0.377	1.79	50	04/09/2019 16:06	WG1262278
Benzo(k)fluoranthene	U		0.316	1.79	50	04/09/2019 16:06	WG1262278
Benzo(g,h,i)perylene	1.89		0.392	1.79	50	04/09/2019 16:06	WG1262278
Benzo(a)pyrene	3.43		0.298	1.79	50	04/09/2019 16:06	WG1262278
Biphenyl	U	J3 J4	0.319	8.15	50	04/09/2019 16:06	WG1262278
Bis(2-chlorethoxy)methane	U	J3 J4	0.418	8.15	50	04/09/2019 16:06	WG1262278
Bis(2-chloroethyl)ether	U	J3 J4	0.487	8.15	50	04/09/2019 16:06	WG1262278
Bis(2-chloroisopropyl)ether	U	J3 J4	0.413	8.15	50	04/09/2019 16:06	WG1262278
4-Bromophenyl-phenylether	U	J4	0.619	8.15	50	04/09/2019 16:06	WG1262278
Caprolactam	U		5.65	8.15	50	04/09/2019 16:06	WG1262278
Carbazole	U		0.285	8.15	50	04/09/2019 16:06	WG1262278
4-Chloroaniline	U	J3 J4	1.91	8.15	50	04/09/2019 16:06	WG1262278
2-Chloronaphthalene	U	J3 J4	0.348	1.79	50	04/09/2019 16:06	WG1262278
4-Chlorophenyl-phenylether	U	J4	0.341	8.15	50	04/09/2019 16:06	WG1262278
Chrysene	7.02	J4	0.302	1.79	50	04/09/2019 16:06	WG1262278
Dibenz(a,h)anthracene	U		0.447	1.79	50	04/09/2019 16:06	WG1262278
Dibenzofuran	U	J3 J4	0.281	8.15	50	04/09/2019 16:06	WG1262278
3,3-Dichlorobenzidine	U		4.31	8.15	50	04/09/2019 16:06	WG1262278
2,4-Dinitrotoluene	U	J4	0.330	8.15	50	04/09/2019 16:06	WG1262278
2,6-Dinitrotoluene	U	J4	0.401	8.15	50	04/09/2019 16:06	WG1262278
Fluoranthene	U		0.269	1.79	50	04/09/2019 16:06	WG1262278
Fluorene	9.44	J4	0.371	1.79	50	04/09/2019 16:06	WG1262278
Hexachlorobenzene	U	J4	0.465	8.15	50	04/09/2019 16:06	WG1262278
Hexachloro-1,3-butadiene	U	J3 J4	0.543	8.15	50	04/09/2019 16:06	WG1262278
Hexachlorocyclopentadiene	U	J0 J3	3.19	8.15	50	04/09/2019 16:06	WG1262278
Hexachloroethane	U	J3	0.728	8.15	50	04/09/2019 16:06	WG1262278
Indeno(1,2,3-cd)pyrene	U		0.419	1.79	50	04/09/2019 16:06	WG1262278
Isophorone	U	J3 J4	0.284	8.15	50	04/09/2019 16:06	WG1262278
2-Methylnaphthalene	108	J3 J4	0.936	3.59	100	04/10/2019 22:31	WG1262278
Naphthalene	U	J3 J4	0.484	1.79	50	04/09/2019 16:06	WG1262278
2-Nitroaniline	U	J4	0.411	8.15	50	04/09/2019 16:06	WG1262278
3-Nitroaniline	U	J4	0.462	8.15	50	04/09/2019 16:06	WG1262278
4-Nitroaniline	U	J4	0.348	8.15	50	04/09/2019 16:06	WG1262278
Nitrobenzene	U	J3 J4	0.377	8.15	50	04/09/2019 16:06	WG1262278
n-Nitrosodiphenylamine	U		0.323	8.15	50	04/09/2019 16:06	WG1262278
n-Nitrosodi-n-propylamine	U	J3 J4	0.492	8.15	50	04/09/2019 16:06	WG1262278

Semi Volatile Organic Compounds (GC/MS) by Method 8270D

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Phenanthrene	36.1	J4	0.287	1.79	50	04/09/2019 16:06	WG1262278
Benzylbutyl phthalate	U		0.560	8.15	50	04/09/2019 16:06	WG1262278
Bis(2-ethylhexyl)phthalate	U		0.652	8.15	50	04/09/2019 16:06	WG1262278
Di-n-butyl phthalate	U		0.592	8.15	50	04/09/2019 16:06	WG1262278
Diethyl phthalate	U	J4	0.376	8.15	50	04/09/2019 16:06	WG1262278
Dimethyl phthalate	U	J4	0.293	8.15	50	04/09/2019 16:06	WG1262278
Di-n-octyl phthalate	U		0.493	8.15	50	04/09/2019 16:06	WG1262278
Pyrene	17.3		0.668	1.79	50	04/09/2019 16:06	WG1262278
1,2,4,5-Tetrachlorobenzene	U	J3 J4	4.14	8.15	50	04/09/2019 16:06	WG1262278
4-Chloro-3-methylphenol	U	J4	0.260	8.15	50	04/09/2019 16:06	WG1262278
2-Chlorophenol	U	J3 J4	0.451	8.15	50	04/09/2019 16:06	WG1262278
2-Methylphenol	U	J3 J4	0.536	8.15	50	04/09/2019 16:06	WG1262278
3&4-Methyl Phenol	U	J3	0.426	8.15	50	04/09/2019 16:06	WG1262278
2,4-Dichlorophenol	U	J3 J4	0.405	8.15	50	04/09/2019 16:06	WG1262278
2,4-Dimethylphenol	U	J3 J4	2.56	8.15	50	04/09/2019 16:06	WG1262278
4,6-Dinitro-2-methylphenol	U	J4	6.74	10.9	50	04/09/2019 16:06	WG1262278
2,4-Dinitrophenol	U	J3	5.32	10.9	50	04/09/2019 16:06	WG1262278
2-Nitrophenol	U	J3 J4	0.706	8.15	50	04/09/2019 16:06	WG1262278
4-Nitrophenol	U		2.86	8.15	50	04/09/2019 16:06	WG1262278
Pentachlorophenol	U		2.61	8.15	50	04/09/2019 16:06	WG1262278
Phenol	U	J3	0.377	8.15	50	04/09/2019 16:06	WG1262278
2,4,5-Trichlorophenol	U	J4	0.565	8.15	50	04/09/2019 16:06	WG1262278
2,4,6-Trichlorophenol	U	J3 J4	0.424	8.15	50	04/09/2019 16:06	WG1262278
(S) 2-Fluorophenol	*73.1*	J7		*30.0-130*		*04/09/2019 16:06*	WG1262278
(S) 2-Fluorophenol	*66.5*	J7		*30.0-130*		*04/10/2019 22:31*	WG1262278
(S) Phenol-d5	*77.5*	J7		*30.0-130*		*04/10/2019 22:31*	WG1262278
(S) Phenol-d5	*71.8*	J7		*30.0-130*		*04/09/2019 16:06*	WG1262278
(S) Nitrobenzene-d5	*321*	J7		*30.0-130*		*04/09/2019 16:06*	WG1262278
(S) Nitrobenzene-d5	*0.000*	J7		*30.0-130*		*04/10/2019 22:31*	WG1262278
(S) 2-Fluorobiphenyl	*236*	J7		*30.0-130*		*04/09/2019 16:06*	WG1262278
(S) 2-Fluorobiphenyl	*0.000*	J7		*30.0-130*		*04/10/2019 22:31*	WG1262278
(S) 2,4,6-Tribromophenol	*68.3*	J7		*30.0-130*		*04/10/2019 22:31*	WG1262278
(S) 2,4,6-Tribromophenol	*69.8*	J7		*30.0-130*		*04/09/2019 16:06*	WG1262278
(S) p-Terphenyl-d14	*129*	J7		*30.0-130*		*04/10/2019 22:31*	WG1262278
(S) p-Terphenyl-d14	*94.0*	J7		*30.0-130*		*04/09/2019 16:06*	WG1262278

Sample Narrative:

L1083840-22 WG1262278: Dilution due to viscosity

Semi Volatile Organic Compounds (GC/MS) by Method 8270D - TENTATIVELY IDENTIFIED COMPOUNDS

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch	CAS #
Total Tic	0.000		0.000	0.000	100	04/10/2019 22:31	WG1262278	
Total Tic	685	J N	0.000	0.000	50	04/09/2019 16:06	WG1262278	
Tridecane, 5-Propyl-	86.9	J N	0.000	0.000	50	04/09/2019 16:06	WG1262278	055045-11-9
Naphthalene, 2,6-Dimethyl-	83.3	J N	0.000	0.000	50	04/09/2019 16:06	WG1262278	000581-42-0
Phenanthrene, 2,5-Dimethyl-	62.8	J N	0.000	0.000	50	04/09/2019 16:06	WG1262278	003674-66-6
Anthracene, 2-Methyl-	55.8	J N	0.000	0.000	50	04/09/2019 16:06	WG1262278	000613-12-7
Hexadecane, 2,6,10,14-Tetramethyl-	47.0	J N	0.000	0.000	50	04/09/2019 16:06	WG1262278	000638-36-8
Unknown-03	47.0	J N	0.000	0.000	50	04/09/2019 16:06	WG1262278	000832-69-9
Unknown-02	43.7	J N	0.000	0.000	50	04/09/2019 16:06	WG1262278	000612-75-9
Naphthalene, 1,4,6-Trimethyl-	43.4	J N	0.000	0.000	50	04/09/2019 16:06	WG1262278	002131-42-2
Naphthalene, 1-Ethyl-	38.1	J N	0.000	0.000	50	04/09/2019 16:06	WG1262278	001127-76-0
Phenanthrene, 3,6-Dimethyl-	31.5	J N	0.000	0.000	50	04/09/2019 16:06	WG1262278	001576-67-6
Naphthalene, 1,6,7-Trimethyl-	30.7	J N	0.000	0.000	50	04/09/2019 16:06	WG1262278	002245-38-7
Dibenzothiophene, 3-Methyl-	30.7	J N	0.000	0.000	50	04/09/2019 16:06	WG1262278	016587-52-3

Semi Volatile Organic Compounds (GC/MS) by Method 8270D - TENTATIVELY IDENTIFIED COMPOUNDS

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch	CAS #
Dodecane, 2,6,11-Trimethyl-	28.2	J N	0.000	0.000	50	04/09/2019 16:06	WG1262278	031295-56-4
Unknown-01	27.9	J N	0.000	0.000	50	04/09/2019 16:06	WG1262278	054965-05-8
Naphthalene, 2,3-Dimethyl-	27.7	J N	0.000	0.000	50	04/09/2019 16:06	WG1262278	000581-40-8

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Wet Chemistry by Method 4500CN E-2011

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Cyanide	U		1.80	5.00	1	04/04/2019 19:45	WG1260640

Mercury by Method 7470A

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Mercury	0.0660	B J	0.0490	0.200	1	04/03/2019 12:00	WG1258686

Metals (ICP) by Method 6010D

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Aluminum	U		35.0	200	1	04/05/2019 20:53	WG1259748
Antimony	U		7.50	10.0	1	04/05/2019 20:53	WG1259748
Arsenic	U		6.50	10.0	1	04/05/2019 20:53	WG1259748
Barium	U		1.70	5.00	1	04/05/2019 20:53	WG1259748
Beryllium	U		0.700	2.00	1	04/05/2019 20:53	WG1259748
Cadmium	U		0.700	2.00	1	04/05/2019 20:53	WG1259748
Calcium	53.0	J	46.3	1000	1	04/05/2019 20:53	WG1259748
Chromium	U		1.40	10.0	1	04/05/2019 20:53	WG1259748
Cobalt	U		2.30	10.0	1	04/05/2019 20:53	WG1259748
Copper	U		5.30	10.0	1	04/05/2019 20:53	WG1259748
Iron	U		14.1	100	1	04/05/2019 20:53	WG1259748
Lead	U		1.90	5.00	1	04/05/2019 20:53	WG1259748
Magnesium	U		11.1	1000	1	04/05/2019 20:53	WG1259748
Manganese	U		1.20	10.0	1	04/05/2019 20:53	WG1259748
Nickel	U		4.90	10.0	1	04/05/2019 20:53	WG1259748
Potassium	U		102	1000	1	04/05/2019 20:53	WG1259748
Silver	U		2.80	5.00	1	04/05/2019 20:53	WG1259748
Sodium	159	J	98.5	1000	1	04/05/2019 20:53	WG1259748
Vanadium	2.58	J	2.40	20.0	1	04/05/2019 20:53	WG1259748
Zinc	U		5.90	50.0	1	04/05/2019 20:53	WG1259748

Metals (ICPMS) by Method 6020B

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Selenium	U		0.380	2.00	1	04/06/2019 14:08	WG1259747
Thallium	U		0.190	2.00	1	04/06/2019 14:08	WG1259747

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

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Acetone	U		10.0	50.0	1	04/01/2019 19:36	WG1258768
Benzene	U		0.331	1.00	1	04/01/2019 19:36	WG1258768
Bromochloromethane	U		0.520	1.00	1	04/01/2019 19:36	WG1258768
Bromodichloromethane	U		0.380	1.00	1	04/01/2019 19:36	WG1258768
Bromoform	U		0.469	1.00	1	04/01/2019 19:36	WG1258768
Bromomethane	U		0.866	5.00	1	04/01/2019 19:36	WG1258768
Carbon disulfide	U		0.275	1.00	1	04/01/2019 19:36	WG1258768
Carbon tetrachloride	U		0.379	1.00	1	04/01/2019 19:36	WG1258768
Chlorobenzene	U		0.348	1.00	1	04/01/2019 19:36	WG1258768
Chlorodibromomethane	U		0.327	1.00	1	04/01/2019 19:36	WG1258768
Chloroethane	U		0.453	5.00	1	04/01/2019 19:36	WG1258768
Chloroform	U		0.324	5.00	1	04/01/2019 19:36	WG1258768
Chloromethane	U	J3	0.276	2.50	1	04/01/2019 19:36	WG1258768
Cyclohexane	U		0.390	1.00	1	04/01/2019 19:36	WG1258768

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

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
1,2-Dibromo-3-Chloropropane	U		1.33	5.00	1	04/01/2019 19:36	WG1258768
1,2-Dibromoethane	U		0.381	1.00	1	04/01/2019 19:36	WG1258768
1,2-Dichlorobenzene	U		0.349	1.00	1	04/01/2019 19:36	WG1258768
1,3-Dichlorobenzene	U		0.220	1.00	1	04/01/2019 19:36	WG1258768
1,4-Dichlorobenzene	U		0.274	1.00	1	04/01/2019 19:36	WG1258768
Dichlorodifluoromethane	U		0.551	5.00	1	04/01/2019 19:36	WG1258768
1,1-Dichloroethane	U		0.259	1.00	1	04/01/2019 19:36	WG1258768
1,2-Dichloroethane	U		0.361	1.00	1	04/01/2019 19:36	WG1258768
1,1-Dichloroethene	U		0.398	1.00	1	04/01/2019 19:36	WG1258768
cis-1,2-Dichloroethene	U		0.260	1.00	1	04/01/2019 19:36	WG1258768
trans-1,2-Dichloroethene	U		0.396	1.00	1	04/01/2019 19:36	WG1258768
1,2-Dichloropropane	U		0.306	1.00	1	04/01/2019 19:36	WG1258768
cis-1,3-Dichloropropene	U		0.418	1.00	1	04/01/2019 19:36	WG1258768
trans-1,3-Dichloropropene	U		0.419	1.00	1	04/01/2019 19:36	WG1258768
Ethylbenzene	U		0.384	1.00	1	04/01/2019 19:36	WG1258768
2-Hexanone	U		3.82	10.0	1	04/01/2019 19:36	WG1258768
Isopropylbenzene	U		0.326	1.00	1	04/01/2019 19:36	WG1258768
2-Butanone (MEK)	U		3.93	10.0	1	04/01/2019 19:36	WG1258768
Methyl Acetate	U		4.30	20.0	1	04/01/2019 19:36	WG1258768
Methyl Cyclohexane	U		0.380	1.00	1	04/01/2019 19:36	WG1258768
Methylene Chloride	U		1.00	3.00	1	04/01/2019 19:36	WG1258768
4-Methyl-2-pentanone (MIBK)	U		2.14	10.0	1	04/01/2019 19:36	WG1258768
Methyl tert-butyl ether	U		0.367	1.00	1	04/01/2019 19:36	WG1258768
Naphthalene	U		1.00	5.00	1	04/01/2019 19:36	WG1258768
tert-Butyl alcohol	U		2.40	5.00	1	04/01/2019 19:36	WG1258768
Styrene	U		0.307	1.00	1	04/01/2019 19:36	WG1258768
1,1,2,2-Tetrachloroethane	U		0.130	1.00	1	04/01/2019 19:36	WG1258768
Tetrachloroethene	U		0.372	1.00	1	04/01/2019 19:36	WG1258768
Toluene	U		0.412	1.00	1	04/01/2019 19:36	WG1258768
1,2,3-Trichlorobenzene	U		0.230	1.00	1	04/01/2019 19:36	WG1258768
1,2,4-Trichlorobenzene	U		0.355	1.00	1	04/01/2019 19:36	WG1258768
1,1,1-Trichloroethane	U		0.319	1.00	1	04/01/2019 19:36	WG1258768
1,1,2-Trichloroethane	U		0.383	1.00	1	04/01/2019 19:36	WG1258768
Trichloroethene	U		0.398	1.00	1	04/01/2019 19:36	WG1258768
Trichlorofluoromethane	U		1.20	5.00	1	04/01/2019 19:36	WG1258768
1,1,2-Trichlorotrifluoroethane	U		0.303	1.00	1	04/01/2019 19:36	WG1258768
Vinyl chloride	U		0.259	1.00	1	04/01/2019 19:36	WG1258768
Xylenes, Total	U		1.06	3.00	1	04/01/2019 19:36	WG1258768
(S) Toluene-d8	*106*			*80.0-120*		*04/01/2019 19:36*	WG1258768
(S) a,a,a-Trifluorotoluene	*104*			*80.0-120*		*04/01/2019 19:36*	WG1258768
(S) 4-Bromofluorobenzene	*92.8*			*77.0-126*		*04/01/2019 19:36*	WG1258768
(S) 1,2-Dichloroethane-d4	*98.7*			*70.0-130*		*04/01/2019 19:36*	WG1258768

Volatile Organic Compounds (GC/MS) by Method 8260C - TENTATIVELY IDENTIFIED COMPOUNDS

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch	CAS #
Total Tic	0.000		0.000	0.000	1	04/01/2019 19:36	WG1258768	

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Pesticides (GC) by Method 8081B

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Aldrin	U		0.00813	0.0400	1	04/03/2019 11:37	WG1259577
Alpha BHC	U		0.0166	0.0200	1	04/03/2019 11:37	WG1259577
Beta BHC	U		0.0184	0.0400	1	04/03/2019 11:37	WG1259577
Delta BHC	U		0.0197	0.0500	1	04/03/2019 11:37	WG1259577
Gamma BHC	U		0.0176	0.0300	1	04/03/2019 11:37	WG1259577
Chlordane	U		0.0977	0.500	1	04/03/2019 11:37	WG1259577
alpha-Chlordane	U		0.0149	0.0500	1	04/03/2019 11:37	WG1259577
gamma-Chlordane	U		0.0137	0.0500	1	04/03/2019 11:37	WG1259577
4,4-DDD	U		0.0170	0.0500	1	04/03/2019 11:37	WG1259577
4,4-DDE	U		0.0164	0.0500	1	04/03/2019 11:37	WG1259577
4,4-DDT	U		0.0177	0.0500	1	04/03/2019 11:37	WG1259577
Dieldrin	U		0.00751	0.0500	1	04/03/2019 11:37	WG1259577
Endosulfan I	U		0.0179	0.0500	1	04/03/2019 11:37	WG1259577
Endosulfan II	U		0.0176	0.0500	1	04/03/2019 11:37	WG1259577
Endosulfan sulfate	U		0.0196	0.0500	1	04/03/2019 11:37	WG1259577
Endrin	U		0.0189	0.0500	1	04/03/2019 11:37	WG1259577
Endrin aldehyde	U		0.0142	0.0500	1	04/03/2019 11:37	WG1259577
Endrin ketone	U		0.0170	0.0500	1	04/03/2019 11:37	WG1259577
Hexachlorobenzene	U		0.0134	0.0500	1	04/03/2019 11:37	WG1259577
Heptachlor	U	J3 J4	0.0108	0.0500	1	04/03/2019 11:37	WG1259577
Heptachlor epoxide	U		0.0175	0.0500	1	04/03/2019 11:37	WG1259577
Methoxychlor	U		0.0193	0.0500	1	04/03/2019 11:37	WG1259577
Toxaphene	U		0.168	0.500	1	04/03/2019 11:37	WG1259577
(S) Decachlorobiphenyl	*25.7*	J2		*30.0-150*		*04/03/2019 11:37*	WG1259577
(S) Tetrachloro-m-xylene	*78.3*			*30.0-150*		*04/03/2019 11:37*	WG1259577

Polychlorinated Biphenyls (GC) by Method 8082 A

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
PCB 1016	U		0.100	0.500	1	04/03/2019 14:21	WG1259577
PCB 1221	U		0.0730	0.500	1	04/03/2019 14:21	WG1259577
PCB 1232	U		0.0420	0.500	1	04/03/2019 14:21	WG1259577
PCB 1242	U		0.0470	0.500	1	04/03/2019 14:21	WG1259577
PCB 1248	U		0.0860	0.500	1	04/03/2019 14:21	WG1259577
PCB 1254	U		0.0470	0.500	1	04/03/2019 14:21	WG1259577
PCB 1260	U		0.120	0.500	1	04/03/2019 14:21	WG1259577
(S) Decachlorobiphenyl	*30.1*			*30.0-150*		*04/03/2019 14:21*	WG1259577
(S) Tetrachloro-m-xylene	*77.7*			*30.0-150*		*04/03/2019 14:21*	WG1259577

Semi Volatile Organic Compounds (GC/MS) by Method 8270 D

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Acetophenone	U	J4	2.71	10.0	1	04/03/2019 21:07	WG1259548
Atrazine	U		0.260	10.0	1	04/03/2019 21:07	WG1259548
Benzaldehyde	U		1.40	10.0	1	04/03/2019 21:07	WG1259548
Biphenyl	U	J4	0.325	10.0	1	04/03/2019 21:07	WG1259548
Bis(2-chlorethoxy)methane	U	J4	0.329	10.0	1	04/03/2019 21:07	WG1259548
Bis(2-chloroethyl)ether	U	J4	1.62	7.00	1	04/03/2019 21:07	WG1259548
Bis(2-chloroisopropyl)ether	U	J4	0.445	10.0	1	04/03/2019 21:07	WG1259548
4-Bromophenyl-phenylether	U	J4	0.335	10.0	1	04/03/2019 21:07	WG1259548
Caprolactam	U		2.59	10.0	1	04/03/2019 21:07	WG1259548
Carbazole	U		0.260	10.0	1	04/03/2019 21:07	WG1259548
4-Chloroaniline	U	J4	0.382	10.0	1	04/03/2019 21:07	WG1259548
4-Chlorophenyl-phenylether	U	J4	0.303	10.0	1	04/03/2019 21:07	WG1259548
Dibenzofuran	U	J4	0.338	10.0	1	04/03/2019 21:07	WG1259548

Semi Volatile Organic Compounds (GC/MS) by Method 8270 D

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
3,3-Dichlorobenzidine	U	J4	2.02	10.0	1	04/03/2019 21:07	WG1259548
2,4-Dinitrotoluene	U		1.65	10.0	1	04/03/2019 21:07	WG1259548
2,6-Dinitrotoluene	U		0.279	10.0	1	04/03/2019 21:07	WG1259548
Hexachloro-1,3-butadiene	U	J4	0.329	10.0	1	04/03/2019 21:07	WG1259548
Hexachlorocyclopentadiene	U		2.33	10.0	1	04/03/2019 21:07	WG1259548
Hexachloroethane	U		0.365	7.00	1	04/03/2019 21:07	WG1259548
Isophorone	U	J4	0.272	10.0	1	04/03/2019 21:07	WG1259548
2-Nitroaniline	U		1.90	10.0	1	04/03/2019 21:07	WG1259548
3-Nitroaniline	U		0.308	10.0	1	04/03/2019 21:07	WG1259548
4-Nitroaniline	U		0.349	10.0	1	04/03/2019 21:07	WG1259548
Nitrobenzene	U	J4	0.367	6.00	1	04/03/2019 21:07	WG1259548
n-Nitrosodiphenylamine	U		1.19	10.0	1	04/03/2019 21:07	WG1259548
n-Nitrosodi-n-propylamine	U	J4	0.403	10.0	1	04/03/2019 21:07	WG1259548
Benzylbutyl phthalate	U		0.275	10.0	1	04/03/2019 21:07	WG1259548
Bis(2-ethylhexyl)phthalate	U		0.709	10.0	1	04/03/2019 21:07	WG1259548
Di-n-butyl phthalate	U		0.266	10.0	1	04/03/2019 21:07	WG1259548
Diethyl phthalate	U		0.282	10.0	1	04/03/2019 21:07	WG1259548
Dimethyl phthalate	U		0.283	10.0	1	04/03/2019 21:07	WG1259548
Di-n-octyl phthalate	U		0.278	10.0	1	04/03/2019 21:07	WG1259548
1,2,4,5-Tetrachlorobenzene	U	J4	2.41	10.0	1	04/03/2019 21:07	WG1259548
4-Chloro-3-methylphenol	U	J4	0.263	10.0	1	04/03/2019 21:07	WG1259548
2-Chlorophenol	U	J4	0.283	10.0	1	04/03/2019 21:07	WG1259548
2-Methylphenol	U	J4	0.312	10.0	1	04/03/2019 21:07	WG1259548
3&4-Methyl Phenol	U		0.266	10.0	1	04/03/2019 21:07	WG1259548
2,4-Dichlorophenol	U	J4	0.284	10.0	1	04/03/2019 21:07	WG1259548
2,4-Dimethylphenol	U	J4	0.264	10.0	1	04/03/2019 21:07	WG1259548
4,6-Dinitro-2-methylphenol	U		2.62	10.0	1	04/03/2019 21:07	WG1259548
2,4-Dinitrophenol	U		3.25	10.0	1	04/03/2019 21:07	WG1259548
2-Nitrophenol	U	J4	0.320	10.0	1	04/03/2019 21:07	WG1259548
4-Nitrophenol	U		2.01	10.0	1	04/03/2019 21:07	WG1259548
Pentachlorophenol	U		0.313	10.0	1	04/03/2019 21:07	WG1259548
Phenol	1.16	J	0.334	10.0	1	04/03/2019 21:07	WG1259548
2,4,5-Trichlorophenol	U	J4	0.236	10.0	1	04/03/2019 21:07	WG1259548
2,4,6-Trichlorophenol	U	J4	0.297	10.0	1	04/03/2019 21:07	WG1259548
(S) 2-Fluorophenol	*20.1*			*15.0-110*		*04/03/2019 21:07*	WG1259548
(S) Phenol-d5	*11.9*	J2		*15.0-110*		*04/03/2019 21:07*	WG1259548
(S) Nitrobenzene-d5	*26.4*	J2		*30.0-130*		*04/03/2019 21:07*	WG1259548
(S) 2-Fluorobiphenyl	*31.8*			*30.0-130*		*04/03/2019 21:07*	WG1259548
(S) 2,4,6-Tribromophenol	*36.4*			*15.0-110*		*04/03/2019 21:07*	WG1259548
(S) p-Terphenyl-d14	*65.5*			*30.0-130*		*04/03/2019 21:07*	WG1259548

Semi Volatile Organic Compounds (GC/MS) by Method 8270 D - TENTATIVELY IDENTIFIED COMPOUNDS

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch	CAS #
	ug/l		ug/l	ug/l		date / time		
Total Tic	22.3	J N	0.000	0.000	1	04/03/2019 21:07	WG1259548	
Butanoic Acid	18.4	J N	0.000	0.000	1	04/03/2019 21:07	WG1259548	000107-92-6
Butanoic Acid, Methyl Ester	3.88	J N	0.000	0.000	1	04/03/2019 21:07	WG1259548	000623-42-7

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Anthracene	U		0.00800	0.0500	1	04/04/2019 12:03	WG1260608
Acenaphthene	U		0.0100	0.0500	1	04/04/2019 12:03	WG1260608
Acenaphthylene	U		0.0120	0.0500	1	04/04/2019 12:03	WG1260608
Benzo(a)anthracene	U		0.00410	0.0500	1	04/04/2019 12:03	WG1260608
Benzo(a)pyrene	U		0.0116	0.0500	1	04/04/2019 12:03	WG1260608
Benzo(b)fluoranthene	U		0.00212	0.0500	1	04/04/2019 12:03	WG1260608
Benzo(g,h,i)perylene	U		0.00227	0.0500	1	04/04/2019 12:03	WG1260608
Benzo(k)fluoranthene	U		0.0136	0.0500	1	04/04/2019 12:03	WG1260608
Chrysene	U		0.0108	0.0500	1	04/04/2019 12:03	WG1260608
Dibenz(a,h)anthracene	U		0.00396	0.0500	1	04/04/2019 12:03	WG1260608
Fluoranthene	U		0.0157	0.0500	1	04/04/2019 12:03	WG1260608
Fluorene	U		0.00850	0.0500	1	04/04/2019 12:03	WG1260608
Hexachlorobenzene	U		0.00670	0.0200	1	04/04/2019 12:03	WG1260608
Indeno(1,2,3-cd)pyrene	U		0.0148	0.0500	1	04/04/2019 12:03	WG1260608
Naphthalene	0.0629	J	0.0198	0.250	1	04/04/2019 12:03	WG1260608
Phenanthrene	U		0.00820	0.0500	1	04/04/2019 12:03	WG1260608
Pyrene	U		0.0117	0.0500	1	04/04/2019 12:03	WG1260608
1-Methylnaphthalene	U		0.00821	0.250	1	04/04/2019 12:03	WG1260608
2-Methylnaphthalene	U		0.00902	0.250	1	04/04/2019 12:03	WG1260608
2-Chloronaphthalene	U		0.00647	0.250	1	04/04/2019 12:03	WG1260608
(S) Nitrobenzene-d5	*108*			*31.0-160*		*04/04/2019 12:03*	WG1260608
(S) 2-Fluorobiphenyl	*89.5*			*48.0-148*		*04/04/2019 12:03*	WG1260608
(S) p-Terphenyl-d14	*98.9*			*37.0-146*		*04/04/2019 12:03*	WG1260608

Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM - TENTATIVELY IDENTIFIED COMPOUNDS

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch	CAS #
	ug/l		ug/l	ug/l		date / time		

Number of TICs found: 0

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Wet Chemistry by Method 4500CN E-2011

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Cyanide	U		1.80	5.00	1	04/04/2019 19:46	WG1260640

Mercury by Method 7470A

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Mercury	0.0724	B J	0.0490	0.200	1	04/03/2019 12:03	WG1258686

Metals (ICP) by Method 6010D

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Aluminum	60.1	J	35.0	200	1	04/05/2019 21:02	WG1259748
Antimony	U		7.50	10.0	1	04/05/2019 21:02	WG1259748
Arsenic	U		6.50	10.0	1	04/05/2019 21:02	WG1259748
Barium	U		1.70	5.00	1	04/05/2019 21:02	WG1259748
Beryllium	U		0.700	2.00	1	04/05/2019 21:02	WG1259748
Cadmium	U		0.700	2.00	1	04/05/2019 21:02	WG1259748
Calcium	150	J	46.3	1000	1	04/05/2019 21:02	WG1259748
Chromium	3.50	J	1.40	10.0	1	04/05/2019 21:02	WG1259748
Cobalt	U		2.30	10.0	1	04/05/2019 21:02	WG1259748
Copper	U		5.30	10.0	1	04/05/2019 21:02	WG1259748
Iron	421		14.1	100	1	04/05/2019 21:02	WG1259748
Lead	U		1.90	5.00	1	04/05/2019 21:02	WG1259748
Magnesium	U		11.1	1000	1	04/05/2019 21:02	WG1259748
Manganese	3.34	J	1.20	10.0	1	04/05/2019 21:02	WG1259748
Nickel	U		4.90	10.0	1	04/05/2019 21:02	WG1259748
Potassium	U		102	1000	1	04/05/2019 21:02	WG1259748
Silver	U		2.80	5.00	1	04/05/2019 21:02	WG1259748
Sodium	505	J	98.5	1000	1	04/05/2019 21:02	WG1259748
Vanadium	2.88	J	2.40	20.0	1	04/05/2019 21:02	WG1259748
Zinc	U		5.90	50.0	1	04/05/2019 21:02	WG1259748

Metals (ICPMS) by Method 6020B

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Selenium	U		0.380	2.00	1	04/06/2019 14:29	WG1259747
Thallium	U		0.190	2.00	1	04/06/2019 14:29	WG1259747

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

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Acetone	U		10.0	50.0	1	04/01/2019 19:58	WG1258768
Benzene	U		0.331	1.00	1	04/01/2019 19:58	WG1258768
Bromochloromethane	U		0.520	1.00	1	04/01/2019 19:58	WG1258768
Bromodichloromethane	U		0.380	1.00	1	04/01/2019 19:58	WG1258768
Bromoform	U		0.469	1.00	1	04/01/2019 19:58	WG1258768
Bromomethane	U		0.866	5.00	1	04/01/2019 19:58	WG1258768
Carbon disulfide	U		0.275	1.00	1	04/01/2019 19:58	WG1258768
Carbon tetrachloride	U		0.379	1.00	1	04/01/2019 19:58	WG1258768
Chlorobenzene	U		0.348	1.00	1	04/01/2019 19:58	WG1258768
Chlorodibromomethane	U		0.327	1.00	1	04/01/2019 19:58	WG1258768
Chloroethane	U		0.453	5.00	1	04/01/2019 19:58	WG1258768
Chloroform	U		0.324	5.00	1	04/01/2019 19:58	WG1258768
Chloromethane	U	J3	0.276	2.50	1	04/01/2019 19:58	WG1258768
Cyclohexane	U		0.390	1.00	1	04/01/2019 19:58	WG1258768

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

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
1,2-Dibromo-3-Chloropropane	U		1.33	5.00	1	04/01/2019 19:58	WG1258768
1,2-Dibromoethane	U		0.381	1.00	1	04/01/2019 19:58	WG1258768
1,2-Dichlorobenzene	U		0.349	1.00	1	04/01/2019 19:58	WG1258768
1,3-Dichlorobenzene	U		0.220	1.00	1	04/01/2019 19:58	WG1258768
1,4-Dichlorobenzene	U		0.274	1.00	1	04/01/2019 19:58	WG1258768
Dichlorodifluoromethane	U		0.551	5.00	1	04/01/2019 19:58	WG1258768
1,1-Dichloroethane	U		0.259	1.00	1	04/01/2019 19:58	WG1258768
1,2-Dichloroethane	U		0.361	1.00	1	04/01/2019 19:58	WG1258768
1,1-Dichloroethene	U		0.398	1.00	1	04/01/2019 19:58	WG1258768
cis-1,2-Dichloroethene	U		0.260	1.00	1	04/01/2019 19:58	WG1258768
trans-1,2-Dichloroethene	U		0.396	1.00	1	04/01/2019 19:58	WG1258768
1,2-Dichloropropane	U		0.306	1.00	1	04/01/2019 19:58	WG1258768
cis-1,3-Dichloropropene	U		0.418	1.00	1	04/01/2019 19:58	WG1258768
trans-1,3-Dichloropropene	U		0.419	1.00	1	04/01/2019 19:58	WG1258768
Ethylbenzene	U		0.384	1.00	1	04/01/2019 19:58	WG1258768
2-Hexanone	U		3.82	10.0	1	04/01/2019 19:58	WG1258768
Isopropylbenzene	U		0.326	1.00	1	04/01/2019 19:58	WG1258768
2-Butanone (MEK)	U		3.93	10.0	1	04/01/2019 19:58	WG1258768
Methyl Acetate	U		4.30	20.0	1	04/01/2019 19:58	WG1258768
Methyl Cyclohexane	U		0.380	1.00	1	04/01/2019 19:58	WG1258768
Methylene Chloride	U		1.00	3.00	1	04/01/2019 19:58	WG1258768
4-Methyl-2-pentanone (MIBK)	U		2.14	10.0	1	04/01/2019 19:58	WG1258768
Methyl tert-butyl ether	U		0.367	1.00	1	04/01/2019 19:58	WG1258768
Naphthalene	U		1.00	5.00	1	04/01/2019 19:58	WG1258768
tert-Butyl alcohol	U		2.40	5.00	1	04/01/2019 19:58	WG1258768
Styrene	U		0.307	1.00	1	04/01/2019 19:58	WG1258768
1,1,2,2-Tetrachloroethane	U		0.130	1.00	1	04/01/2019 19:58	WG1258768
Tetrachloroethene	U		0.372	1.00	1	04/01/2019 19:58	WG1258768
Toluene	U		0.412	1.00	1	04/01/2019 19:58	WG1258768
1,2,3-Trichlorobenzene	U		0.230	1.00	1	04/01/2019 19:58	WG1258768
1,2,4-Trichlorobenzene	U		0.355	1.00	1	04/01/2019 19:58	WG1258768
1,1,1-Trichloroethane	U		0.319	1.00	1	04/01/2019 19:58	WG1258768
1,1,2-Trichloroethane	U		0.383	1.00	1	04/01/2019 19:58	WG1258768
Trichloroethene	U		0.398	1.00	1	04/01/2019 19:58	WG1258768
Trichlorofluoromethane	U		1.20	5.00	1	04/01/2019 19:58	WG1258768
1,1,2-Trichlorotrifluoroethane	U		0.303	1.00	1	04/01/2019 19:58	WG1258768
Vinyl chloride	U		0.259	1.00	1	04/01/2019 19:58	WG1258768
Xylenes, Total	U		1.06	3.00	1	04/01/2019 19:58	WG1258768
(S) Toluene-d8	*95.4*			*80.0-120*		*04/01/2019 19:58*	WG1258768
(S) a,a,a-Trifluorotoluene	*103*			*80.0-120*		*04/01/2019 19:58*	WG1258768
(S) 4-Bromofluorobenzene	*94.2*			*77.0-126*		*04/01/2019 19:58*	WG1258768
(S) 1,2-Dichloroethane-d4	*96.8*			*70.0-130*		*04/01/2019 19:58*	WG1258768

Volatile Organic Compounds (GC/MS) by Method 8260C - TENTATIVELY IDENTIFIED COMPOUNDS

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch	CAS #
	ug/l		ug/l	ug/l		date / time		
Total Tic	0.000		0.000	0.000	1	04/01/2019 19:58	WG1258768	

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Pesticides (GC) by Method 8081B

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Aldrin	U		0.00813	0.0400	1	04/03/2019 11:50	WG1259577
Alpha BHC	U		0.0166	0.0200	1	04/03/2019 11:50	WG1259577
Beta BHC	U		0.0184	0.0400	1	04/03/2019 11:50	WG1259577
Delta BHC	U		0.0197	0.0500	1	04/03/2019 11:50	WG1259577
Gamma BHC	U		0.0176	0.0300	1	04/03/2019 11:50	WG1259577
Chlordane	U		0.0977	0.500	1	04/03/2019 11:50	WG1259577
alpha-Chlordane	U		0.0149	0.0500	1	04/03/2019 11:50	WG1259577
gamma-Chlordane	U		0.0137	0.0500	1	04/03/2019 11:50	WG1259577
4,4-DDD	U		0.0170	0.0500	1	04/03/2019 11:50	WG1259577
4,4-DDE	U		0.0164	0.0500	1	04/03/2019 11:50	WG1259577
4,4-DDT	U		0.0177	0.0500	1	04/03/2019 11:50	WG1259577
Dieldrin	U		0.00751	0.0500	1	04/03/2019 11:50	WG1259577
Endosulfan I	U		0.0179	0.0500	1	04/03/2019 11:50	WG1259577
Endosulfan II	U		0.0176	0.0500	1	04/03/2019 11:50	WG1259577
Endosulfan sulfate	U		0.0196	0.0500	1	04/03/2019 11:50	WG1259577
Endrin	U		0.0189	0.0500	1	04/03/2019 11:50	WG1259577
Endrin aldehyde	U		0.0142	0.0500	1	04/03/2019 11:50	WG1259577
Endrin ketone	U		0.0170	0.0500	1	04/03/2019 11:50	WG1259577
Hexachlorobenzene	U		0.0134	0.0500	1	04/03/2019 11:50	WG1259577
Heptachlor	U	J3 J4	0.0108	0.0500	1	04/03/2019 11:50	WG1259577
Heptachlor epoxide	U		0.0175	0.0500	1	04/03/2019 11:50	WG1259577
Methoxychlor	U		0.0193	0.0500	1	04/03/2019 11:50	WG1259577
Toxaphene	U		0.168	0.500	1	04/03/2019 11:50	WG1259577
(S) Decachlorobiphenyl	*63.7*			*30.0-150*		*04/03/2019 11:50*	WG1259577
(S) Tetrachloro-m-xylene	*92.1*			*30.0-150*		*04/03/2019 11:50*	WG1259577

Polychlorinated Biphenyls (GC) by Method 8082 A

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
PCB 1016	U		0.100	0.500	1	04/03/2019 14:35	WG1259577
PCB 1221	U		0.0730	0.500	1	04/03/2019 14:35	WG1259577
PCB 1232	U		0.0420	0.500	1	04/03/2019 14:35	WG1259577
PCB 1242	U		0.0470	0.500	1	04/03/2019 14:35	WG1259577
PCB 1248	U		0.0860	0.500	1	04/03/2019 14:35	WG1259577
PCB 1254	U		0.0470	0.500	1	04/03/2019 14:35	WG1259577
PCB 1260	U		0.120	0.500	1	04/03/2019 14:35	WG1259577
(S) Decachlorobiphenyl	*69.6*			*30.0-150*		*04/03/2019 14:35*	WG1259577
(S) Tetrachloro-m-xylene	*86.0*			*30.0-150*		*04/03/2019 14:35*	WG1259577

Semi Volatile Organic Compounds (GC/MS) by Method 8270 D

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Acetophenone	U	J4	2.71	10.0	1	04/03/2019 21:27	WG1259548
Atrazine	U		0.260	10.0	1	04/03/2019 21:27	WG1259548
Benzaldehyde	U		1.40	10.0	1	04/03/2019 21:27	WG1259548
Biphenyl	U	J4	0.325	10.0	1	04/03/2019 21:27	WG1259548
Bis(2-chlorethoxy)methane	U	J4	0.329	10.0	1	04/03/2019 21:27	WG1259548
Bis(2-chloroethyl)ether	U	J4	1.62	7.00	1	04/03/2019 21:27	WG1259548
Bis(2-chloroisopropyl)ether	U	J4	0.445	10.0	1	04/03/2019 21:27	WG1259548
4-Bromophenyl-phenylether	U	J4	0.335	10.0	1	04/03/2019 21:27	WG1259548
Caprolactam	U		2.59	10.0	1	04/03/2019 21:27	WG1259548
Carbazole	U		0.260	10.0	1	04/03/2019 21:27	WG1259548
4-Chloroaniline	U	J4	0.382	10.0	1	04/03/2019 21:27	WG1259548
4-Chlorophenyl-phenylether	U	J4	0.303	10.0	1	04/03/2019 21:27	WG1259548
Dibenzofuran	U	J4	0.338	10.0	1	04/03/2019 21:27	WG1259548

Semi Volatile Organic Compounds (GC/MS) by Method 8270 D

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
3,3-Dichlorobenzidine	U	J4	2.02	10.0	1	04/03/2019 21:27	WG1259548
2,4-Dinitrotoluene	U		1.65	10.0	1	04/03/2019 21:27	WG1259548
2,6-Dinitrotoluene	U		0.279	10.0	1	04/03/2019 21:27	WG1259548
Hexachloro-1,3-butadiene	U	J4	0.329	10.0	1	04/03/2019 21:27	WG1259548
Hexachlorocyclopentadiene	U		2.33	10.0	1	04/03/2019 21:27	WG1259548
Hexachloroethane	U		0.365	7.00	1	04/03/2019 21:27	WG1259548
Isophorone	U	J4	0.272	10.0	1	04/03/2019 21:27	WG1259548
2-Nitroaniline	U		1.90	10.0	1	04/03/2019 21:27	WG1259548
3-Nitroaniline	U		0.308	10.0	1	04/03/2019 21:27	WG1259548
4-Nitroaniline	U		0.349	10.0	1	04/03/2019 21:27	WG1259548
Nitrobenzene	U	J4	0.367	6.00	1	04/03/2019 21:27	WG1259548
n-Nitrosodiphenylamine	U		1.19	10.0	1	04/03/2019 21:27	WG1259548
n-Nitrosodi-n-propylamine	U	J4	0.403	10.0	1	04/03/2019 21:27	WG1259548
Benzylbutyl phthalate	U		0.275	10.0	1	04/03/2019 21:27	WG1259548
Bis(2-ethylhexyl)phthalate	U		0.709	10.0	1	04/03/2019 21:27	WG1259548
Di-n-butyl phthalate	U		0.266	10.0	1	04/03/2019 21:27	WG1259548
Diethyl phthalate	U		0.282	10.0	1	04/03/2019 21:27	WG1259548
Dimethyl phthalate	U		0.283	10.0	1	04/03/2019 21:27	WG1259548
Di-n-octyl phthalate	U		0.278	10.0	1	04/03/2019 21:27	WG1259548
1,2,4,5-Tetrachlorobenzene	U	J4	2.41	10.0	1	04/03/2019 21:27	WG1259548
4-Chloro-3-methylphenol	U	J4	0.263	10.0	1	04/03/2019 21:27	WG1259548
2-Chlorophenol	U	J4	0.283	10.0	1	04/03/2019 21:27	WG1259548
2-Methylphenol	U	J4	0.312	10.0	1	04/03/2019 21:27	WG1259548
3&4-Methyl Phenol	U		0.266	10.0	1	04/03/2019 21:27	WG1259548
2,4-Dichlorophenol	U	J4	0.284	10.0	1	04/03/2019 21:27	WG1259548
2,4-Dimethylphenol	U	J4	0.264	10.0	1	04/03/2019 21:27	WG1259548
4,6-Dinitro-2-methylphenol	U		2.62	10.0	1	04/03/2019 21:27	WG1259548
2,4-Dinitrophenol	U		3.25	10.0	1	04/03/2019 21:27	WG1259548
2-Nitrophenol	0.390	J J4	0.320	10.0	1	04/03/2019 21:27	WG1259548
4-Nitrophenol	U		2.01	10.0	1	04/03/2019 21:27	WG1259548
Pentachlorophenol	U		0.313	10.0	1	04/03/2019 21:27	WG1259548
Phenol	2.93	J	0.334	10.0	1	04/03/2019 21:27	WG1259548
2,4,5-Trichlorophenol	U	J4	0.236	10.0	1	04/03/2019 21:27	WG1259548
2,4,6-Trichlorophenol	U	J4	0.297	10.0	1	04/03/2019 21:27	WG1259548
(S) 2-Fluorophenol	*21.9*			*15.0-110*		*04/03/2019 21:27*	WG1259548
(S) Phenol-d5	*14.2*	J2		*15.0-110*		*04/03/2019 21:27*	WG1259548
(S) Nitrobenzene-d5	*25.0*	J2		*30.0-130*		*04/03/2019 21:27*	WG1259548
(S) 2-Fluorobiphenyl	*29.3*	J2		*30.0-130*		*04/03/2019 21:27*	WG1259548
(S) 2,4,6-Tribromophenol	*41.1*			*15.0-110*		*04/03/2019 21:27*	WG1259548
(S) p-Terphenyl-d14	*62.5*			*30.0-130*		*04/03/2019 21:27*	WG1259548

Semi Volatile Organic Compounds (GC/MS) by Method 8270 D - TENTATIVELY IDENTIFIED COMPOUNDS

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch	CAS #
	ug/l		ug/l	ug/l		date / time		
Total Tic	0.000		0.000	0.000	1	04/03/2019 21:27	WG1259548	

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Anthracene	0.00979	J	0.00800	0.0500	1	04/04/2019 12:25	WG1260608
Acenaphthene	U		0.0100	0.0500	1	04/04/2019 12:25	WG1260608
Acenaphthylene	U		0.0120	0.0500	1	04/04/2019 12:25	WG1260608
Benzo(a)anthracene	U		0.00410	0.0500	1	04/04/2019 12:25	WG1260608
Benzo(a)pyrene	U		0.0116	0.0500	1	04/04/2019 12:25	WG1260608
Benzo(b)fluoranthene	0.00293	J	0.00212	0.0500	1	04/04/2019 12:25	WG1260608
Benzo(g,h,i)perylene	U		0.00227	0.0500	1	04/04/2019 12:25	WG1260608
Benzo(k)fluoranthene	U		0.0136	0.0500	1	04/04/2019 12:25	WG1260608
Chrysene	U		0.0108	0.0500	1	04/04/2019 12:25	WG1260608
Dibenz(a,h)anthracene	U		0.00396	0.0500	1	04/04/2019 12:25	WG1260608
Fluoranthene	U		0.0157	0.0500	1	04/04/2019 12:25	WG1260608
Fluorene	0.0162	J	0.00850	0.0500	1	04/04/2019 12:25	WG1260608
Hexachlorobenzene	U		0.00670	0.0200	1	04/04/2019 12:25	WG1260608
Indeno(1,2,3-cd)pyrene	U		0.0148	0.0500	1	04/04/2019 12:25	WG1260608
Naphthalene	U		0.0198	0.250	1	04/04/2019 12:25	WG1260608
Phenanthrene	0.0515		0.00820	0.0500	1	04/04/2019 12:25	WG1260608
Pyrene	0.0274	J	0.0117	0.0500	1	04/04/2019 12:25	WG1260608
1-Methylnaphthalene	0.0317	J	0.00821	0.250	1	04/04/2019 12:25	WG1260608
2-Methylnaphthalene	0.0200	J	0.00902	0.250	1	04/04/2019 12:25	WG1260608
2-Chloronaphthalene	U		0.00647	0.250	1	04/04/2019 12:25	WG1260608
(S) Nitrobenzene-d5	*103*			*31.0-160*		*04/04/2019 12:25*	WG1260608
(S) 2-Fluorobiphenyl	*85.3*			*48.0-148*		*04/04/2019 12:25*	WG1260608
(S) p-Terphenyl-d14	*82.6*			*37.0-146*		*04/04/2019 12:25*	WG1260608

Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM - TENTATIVELY IDENTIFIED COMPOUNDS

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch	CAS #
	ug/l		ug/l	ug/l		date / time		

Number of TICs found: 0

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Total Solids by Method 2540 G-2011

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	%			date / time	
Total Solids	90.3		1	04/04/2019 11:06	WG1260343

Wet Chemistry by Method 9012B

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
Cyanide	0.111	J	0.0432	0.277	1	04/05/2019 14:24	WG1260642

Mercury by Method 7471B

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
Mercury	U		0.00310	0.0221	1	04/04/2019 10:40	WG1260270

Metals (ICP) by Method 6010D

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
Aluminum	5190		3.88	11.1	1	04/04/2019 16:42	WG1260035
Antimony	U		0.830	2.21	1	04/04/2019 16:42	WG1260035
Arsenic	4.77		0.509	2.21	1	04/04/2019 16:42	WG1260035
Barium	14.2		0.188	0.554	1	04/04/2019 16:42	WG1260035
Beryllium	0.479		0.0775	0.221	1	04/04/2019 16:42	WG1260035
Cadmium	0.101	J	0.0775	0.554	1	04/04/2019 16:42	WG1260035
Calcium	301		5.13	111	1	04/04/2019 16:42	WG1260035
Chromium	11.4		0.155	1.11	1	04/04/2019 16:42	WG1260035
Cobalt	5.39		0.255	1.11	1	04/04/2019 16:42	WG1260035
Copper	6.87		0.587	2.21	1	04/04/2019 16:42	WG1260035
Iron	14400		1.56	11.1	1	04/04/2019 16:42	WG1260035
Lead	4.83		0.210	0.554	1	04/04/2019 16:42	WG1260035
Magnesium	1640		1.23	111	1	04/04/2019 16:42	WG1260035
Manganese	232		0.133	1.11	1	04/04/2019 16:42	WG1260035
Nickel	10.5		0.543	2.21	1	04/04/2019 16:42	WG1260035
Potassium	1620		11.3	111	1	04/04/2019 16:42	WG1260035
Selenium	U		0.686	2.21	1	04/04/2019 16:42	WG1260035
Silver	U		0.133	1.11	1	04/04/2019 16:42	WG1260035
Sodium	88.3	B J	10.9	111	1	04/04/2019 16:42	WG1260035
Thallium	U		0.720	2.21	1	04/04/2019 16:42	WG1260035
Vanadium	12.6		0.266	2.21	1	04/04/2019 16:42	WG1260035
Zinc	24.9		0.653	5.54	1	04/04/2019 16:42	WG1260035

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

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
Acetone	0.0268	J	0.0111	0.0554	1	04/03/2019 16:17	WG1260000
Benzene	U		0.000299	0.00111	1	04/01/2019 20:29	WG1258825
Bromochloromethane	U		0.000432	0.00111	1	04/01/2019 20:29	WG1258825
Bromodichloromethane	U		0.000281	0.00111	1	04/01/2019 20:29	WG1258825
Bromoform	U		0.000469	0.00111	1	04/01/2019 20:29	WG1258825
Bromomethane	U		0.00148	0.00554	1	04/01/2019 20:29	WG1258825
Carbon disulfide	U		0.000245	0.00111	1	04/01/2019 20:29	WG1258825
Carbon tetrachloride	U		0.000363	0.00111	1	04/01/2019 20:29	WG1258825
Chlorobenzene	U		0.000235	0.00111	1	04/01/2019 20:29	WG1258825
Chlorodibromomethane	U		0.000413	0.00111	1	04/01/2019 20:29	WG1258825
Chloroethane	U		0.00105	0.00554	1	04/01/2019 20:29	WG1258825
Chloroform	U		0.000254	0.00554	1	04/01/2019 20:29	WG1258825
Chloromethane	U		0.000415	0.00277	1	04/01/2019 20:29	WG1258825

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

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Cyclohexane	U		0.000388	0.00111	1	04/01/2019 20:29	WG1258825
1,2-Dibromo-3-Chloropropane	U		0.00116	0.00332	1	04/01/2019 20:29	WG1258825
1,2-Dibromoethane	U		0.000380	0.00111	1	04/01/2019 20:29	WG1258825
Dichlorodifluoromethane	U		0.000789	0.00554	1	04/01/2019 20:29	WG1258825
1,1-Dichloroethane	U		0.000220	0.00111	1	04/01/2019 20:29	WG1258825
1,2-Dichloroethane	U		0.000293	0.00111	1	04/01/2019 20:29	WG1258825
1,2-Dichlorobenzene	U		0.000338	0.00111	1	04/01/2019 20:29	WG1258825
1,3-Dichlorobenzene	U		0.000265	0.00111	1	04/01/2019 20:29	WG1258825
1,4-Dichlorobenzene	U		0.000250	0.00111	1	04/01/2019 20:29	WG1258825
1,1-Dichloroethene	U		0.000335	0.00111	1	04/01/2019 20:29	WG1258825
cis-1,2-Dichloroethene	U		0.000260	0.00111	1	04/01/2019 20:29	WG1258825
trans-1,2-Dichloroethene	U		0.000292	0.00111	1	04/01/2019 20:29	WG1258825
1,2-Dichloropropane	U		0.000396	0.00111	1	04/01/2019 20:29	WG1258825
cis-1,3-Dichloropropene	U		0.000290	0.00111	1	04/01/2019 20:29	WG1258825
trans-1,3-Dichloropropene	U		0.000296	0.00111	1	04/01/2019 20:29	WG1258825
Ethylbenzene	U		0.000329	0.00111	1	04/01/2019 20:29	WG1258825
2-Hexanone	U		0.00152	0.0111	1	04/01/2019 20:29	WG1258825
Isopropylbenzene	U		0.000269	0.0111	1	04/01/2019 20:29	WG1258825
2-Butanone (MEK)	U		0.00518	0.0111	1	04/01/2019 20:29	WG1258825
Methyl Acetate	U	J4	0.00675	0.0221	1	04/03/2019 16:17	WG1260000
Methyl Cyclohexane	U		0.000421	0.00111	1	04/01/2019 20:29	WG1258825
Methylene Chloride	U		0.00111	0.00554	1	04/01/2019 20:29	WG1258825
4-Methyl-2-pentanone (MIBK)	U		0.00208	0.0111	1	04/01/2019 20:29	WG1258825
Methyl tert-butyl ether	U		0.000235	0.00111	1	04/01/2019 20:29	WG1258825
Styrene	U		0.000259	0.00111	1	04/01/2019 20:29	WG1258825
1,1,2,2-Tetrachloroethane	U		0.000404	0.00111	1	04/01/2019 20:29	WG1258825
Tetrachloroethene	U		0.000306	0.00111	1	04/01/2019 20:29	WG1258825
Toluene	U		0.000481	0.00554	1	04/01/2019 20:29	WG1258825
1,2,3-Trichlorobenzene	U		0.000339	0.00111	1	04/01/2019 20:29	WG1258825
1,2,4-Trichlorobenzene	U		0.000430	0.00111	1	04/01/2019 20:29	WG1258825
1,1,1-Trichloroethane	U		0.000317	0.00111	1	04/01/2019 20:29	WG1258825
1,1,2-Trichloroethane	U		0.000307	0.00111	1	04/01/2019 20:29	WG1258825
Trichloroethene	U		0.000309	0.00111	1	04/01/2019 20:29	WG1258825
Trichlorofluoromethane	U		0.000423	0.00554	1	04/01/2019 20:29	WG1258825
1,1,2-Trichlorotrifluoroethane	U		0.000404	0.00111	1	04/01/2019 20:29	WG1258825
Vinyl chloride	U		0.000322	0.00111	1	04/01/2019 20:29	WG1258825
Xylenes, Total	U		0.000773	0.00332	1	04/01/2019 20:29	WG1258825
(S) Toluene-d8	*99.3*			*75.0-131*		*04/01/2019 20:29*	WG1258825
(S) Toluene-d8	*117*			*75.0-131*		*04/03/2019 16:17*	WG1260000
(S) a,a,a-Trifluorotoluene	*99.9*			*80.0-120*		*04/01/2019 20:29*	WG1258825
(S) a,a,a-Trifluorotoluene	*101*			*80.0-120*		*04/03/2019 16:17*	WG1260000
(S) 4-Bromofluorobenzene	*101*			*67.0-138*		*04/01/2019 20:29*	WG1258825
(S) 4-Bromofluorobenzene	*118*			*67.0-138*		*04/03/2019 16:17*	WG1260000
(S) 1,2-Dichloroethane-d4	*103*			*70.0-130*		*04/01/2019 20:29*	WG1258825
(S) 1,2-Dichloroethane-d4	*104*			*70.0-130*		*04/03/2019 16:17*	WG1260000

Volatile Organic Compounds (GC/MS) by Method 8260C - TENTATIVELY IDENTIFIED COMPOUNDS

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch	CAS #
Total Tic	0.00498	J N	0.000	0.000	1	04/01/2019 20:29	WG1258825	
Total Tic	0.0125	J N	0.000	0.000	1	04/03/2019 16:17	WG1260000	
Benzene, 1,4-Difluoro-	0.0125	J N	0.000	0.000	1	04/03/2019 16:17	WG1260000	000540-36-3
Isopropyl Alcohol	0.00498	J N	0.000	0.000	1	04/01/2019 20:29	WG1258825	000067-63-0

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Semi-Volatile Organic Compounds (GC) by Method NJDEP EPH

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
C9-C12 Aliphatics	U		3.65	11.1	1	04/05/2019 18:02	WG1260316
C12-C16 Aliphatics	U		3.65	11.1	1	04/05/2019 18:02	WG1260316
C16-C21 Aliphatics	U		3.65	11.1	1	04/05/2019 18:02	WG1260316
C21-C40 Aliphatics	U		3.65	11.1	1	04/05/2019 18:02	WG1260316
C10 - C12 Aromatics	U		3.65	11.1	1	04/08/2019 12:16	WG1260316
C12-C16 Aromatics	U		3.65	11.1	1	04/08/2019 12:16	WG1260316
C16-C21 Aromatics	4.94	J	3.65	11.1	1	04/08/2019 12:16	WG1260316
C21-C36 Aromatics	U		3.65	11.1	1	04/08/2019 12:16	WG1260316
Total EPH	4.94	J	0.000	11.1	1	04/08/2019 12:16	WG1260316
(S) 1-Chloro-octadecane	*82.1*			*40.0-140*		*04/05/2019 18:02*	WG1260316
(S) 2-Fluorobiphenyl	*88.3*			*40.0-140*		*04/08/2019 12:16*	WG1260316
(S) 2-Bromonaphthalene	*88.3*			*40.0-140*		*04/08/2019 12:16*	WG1260316
(S) o-Terphenyl	*75.4*			*40.0-140*		*04/08/2019 12:16*	WG1260316

Pesticides (GC) by Method 8081B

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Aldrin	U		0.00149	0.0221	1	04/04/2019 11:34	WG1260104
Alpha BHC	U		0.00151	0.00277	1	04/04/2019 11:34	WG1260104
Beta BHC	U		0.00177	0.00277	1	04/04/2019 11:34	WG1260104
Delta BHC	U		0.00158	0.0221	1	04/04/2019 11:34	WG1260104
Gamma BHC	U		0.00161	0.00277	1	04/04/2019 11:34	WG1260104
Chlordane	U		0.0432	0.221	1	04/04/2019 11:34	WG1260104
alpha-Chlordane	U		0.00156	0.0221	1	04/04/2019 11:34	WG1260104
gamma-Chlordane	U		0.00217	0.0221	1	04/04/2019 11:34	WG1260104
4,4-DDD	U		0.00173	0.0221	1	04/04/2019 11:34	WG1260104
4,4-DDE	U		0.00171	0.0221	1	04/04/2019 11:34	WG1260104
4,4-DDT	U		0.00221	0.0221	1	04/04/2019 11:34	WG1260104
Dieldrin	U		0.00168	0.00332	1	04/04/2019 11:34	WG1260104
Endosulfan I	U		0.00165	0.0221	1	04/04/2019 11:34	WG1260104
Endosulfan II	U		0.00177	0.0221	1	04/04/2019 11:34	WG1260104
Endosulfan sulfate	U		0.00167	0.0221	1	04/04/2019 11:34	WG1260104
Endrin	U		0.00174	0.0221	1	04/04/2019 11:34	WG1260104
Endrin aldehyde	U		0.00143	0.0221	1	04/04/2019 11:34	WG1260104
Endrin ketone	U		0.00183	0.0221	1	04/04/2019 11:34	WG1260104
Hexachlorobenzene	U		0.00137	0.0221	1	04/04/2019 11:34	WG1260104
Heptachlor	U		0.00171	0.0221	1	04/04/2019 11:34	WG1260104
Heptachlor epoxide	U		0.00178	0.0111	1	04/04/2019 11:34	WG1260104
Methoxychlor	U		0.00197	0.0221	1	04/04/2019 11:34	WG1260104
Toxaphene	U		0.0399	0.443	1	04/04/2019 11:34	WG1260104
(S) Decachlorobiphenyl	*75.0*			*30.0-150*		*04/04/2019 11:34*	WG1260104
(S) Tetrachloro-m-xylene	*89.1*			*30.0-150*		*04/04/2019 11:34*	WG1260104

Polychlorinated Biphenyls (GC) by Method 8082 A

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
PCB 1016	U		0.00388	0.0188	1	04/04/2019 15:35	WG1260104
PCB 1221	U		0.00595	0.0188	1	04/04/2019 15:35	WG1260104
PCB 1232	U		0.00462	0.0188	1	04/04/2019 15:35	WG1260104
PCB 1242	U		0.00352	0.0188	1	04/04/2019 15:35	WG1260104
PCB 1248	U		0.00349	0.0188	1	04/04/2019 15:35	WG1260104
PCB 1254	U		0.00523	0.0188	1	04/04/2019 15:35	WG1260104
PCB 1260	U		0.00547	0.0188	1	04/04/2019 15:35	WG1260104
(S) Decachlorobiphenyl	*79.0*			*30.0-150*		*04/04/2019 15:35*	WG1260104
(S) Tetrachloro-m-xylene	*76.3*			*30.0-150*		*04/04/2019 15:35*	WG1260104

Semi Volatile Organic Compounds (GC/MS) by Method 8270D

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Acenaphthene	U	J3 J4	0.00711	0.0365	1	04/09/2019 12:11	WG1262278
Acenaphthylene	U	J3 J4	0.00743	0.0365	1	04/09/2019 12:11	WG1262278
Acetophenone	U	J3 J4	0.0833	0.166	1	04/09/2019 12:11	WG1262278
Anthracene	U	J4	0.00700	0.0365	1	04/09/2019 12:11	WG1262278
Atrazine	U		0.104	0.166	1	04/09/2019 12:11	WG1262278
Benzaldehyde	U	J3	0.0589	0.166	1	04/09/2019 12:11	WG1262278
Benzo(a)anthracene	U		0.00474	0.0365	1	04/09/2019 12:11	WG1262278
Benzo(b)fluoranthene	U		0.00770	0.0365	1	04/09/2019 12:11	WG1262278
Benzo(k)fluoranthene	U		0.00644	0.0365	1	04/09/2019 12:11	WG1262278
Benzo(g,h,i)perylene	U		0.00798	0.0365	1	04/09/2019 12:11	WG1262278
Benzo(a)pyrene	U		0.00607	0.0365	1	04/09/2019 12:11	WG1262278
Biphenyl	U	J3 J4	0.00651	0.166	1	04/09/2019 12:11	WG1262278
Bis(2-chlorethoxy)methane	U	J3 J4	0.00853	0.166	1	04/09/2019 12:11	WG1262278
Bis(2-chloroethyl)ether	U	J3 J4	0.00992	0.166	1	04/09/2019 12:11	WG1262278
Bis(2-chloroisopropyl)ether	U	J3 J4	0.00842	0.166	1	04/09/2019 12:11	WG1262278
4-Bromophenyl-phenylether	U	J4	0.0126	0.166	1	04/09/2019 12:11	WG1262278
Caprolactam	U		0.115	0.166	1	04/09/2019 12:11	WG1262278
Carbazole	U		0.00580	0.166	1	04/09/2019 12:11	WG1262278
4-Chloroaniline	U	J3 J4	0.0390	0.166	1	04/09/2019 12:11	WG1262278
2-Chloronaphthalene	U	J3 J4	0.00708	0.0365	1	04/09/2019 12:11	WG1262278
4-Chlorophenyl-phenylether	U	J4	0.00694	0.166	1	04/09/2019 12:11	WG1262278
Chrysene	U	J4	0.00615	0.0365	1	04/09/2019 12:11	WG1262278
Dibenz(a,h)anthracene	U		0.00909	0.0365	1	04/09/2019 12:11	WG1262278
Dibenzofuran	U	J3 J4	0.00574	0.166	1	04/09/2019 12:11	WG1262278
3,3-Dichlorobenzidine	U		0.0879	0.166	1	04/09/2019 12:11	WG1262278
2,4-Dinitrotoluene	U	J4	0.00672	0.166	1	04/09/2019 12:11	WG1262278
2,6-Dinitrotoluene	U	J4	0.00816	0.166	1	04/09/2019 12:11	WG1262278
Fluoranthene	U		0.00549	0.0365	1	04/09/2019 12:11	WG1262278
Fluorene	U	J4	0.00755	0.0365	1	04/09/2019 12:11	WG1262278
Hexachlorobenzene	U	J4	0.00948	0.166	1	04/09/2019 12:11	WG1262278
Hexachloro-1,3-butadiene	U	J3 J4	0.0111	0.166	1	04/09/2019 12:11	WG1262278
Hexachlorocyclopentadiene	U	J0 J3	0.0650	0.166	1	04/09/2019 12:11	WG1262278
Hexachloroethane	U	J3	0.0148	0.166	1	04/09/2019 12:11	WG1262278
Indeno(1,2,3-cd)pyrene	U		0.00855	0.0365	1	04/09/2019 12:11	WG1262278
Isophorone	U	J3 J4	0.00578	0.166	1	04/09/2019 12:11	WG1262278
2-Methylnaphthalene	0.0179	J J3 J4	0.00953	0.0365	1	04/09/2019 12:11	WG1262278
Naphthalene	U	J3 J4	0.00984	0.0365	1	04/09/2019 12:11	WG1262278
2-Nitroaniline	U	J4	0.00836	0.166	1	04/09/2019 12:11	WG1262278
3-Nitroaniline	U	J4	0.00941	0.166	1	04/09/2019 12:11	WG1262278
4-Nitroaniline	U	J4	0.00708	0.166	1	04/09/2019 12:11	WG1262278
Nitrobenzene	U	J3 J4	0.00770	0.166	1	04/09/2019 12:11	WG1262278
n-Nitrosodiphenylamine	U		0.00658	0.166	1	04/09/2019 12:11	WG1262278
n-Nitrosodi-n-propylamine	U	J3 J4	0.0100	0.166	1	04/09/2019 12:11	WG1262278
Phenanthrene	U	J4	0.00585	0.0365	1	04/09/2019 12:11	WG1262278
Benzylbutyl phthalate	U		0.0114	0.166	1	04/09/2019 12:11	WG1262278
Bis(2-ethylhexyl)phthalate	U		0.0133	0.166	1	04/09/2019 12:11	WG1262278
Di-n-butyl phthalate	U		0.0121	0.166	1	04/09/2019 12:11	WG1262278
Diethyl phthalate	U	J4	0.00765	0.166	1	04/09/2019 12:11	WG1262278
Dimethyl phthalate	U	J4	0.00598	0.166	1	04/09/2019 12:11	WG1262278
Di-n-octyl phthalate	U		0.0100	0.166	1	04/09/2019 12:11	WG1262278
Pyrene	U		0.0136	0.0365	1	04/09/2019 12:11	WG1262278
1,2,4,5-Tetrachlorobenzene	U	J3 J4	0.0844	0.166	1	04/09/2019 12:11	WG1262278
4-Chloro-3-methylphenol	U	J4	0.00528	0.166	1	04/09/2019 12:11	WG1262278
2-Chlorophenol	U	J3 J4	0.00920	0.166	1	04/09/2019 12:11	WG1262278
2-Methylphenol	U	J3 J4	0.0109	0.166	1	04/09/2019 12:11	WG1262278
3&4-Methyl Phenol	U	J3	0.00867	0.166	1	04/09/2019 12:11	WG1262278

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Semi Volatile Organic Compounds (GC/MS) by Method 8270D

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
2,4-Dichlorophenol	U	J3 J4	0.00826	0.166	1	04/09/2019 12:11	WG1262278
2,4-Dimethylphenol	U	J3 J4	0.0522	0.166	1	04/09/2019 12:11	WG1262278
4,6-Dinitro-2-methylphenol	U	J4	0.137	0.221	1	04/09/2019 12:11	WG1262278
2,4-Dinitrophenol	U	J3	0.109	0.221	1	04/09/2019 12:11	WG1262278
2-Nitrophenol	U	J3 J4	0.0144	0.166	1	04/09/2019 12:11	WG1262278
4-Nitrophenol	U		0.0581	0.166	1	04/09/2019 12:11	WG1262278
Pentachlorophenol	U		0.0531	0.166	1	04/09/2019 12:11	WG1262278
Phenol	U	J3	0.00770	0.166	1	04/09/2019 12:11	WG1262278
2,4,5-Trichlorophenol	U	J4	0.0115	0.166	1	04/09/2019 12:11	WG1262278
2,4,6-Trichlorophenol	U	J3 J4	0.00863	0.166	1	04/09/2019 12:11	WG1262278
(S) 2-Fluorophenol	*55.1*			*30.0-130*		*04/09/2019 12:11*	WG1262278
(S) Phenol-d5	*51.7*			*30.0-130*		*04/09/2019 12:11*	WG1262278
(S) Nitrobenzene-d5	*46.2*			*30.0-130*		*04/09/2019 12:11*	WG1262278
(S) 2-Fluorobiphenyl	*46.5*			*30.0-130*		*04/09/2019 12:11*	WG1262278
(S) 2,4,6-Tribromophenol	*29.4*	J2		*30.0-130*		*04/09/2019 12:11*	WG1262278
(S) p-Terphenyl-d14	*61.0*			*30.0-130*		*04/09/2019 12:11*	WG1262278

Semi Volatile Organic Compounds (GC/MS) by Method 8270D - TENTATIVELY IDENTIFIED COMPOUNDS

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch	CAS #
Total Tic	0.724	J N	0.000	0.000	1	04/09/2019 12:11	WG1262278	
Unknown-03	0.467	J N	0.000	0.000	1	04/09/2019 12:11	WG1262278	000123-42-2
Unknown-06	0.108	J N	0.000	0.000	1	04/09/2019 12:11	WG1262278	001599-67-3
Unknown-04	0.0682	J N	0.000	0.000	1	04/09/2019 12:11	WG1262278	004464-77-1
Unknown-01	0.0296	J N	0.000	0.000	1	04/09/2019 12:11	WG1262278	006269-92-7
Unknown-05	0.0259	J N	0.000	0.000	1	04/09/2019 12:11	WG1262278	054823-96-0
Unknown-02	0.0254	J N	0.000	0.000	1	04/09/2019 12:11	WG1262278	000764-01-2

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Total Solids by Method 2540 G-2011

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	%			date / time	
Total Solids	88.3		1	04/04/2019 11:06	WG1260343

Semi-Volatile Organic Compounds (GC) by Method NJDEP EPH

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
C9-C12 Aliphatics	U		3.74	11.3	1	04/03/2019 01:32	WG1258997
C12-C16 Aliphatics	U		3.74	11.3	1	04/03/2019 01:32	WG1258997
C16-C21 Aliphatics	U		3.74	11.3	1	04/03/2019 01:32	WG1258997
C21-C40 Aliphatics	U		3.74	11.3	1	04/03/2019 01:32	WG1258997
C10 - C12 Aromatics	U		3.74	11.3	1	04/03/2019 02:38	WG1258997
C12-C16 Aromatics	U		3.74	11.3	1	04/03/2019 02:38	WG1258997
C16-C21 Aromatics	U		3.74	11.3	1	04/03/2019 02:38	WG1258997
C21-C36 Aromatics	U		3.74	11.3	1	04/03/2019 02:38	WG1258997
Total EPH	0.000		0.000	11.3	1	04/03/2019 01:32	WG1258997
(S) 1-Chloro-octadecane	*83.8*			*40.0-140*		*04/03/2019 01:32*	WG1258997
(S) 2-Fluorobiphenyl	*80.5*			*40.0-140*		*04/03/2019 02:38*	WG1258997
(S) 2-Bromonaphthalene	*75.4*			*40.0-140*		*04/03/2019 02:38*	WG1258997
(S) o-Terphenyl	*80.8*			*40.0-140*		*04/03/2019 02:38*	WG1258997

Total Solids by Method 2540 G-2011

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	%			date / time	
Total Solids	92.4		1	04/04/2019 11:06	WG1260343

Semi-Volatile Organic Compounds (GC) by Method NJDEP EPH

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
C9-C12 Aliphatics	U		3.57	10.8	1	04/03/2019 01:54	WG1258997
C12-C16 Aliphatics	U		3.57	10.8	1	04/03/2019 01:54	WG1258997
C16-C21 Aliphatics	U		3.57	10.8	1	04/03/2019 01:54	WG1258997
C21-C40 Aliphatics	U		3.57	10.8	1	04/03/2019 01:54	WG1258997
C10 - C12 Aromatics	U		3.57	10.8	1	04/03/2019 02:16	WG1258997
C12-C16 Aromatics	U		3.57	10.8	1	04/03/2019 02:16	WG1258997
C16-C21 Aromatics	U		3.57	10.8	1	04/03/2019 02:16	WG1258997
C21-C36 Aromatics	U		3.57	10.8	1	04/03/2019 02:16	WG1258997
Total EPH	0.000		0.000	10.8	1	04/03/2019 01:54	WG1258997
(S) 1-Chloro-octadecane	*84.0*			*40.0-140*		*04/03/2019 01:54*	WG1258997
(S) 2-Fluorobiphenyl	*77.4*			*40.0-140*		*04/03/2019 02:16*	WG1258997
(S) 2-Bromonaphthalene	*71.6*			*40.0-140*		*04/03/2019 02:16*	WG1258997
(S) o-Terphenyl	*73.7*			*40.0-140*		*04/03/2019 02:16*	WG1258997

Total Solids by Method 2540 G-2011

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	%			date / time	
Total Solids	96.4		1	04/04/2019 11:06	WG1260343

Wet Chemistry by Method 9012B

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
Cyanide	U	P1	0.0404	0.259	1	04/05/2019 14:25	WG1260642

Mercury by Method 7471B

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
Mercury	U		0.00290	0.0207	1	04/04/2019 10:43	WG1260270

Metals (ICP) by Method 6010D

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
Aluminum	2810		3.63	10.4	1	04/04/2019 16:45	WG1260035
Antimony	U		0.778	2.07	1	04/04/2019 16:45	WG1260035
Arsenic	2.09		0.477	2.07	1	04/04/2019 16:45	WG1260035
Barium	7.22		0.176	0.518	1	04/04/2019 16:45	WG1260035
Beryllium	0.216		0.0726	0.207	1	04/04/2019 16:45	WG1260035
Cadmium	U		0.0726	0.518	1	04/04/2019 16:45	WG1260035
Calcium	142		4.80	104	1	04/04/2019 16:45	WG1260035
Chromium	7.15		0.145	1.04	1	04/04/2019 16:45	WG1260035
Cobalt	2.52		0.239	1.04	1	04/04/2019 16:45	WG1260035
Copper	2.94		0.550	2.07	1	04/04/2019 16:45	WG1260035
Iron	6780		1.46	10.4	1	04/04/2019 16:45	WG1260035
Lead	2.24		0.197	0.518	1	04/04/2019 16:45	WG1260035
Magnesium	560		1.15	104	1	04/04/2019 16:45	WG1260035
Manganese	73.5		0.124	1.04	1	04/04/2019 16:45	WG1260035
Nickel	4.15		0.508	2.07	1	04/04/2019 16:45	WG1260035
Potassium	708		10.6	104	1	04/04/2019 16:45	WG1260035
Selenium	U		0.643	2.07	1	04/04/2019 16:45	WG1260035
Silver	U		0.124	1.04	1	04/04/2019 16:45	WG1260035
Sodium	75.3	B J	10.2	104	1	04/04/2019 16:45	WG1260035
Thallium	U		0.674	2.07	1	04/04/2019 16:45	WG1260035
Vanadium	6.19		0.249	2.07	1	04/04/2019 16:45	WG1260035
Zinc	9.66		0.612	5.18	1	04/04/2019 16:45	WG1260035

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

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
Acetone	U		0.0104	0.0518	1	04/03/2019 16:37	WG1260000
Benzene	U		0.000280	0.00104	1	04/01/2019 20:48	WG1258825
Bromochloromethane	U		0.000404	0.00104	1	04/01/2019 20:48	WG1258825
Bromodichloromethane	U		0.000263	0.00104	1	04/01/2019 20:48	WG1258825
Bromoform	U		0.000440	0.00104	1	04/01/2019 20:48	WG1258825
Bromomethane	U		0.00139	0.00518	1	04/01/2019 20:48	WG1258825
Carbon disulfide	U		0.000229	0.00104	1	04/01/2019 20:48	WG1258825
Carbon tetrachloride	U		0.000340	0.00104	1	04/01/2019 20:48	WG1258825
Chlorobenzene	U		0.000220	0.00104	1	04/01/2019 20:48	WG1258825
Chlorodibromomethane	U		0.000387	0.00104	1	04/01/2019 20:48	WG1258825
Chloroethane	U		0.000981	0.00518	1	04/01/2019 20:48	WG1258825
Chloroform	U		0.000237	0.00518	1	04/01/2019 20:48	WG1258825
Chloromethane	U		0.000389	0.00259	1	04/01/2019 20:48	WG1258825

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

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Cyclohexane	U		0.000363	0.00104	1	04/01/2019 20:48	WG1258825
1,2-Dibromo-3-Chloropropane	U		0.00109	0.00311	1	04/01/2019 20:48	WG1258825
1,2-Dibromoethane	U		0.000356	0.00104	1	04/01/2019 20:48	WG1258825
Dichlorodifluoromethane	U		0.000739	0.00518	1	04/01/2019 20:48	WG1258825
1,1-Dichloroethane	U		0.000206	0.00104	1	04/01/2019 20:48	WG1258825
1,2-Dichloroethane	U		0.000275	0.00104	1	04/01/2019 20:48	WG1258825
1,2-Dichlorobenzene	U		0.000316	0.00104	1	04/01/2019 20:48	WG1258825
1,3-Dichlorobenzene	U		0.000248	0.00104	1	04/01/2019 20:48	WG1258825
1,4-Dichlorobenzene	U		0.000234	0.00104	1	04/01/2019 20:48	WG1258825
1,1-Dichloroethene	U		0.000314	0.00104	1	04/01/2019 20:48	WG1258825
cis-1,2-Dichloroethene	U		0.000244	0.00104	1	04/01/2019 20:48	WG1258825
trans-1,2-Dichloroethene	U		0.000274	0.00104	1	04/01/2019 20:48	WG1258825
1,2-Dichloropropane	U		0.000371	0.00104	1	04/01/2019 20:48	WG1258825
cis-1,3-Dichloropropene	U		0.000272	0.00104	1	04/01/2019 20:48	WG1258825
trans-1,3-Dichloropropene	U		0.000277	0.00104	1	04/01/2019 20:48	WG1258825
Ethylbenzene	U		0.000308	0.00104	1	04/01/2019 20:48	WG1258825
2-Hexanone	U		0.00142	0.0104	1	04/01/2019 20:48	WG1258825
Isopropylbenzene	U		0.000252	0.0104	1	04/01/2019 20:48	WG1258825
2-Butanone (MEK)	U		0.00485	0.0104	1	04/01/2019 20:48	WG1258825
Methyl Acetate	U	J4	0.00633	0.0207	1	04/03/2019 16:37	WG1260000
Methyl Cyclohexane	U		0.000394	0.00104	1	04/01/2019 20:48	WG1258825
Methylene Chloride	U		0.00104	0.00518	1	04/01/2019 20:48	WG1258825
4-Methyl-2-pentanone (MIBK)	U		0.00195	0.0104	1	04/01/2019 20:48	WG1258825
Methyl tert-butyl ether	U		0.000220	0.00104	1	04/01/2019 20:48	WG1258825
Styrene	U		0.000243	0.00104	1	04/01/2019 20:48	WG1258825
1,1,2,2-Tetrachloroethane	U		0.000378	0.00104	1	04/01/2019 20:48	WG1258825
Tetrachloroethene	U		0.000286	0.00104	1	04/01/2019 20:48	WG1258825
Toluene	U		0.000450	0.00518	1	04/01/2019 20:48	WG1258825
1,2,3-Trichlorobenzene	U		0.000317	0.00104	1	04/01/2019 20:48	WG1258825
1,2,4-Trichlorobenzene	U		0.000402	0.00104	1	04/01/2019 20:48	WG1258825
1,1,1-Trichloroethane	U		0.000297	0.00104	1	04/01/2019 20:48	WG1258825
1,1,2-Trichloroethane	U		0.000287	0.00104	1	04/01/2019 20:48	WG1258825
Trichloroethene	U		0.000289	0.00104	1	04/01/2019 20:48	WG1258825
Trichlorofluoromethane	U		0.000396	0.00518	1	04/01/2019 20:48	WG1258825
1,1,2-Trichlorotrifluoroethane	U		0.000378	0.00104	1	04/01/2019 20:48	WG1258825
Vinyl chloride	U		0.000302	0.00104	1	04/01/2019 20:48	WG1258825
Xylenes, Total	U		0.000724	0.00311	1	04/01/2019 20:48	WG1258825
(S) Toluene-d8	*97.6*			*75.0-131*		*04/01/2019 20:48*	WG1258825
(S) Toluene-d8	*114*			*75.0-131*		*04/03/2019 16:37*	WG1260000
(S) a,a,a-Trifluorotoluene	*100*			*80.0-120*		*04/01/2019 20:48*	WG1258825
(S) a,a,a-Trifluorotoluene	*105*			*80.0-120*		*04/03/2019 16:37*	WG1260000
(S) 4-Bromofluorobenzene	*97.9*			*67.0-138*		*04/01/2019 20:48*	WG1258825
(S) 4-Bromofluorobenzene	*115*			*67.0-138*		*04/03/2019 16:37*	WG1260000
(S) 1,2-Dichloroethane-d4	*103*			*70.0-130*		*04/01/2019 20:48*	WG1258825
(S) 1,2-Dichloroethane-d4	*103*			*70.0-130*		*04/03/2019 16:37*	WG1260000

Volatile Organic Compounds (GC/MS) by Method 8260C - TENTATIVELY IDENTIFIED COMPOUNDS

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch	CAS #
Total Tic	0.0155	J N	0.000	0.000	1	04/01/2019 20:48	WG1258825	
Total Tic	0.0111	J N	0.000	0.000	1	04/03/2019 16:37	WG1260000	
Benzene, 1,4-Difluoro-	0.0111	J N	0.000	0.000	1	04/03/2019 16:37	WG1260000	000540-36-3
Decane, 2,6,7-Trimethyl-	0.00640	J N	0.000	0.000	1	04/01/2019 20:48	WG1258825	062108-25-2
Undecane, 2,6-Dimethyl-	0.00521	J N	0.000	0.000	1	04/01/2019 20:48	WG1258825	017301-23-4
Decane, 4-Methyl-	0.00392	J N	0.000	0.000	1	04/01/2019 20:48	WG1258825	002847-72-5

Volatile Organic Compounds (GC/MS) by Method 8260C - TENTATIVELY IDENTIFIED COMPOUNDS

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch	CAS #

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Semi-Volatile Organic Compounds (GC) by Method NJDEP EPH

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
C9-C12 Aliphatics	U		3.42	10.4	1	04/05/2019 18:24	WG1260316
C12-C16 Aliphatics	U		3.42	10.4	1	04/05/2019 18:24	WG1260316
C16-C21 Aliphatics	U		3.42	10.4	1	04/05/2019 18:24	WG1260316
C21-C40 Aliphatics	4.56	J	3.42	10.4	1	04/05/2019 18:24	WG1260316
C10 - C12 Aromatics	U		3.42	10.4	1	04/08/2019 12:40	WG1260316
C12-C16 Aromatics	U		3.42	10.4	1	04/08/2019 12:40	WG1260316
C16-C21 Aromatics	4.75	J	3.42	10.4	1	04/08/2019 12:40	WG1260316
C21-C36 Aromatics	U		3.42	10.4	1	04/08/2019 12:40	WG1260316
Total EPH	9.31	J	0.000	10.4	1	04/08/2019 12:40	WG1260316
(S) 1-Chloro-octadecane	*83.8*			*40.0-140*		*04/05/2019 18:24*	WG1260316
(S) 2-Fluorobiphenyl	*91.5*			*40.0-140*		*04/08/2019 12:40*	WG1260316
(S) 2-Bromonaphthalene	*89.7*			*40.0-140*		*04/08/2019 12:40*	WG1260316
(S) o-Terphenyl	*82.1*			*40.0-140*		*04/08/2019 12:40*	WG1260316

Pesticides (GC) by Method 8081B

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Aldrin	U		0.00140	0.0207	1	04/04/2019 11:47	WG1260104
Alpha BHC	U		0.00141	0.00259	1	04/04/2019 11:47	WG1260104
Beta BHC	U		0.00166	0.00259	1	04/04/2019 11:47	WG1260104
Delta BHC	U		0.00148	0.0207	1	04/04/2019 11:47	WG1260104
Gamma BHC	U		0.00150	0.00259	1	04/04/2019 11:47	WG1260104
Chlordane	U		0.0404	0.207	1	04/04/2019 11:47	WG1260104
alpha-Chlordane	U		0.00146	0.0207	1	04/04/2019 11:47	WG1260104
gamma-Chlordane	U		0.00203	0.0207	1	04/04/2019 11:47	WG1260104
4,4-DDD	U		0.00162	0.0207	1	04/04/2019 11:47	WG1260104
4,4-DDE	U		0.00160	0.0207	1	04/04/2019 11:47	WG1260104
4,4-DDT	U		0.00207	0.0207	1	04/04/2019 11:47	WG1260104
Dieldrin	U		0.00158	0.00311	1	04/04/2019 11:47	WG1260104
Endosulfan I	U		0.00155	0.0207	1	04/04/2019 11:47	WG1260104
Endosulfan II	U		0.00166	0.0207	1	04/04/2019 11:47	WG1260104
Endosulfan sulfate	U		0.00157	0.0207	1	04/04/2019 11:47	WG1260104
Endrin	U		0.00163	0.0207	1	04/04/2019 11:47	WG1260104
Endrin aldehyde	U		0.00134	0.0207	1	04/04/2019 11:47	WG1260104
Endrin ketone	U		0.00171	0.0207	1	04/04/2019 11:47	WG1260104
Hexachlorobenzene	U		0.00129	0.0207	1	04/04/2019 11:47	WG1260104
Heptachlor	U		0.00160	0.0207	1	04/04/2019 11:47	WG1260104
Heptachlor epoxide	U		0.00167	0.0104	1	04/04/2019 11:47	WG1260104
Methoxychlor	U		0.00185	0.0207	1	04/04/2019 11:47	WG1260104
Toxaphene	U		0.0373	0.415	1	04/04/2019 11:47	WG1260104
(S) Decachlorobiphenyl	*81.2*			*30.0-150*		*04/04/2019 11:47*	WG1260104
(S) Tetrachloro-m-xylene	*92.0*			*30.0-150*		*04/04/2019 11:47*	WG1260104

Polychlorinated Biphenyls (GC) by Method 8082 A

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
PCB 1016	U		0.00363	0.0176	1	04/04/2019 15:50	WG1260104
PCB 1221	U		0.00557	0.0176	1	04/04/2019 15:50	WG1260104
PCB 1232	U		0.00432	0.0176	1	04/04/2019 15:50	WG1260104
PCB 1242	U		0.00330	0.0176	1	04/04/2019 15:50	WG1260104
PCB 1248	U		0.00327	0.0176	1	04/04/2019 15:50	WG1260104
PCB 1254	U		0.00489	0.0176	1	04/04/2019 15:50	WG1260104
PCB 1260	U		0.00512	0.0176	1	04/04/2019 15:50	WG1260104
(S) Decachlorobiphenyl	*77.0*			*30.0-150*		*04/04/2019 15:50*	WG1260104
(S) Tetrachloro-m-xylene	*72.1*			*30.0-150*		*04/04/2019 15:50*	WG1260104

Semi Volatile Organic Compounds (GC/MS) by Method 8270D

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Acenaphthene	U	J3 J4	0.00666	0.0342	1	04/09/2019 12:31	WG1262278
Acenaphthylene	U	J3 J4	0.00696	0.0342	1	04/09/2019 12:31	WG1262278
Acetophenone	U	J3 J4	0.0780	0.156	1	04/09/2019 12:31	WG1262278
Anthracene	U	J4	0.00655	0.0342	1	04/09/2019 12:31	WG1262278
Atrazine	U		0.0973	0.156	1	04/09/2019 12:31	WG1262278
Benzaldehyde	U	J3	0.0552	0.156	1	04/09/2019 12:31	WG1262278
Benzo(a)anthracene	U		0.00444	0.0342	1	04/09/2019 12:31	WG1262278
Benzo(b)fluoranthene	U		0.00721	0.0342	1	04/09/2019 12:31	WG1262278
Benzo(k)fluoranthene	U		0.00604	0.0342	1	04/09/2019 12:31	WG1262278
Benzo(g,h,i)perylene	U		0.00748	0.0342	1	04/09/2019 12:31	WG1262278
Benzo(a)pyrene	U		0.00568	0.0342	1	04/09/2019 12:31	WG1262278
Biphenyl	U	J3 J4	0.00610	0.156	1	04/09/2019 12:31	WG1262278
Bis(2-chlorethoxy)methane	U	J3 J4	0.00798	0.156	1	04/09/2019 12:31	WG1262278
Bis(2-chloroethyl)ether	U	J3 J4	0.00929	0.156	1	04/09/2019 12:31	WG1262278
Bis(2-chloroisopropyl)ether	U	J3 J4	0.00788	0.156	1	04/09/2019 12:31	WG1262278
4-Bromophenyl-phenylether	U	J4	0.0118	0.156	1	04/09/2019 12:31	WG1262278
Caprolactam	U		0.108	0.156	1	04/09/2019 12:31	WG1262278
Carbazole	U		0.00543	0.156	1	04/09/2019 12:31	WG1262278
4-Chloroaniline	U	J3 J4	0.0365	0.156	1	04/09/2019 12:31	WG1262278
2-Chloronaphthalene	U	J3 J4	0.00663	0.0342	1	04/09/2019 12:31	WG1262278
4-Chlorophenyl-phenylether	U	J4	0.00650	0.156	1	04/09/2019 12:31	WG1262278
Chrysene	U	J4	0.00576	0.0342	1	04/09/2019 12:31	WG1262278
Dibenz(a,h)anthracene	U		0.00851	0.0342	1	04/09/2019 12:31	WG1262278
Dibenzofuran	U	J3 J4	0.00537	0.156	1	04/09/2019 12:31	WG1262278
3,3-Dichlorobenzidine	U		0.0823	0.156	1	04/09/2019 12:31	WG1262278
2,4-Dinitrotoluene	U	J4	0.00629	0.156	1	04/09/2019 12:31	WG1262278
2,6-Dinitrotoluene	U	J4	0.00764	0.156	1	04/09/2019 12:31	WG1262278
Fluoranthene	U		0.00514	0.0342	1	04/09/2019 12:31	WG1262278
Fluorene	U	J4	0.00707	0.0342	1	04/09/2019 12:31	WG1262278
Hexachlorobenzene	U	J4	0.00888	0.156	1	04/09/2019 12:31	WG1262278
Hexachloro-1,3-butadiene	U	J3 J4	0.0104	0.156	1	04/09/2019 12:31	WG1262278
Hexachlorocyclopentadiene	U	J0 J3	0.0609	0.156	1	04/09/2019 12:31	WG1262278
Hexachloroethane	U	J3	0.0139	0.156	1	04/09/2019 12:31	WG1262278
Indeno(1,2,3-cd)pyrene	U		0.00801	0.0342	1	04/09/2019 12:31	WG1262278
Isophorone	U	J3 J4	0.00541	0.156	1	04/09/2019 12:31	WG1262278
2-Methylnaphthalene	U	J3 J4	0.00893	0.0342	1	04/09/2019 12:31	WG1262278
Naphthalene	U	J3 J4	0.00922	0.0342	1	04/09/2019 12:31	WG1262278
2-Nitroaniline	U	J4	0.00783	0.156	1	04/09/2019 12:31	WG1262278
3-Nitroaniline	U	J4	0.00881	0.156	1	04/09/2019 12:31	WG1262278
4-Nitroaniline	U	J4	0.00663	0.156	1	04/09/2019 12:31	WG1262278
Nitrobenzene	U	J3 J4	0.00721	0.156	1	04/09/2019 12:31	WG1262278
n-Nitrosodiphenylamine	U		0.00616	0.156	1	04/09/2019 12:31	WG1262278
n-Nitrosodi-n-propylamine	U	J3 J4	0.00939	0.156	1	04/09/2019 12:31	WG1262278

Semi Volatile Organic Compounds (GC/MS) by Method 8270D

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Phenanthrene	U	J4	0.00548	0.0342	1	04/09/2019 12:31	WG1262278
Benzylbutyl phthalate	U		0.0107	0.156	1	04/09/2019 12:31	WG1262278
Bis(2-ethylhexyl)phthalate	U		0.0124	0.156	1	04/09/2019 12:31	WG1262278
Di-n-butyl phthalate	U		0.0113	0.156	1	04/09/2019 12:31	WG1262278
Diethyl phthalate	U	J4	0.00717	0.156	1	04/09/2019 12:31	WG1262278
Dimethyl phthalate	U	J4	0.00560	0.156	1	04/09/2019 12:31	WG1262278
Di-n-octyl phthalate	U		0.00941	0.156	1	04/09/2019 12:31	WG1262278
Pyrene	U		0.0128	0.0342	1	04/09/2019 12:31	WG1262278
1,2,4,5-Tetrachlorobenzene	U	J3 J4	0.0790	0.156	1	04/09/2019 12:31	WG1262278
4-Chloro-3-methylphenol	U	J4	0.00495	0.156	1	04/09/2019 12:31	WG1262278
2-Chlorophenol	U	J3 J4	0.00862	0.156	1	04/09/2019 12:31	WG1262278
2-Methylphenol	U	J3 J4	0.0102	0.156	1	04/09/2019 12:31	WG1262278
3&4-Methyl Phenol	U	J3	0.00812	0.156	1	04/09/2019 12:31	WG1262278
2,4-Dichlorophenol	U	J3 J4	0.00774	0.156	1	04/09/2019 12:31	WG1262278
2,4-Dimethylphenol	U	J3 J4	0.0488	0.156	1	04/09/2019 12:31	WG1262278
4,6-Dinitro-2-methylphenol	U	J4	0.129	0.207	1	04/09/2019 12:31	WG1262278
2,4-Dinitrophenol	U	J3	0.102	0.207	1	04/09/2019 12:31	WG1262278
2-Nitrophenol	U	J3 J4	0.0135	0.156	1	04/09/2019 12:31	WG1262278
4-Nitrophenol	U		0.0544	0.156	1	04/09/2019 12:31	WG1262278
Pentachlorophenol	U		0.0498	0.156	1	04/09/2019 12:31	WG1262278
Phenol	U	J3	0.00721	0.156	1	04/09/2019 12:31	WG1262278
2,4,5-Trichlorophenol	U	J4	0.0108	0.156	1	04/09/2019 12:31	WG1262278
2,4,6-Trichlorophenol	U	J3 J4	0.00808	0.156	1	04/09/2019 12:31	WG1262278
(S) 2-Fluorophenol	*73.9*			*30.0-130*		*04/09/2019 12:31*	WG1262278
(S) Phenol-d5	*64.9*			*30.0-130*		*04/09/2019 12:31*	WG1262278
(S) Nitrobenzene-d5	*62.8*			*30.0-130*		*04/09/2019 12:31*	WG1262278
(S) 2-Fluorobiphenyl	*60.4*			*30.0-130*		*04/09/2019 12:31*	WG1262278
(S) 2,4,6-Tribromophenol	*69.8*			*30.0-130*		*04/09/2019 12:31*	WG1262278
(S) p-Terphenyl-d14	*69.7*			*30.0-130*		*04/09/2019 12:31*	WG1262278

Semi Volatile Organic Compounds (GC/MS) by Method 8270D - TENTATIVELY IDENTIFIED COMPOUNDS

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch	CAS #
Total Tic	1.24	J N	0.000	0.000	1	04/09/2019 12:31	WG1262278	
Unknown-04	1.07	J N	0.000	0.000	1	04/09/2019 12:31	WG1262278	000123-42-2
Unknown-06	0.0416	J N	0.000	0.000	1	04/09/2019 12:31	WG1262278	002216-34-4
Unknown-01	0.0412	J N	0.000	0.000	1	04/09/2019 12:31	WG1262278	020223-76-1
Unknown-05	0.0410	J N	0.000	0.000	1	04/09/2019 12:31	WG1262278	022581-50-6
Unknown-03	0.0240	J N	0.000	0.000	1	04/09/2019 12:31	WG1262278	002216-30-0
Unknown-02	0.0239	J N	0.000	0.000	1	04/09/2019 12:31	WG1262278	002213-23-2

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Total Solids by Method 2540 G-2011

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	%			date / time	
Total Solids	90.2		1	04/04/2019 11:06	WG1260343

Semi-Volatile Organic Compounds (GC) by Method NJDEP EPH

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
EPH Screen	22.7	J	7.87	555	1	04/06/2019 04:18	WG1259119
(S) o-Terphenyl	*92.1*		*6.67*	*40.0-140*		*04/06/2019 04:18*	WG1259119

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

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
Acetone	U		10.0	50.0	1	04/01/2019 11:47	WG1258768
Benzene	U		0.331	1.00	1	04/01/2019 11:47	WG1258768
Bromochloromethane	U		0.520	1.00	1	04/01/2019 11:47	WG1258768
Bromodichloromethane	U		0.380	1.00	1	04/01/2019 11:47	WG1258768
Bromoform	U		0.469	1.00	1	04/01/2019 11:47	WG1258768
Bromomethane	U		0.866	5.00	1	04/01/2019 11:47	WG1258768
Carbon disulfide	U		0.275	1.00	1	04/01/2019 11:47	WG1258768
Carbon tetrachloride	U		0.379	1.00	1	04/01/2019 11:47	WG1258768
Chlorobenzene	U		0.348	1.00	1	04/01/2019 11:47	WG1258768
Chlorodibromomethane	U		0.327	1.00	1	04/01/2019 11:47	WG1258768
Chloroethane	U		0.453	5.00	1	04/01/2019 11:47	WG1258768
Chloroform	U		0.324	5.00	1	04/01/2019 11:47	WG1258768
Chloromethane	U	J3	0.276	2.50	1	04/01/2019 11:47	WG1258768
Cyclohexane	U		0.390	1.00	1	04/01/2019 11:47	WG1258768
1,2-Dibromo-3-Chloropropane	U		1.33	5.00	1	04/01/2019 11:47	WG1258768
1,2-Dibromoethane	U		0.381	1.00	1	04/01/2019 11:47	WG1258768
1,2-Dichlorobenzene	U		0.349	1.00	1	04/01/2019 11:47	WG1258768
1,3-Dichlorobenzene	U		0.220	1.00	1	04/01/2019 11:47	WG1258768
1,4-Dichlorobenzene	U		0.274	1.00	1	04/01/2019 11:47	WG1258768
Dichlorodifluoromethane	U		0.551	5.00	1	04/01/2019 11:47	WG1258768
1,1-Dichloroethane	U		0.259	1.00	1	04/01/2019 11:47	WG1258768
1,2-Dichloroethane	U		0.361	1.00	1	04/01/2019 11:47	WG1258768
1,1-Dichloroethene	U		0.398	1.00	1	04/01/2019 11:47	WG1258768
cis-1,2-Dichloroethene	U		0.260	1.00	1	04/01/2019 11:47	WG1258768
trans-1,2-Dichloroethene	U		0.396	1.00	1	04/01/2019 11:47	WG1258768
1,2-Dichloropropane	U		0.306	1.00	1	04/01/2019 11:47	WG1258768
cis-1,3-Dichloropropene	U		0.418	1.00	1	04/01/2019 11:47	WG1258768
trans-1,3-Dichloropropene	U		0.419	1.00	1	04/01/2019 11:47	WG1258768
Ethylbenzene	U		0.384	1.00	1	04/01/2019 11:47	WG1258768
2-Hexanone	U		3.82	10.0	1	04/01/2019 11:47	WG1258768
Isopropylbenzene	U		0.326	1.00	1	04/01/2019 11:47	WG1258768
2-Butanone (MEK)	U		3.93	10.0	1	04/01/2019 11:47	WG1258768
Methyl Acetate	U		4.30	20.0	1	04/01/2019 11:47	WG1258768
Methyl Cyclohexane	U		0.380	1.00	1	04/01/2019 11:47	WG1258768
Methylene Chloride	U		1.00	3.00	1	04/01/2019 11:47	WG1258768
4-Methyl-2-pentanone (MIBK)	U		2.14	10.0	1	04/01/2019 11:47	WG1258768
Methyl tert-butyl ether	U		0.367	1.00	1	04/01/2019 11:47	WG1258768
Naphthalene	U		1.00	5.00	1	04/01/2019 11:47	WG1258768
tert-Butyl alcohol	U		2.40	5.00	1	04/01/2019 11:47	WG1258768
Styrene	U		0.307	1.00	1	04/01/2019 11:47	WG1258768
1,1,2,2-Tetrachloroethane	U		0.130	1.00	1	04/01/2019 11:47	WG1258768
Tetrachloroethene	U		0.372	1.00	1	04/01/2019 11:47	WG1258768
Toluene	U		0.412	1.00	1	04/01/2019 11:47	WG1258768
1,2,3-Trichlorobenzene	U		0.230	1.00	1	04/01/2019 11:47	WG1258768
1,2,4-Trichlorobenzene	U		0.355	1.00	1	04/01/2019 11:47	WG1258768
1,1,1-Trichloroethane	U		0.319	1.00	1	04/01/2019 11:47	WG1258768
1,1,2-Trichloroethane	U		0.383	1.00	1	04/01/2019 11:47	WG1258768
Trichloroethene	U		0.398	1.00	1	04/01/2019 11:47	WG1258768
Trichlorofluoromethane	U		1.20	5.00	1	04/01/2019 11:47	WG1258768
1,1,2-Trichlorotrifluoroethane	U		0.303	1.00	1	04/01/2019 11:47	WG1258768
Vinyl chloride	U		0.259	1.00	1	04/01/2019 11:47	WG1258768
Xylenes, Total	U		1.06	3.00	1	04/01/2019 11:47	WG1258768
(S) Toluene-d8	*100*			*80.0-120*		*04/01/2019 11:47*	WG1258768
(S) a,a,a-Trifluorotoluene	*96.5*			*80.0-120*		*04/01/2019 11:47*	WG1258768
(S) 4-Bromofluorobenzene	*99.2*			*77.0-126*		*04/01/2019 11:47*	WG1258768
(S) 1,2-Dichloroethane-d4	*92.3*			*70.0-130*		*04/01/2019 11:47*	WG1258768

Volatile Organic Compounds (GC/MS) by Method 8260C - TENTATIVELY IDENTIFIED COMPOUNDS

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch	CAS #
	ug/l		ug/l	ug/l		date / time		
Total Tic	13.9	J N	0.000	0.000	1	04/01/2019 11:47	WG1258768	
Benzene, 1,4-Difluoro-	13.9	J N	0.000	0.000	1	04/01/2019 11:47	WG1258768	000540-36-3

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Total Solids by Method 2540 G-2011

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	%			date / time	
Total Solids	95.5		1	04/04/2019 11:06	WG1260343

Wet Chemistry by Method 9012B

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
Cyanide	U	J6	0.0408	0.262	1	04/05/2019 14:51	WG1260642

Mercury by Method 7471B

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
Mercury	0.0179	B J	0.00293	0.0209	1	04/03/2019 16:33	WG1259467

Metals (ICP) by Method 6010D

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
Aluminum	3610	J5	3.66	10.5	1	04/04/2019 16:01	WG1260035
Antimony	U	J6	0.785	2.09	1	04/04/2019 16:01	WG1260035
Arsenic	1.54	J	0.482	2.09	1	04/04/2019 16:01	WG1260035
Barium	12.5		0.178	0.523	1	04/04/2019 16:01	WG1260035
Beryllium	0.274		0.0733	0.209	1	04/04/2019 16:01	WG1260035
Cadmium	U		0.0733	0.523	1	04/04/2019 16:01	WG1260035
Calcium	217		4.85	105	1	04/04/2019 16:01	WG1260035
Chromium	20.1		0.147	1.05	1	04/04/2019 16:01	WG1260035
Cobalt	3.30		0.241	1.05	1	04/04/2019 16:01	WG1260035
Copper	5.95		0.555	2.09	1	04/04/2019 16:01	WG1260035
Iron	9430	V	1.48	10.5	1	04/04/2019 16:01	WG1260035
Lead	2.51		0.199	0.523	1	04/04/2019 16:01	WG1260035
Magnesium	779		1.16	105	1	04/04/2019 16:01	WG1260035
Manganese	144		0.126	1.05	1	04/04/2019 16:01	WG1260035
Nickel	6.55		0.513	2.09	1	04/04/2019 16:01	WG1260035
Potassium	869		10.7	105	1	04/04/2019 16:01	WG1260035
Selenium	U		0.649	2.09	1	04/04/2019 16:01	WG1260035
Silver	U		0.126	1.05	1	04/04/2019 16:01	WG1260035
Sodium	77.3	B J	10.3	105	1	04/04/2019 16:01	WG1260035
Thallium	U		0.681	2.09	1	04/04/2019 16:01	WG1260035
Vanadium	9.52		0.251	2.09	1	04/04/2019 16:01	WG1260035
Zinc	13.1		0.618	5.23	1	04/04/2019 16:01	WG1260035

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

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
Acetone	0.0198	J	0.0105	0.0523	1	04/05/2019 11:56	WG1261228
Benzene	U	J3 J6	0.000283	0.00105	1	04/03/2019 16:31	WG1260321
Bromochloromethane	U	J3 J6	0.000408	0.00105	1	04/03/2019 16:31	WG1260321
Bromodichloromethane	U	J3 J6	0.000266	0.00105	1	04/03/2019 16:31	WG1260321
Bromoform	U		0.000444	0.00105	1	04/03/2019 16:31	WG1260321
Bromomethane	U	J3	0.00140	0.00523	1	04/03/2019 16:31	WG1260321
Carbon disulfide	U	J3 J6	0.000231	0.00105	1	04/03/2019 16:31	WG1260321
Carbon tetrachloride	U	J3 J6	0.000343	0.00105	1	04/03/2019 16:31	WG1260321
Chlorobenzene	U	J6	0.000222	0.00105	1	04/03/2019 16:31	WG1260321
Chlorodibromomethane	U	J6	0.000391	0.00105	1	04/03/2019 16:31	WG1260321
Chloroethane	U	J3	0.000990	0.00523	1	04/03/2019 16:31	WG1260321
Chloroform	U	J3 J6	0.000240	0.00523	1	04/03/2019 16:31	WG1260321
Chloromethane	U		0.000393	0.00262	1	04/03/2019 16:31	WG1260321

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

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Cyclohexane	U	J3 J6	0.000366	0.00105	1	04/03/2019 16:31	WG1260321
1,2-Dibromo-3-Chloropropane	U		0.00110	0.00314	1	04/03/2019 16:31	WG1260321
1,2-Dibromoethane	U	J6	0.000359	0.00105	1	04/03/2019 16:31	WG1260321
Dichlorodifluoromethane	U	J3	0.000746	0.00523	1	04/03/2019 16:31	WG1260321
1,1-Dichloroethane	U	J3 J6	0.000208	0.00105	1	04/03/2019 16:31	WG1260321
1,2-Dichloroethane	U	J3 J6	0.000277	0.00105	1	04/03/2019 16:31	WG1260321
1,2-Dichlorobenzene	U	J6	0.000319	0.00105	1	04/03/2019 16:31	WG1260321
1,3-Dichlorobenzene	U	J3 J6	0.000250	0.00105	1	04/03/2019 16:31	WG1260321
1,4-Dichlorobenzene	U	J3 J6	0.000237	0.00105	1	04/03/2019 16:31	WG1260321
1,1-Dichloroethene	U	J3 J6	0.000317	0.00105	1	04/03/2019 16:31	WG1260321
cis-1,2-Dichloroethene	U	J3 J6	0.000246	0.00105	1	04/03/2019 16:31	WG1260321
trans-1,2-Dichloroethene	U	J3 J6	0.000276	0.00105	1	04/03/2019 16:31	WG1260321
1,2-Dichloropropane	U	J3 J6	0.000375	0.00105	1	04/03/2019 16:31	WG1260321
cis-1,3-Dichloropropene	U	J3 J6	0.000274	0.00105	1	04/03/2019 16:31	WG1260321
trans-1,3-Dichloropropene	U	J6	0.000280	0.00105	1	04/03/2019 16:31	WG1260321
Ethylbenzene	U	J3 J6	0.000311	0.00105	1	04/03/2019 16:31	WG1260321
2-Hexanone	U	J3	0.00143	0.0105	1	04/03/2019 16:31	WG1260321
Isopropylbenzene	U	J3 J6	0.000254	0.0105	1	04/03/2019 16:31	WG1260321
2-Butanone (MEK)	U	J3	0.00490	0.0105	1	04/03/2019 16:31	WG1260321
Methyl Acetate	U	J4	0.00639	0.0209	1	04/05/2019 11:56	WG1261228
Methyl Cyclohexane	U	J3 J6	0.000398	0.00105	1	04/03/2019 16:31	WG1260321
Methylene Chloride	U	J3 J6	0.00105	0.00523	1	04/03/2019 16:31	WG1260321
4-Methyl-2-pentanone (MIBK)	U	J3	0.00197	0.0105	1	04/03/2019 16:31	WG1260321
Methyl tert-butyl ether	U	J3 J6	0.000222	0.00105	1	04/03/2019 16:31	WG1260321
Styrene	U	J6	0.000245	0.00105	1	04/03/2019 16:31	WG1260321
1,1,2,2-Tetrachloroethane	U	J6	0.000382	0.00105	1	04/03/2019 16:31	WG1260321
Tetrachloroethene	U	J3 J6	0.000289	0.00105	1	04/03/2019 16:31	WG1260321
Toluene	U	J3 J6	0.000454	0.00523	1	04/03/2019 16:31	WG1260321
1,2,3-Trichlorobenzene	U	J6	0.000320	0.00105	1	04/03/2019 16:31	WG1260321
1,2,4-Trichlorobenzene	U	J6	0.000406	0.00105	1	04/03/2019 16:31	WG1260321
1,1,1-Trichloroethane	U	J3 J6	0.000299	0.00105	1	04/03/2019 16:31	WG1260321
1,1,2-Trichloroethane	U	J3 J6	0.000290	0.00105	1	04/03/2019 16:31	WG1260321
Trichloroethene	U	J3 J6	0.000292	0.00105	1	04/03/2019 16:31	WG1260321
Trichlorofluoromethane	U	J3	0.000400	0.00523	1	04/03/2019 16:31	WG1260321
1,1,2-Trichlorotrifluoroethane	U	J3 J6	0.000382	0.00105	1	04/03/2019 16:31	WG1260321
Vinyl chloride	U	J3 J6	0.000305	0.00105	1	04/03/2019 16:31	WG1260321
Xylenes, Total	U	J3 J6	0.000731	0.00314	1	04/03/2019 16:31	WG1260321
(S) Toluene-d8	*100*			*75.0-131*		*04/03/2019 16:31*	WG1260321
(S) Toluene-d8	*112*			*75.0-131*		*04/05/2019 11:56*	WG1261228
(S) a,a,a-Trifluorotoluene	*99.0*			*80.0-120*		*04/03/2019 16:31*	WG1260321
(S) a,a,a-Trifluorotoluene	*105*			*80.0-120*		*04/05/2019 11:56*	WG1261228
(S) 4-Bromofluorobenzene	*103*			*67.0-138*		*04/03/2019 16:31*	WG1260321
(S) 4-Bromofluorobenzene	*112*			*67.0-138*		*04/05/2019 11:56*	WG1261228
(S) 1,2-Dichloroethane-d4	*102*			*70.0-130*		*04/03/2019 16:31*	WG1260321
(S) 1,2-Dichloroethane-d4	*99.9*			*70.0-130*		*04/05/2019 11:56*	WG1261228

Volatile Organic Compounds (GC/MS) by Method 8260C - TENTATIVELY IDENTIFIED COMPOUNDS

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch	CAS #
Total Tic	0.000		0.000	0.000	1	04/03/2019 16:31	WG1260321	
Total Tic	0.000		0.000	0.000	1	04/05/2019 11:56	WG1261228	

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Semi-Volatile Organic Compounds (GC) by Method NJDEP EPH

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
C9-C12 Aliphatics	U		3.45	10.5	1	04/05/2019 18:46	WG1260316
C12-C16 Aliphatics	U		3.45	10.5	1	04/05/2019 18:46	WG1260316
C16-C21 Aliphatics	U		3.45	10.5	1	04/05/2019 18:46	WG1260316
C21-C40 Aliphatics	U		3.45	10.5	1	04/05/2019 18:46	WG1260316
C10 - C12 Aromatics	U		3.45	10.5	1	04/08/2019 13:04	WG1260316
C12-C16 Aromatics	U		3.45	10.5	1	04/08/2019 13:04	WG1260316
C16-C21 Aromatics	5.01	J	3.45	10.5	1	04/08/2019 13:04	WG1260316
C21-C36 Aromatics	U		3.45	10.5	1	04/08/2019 13:04	WG1260316
Total EPH	5.01	J	0.000	10.5	1	04/08/2019 13:04	WG1260316
(S) 1-Chloro-octadecane	*87.2*			*40.0-140*		*04/05/2019 18:46*	WG1260316
(S) 2-Fluorobiphenyl	*95.3*			*40.0-140*		*04/08/2019 13:04*	WG1260316
(S) 2-Bromonaphthalene	*94.9*			*40.0-140*		*04/08/2019 13:04*	WG1260316
(S) o-Terphenyl	*84.0*			*40.0-140*		*04/08/2019 13:04*	WG1260316

Pesticides (GC) by Method 8081B

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Aldrin	U		0.00141	0.0209	1	04/03/2019 12:46	WG1259761
Alpha BHC	U		0.00142	0.00262	1	04/03/2019 12:46	WG1259761
Beta BHC	U		0.00168	0.00262	1	04/03/2019 12:46	WG1259761
Delta BHC	U		0.00150	0.0209	1	04/03/2019 12:46	WG1259761
Gamma BHC	U		0.00152	0.00262	1	04/03/2019 12:46	WG1259761
Chlordane	U		0.0408	0.209	1	04/03/2019 12:46	WG1259761
alpha-Chlordane	U		0.00148	0.0209	1	04/03/2019 12:46	WG1259761
gamma-Chlordane	U		0.00205	0.0209	1	04/03/2019 12:46	WG1259761
4,4-DDD	U		0.00163	0.0209	1	04/03/2019 12:46	WG1259761
4,4-DDE	U		0.00161	0.0209	1	04/03/2019 12:46	WG1259761
4,4-DDT	U		0.00209	0.0209	1	04/03/2019 12:46	WG1259761
Dieldrin	U		0.00159	0.00314	1	04/03/2019 12:46	WG1259761
Endosulfan I	U		0.00156	0.0209	1	04/03/2019 12:46	WG1259761
Endosulfan II	U		0.00168	0.0209	1	04/03/2019 12:46	WG1259761
Endosulfan sulfate	U		0.00158	0.0209	1	04/03/2019 12:46	WG1259761
Endrin	U		0.00164	0.0209	1	04/03/2019 12:46	WG1259761
Endrin aldehyde	U		0.00135	0.0209	1	04/03/2019 12:46	WG1259761
Endrin ketone	U		0.00173	0.0209	1	04/03/2019 12:46	WG1259761
Hexachlorobenzene	U		0.00130	0.0209	1	04/03/2019 12:46	WG1259761
Heptachlor	U		0.00161	0.0209	1	04/03/2019 12:46	WG1259761
Heptachlor epoxide	U		0.00169	0.0105	1	04/03/2019 12:46	WG1259761
Methoxychlor	U		0.00186	0.0209	1	04/03/2019 12:46	WG1259761
Toxaphene	U		0.0377	0.419	1	04/03/2019 12:46	WG1259761
(S) Decachlorobiphenyl	*89.7*			*30.0-150*		*04/03/2019 12:46*	WG1259761
(S) Tetrachloro-m-xylene	*98.6*			*30.0-150*		*04/03/2019 12:46*	WG1259761

Polychlorinated Biphenyls (GC) by Method 8082 A

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
PCB 1016	U	J3	0.00366	0.0178	1	04/03/2019 13:22	WG1259761
PCB 1221	U		0.00562	0.0178	1	04/03/2019 13:22	WG1259761
PCB 1232	U		0.00437	0.0178	1	04/03/2019 13:22	WG1259761
PCB 1242	U		0.00333	0.0178	1	04/03/2019 13:22	WG1259761
PCB 1248	U		0.00330	0.0178	1	04/03/2019 13:22	WG1259761
PCB 1254	U		0.00494	0.0178	1	04/03/2019 13:22	WG1259761
PCB 1260	U	J3	0.00517	0.0178	1	04/03/2019 13:22	WG1259761
(S) Decachlorobiphenyl	*109*			*30.0-150*		*04/03/2019 13:22*	WG1259761
(S) Tetrachloro-m-xylene	*117*			*30.0-150*		*04/03/2019 13:22*	WG1259761

Semi Volatile Organic Compounds (GC/MS) by Method 8270D

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Acenaphthene	U	J3 J4 J6	0.00672	0.0345	1	04/09/2019 10:53	WG1262278
Acenaphthylene	U	J3 J4 J6	0.00703	0.0345	1	04/09/2019 10:53	WG1262278
Acetophenone	U	J3 J4 J6	0.0787	0.157	1	04/09/2019 10:53	WG1262278
Anthracene	U	J4 J6	0.00662	0.0345	1	04/09/2019 10:53	WG1262278
Atrazine	U	J6	0.0982	0.157	1	04/09/2019 10:53	WG1262278
Benzaldehyde	U		0.0557	0.157	1	04/09/2019 10:53	WG1262278
Benzo(a)anthracene	U	J6	0.00448	0.0345	1	04/09/2019 10:53	WG1262278
Benzo(b)fluoranthene	U	J6	0.00728	0.0345	1	04/09/2019 10:53	WG1262278
Benzo(k)fluoranthene	U	J6	0.00609	0.0345	1	04/09/2019 10:53	WG1262278
Benzo(g,h,i)perylene	U	J6	0.00755	0.0345	1	04/09/2019 10:53	WG1262278
Benzo(a)pyrene	U	J6	0.00574	0.0345	1	04/09/2019 10:53	WG1262278
Biphenyl	U	J3 J4 J6	0.00616	0.157	1	04/09/2019 10:53	WG1262278
Bis(2-chlorethoxy)methane	U	J3 J4 J6	0.00806	0.157	1	04/09/2019 10:53	WG1262278
Bis(2-chloroethyl)ether	U	J3 J4 J6	0.00938	0.157	1	04/09/2019 10:53	WG1262278
Bis(2-chloroisopropyl)ether	U	J3 J4 J6	0.00796	0.157	1	04/09/2019 10:53	WG1262278
4-Bromophenyl-phenylether	U	J4 J6	0.0119	0.157	1	04/09/2019 10:53	WG1262278
Caprolactam	U		0.109	0.157	1	04/09/2019 10:53	WG1262278
Carbazole	U	J6	0.00549	0.157	1	04/09/2019 10:53	WG1262278
4-Chloroaniline	U	J4 J6	0.0369	0.157	1	04/09/2019 10:53	WG1262278
2-Chloronaphthalene	U	J3 J4 J6	0.00669	0.0345	1	04/09/2019 10:53	WG1262278
4-Chlorophenyl-phenylether	U	J3 J4 J6	0.00656	0.157	1	04/09/2019 10:53	WG1262278
Chrysene	U	J4 J6	0.00581	0.0345	1	04/09/2019 10:53	WG1262278
Dibenz(a,h)anthracene	U	J6	0.00860	0.0345	1	04/09/2019 10:53	WG1262278
Dibenzofuran	U	J3 J4 J6	0.00542	0.157	1	04/09/2019 10:53	WG1262278
3,3-Dichlorobenzidine	U	J6	0.0831	0.157	1	04/09/2019 10:53	WG1262278
2,4-Dinitrotoluene	U	J4 J6	0.00635	0.157	1	04/09/2019 10:53	WG1262278
2,6-Dinitrotoluene	U	J3 J4 J6	0.00772	0.157	1	04/09/2019 10:53	WG1262278
Fluoranthene	U	J6	0.00519	0.0345	1	04/09/2019 10:53	WG1262278
Fluorene	U	J3 J4 J6	0.00714	0.0345	1	04/09/2019 10:53	WG1262278
Hexachlorobenzene	U	J4 J6	0.00896	0.157	1	04/09/2019 10:53	WG1262278
Hexachloro-1,3-butadiene	U	J3 J4 J6	0.0105	0.157	1	04/09/2019 10:53	WG1262278
Hexachlorocyclopentadiene	U	J0 J3	0.0615	0.157	1	04/09/2019 10:53	WG1262278
Hexachloroethane	U	J3	0.0140	0.157	1	04/09/2019 10:53	WG1262278
Indeno(1,2,3-cd)pyrene	U	J6	0.00808	0.0345	1	04/09/2019 10:53	WG1262278
Isophorone	U	J4 J6	0.00547	0.157	1	04/09/2019 10:53	WG1262278
2-Methylnaphthalene	U	J3 J4 J6	0.00901	0.0345	1	04/09/2019 10:53	WG1262278
Naphthalene	U	J3 J4 J6	0.00931	0.0345	1	04/09/2019 10:53	WG1262278
2-Nitroaniline	U	J4 J6	0.00790	0.157	1	04/09/2019 10:53	WG1262278
3-Nitroaniline	U	J4 J6	0.00890	0.157	1	04/09/2019 10:53	WG1262278
4-Nitroaniline	U	J4 J6	0.00669	0.157	1	04/09/2019 10:53	WG1262278
Nitrobenzene	U	J3 J4 J6	0.00728	0.157	1	04/09/2019 10:53	WG1262278
n-Nitrosodiphenylamine	U		0.00622	0.157	1	04/09/2019 10:53	WG1262278
n-Nitrosodi-n-propylamine	U	J4 J6	0.00949	0.157	1	04/09/2019 10:53	WG1262278
Phenanthrene	U	J4 J6	0.00553	0.0345	1	04/09/2019 10:53	WG1262278
Benzylbutyl phthalate	U	J6	0.0108	0.157	1	04/09/2019 10:53	WG1262278
Bis(2-ethylhexyl)phthalate	U	J6	0.0126	0.157	1	04/09/2019 10:53	WG1262278
Di-n-butyl phthalate	U	J6	0.0114	0.157	1	04/09/2019 10:53	WG1262278
Diethyl phthalate	U	J4 J6	0.00723	0.157	1	04/09/2019 10:53	WG1262278
Dimethyl phthalate	U	J4 J6	0.00565	0.157	1	04/09/2019 10:53	WG1262278
Di-n-octyl phthalate	U	J6	0.00950	0.157	1	04/09/2019 10:53	WG1262278
Pyrene	U	J6	0.0129	0.0345	1	04/09/2019 10:53	WG1262278
1,2,4,5-Tetrachlorobenzene	U	J3 J4 J6	0.0798	0.157	1	04/09/2019 10:53	WG1262278
4-Chloro-3-methylphenol	U	J4 J6	0.00499	0.157	1	04/09/2019 10:53	WG1262278
2-Chlorophenol	U	J4 J6	0.00870	0.157	1	04/09/2019 10:53	WG1262278
2-Methylphenol	U	J4 J6	0.0103	0.157	1	04/09/2019 10:53	WG1262278
3&4-Methyl Phenol	U		0.00820	0.157	1	04/09/2019 10:53	WG1262278

Semi Volatile Organic Compounds (GC/MS) by Method 8270D

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
2,4-Dichlorophenol	U	J4 J6	0.00781	0.157	1	04/09/2019 10:53	WG1262278
2,4-Dimethylphenol	U	J4 J6	0.0493	0.157	1	04/09/2019 10:53	WG1262278
4,6-Dinitro-2-methylphenol	U	J4 J6	0.130	0.209	1	04/09/2019 10:53	WG1262278
2,4-Dinitrophenol	U		0.103	0.209	1	04/09/2019 10:53	WG1262278
2-Nitrophenol	U	J3 J4 J6	0.0136	0.157	1	04/09/2019 10:53	WG1262278
4-Nitrophenol	U		0.0550	0.157	1	04/09/2019 10:53	WG1262278
Pentachlorophenol	U		0.0503	0.157	1	04/09/2019 10:53	WG1262278
Phenol	U		0.00728	0.157	1	04/09/2019 10:53	WG1262278
2,4,5-Trichlorophenol	U	J3 J4 J6	0.0109	0.157	1	04/09/2019 10:53	WG1262278
2,4,6-Trichlorophenol	U	J3 J4 J6	0.00816	0.157	1	04/09/2019 10:53	WG1262278
(S) 2-Fluorophenol	*61.4*			*30.0-130*		*04/09/2019 10:53*	WG1262278
(S) Phenol-d5	*55.6*			*30.0-130*		*04/09/2019 10:53*	WG1262278
(S) Nitrobenzene-d5	*52.3*			*30.0-130*		*04/09/2019 10:53*	WG1262278
(S) 2-Fluorobiphenyl	*51.1*			*30.0-130*		*04/09/2019 10:53*	WG1262278
(S) 2,4,6-Tribromophenol	*59.9*			*30.0-130*		*04/09/2019 10:53*	WG1262278
(S) p-Terphenyl-d14	*68.5*			*30.0-130*		*04/09/2019 10:53*	WG1262278

Semi Volatile Organic Compounds (GC/MS) by Method 8270D - TENTATIVELY IDENTIFIED COMPOUNDS

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch	CAS #
Total Tic	0.150	J N	0.000	0.000	1	04/09/2019 10:53	WG1262278	
Unknown-03	0.0852	J N	0.000	0.000	1	04/09/2019 10:53	WG1262278	000591-78-6
Unknown-02	0.0372	J N	0.000	0.000	1	04/09/2019 10:53	WG1262278	014339-23-2
Unknown-01	0.0273	J N	0.000	0.000	1	04/09/2019 10:53	WG1262278	003555-47-3

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Method Blank (MB)

(MB) R3398738-1 04/04/19 10:39

Analyte	MB Result %	MB Qualifier	MB MDL %	MB RDL %
Total Solids	0.00100			

L1083840-07 Original Sample (OS) • Duplicate (DUP)

(OS) L1083840-07 04/04/19 10:39 • (DUP) R3398738-3 04/04/19 10:39

Analyte	Original Result %	DUP Result %	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Total Solids	91.5	91.9	1	0.343		10

Laboratory Control Sample (LCS)

(LCS) R3398738-2 04/04/19 10:39

Analyte	Spike Amount %	LCS Result %	LCS Rec. %	Rec. Limits %	LCS Qualifier
Total Solids	50.0	50.0	100	85.0-115	

Method Blank (MB)

(MB) R3398803-1 04/04/19 13:59

Analyte	MB Result %	MB Qualifier	MB MDL %	MB RDL %
Total Solids	0.000			

L1083840-13 Original Sample (OS) • Duplicate (DUP)

(OS) L1083840-13 04/04/19 13:59 • (DUP) R3398803-3 04/04/19 13:59

Analyte	Original Result %	DUP Result %	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Total Solids	92.2	91.3	1	1.02		10

Laboratory Control Sample (LCS)

(LCS) R3398803-2 04/04/19 13:59

Analyte	Spike Amount %	LCS Result %	LCS Rec. %	Rec. Limits %	LCS Qualifier
Total Solids	50.0	50.0	100	85.0-115	

Method Blank (MB)

(MB) R3398764-1 04/04/19 11:06

Analyte	MB Result %	MB Qualifier	MB MDL %	MB RDL %
Total Solids	0.00100			

L1083840-31 Original Sample (OS) • Duplicate (DUP)

(OS) L1083840-31 04/04/19 11:06 • (DUP) R3398764-3 04/04/19 11:06

Analyte	Original Result %	DUP Result %	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Total Solids	95.5	95.4	1	0.0725		10

Laboratory Control Sample (LCS)

(LCS) R3398764-2 04/04/19 11:06

Analyte	Spike Amount %	LCS Result %	LCS Rec. %	Rec. Limits %	LCS Qualifier
Total Solids	50.0	50.0	100	85.0-115	

Method Blank (MB)

(MB) R3400864-1 04/11/19 16:05

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
Chromium,Hexavalent	U		0.640	2.00

L1085834-02 Original Sample (OS) • Duplicate (DUP)

(OS) L1085834-02 04/11/19 16:46 • (DUP) R3400864-3 04/11/19 16:47

Analyte	Original Result (dry) mg/kg	DUP Result (dry) mg/kg	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Chromium,Hexavalent	U	0.000	1	0.000		20

L1086263-02 Original Sample (OS) • Duplicate (DUP)

(OS) L1086263-02 04/11/19 16:51 • (DUP) R3400864-4 04/11/19 16:52

Analyte	Original Result mg/kg	DUP Result mg/kg	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Chromium,Hexavalent	ND	0.000	1	0.000		20

Laboratory Control Sample (LCS)

(LCS) R3400864-2 04/11/19 16:06

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCS Rec. %	Rec. Limits %	LCS Qualifier
Chromium,Hexavalent	24.0	25.4	106	80.0-120	

L1086263-03 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1086263-03 04/11/19 16:52 • (MS) R3400864-5 04/11/19 16:58 • (MSD) R3400864-6 04/11/19 17:00

Analyte	Spike Amount mg/kg	Original Result mg/kg	MS Result mg/kg	MSD Result mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Chromium,Hexavalent	20.0	ND	13.0	14.6	64.8	73.0	1	75.0-125	J6	J6	11.9	20

Sample Narrative:

OS: Sample is a reducer

L1086263-03 Original Sample (OS) • Matrix Spike (MS)

(OS) L1086263-03 04/11/19 16:52 • (MS) R3400864-7 04/11/19 17:02

Analyte	Spike Amount mg/kg	Original Result mg/kg	MS Result mg/kg	MS Rec. %	Dilution	Rec. Limits %	MS Qualifier
Chromium,Hexavalent	708	ND	550	77.7	50	75.0-125	

Sample Narrative:

OS: Sample is a reducer

Method Blank (MB)

(MB) R3401368-1 04/12/19 17:56

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
Chromium,Hexavalent	U		0.640	2.00

L1086496-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1086496-01 04/12/19 18:15 • (DUP) R3401368-3 04/12/19 18:16

Analyte	Original Result mg/kg	DUP Result mg/kg	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Chromium,Hexavalent	ND	0.000	1	0.000		20

Laboratory Control Sample (LCS)

(LCS) R3401368-2 04/12/19 17:58

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCS Rec. %	Rec. Limits %	LCS Qualifier
Chromium,Hexavalent	24.0	28.2	118	80.0-120	

L1087657-02 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1087657-02 04/12/19 18:22 • (MS) R3401368-4 04/12/19 18:25 • (MSD) R3401368-5 04/12/19 18:26

Analyte	Spike Amount mg/kg	Original Result mg/kg	MS Result mg/kg	MSD Result mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Chromium,Hexavalent	20.0	ND	14.6	18.4	73.0	91.8	1	75.0-125	J6	J3	22.8	20

Sample Narrative:
OS: Sample is a reducer

L1087657-02 Original Sample (OS) • Matrix Spike (MS)

(OS) L1087657-02 04/12/19 18:22 • (MS) R3401368-6 04/12/19 18:28

Analyte	Spike Amount mg/kg	Original Result mg/kg	MS Result mg/kg	MS Rec. %	Dilution	Rec. Limits %	MS Qualifier
Chromium,Hexavalent	643	ND	615	95.6	50	75.0-125	

Sample Narrative:
OS: Sample is a reducer

Method Blank (MB)

(MB) R3398659-1 04/04/19 17:19

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Cyanide	U		1.80	5.00

L1083626-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1083626-01 04/04/19 17:26 • (DUP) R3398659-3 04/04/19 17:27

Analyte	Original Result ug/l	DUP Result ug/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Cyanide	ND	0.000	1	0.000		20

L1083840-19 Original Sample (OS) • Duplicate (DUP)

(OS) L1083840-19 04/04/19 17:41 • (DUP) R3398659-6 04/04/19 19:41

Analyte	Original Result ug/l	DUP Result ug/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Cyanide	U	0.000	1	0.000		20

Laboratory Control Sample (LCS)

(LCS) R3398659-2 04/04/19 17:20

Analyte	Spike Amount ug/l	LCS Result ug/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Cyanide	100	108	108	85.0-115	

L1083785-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1083785-01 04/04/19 17:33 • (MS) R3398659-4 04/04/19 17:34 • (MSD) R3398659-5 04/04/19 17:35

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Cyanide	100	3.70	87.3	103	83.6	99.3	1	75.0-125			16.5	20

L1083840-20 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1083840-20 04/04/19 19:42 • (MS) R3398659-7 04/04/19 19:43 • (MSD) R3398659-8 04/04/19 19:44

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Cyanide	100	U	93.7	92.9	93.7	92.9	1	75.0-125			0.857	20

Method Blank (MB)

(MB) R3398476-1 04/04/19 12:47

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
Cyanide	U		0.0390	0.250

L1083400-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1083400-01 04/04/19 12:52 • (DUP) R3398476-3 04/04/19 12:53

Analyte	Original Result (dry) mg/kg	DUP Result (dry) mg/kg	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Cyanide	0.160	0.160	1	0.161	J	20

L1083840-02 Original Sample (OS) • Duplicate (DUP)

(OS) L1083840-02 04/04/19 13:16 • (DUP) R3398476-8 04/04/19 13:17

Analyte	Original Result (dry) mg/kg	DUP Result (dry) mg/kg	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Cyanide	0.182	0.178	1	2.57	J	20

Laboratory Control Sample (LCS)

(LCS) R3398476-2 04/04/19 12:48

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCS Rec. %	Rec. Limits %	LCS Qualifier
Cyanide	2.50	2.57	103	50.0-150	

L1083400-02 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1083400-02 04/04/19 12:54 • (MS) R3398476-4 04/04/19 12:55 • (MSD) R3398476-5 04/04/19 12:56

Analyte	Spike Amount (dry) mg/kg	Original Result (dry) mg/kg	MS Result (dry) mg/kg	MSD Result (dry) mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Cyanide	2.14	0.276	2.08	1.93	84.2	77.6	1	75.0-125			7.08	20

L1083441-04 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1083441-04 04/04/19 13:07 • (MS) R3398476-6 04/04/19 13:08 • (MSD) R3398476-7 04/04/19 13:11

Analyte	Spike Amount mg/kg	Original Result mg/kg	MS Result mg/kg	MSD Result mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Cyanide	1.67	U	1.28	1.34	76.8	80.7	1	75.0-125			4.96	20

Method Blank (MB)

(MB) R3398962-1 04/05/19 14:06

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
Cyanide	U		0.0390	0.250

L1083840-12 Original Sample (OS) • Duplicate (DUP)

(OS) L1083840-12 04/05/19 14:13 • (DUP) R3398962-3 04/05/19 14:14

Analyte	Original Result (dry) mg/kg	DUP Result (dry) mg/kg	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Cyanide	0.116	0.000	1	200	P1	20

L1083840-28 Original Sample (OS) • Duplicate (DUP)

(OS) L1083840-28 04/05/19 14:25 • (DUP) R3398962-6 04/05/19 14:26

Analyte	Original Result (dry) mg/kg	DUP Result (dry) mg/kg	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Cyanide	U	0.0484	1	200	J P1	20

Laboratory Control Sample (LCS)

(LCS) R3398962-2 04/05/19 14:07

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCS Rec. %	Rec. Limits %	LCS Qualifier
Cyanide	2.50	2.45	98.1	50.0-150	

L1083840-15 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1083840-15 04/05/19 14:15 • (MS) R3398962-4 04/05/19 14:18 • (MSD) R3398962-5 04/05/19 14:19

Analyte	Spike Amount (dry) mg/kg	Original Result (dry) mg/kg	MS Result (dry) mg/kg	MSD Result (dry) mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Cyanide	1.83	0.0449	1.33	1.56	70.2	82.9	1	75.0-125	J6		16.0	20

L1083840-31 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1083840-31 04/05/19 14:51 • (MS) R3398962-7 04/05/19 14:30 • (MSD) R3398962-8 04/05/19 14:32

Analyte	Spike Amount (dry) mg/kg	Original Result (dry) mg/kg	MS Result (dry) mg/kg	MSD Result (dry) mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Cyanide	1.74	U	1.25	1.14	71.5	65.3	1	75.0-125	J6	J6	9.08	20

Method Blank (MB)

(MB) R3398038-1 04/03/19 10:52

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Mercury	0.0693	J	0.0490	0.200

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3398038-2 04/03/19 10:54 • (LCSD) R3398038-3 04/03/19 10:57

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Mercury	3.00	3.10	3.09	103	103	80.0-120			0.268	20

L1083803-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1083803-01 04/03/19 10:59 • (MS) R3398038-4 04/03/19 11:01 • (MSD) R3398038-5 04/03/19 11:04

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Mercury	3.00	U	3.26	3.27	109	109	1	75.0-125			0.0949	20

Method Blank (MB)

(MB) R3398144-1 04/03/19 16:25

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
Mercury	0.00446	J	0.00280	0.0200

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3398144-2 04/03/19 16:28 • (LCSD) R3398144-3 04/03/19 16:30

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Mercury	0.300	0.278	0.277	92.6	92.5	80.0-120			0.126	20

L1083840-31 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1083840-31 04/03/19 16:33 • (MS) R3398144-4 04/03/19 16:35 • (MSD) R3398144-5 04/03/19 16:38

Analyte	Spike Amount (dry) mg/kg	Original Result (dry) mg/kg	MS Result (dry) mg/kg	MSD Result (dry) mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Mercury	0.314	0.0179	0.309	0.299	92.8	89.7	1	75.0-125			3.25	20

Method Blank (MB)

(MB) R3398450-1 04/04/19 09:44

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
Mercury	U		0.00280	0.0200

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3398450-2 04/04/19 09:47 • (LCSD) R3398450-3 04/04/19 09:49

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Mercury	0.300	0.319	0.305	106	102	80.0-120			4.38	20

L1083840-05 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1083840-05 04/04/19 09:52 • (MS) R3398450-4 04/04/19 09:54 • (MSD) R3398450-5 04/04/19 10:05

Analyte	Spike Amount (dry) mg/kg	Original Result (dry) mg/kg	MS Result (dry) mg/kg	MSD Result (dry) mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Mercury	0.377	0.508	0.702	0.765	51.6	68.1	1	75.0-125	J6	J6	8.48	20

Method Blank (MB)

(MB) R3399277-1 04/05/19 20:29

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Aluminum	U		35.0	200
Antimony	U		7.50	10.0
Arsenic	U		6.50	10.0
Barium	U		1.70	5.00
Beryllium	U		0.700	2.00
Cadmium	U		0.700	2.00
Calcium	U		46.3	1000
Chromium	U		1.40	10.0
Cobalt	U		2.30	10.0
Copper	U		5.30	10.0
Iron	U		14.1	100
Lead	U		1.90	5.00
Magnesium	U		11.1	1000
Manganese	U		1.20	10.0
Nickel	U		4.90	10.0
Potassium	U		102	1000
Silver	U		2.80	5.00
Sodium	U		98.5	1000
Vanadium	U		2.40	20.0
Zinc	U		5.90	50.0

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3399277-2 04/05/19 20:31 • (LCSD) R3399277-3 04/05/19 20:34

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Aluminum	10000	10000	10000	100	100	80.0-120			0.0779	20
Antimony	1000	978	966	97.8	96.6	80.0-120			1.31	20
Arsenic	1000	951	952	95.1	95.2	80.0-120			0.109	20
Barium	1000	1050	1040	105	104	80.0-120			0.855	20
Beryllium	1000	997	1000	99.7	100	80.0-120			0.365	20
Cadmium	1000	1010	997	101	99.7	80.0-120			1.10	20
Calcium	10000	9860	9910	98.6	99.1	80.0-120			0.514	20
Chromium	1000	993	1000	99.3	100	80.0-120			0.943	20
Cobalt	1000	1020	1010	102	101	80.0-120			0.564	20
Copper	1000	994	1000	99.4	100	80.0-120			0.664	20
Iron	10000	10000	10000	100	100	80.0-120			0.183	20
Lead	1000	985	976	98.5	97.6	80.0-120			0.889	20
Magnesium	10000	9850	9860	98.5	98.6	80.0-120			0.104	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3399277-2 04/05/19 20:31 • (LCSD) R3399277-3 04/05/19 20:34

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Manganese	1000	957	967	95.7	96.7	80.0-120			1.04	20
Nickel	1000	995	988	99.5	98.8	80.0-120			0.779	20
Potassium	10000	9590	9620	95.9	96.2	80.0-120			0.313	20
Silver	200	198	199	98.8	99.5	80.0-120			0.681	20
Sodium	10000	9900	9940	99.0	99.4	80.0-120			0.352	20
Vanadium	1000	986	997	98.6	99.7	80.0-120			1.16	20
Zinc	1000	968	965	96.8	96.5	80.0-120			0.258	20

L1084053-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1084053-01 04/05/19 20:37 • (MS) R3399277-5 04/05/19 20:42 • (MSD) R3399277-6 04/05/19 20:45

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Aluminum	10000	113	10100	10000	100	99.3	1	75.0-125			0.772	20
Antimony	1000	U	975	957	97.5	95.7	1	75.0-125			1.87	20
Arsenic	1000	U	939	937	93.9	93.7	1	75.0-125			0.193	20
Barium	1000	52.1	1090	1070	104	102	1	75.0-125			1.16	20
Beryllium	1000	U	996	983	99.6	98.3	1	75.0-125			1.28	20
Cadmium	1000	U	1000	989	100	98.9	1	75.0-125			1.10	20
Calcium	10000	8300	17900	17900	96.3	95.8	1	75.0-125			0.270	20
Chromium	1000	U	999	984	99.9	98.4	1	75.0-125			1.48	20
Cobalt	1000	2.32	1020	1010	102	101	1	75.0-125			0.862	20
Copper	1000	8.84	1010	983	99.6	97.4	1	75.0-125			2.22	20
Iron	10000	389	10300	10300	99.5	99.3	1	75.0-125			0.150	20
Lead	1000	U	976	970	97.6	97.0	1	75.0-125			0.653	20
Magnesium	10000	1940	11700	11700	97.7	97.1	1	75.0-125			0.527	20
Manganese	1000	206	1170	1150	96.1	94.5	1	75.0-125			1.40	20
Nickel	1000	U	991	986	99.1	98.6	1	75.0-125			0.539	20
Potassium	10000	2420	11800	11700	93.5	92.7	1	75.0-125			0.704	20
Silver	200	U	198	195	99.1	97.4	1	75.0-125			1.67	20
Sodium	10000	7670	17300	17200	95.9	94.9	1	75.0-125			0.554	20
Vanadium	1000	U	986	973	98.6	97.3	1	75.0-125			1.27	20
Zinc	1000	36.7	1000	994	96.3	95.7	1	75.0-125			0.552	20

Method Blank (MB)

(MB) R3398704-1 04/04/19 15:53

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
Aluminum	U		3.50	10.0
Antimony	U		0.750	2.00
Arsenic	U		0.460	2.00
Barium	U		0.170	0.500
Beryllium	U		0.0700	0.200
Cadmium	U		0.0700	0.500
Calcium	U		4.63	100
Chromium	U		0.140	1.00
Cobalt	U		0.230	1.00
Copper	U		0.530	2.00
Iron	U		1.41	10.0
Lead	U		0.190	0.500
Magnesium	2.24	J	1.11	100
Manganese	U		0.120	1.00
Nickel	U		0.490	2.00
Potassium	U		10.2	100
Selenium	U		0.620	2.00
Silver	U		0.120	1.00
Sodium	59.2	J	9.85	100
Thallium	U		0.650	2.00
Vanadium	U		0.240	2.00
Zinc	0.636	J	0.590	5.00

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3398704-2 04/04/19 15:56 • (LCSD) R3398704-3 04/04/19 15:59

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Aluminum	1000	1010	1030	101	103	80.0-120			1.33	20
Antimony	100	102	103	102	103	80.0-120			0.563	20
Arsenic	100	102	102	102	102	80.0-120			0.0345	20
Barium	100	105	106	105	106	80.0-120			0.272	20
Beryllium	100	107	107	107	107	80.0-120			0.392	20
Cadmium	100	100	100	100	100	80.0-120			0.202	20
Calcium	1000	1050	1050	105	105	80.0-120			0.469	20
Chromium	100	103	103	103	103	80.0-120			0.511	20
Cobalt	100	106	106	106	106	80.0-120			0.00945	20
Copper	100	103	104	103	104	80.0-120			0.564	20
Iron	1000	1030	1040	103	104	80.0-120			0.998	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3398704-2 04/04/19 15:56 • (LCSD) R3398704-3 04/04/19 15:59

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Lead	100	103	102	103	102	80.0-120			0.0868	20
Magnesium	1000	1010	1020	101	102	80.0-120			0.629	20
Manganese	100	101	102	101	102	80.0-120			0.299	20
Nickel	100	105	106	105	106	80.0-120			0.257	20
Potassium	1000	1000	1010	100	101	80.0-120			0.797	20
Selenium	100	105	104	105	104	80.0-120			0.812	20
Silver	20.0	19.3	19.6	96.7	98.0	80.0-120			1.35	20
Sodium	1000	1100	1110	110	111	80.0-120			0.977	20
Thallium	100	108	107	108	107	80.0-120			0.899	20
Vanadium	100	105	105	105	105	80.0-120			0.724	20
Zinc	100	101	102	101	102	80.0-120			0.316	20

L1083840-31 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1083840-31 04/04/19 16:01 • (MS) R3398704-6 04/04/19 16:09 • (MSD) R3398704-7 04/04/19 16:12

Analyte	Spike Amount (dry) mg/kg	Original Result (dry) mg/kg	MS Result (dry) mg/kg	MSD Result (dry) mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Aluminum	1050	3610	5800	5530	209	184	1	75.0-125	J5	J5	4.61	20
Antimony	105	U	75.7	78.3	72.3	74.8	1	75.0-125	J6	J6	3.32	20
Arsenic	105	1.54	101	102	95.4	96.2	1	75.0-125			0.867	20
Barium	105	12.5	115	116	98.3	98.4	1	75.0-125			0.0554	20
Beryllium	105	0.274	105	106	99.9	101	1	75.0-125			1.26	20
Cadmium	105	U	98.2	98.6	93.8	94.2	1	75.0-125			0.412	20
Calcium	1050	217	1280	1260	101	99.4	1	75.0-125			1.49	20
Chromium	105	20.1	125	123	99.9	98.3	1	75.0-125			1.37	20
Cobalt	105	3.30	109	109	101	101	1	75.0-125			0.517	20
Copper	105	5.95	110	110	99.6	99.5	1	75.0-125			0.129	20
Iron	1050	9430	11500	10800	200	133	1	75.0-125	V	V	6.27	20
Lead	105	2.51	105	105	97.7	97.8	1	75.0-125			0.171	20
Magnesium	1050	779	1940	1900	111	107	1	75.0-125			2.53	20
Manganese	105	144	234	252	86.1	103	1	75.0-125			7.39	20
Nickel	105	6.55	113	114	102	103	1	75.0-125			0.716	20
Potassium	1050	869	1980	1900	106	98.9	1	75.0-125			3.96	20
Selenium	105	U	102	101	97.6	96.8	1	75.0-125			0.821	20
Silver	20.9	U	19.1	19.3	91.4	92.3	1	75.0-125			0.913	20
Sodium	1050	77.3	1100	1110	97.4	98.9	1	75.0-125			1.43	20
Thallium	105	U	104	104	99.7	99.1	1	75.0-125			0.669	20
Vanadium	105	9.52	112	114	98.1	100	1	75.0-125			1.74	20
Zinc	105	13.1	114	113	96.2	95.6	1	75.0-125			0.523	20

Method Blank (MB)

(MB) R3399144-1 04/06/19 13:27

Analyte	MB Result	MB Qualifier	MB MDL	MB RDL
	ug/l		ug/l	ug/l
Selenium	U		0.380	2.00
Thallium	U		0.190	2.00

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3399144-2 04/06/19 13:31 • (LCSD) R3399144-3 04/06/19 13:36

Analyte	Spike Amount	LCS Result	LCSD Result	LCS Rec.	LCSD Rec.	Rec. Limits	LCS Qualifier	LCSD Qualifier	RPD	RPD Limits
	ug/l	ug/l	ug/l	%	%	%			%	%
Selenium	50.0	50.6	51.8	101	104	80.0-120			2.35	20
Thallium	50.0	51.4	51.9	103	104	80.0-120			1.01	20

L1084123-07 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1084123-07 04/06/19 13:41 • (MS) R3399144-5 04/06/19 13:50 • (MSD) R3399144-6 04/06/19 13:54

Analyte	Spike Amount	Original Result	MS Result	MSD Result	MS Rec.	MSD Rec.	Dilution	Rec. Limits	MS Qualifier	MSD Qualifier	RPD	RPD Limits
	ug/l	ug/l	ug/l	ug/l	%	%		%			%	%
Selenium	50.0	U	50.1	49.4	100	98.9	1	75.0-125			1.35	20
Thallium	50.0	U	50.4	50.8	101	102	1	75.0-125			0.711	20

Method Blank (MB)

(MB) R3397246-5 04/01/19 10:42

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Acetone	U		10.0	50.0
Bromochloromethane	U		0.520	1.00
Benzene	U		0.331	1.00
Bromodichloromethane	U		0.380	1.00
Bromoform	U		0.469	1.00
Bromomethane	U		0.866	5.00
Cyclohexane	U		0.390	1.00
Carbon disulfide	U		0.275	1.00
Carbon tetrachloride	U		0.379	1.00
Chlorobenzene	U		0.348	1.00
Chlorodibromomethane	U		0.327	1.00
Chloroethane	U		0.453	5.00
Chloroform	U		0.324	5.00
Chloromethane	U		0.276	2.50
1,2-Dibromo-3-Chloropropane	U		1.33	5.00
1,2-Dibromoethane	U		0.381	1.00
1,2-Dichlorobenzene	U		0.349	1.00
1,3-Dichlorobenzene	U		0.220	1.00
1,4-Dichlorobenzene	U		0.274	1.00
2-Hexanone	U		3.82	10.0
Dichlorodifluoromethane	U		0.551	5.00
Methyl Acetate	U		4.30	20.0
1,1-Dichloroethane	U		0.259	1.00
Methyl Cyclohexane	U		0.380	1.00
1,2-Dichloroethane	U		0.361	1.00
1,1-Dichloroethene	U		0.398	1.00
cis-1,2-Dichloroethene	U		0.260	1.00
trans-1,2-Dichloroethene	U		0.396	1.00
1,2-Dichloropropane	U		0.306	1.00
tert-Butyl alcohol	U		2.40	5.00
cis-1,3-Dichloropropene	U		0.418	1.00
trans-1,3-Dichloropropene	U		0.419	1.00
Ethylbenzene	U		0.384	1.00
Isopropylbenzene	U		0.326	1.00
2-Butanone (MEK)	U		3.93	10.0
Methylene Chloride	U		1.00	3.00
4-Methyl-2-pentanone (MIBK)	U		2.14	10.0
Methyl tert-butyl ether	U		0.367	1.00
Naphthalene	U		1.00	5.00
Styrene	U		0.307	1.00

Method Blank (MB)

(MB) R3397246-5 04/01/19 10:42

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
1,1,2,2-Tetrachloroethane	U		0.130	1.00
Tetrachloroethene	U		0.372	1.00
Toluene	U		0.412	1.00
1,1,2-Trichlorotrifluoroethane	U		0.303	1.00
1,2,3-Trichlorobenzene	U		0.230	1.00
1,2,4-Trichlorobenzene	U		0.355	1.00
1,1,1-Trichloroethane	U		0.319	1.00
1,1,2-Trichloroethane	U		0.383	1.00
Trichloroethene	U		0.398	1.00
Trichlorofluoromethane	U		1.20	5.00
Vinyl chloride	U		0.259	1.00
Xylenes, Total	U		1.06	3.00
(S) a,a,a-Trifluorotoluene	*104*			*80.0-120*
(S) Toluene-d8	*97.0*			*80.0-120*
(S) 4-Bromofluorobenzene	*93.9*			*77.0-126*
(S) 1,2-Dichloroethane-d4	*96.9*			*70.0-130*

Method Blank (MB) - TENTATIVELY IDENTIFIED COMPOUNDS

(MB) R3397246-5 04/01/19 10:42

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l	CAS #

Number of TICs found: 0

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3397246-1 04/01/19 08:56 • (LCSD) R3397246-2 04/01/19 09:17

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Bromochloromethane	25.0	29.3	27.4	117	110	70.0-130			6.62	20
Acetone	125	107	120	85.8	96.2	40.0-160			11.4	20
2-Hexanone	125	150	158	120	127	40.0-160			5.58	20
Benzene	25.0	29.1	28.8	117	115	70.0-130			1.25	20
Bromodichloromethane	25.0	28.8	28.0	115	112	70.0-130			2.67	20
Bromoform	25.0	26.9	27.1	108	108	70.0-130			0.525	20
Bromomethane	25.0	26.1	24.6	104	98.5	40.0-160			5.86	20
Carbon disulfide	25.0	22.7	22.3	90.7	89.2	40.0-160			1.64	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3397246-1 04/01/19 08:56 • (LCSD) R3397246-2 04/01/19 09:17

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Carbon tetrachloride	25.0	27.1	27.9	108	111	70.0-130			2.69	20
Chlorobenzene	25.0	27.4	27.7	109	111	70.0-130			1.11	20
Chlorodibromomethane	25.0	26.7	27.6	107	110	70.0-130			3.30	20
Chloroethane	25.0	22.5	21.7	89.9	86.9	40.0-160			3.48	20
Chloroform	25.0	28.8	27.8	115	111	70.0-130			3.29	20
Chloromethane	25.0	30.2	22.6	121	90.4	40.0-160		J3	28.7	20
1,2-Dibromo-3-Chloropropane	25.0	26.8	27.6	107	110	40.0-160			3.15	20
1,2-Dibromoethane	25.0	28.4	27.9	113	112	70.0-130			1.69	20
1,2-Dichlorobenzene	25.0	26.5	28.8	106	115	70.0-130			8.12	20
1,3-Dichlorobenzene	25.0	26.8	29.1	107	116	70.0-130			8.24	20
1,4-Dichlorobenzene	25.0	26.9	27.7	108	111	70.0-130			2.92	20
Dichlorodifluoromethane	25.0	21.7	19.6	86.9	78.3	40.0-160			10.5	20
1,1-Dichloroethane	25.0	28.7	28.2	115	113	70.0-130			1.85	20
1,2-Dichloroethane	25.0	26.1	24.8	104	99.3	70.0-130			4.86	20
1,1-Dichloroethene	25.0	22.0	21.8	88.0	87.1	70.0-130			1.04	20
cis-1,2-Dichloroethene	25.0	30.4	29.5	121	118	70.0-130			2.71	20
trans-1,2-Dichloroethene	25.0	25.2	24.5	101	98.0	70.0-130			2.89	20
1,2-Dichloropropane	25.0	28.9	29.2	116	117	70.0-130			0.909	20
Methyl Acetate	125	119	111	94.9	88.7	70.0-130			6.78	30
Cyclohexane	25.0	28.0	28.3	112	113	70.0-130			1.08	30
Methyl Cyclohexane	25.0	25.7	25.1	103	100	40.0-160			2.57	30
cis-1,3-Dichloropropene	25.0	28.5	28.6	114	114	70.0-130			0.575	20
trans-1,3-Dichloropropene	25.0	27.8	28.5	111	114	70.0-130			2.60	20
Ethylbenzene	25.0	28.0	28.4	112	114	70.0-130			1.58	20
Isopropylbenzene	25.0	26.8	27.6	107	110	70.0-130			3.00	20
2-Butanone (MEK)	125	144	158	115	126	40.0-160			8.97	20
Methylene Chloride	25.0	23.6	22.1	94.3	88.4	70.0-130			6.45	20
4-Methyl-2-pentanone (MIBK)	125	142	151	114	121	40.0-160			6.05	20
Methyl tert-butyl ether	25.0	25.0	25.1	100	100	70.0-130			0.249	20
Naphthalene	25.0	26.1	27.8	104	111	40.0-160			6.33	20
Styrene	25.0	26.3	27.1	105	108	70.0-130			2.99	20
1,1,2,2-Tetrachloroethane	25.0	26.7	26.7	107	107	70.0-130			0.0287	20
Tetrachloroethene	25.0	27.3	27.9	109	111	70.0-130			1.93	20
Toluene	25.0	27.1	28.4	108	114	70.0-130			4.80	20
1,1,2-Trichlorotrifluoroethane	25.0	20.9	20.5	83.7	82.1	70.0-130			1.93	20
1,2,3-Trichlorobenzene	25.0	27.2	28.9	109	116	70.0-130			6.09	20
1,2,4-Trichlorobenzene	25.0	27.8	29.1	111	116	70.0-130			4.61	20
1,1,1-Trichloroethane	25.0	27.6	27.0	111	108	70.0-130			2.22	20
1,1,2-Trichloroethane	25.0	26.2	27.1	105	108	70.0-130			3.26	20
Trichloroethene	25.0	28.9	28.3	116	113	70.0-130			1.95	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3397246-1 04/01/19 08:56 • (LCSD) R3397246-2 04/01/19 09:17

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Trichlorofluoromethane	25.0	22.4	22.1	89.5	88.6	40.0-160			1.02	20
Vinyl chloride	25.0	22.5	21.7	89.9	86.9	70.0-130			3.37	20
Xylenes, Total	75.0	81.5	85.3	109	114	70.0-130			4.56	20
(S) a,a,a-Trifluorotoluene				*104*	*97.8*	*80.0-120*				
(S) Toluene-d8				*88.3*	*93.1*	*80.0-120*				
(S) 4-Bromofluorobenzene				*91.3*	*91.6*	*77.0-126*				
(S) 1,2-Dichloroethane-d4				*89.3*	*85.6*	*70.0-130*				

Laboratory Control Sample (LCS)

(LCS) R3397246-4 04/01/19 10:00

Analyte	Spike Amount ug/l	LCS Result ug/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
tert-Butyl alcohol	50.0	56.5	113	50.0-150	
(S) a,a,a-Trifluorotoluene			*90.5*	*80.0-120*	
(S) Toluene-d8			*103*	*80.0-120*	
(S) 4-Bromofluorobenzene			*106*	*77.0-126*	
(S) 1,2-Dichloroethane-d4			*99.8*	*70.0-130*	

Method Blank (MB)

(MB) R3397836-4 04/01/19 12:25

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
Bromochloromethane	U		0.000390	0.00100
Benzene	U		0.000270	0.00100
Bromodichloromethane	U		0.000254	0.00100
Bromoform	U		0.000424	0.00100
Bromomethane	U		0.00134	0.00500
Carbon disulfide	U		0.000221	0.00100
Cyclohexane	U		0.000350	0.00100
Carbon tetrachloride	U		0.000328	0.00100
Chlorobenzene	U		0.000212	0.00100
Chlorodibromomethane	U		0.000373	0.00100
Chloroethane	U		0.000946	0.00500
Dichlorodifluoromethane	U		0.000713	0.00500
Chloroform	U		0.000229	0.00500
Chloromethane	U		0.000375	0.00250
1,2-Dibromo-3-Chloropropane	U		0.00105	0.00300
1,2-Dibromoethane	U		0.000343	0.00100
1,2-Dichlorobenzene	U		0.000305	0.00100
1,3-Dichlorobenzene	U		0.000239	0.00100
1,4-Dichlorobenzene	U		0.000226	0.00100
2-Hexanone	U		0.00137	0.0100
Isopropylbenzene	U		0.000243	0.0100
1,1-Dichloroethane	U		0.000199	0.00100
1,2-Dichloroethane	U		0.000265	0.00100
Methyl Cyclohexane	U		0.000380	0.00100
1,1-Dichloroethene	U		0.000303	0.00100
cis-1,2-Dichloroethene	U		0.000235	0.00100
trans-1,2-Dichloroethene	U		0.000264	0.00100
1,2-Dichloropropane	U		0.000358	0.00100
cis-1,3-Dichloropropene	U		0.000262	0.00100
trans-1,3-Dichloropropene	U		0.000267	0.00100
1,2,3-Trichlorobenzene	U		0.000306	0.00100
Ethylbenzene	U		0.000297	0.00100
1,1,2-Trichlorotrifluoroethane	U		0.000365	0.00100
2-Butanone (MEK)	U		0.00468	0.0100
Methylene Chloride	U		0.00100	0.00500
4-Methyl-2-pentanone (MIBK)	U		0.00188	0.0100
Methyl tert-butyl ether	U		0.000212	0.00100
Styrene	U		0.000234	0.00100
1,1,2,2-Tetrachloroethane	U		0.000365	0.00100
Tetrachloroethene	U		0.000276	0.00100

Method Blank (MB)

(MB) R3397836-4 04/01/19 12:25

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
Toluene	U		0.000434	0.00500
1,2,4-Trichlorobenzene	U		0.000388	0.00100
1,1,1-Trichloroethane	U		0.000286	0.00100
1,1,2-Trichloroethane	U		0.000277	0.00100
Trichloroethene	U		0.000279	0.00100
Trichlorofluoromethane	U		0.000382	0.00500
Vinyl chloride	U		0.000291	0.00100
Xylenes, Total	U		0.000698	0.00300
(S) Toluene-d8	*99.2*			*75.0-131*
(S) α,α,α-Trifluorotoluene	*104*			*80.0-120*
(S) 4-Bromofluorobenzene	*101*			*67.0-138*
(S) 1,2-Dichloroethane-d4	*100*			*70.0-130*

Method Blank (MB) - TENTATIVELY IDENTIFIED COMPOUNDS

(MB) R3397836-4 04/01/19 12:25

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg	CAS #

Number of TICs found: 0

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3397836-1 04/01/19 10:46 • (LCSD) R3397836-2 04/01/19 11:05

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Bromochloromethane	0.0250	0.0264	0.0273	106	109	70.0-130			3.19	30
Dichlorodifluoromethane	0.0250	0.0314	0.0308	126	123	40.0-160			2.02	30
2-Hexanone	0.125	0.121	0.131	96.9	104	40.0-160			7.50	30
Benzene	0.0250	0.0244	0.0246	97.6	98.4	70.0-130			0.844	30
Isopropylbenzene	0.0250	0.0252	0.0260	101	104	70.0-130			3.19	30
Bromodichloromethane	0.0250	0.0257	0.0259	103	104	70.0-130			0.859	30
Bromoform	0.0250	0.0286	0.0296	114	118	70.0-130			3.53	30
Bromomethane	0.0250	0.0267	0.0269	107	107	40.0-160			0.605	30
Carbon disulfide	0.0250	0.0238	0.0247	95.2	99.0	40.0-160			3.84	30
Carbon tetrachloride	0.0250	0.0245	0.0257	98.0	103	70.0-130			4.95	30
Chlorobenzene	0.0250	0.0259	0.0256	104	103	70.0-130			0.998	30
Chlorodibromomethane	0.0250	0.0269	0.0271	108	108	70.0-130			0.618	30

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3397836-1 04/01/19 10:46 • (LCSD) R3397836-2 04/01/19 11:05

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Chloroethane	0.0250	0.0260	0.0263	104	105	40.0-160			1.24	30
Chloroform	0.0250	0.0249	0.0248	99.6	99.3	70.0-130			0.271	30
1,1,2-Trichlorotrifluoroethane	0.0250	0.0240	0.0248	96.2	99.3	70.0-130			3.19	30
Chloromethane	0.0250	0.0226	0.0226	90.6	90.4	40.0-160			0.132	30
1,2,3-Trichlorobenzene	0.0250	0.0281	0.0277	112	111	70.0-130			1.51	30
1,2-Dibromo-3-Chloropropane	0.0250	0.0269	0.0268	107	107	40.0-160			0.143	30
1,2-Dibromoethane	0.0250	0.0254	0.0256	102	103	70.0-130			0.736	30
1,2-Dichlorobenzene	0.0250	0.0264	0.0259	105	104	70.0-130			1.58	30
1,3-Dichlorobenzene	0.0250	0.0280	0.0266	112	107	70.0-130			4.87	30
1,4-Dichlorobenzene	0.0250	0.0282	0.0270	113	108	70.0-130			4.27	30
1,1-Dichloroethane	0.0250	0.0239	0.0243	95.8	97.1	70.0-130			1.37	30
1,2-Dichloroethane	0.0250	0.0253	0.0258	101	103	70.0-130			1.96	30
1,1-Dichloroethene	0.0250	0.0240	0.0240	96.0	96.0	70.0-130			0.0272	30
cis-1,2-Dichloroethene	0.0250	0.0258	0.0270	103	108	70.0-130			4.45	30
trans-1,2-Dichloroethene	0.0250	0.0248	0.0248	99.2	99.3	70.0-130			0.112	30
Methyl Cyclohexane	0.0250	0.0219	0.0232	87.7	92.8	40.0-160			5.74	30
Cyclohexane	0.0250	0.0233	0.0240	93.1	96.1	70.0-130			3.13	30
1,2-Dichloropropane	0.0250	0.0240	0.0246	95.8	98.3	70.0-130			2.54	30
cis-1,3-Dichloropropene	0.0250	0.0264	0.0267	106	107	70.0-130			1.09	30
trans-1,3-Dichloropropene	0.0250	0.0266	0.0265	107	106	70.0-130			0.404	30
Ethylbenzene	0.0250	0.0253	0.0250	101	100	70.0-130			1.01	30
2-Butanone (MEK)	0.125	0.114	0.120	91.1	95.8	40.0-160			4.99	30
Methylene Chloride	0.0250	0.0237	0.0238	94.8	95.1	70.0-130			0.394	30
4-Methyl-2-pentanone (MIBK)	0.125	0.118	0.122	94.7	97.3	40.0-160			2.69	30
Methyl tert-butyl ether	0.0250	0.0212	0.0216	84.7	86.4	70.0-130			2.07	30
Styrene	0.0250	0.0261	0.0253	104	101	70.0-130			3.18	30
1,1,2,2-Tetrachloroethane	0.0250	0.0244	0.0238	97.6	95.2	70.0-130			2.50	30
Tetrachloroethene	0.0250	0.0260	0.0259	104	104	70.0-130			0.544	30
Toluene	0.0250	0.0245	0.0237	97.9	94.8	70.0-130			3.15	30
1,2,4-Trichlorobenzene	0.0250	0.0296	0.0285	119	114	70.0-130			3.95	30
1,1,1-Trichloroethane	0.0250	0.0248	0.0257	99.3	103	70.0-130			3.35	30
1,1,2-Trichloroethane	0.0250	0.0255	0.0255	102	102	70.0-130			0.0292	30
Trichloroethene	0.0250	0.0251	0.0251	101	101	70.0-130			0.0440	30
Trichlorofluoromethane	0.0250	0.0254	0.0257	102	103	40.0-160			1.16	30
Vinyl chloride	0.0250	0.0249	0.0248	99.6	99.2	70.0-130			0.388	30
Xylenes, Total	0.0750	0.0774	0.0774	103	103	70.0-130			0.000	30
(S) Toluene-d8				*104*	*97.2*	*75.0-131*				
(S) a,a,a-Trifluorotoluene				*99.9*	*101*	*80.0-120*				
(S) 4-Bromofluorobenzene				*99.4*	*99.1*	*67.0-138*				
(S) 1,2-Dichloroethane-d4				*111*	*113*	*70.0-130*				

Method Blank (MB)

(MB) R3398545-3 04/03/19 11:47

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
Acetone	U		0.0100	0.0500
Methyl Acetate	U		0.00610	0.0200
(S) Toluene-d8	*123*			*75.0-131*
(S) a,a,a-Trifluorotoluene	*105*			*80.0-120*
(S) 4-Bromofluorobenzene	*116*			*67.0-138*
(S) 1,2-Dichloroethane-d4	*103*			*70.0-130*

Method Blank (MB) - TENTATIVELY IDENTIFIED COMPOUNDS

(MB) R3398545-3 04/03/19 11:47

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg	CAS #

Number of TICs found: 0

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3398545-1 04/03/19 10:04 • (LCSD) R3398545-2 04/03/19 10:25

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Acetone	0.125	0.101	0.0943	80.7	75.5	40.0-160			6.72	30
Methyl Acetate	0.125	0.182	0.192	145	153	70.0-130	J4	J4	5.42	30
(S) Toluene-d8				*97.8*	*95.7*	*75.0-131*				
(S) a,a,a-Trifluorotoluene				*105*	*105*	*80.0-120*				
(S) 4-Bromofluorobenzene				*104*	*99.5*	*67.0-138*				
(S) 1,2-Dichloroethane-d4				*114*	*115*	*70.0-130*				

Method Blank (MB)

(MB) R3398643-5 04/03/19 11:57

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
Bromochloromethane	U		0.000390	0.00100
Benzene	U		0.000270	0.00100
Bromodichloromethane	U		0.000254	0.00100
Bromoform	U		0.000424	0.00100
Bromomethane	U		0.00134	0.00500
Carbon disulfide	U		0.000221	0.00100
Cyclohexane	U		0.000350	0.00100
Carbon tetrachloride	U		0.000328	0.00100
Chlorobenzene	U		0.000212	0.00100
Chlorodibromomethane	U		0.000373	0.00100
Chloroethane	U		0.000946	0.00500
Chloroform	U		0.000229	0.00500
Chloromethane	U		0.000375	0.00250
1,2-Dibromo-3-Chloropropane	U		0.00105	0.00300
1,2-Dibromoethane	U		0.000343	0.00100
1,2-Dichlorobenzene	U		0.000305	0.00100
1,3-Dichlorobenzene	U		0.000239	0.00100
1,4-Dichlorobenzene	U		0.000226	0.00100
Dichlorodifluoromethane	U		0.000713	0.00500
Isopropylbenzene	U		0.000243	0.0100
1,1-Dichloroethane	U		0.000199	0.00100
1,2-Dichloroethane	U		0.000265	0.00100
Methyl Cyclohexane	U		0.000380	0.00100
1,1-Dichloroethene	U		0.000303	0.00100
cis-1,2-Dichloroethene	U		0.000235	0.00100
trans-1,2-Dichloroethene	U		0.000264	0.00100
1,2-Dichloropropane	U		0.000358	0.00100
cis-1,3-Dichloropropene	U		0.000262	0.00100
trans-1,3-Dichloropropene	U		0.000267	0.00100
1,2,3-Trichlorobenzene	U		0.000306	0.00100
1,2,4-Trichlorobenzene	U		0.000388	0.00100
Ethylbenzene	U		0.000297	0.00100
1,1,2-Trichlorotrifluoroethane	U		0.000365	0.00100
2-Hexanone	U		0.00137	0.0100
2-Butanone (MEK)	U		0.00468	0.0100
Methylene Chloride	U		0.00100	0.00500
4-Methyl-2-pentanone (MIBK)	U		0.00188	0.0100
Methyl tert-butyl ether	U		0.000212	0.00100
Styrene	U		0.000234	0.00100
1,1,2,2-Tetrachloroethane	U		0.000365	0.00100

Method Blank (MB)

(MB) R3398643-5 04/03/19 11:57

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
Tetrachloroethene	U		0.000276	0.00100
Toluene	U		0.000434	0.00500
1,1,1-Trichloroethane	U		0.000286	0.00100
1,1,2-Trichloroethane	U		0.000277	0.00100
Trichloroethene	U		0.000279	0.00100
Trichlorofluoromethane	U		0.000382	0.00500
Vinyl chloride	U		0.000291	0.00100
Xylenes, Total	U		0.000698	0.00300
(S) Toluene-d8	*104*			*75.0-131*
(S) a,a,a-Trifluorotoluene	*100*			*80.0-120*
(S) 4-Bromofluorobenzene	*99.7*			*67.0-138*
(S) 1,2-Dichloroethane-d4	*87.9*			*70.0-130*

Method Blank (MB) - TENTATIVELY IDENTIFIED COMPOUNDS

(MB) R3398643-5 04/03/19 11:57

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg	CAS #

Number of TICs found: 0

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3398643-1 04/03/19 09:59 • (LCSD) R3398643-2 04/03/19 10:19

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Bromochloromethane	0.0250	0.0273	0.0244	109	97.6	70.0-130			11.4	30
Benzene	0.0250	0.0255	0.0225	102	90.1	70.0-130			12.5	30
Isopropylbenzene	0.0250	0.0261	0.0234	104	93.7	70.0-130			10.8	30
Bromodichloromethane	0.0250	0.0263	0.0237	105	94.9	70.0-130			10.4	30
Bromoform	0.0250	0.0284	0.0260	114	104	70.0-130			8.89	30
Bromomethane	0.0250	0.0252	0.0235	101	94.1	40.0-160			6.73	30
Carbon disulfide	0.0250	0.0256	0.0238	103	95.1	40.0-160			7.53	30
Carbon tetrachloride	0.0250	0.0273	0.0231	109	92.5	70.0-130			16.5	30
Chlorobenzene	0.0250	0.0260	0.0238	104	95.2	70.0-130			8.71	30
Chlorodibromomethane	0.0250	0.0264	0.0244	106	97.7	70.0-130			7.77	30
Chloroethane	0.0250	0.0249	0.0234	99.6	93.8	40.0-160			6.03	30
Chloroform	0.0250	0.0262	0.0228	105	91.2	70.0-130			13.9	30

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3398643-1 04/03/19 09:59 • (LCSD) R3398643-2 04/03/19 10:19

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
1,1,2-Trichlorotrifluoroethane	0.0250	0.0253	0.0236	101	94.6	70.0-130			6.96	30
Chloromethane	0.0250	0.0203	0.0193	81.2	77.4	40.0-160			4.84	30
1,2,3-Trichlorobenzene	0.0250	0.0284	0.0270	113	108	70.0-130			4.75	30
1,2,4-Trichlorobenzene	0.0250	0.0296	0.0278	118	111	70.0-130			6.23	30
1,2-Dibromo-3-Chloropropane	0.0250	0.0269	0.0255	108	102	40.0-160			5.24	30
1,2-Dibromoethane	0.0250	0.0252	0.0231	101	92.5	70.0-130			8.51	30
1,2-Dichlorobenzene	0.0250	0.0267	0.0250	107	99.8	70.0-130			6.87	30
1,3-Dichlorobenzene	0.0250	0.0280	0.0259	112	103	70.0-130			7.94	30
1,4-Dichlorobenzene	0.0250	0.0285	0.0260	114	104	70.0-130			9.04	30
Dichlorodifluoromethane	0.0250	0.0265	0.0257	106	103	40.0-160			3.03	30
1,1-Dichloroethane	0.0250	0.0249	0.0222	99.7	88.7	70.0-130			11.7	30
1,2-Dichloroethane	0.0250	0.0254	0.0238	102	95.3	70.0-130			6.52	30
1,1-Dichloroethene	0.0250	0.0247	0.0232	98.7	92.8	70.0-130			6.23	30
cis-1,2-Dichloroethene	0.0250	0.0272	0.0244	109	97.5	70.0-130			11.2	30
trans-1,2-Dichloroethene	0.0250	0.0259	0.0231	104	92.2	70.0-130			11.7	30
Methyl Cyclohexane	0.0250	0.0244	0.0212	97.6	84.7	40.0-160			14.1	30
Cyclohexane	0.0250	0.0254	0.0227	102	91.0	70.0-130			11.1	30
1,2-Dichloropropane	0.0250	0.0256	0.0230	103	91.9	70.0-130			10.9	30
cis-1,3-Dichloropropene	0.0250	0.0272	0.0244	109	97.4	70.0-130			11.1	30
trans-1,3-Dichloropropene	0.0250	0.0264	0.0238	106	95.3	70.0-130			10.4	30
Ethylbenzene	0.0250	0.0254	0.0234	102	93.6	70.0-130			8.37	30
2-Hexanone	0.125	0.120	0.121	96.0	97.1	40.0-160			1.12	30
2-Butanone (MEK)	0.125	0.120	0.114	96.2	91.4	40.0-160			5.08	30
Methylene Chloride	0.0250	0.0240	0.0223	96.2	89.0	70.0-130			7.73	30
4-Methyl-2-pentanone (MIBK)	0.125	0.116	0.112	92.9	89.6	40.0-160			3.66	30
Methyl tert-butyl ether	0.0250	0.0209	0.0189	83.4	75.4	70.0-130			10.1	30
Styrene	0.0250	0.0269	0.0251	108	100	70.0-130			7.02	30
1,1,2,2-Tetrachloroethane	0.0250	0.0243	0.0227	97.3	91.0	70.0-130			6.71	30
Tetrachloroethene	0.0250	0.0270	0.0247	108	98.8	70.0-130			8.90	30
Toluene	0.0250	0.0245	0.0223	98.1	89.1	70.0-130			9.62	30
1,1,1-Trichloroethane	0.0250	0.0269	0.0237	107	94.7	70.0-130			12.7	30
1,1,2-Trichloroethane	0.0250	0.0254	0.0231	102	92.4	70.0-130			9.62	30
Trichloroethene	0.0250	0.0264	0.0238	105	95.2	70.0-130			10.2	30
Trichlorofluoromethane	0.0250	0.0247	0.0232	98.7	92.9	40.0-160			6.11	30
Vinyl chloride	0.0250	0.0234	0.0215	93.4	86.2	70.0-130			8.09	30
Xylenes, Total	0.0750	0.0793	0.0714	106	95.2	70.0-130			10.5	30
(S) Toluene-d8				*97.4*	*98.3*	*75.0-131*				
(S) a,a,a-Trifluorotoluene				*103*	*100*	*80.0-120*				
(S) 4-Bromofluorobenzene				*98.6*	*99.0*	*67.0-138*				
(S) 1,2-Dichloroethane-d4				*109*	*103*	*70.0-130*				

L1083840-31 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1083840-31 04/03/19 16:31 • (MS) R3398643-6 04/03/19 19:09 • (MSD) R3398643-7 04/03/19 19:28

Analyte	Spike Amount (dry) mg/kg	Original Result (dry) mg/kg	MS Result (dry) mg/kg	MSD Result (dry) mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Bromochloromethane	0.0262	U	0.0157	0.0242	60.0	92.5	1	70.0-130	J6	J3	42.7	30
Isopropylbenzene	0.0262	U	0.0110	0.0175	41.9	66.7	1	70.0-130	J6	J3 J6	45.6	30
Benzene	0.0262	U	0.0129	0.0195	49.4	74.3	1	70.0-130	J6	J3	40.2	30
Bromodichloromethane	0.0262	U	0.0161	0.0236	61.6	90.1	1	70.0-130	J6	J3	37.5	30
Bromoform	0.0262	U	0.0196	0.0219	74.7	83.6	1	70.0-130			11.2	30
Bromomethane	0.0262	U	0.0123	0.0179	47.0	68.5	1	40.0-160		J3	37.3	30
Carbon disulfide	0.0262	U	0.00771	0.0114	29.5	43.7	1	40.0-160	J6	J3	39.0	30
Carbon tetrachloride	0.0262	U	0.0118	0.0181	44.9	69.2	1	70.0-130	J6	J3 J6	42.5	30
Chlorobenzene	0.0262	U	0.0135	0.0180	51.7	68.9	1	70.0-130	J6	J6	28.6	30
Chlorodibromomethane	0.0262	U	0.0179	0.0237	68.4	90.4	1	70.0-130	J6		27.8	30
Chloroethane	0.0262	U	0.0121	0.0180	46.1	68.8	1	40.0-160		J3	39.4	30
1,1,2-Trichlorotrifluoroethane	0.0262	U	0.0110	0.0186	42.0	71.2	1	70.0-130	J6	J3	51.5	30
Chloroform	0.0262	U	0.0147	0.0212	56.2	81.1	1	70.0-130	J6	J3	36.4	30
1,2,3-Trichlorobenzene	0.0262	U	0.00909	0.00956	34.7	36.5	1	70.0-130	J6	J6	5.06	30
Chloromethane	0.0262	U	0.0115	0.0153	44.0	58.5	1	40.0-160			28.4	30
1,2,4-Trichlorobenzene	0.0262	U	0.00874	0.0108	33.4	41.1	1	70.0-130	J6	J6	20.6	30
1,2-Dibromo-3-Chloropropane	0.0262	U	0.0177	0.0184	67.5	70.2	1	40.0-160			3.97	30
1,2-Dibromoethane	0.0262	U	0.0172	0.0214	65.8	81.9	1	70.0-130	J6		21.8	30
1,2-Dichlorobenzene	0.0262	U	0.0126	0.0156	48.2	59.5	1	70.0-130	J6	J6	21.0	30
1,3-Dichlorobenzene	0.0262	U	0.0118	0.0171	45.2	65.3	1	70.0-130	J6	J3 J6	36.4	30
1,4-Dichlorobenzene	0.0262	U	0.0121	0.0169	46.2	64.6	1	70.0-130	J6	J3 J6	33.1	30
Dichlorodifluoromethane	0.0262	U	0.0130	0.0208	49.6	79.4	1	40.0-160		J3	46.1	30
1,1-Dichloroethane	0.0262	U	0.0136	0.0198	52.1	75.6	1	70.0-130	J6	J3	36.9	30
1,2-Dichloroethane	0.0262	U	0.0164	0.0239	62.5	91.4	1	70.0-130	J6	J3	37.6	30
1,1-Dichloroethene	0.0262	U	0.0112	0.0171	42.6	65.4	1	70.0-130	J6	J3 J6	42.2	30
cis-1,2-Dichloroethene	0.0262	U	0.0146	0.0210	55.9	80.4	1	70.0-130	J6	J3	35.9	30
Methyl Cyclohexane	0.0262	U	0.00621	0.0131	23.7	49.9	1	40.0-160	J6	J3	71.1	30
Cyclohexane	0.0262	U	0.00822	0.0141	31.4	53.8	1	70.0-130	J6	J3 J6	52.6	30
trans-1,2-Dichloroethene	0.0262	U	0.0115	0.0169	43.8	64.6	1	70.0-130	J6	J3 J6	38.3	30
1,2-Dichloropropane	0.0262	U	0.0146	0.0218	55.9	83.3	1	70.0-130	J6	J3	39.4	30
cis-1,3-Dichloropropene	0.0262	U	0.0158	0.0221	60.3	84.5	1	70.0-130	J6	J3	33.5	30
trans-1,3-Dichloropropene	0.0262	U	0.0165	0.0221	63.0	84.3	1	70.0-130	J6		28.9	30
Ethylbenzene	0.0262	U	0.0119	0.0179	45.4	68.2	1	70.0-130	J6	J3 J6	40.3	30
2-Hexanone	0.131	U	0.0892	0.149	68.2	114	1	40.0-160		J3	50.1	30
2-Butanone (MEK)	0.131	U	0.0912	0.140	69.7	107	1	40.0-160		J3	42.5	30
Methylene Chloride	0.0262	U	0.0139	0.0204	53.1	78.0	1	70.0-130	J6	J3	38.0	30
4-Methyl-2-pentanone (MIBK)	0.131	U	0.0862	0.136	65.9	104	1	40.0-160		J3	44.7	30
Methyl tert-butyl ether	0.0262	U	0.0142	0.0217	54.3	82.8	1	70.0-130	J6	J3	41.5	30
Styrene	0.0262	U	0.0132	0.0166	50.5	63.5	1	70.0-130	J6	J6	22.9	30

L1083840-31 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1083840-31 04/03/19 16:31 • (MS) R3398643-6 04/03/19 19:09 • (MSD) R3398643-7 04/03/19 19:28

Analyte	Spike Amount (dry) mg/kg	Original Result (dry) mg/kg	MS Result (dry) mg/kg	MSD Result (dry) mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
1,1,2,2-Tetrachloroethane	0.0262	U	0.0170	0.0221	65.0	84.5	1	70.0-130	J6		26.2	30
Tetrachloroethene	0.0262	U	0.0108	0.0174	41.2	66.6	1	70.0-130	J6	J3 J6	47.0	30
Toluene	0.0262	U	0.0123	0.0182	47.1	69.6	1	70.0-130	J6	J3 J6	38.6	30
1,1,1-Trichloroethane	0.0262	U	0.0129	0.0193	49.2	73.8	1	70.0-130	J6	J3	40.0	30
1,1,2-Trichloroethane	0.0262	U	0.0174	0.0241	66.4	92.3	1	70.0-130	J6	J3	32.7	30
Trichloroethene	0.0262	U	0.0124	0.0183	47.4	69.9	1	70.0-130	J6	J3 J6	38.4	30
Trichlorofluoromethane	0.0262	U	0.0115	0.0185	43.9	70.6	1	40.0-160		J3	46.6	30
Vinyl chloride	0.0262	U	0.0111	0.0160	42.3	61.0	1	70.0-130	J6	J3 J6	36.1	30
Xylenes, Total	0.0785	U	0.0366	0.0540	46.7	68.8	1	70.0-130	J6	J3 J6	38.3	30
(S) Toluene-d8					*99.0*	*98.7*		*75.0-131*				
(S) a,a,a-Trifluorotoluene					*102*	*100*		*80.0-120*				
(S) 4-Bromofluorobenzene					*101*	*94.9*		*67.0-138*				
(S) 1,2-Dichloroethane-d4					*106*	*111*		*70.0-130*				

Method Blank (MB)

(MB) R3398783-2 04/04/19 15:54

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
Methyl Acetate	U		0.00610	0.0200
(S) Toluene-d8	*104*			*75.0-131*
(S) α,α,α-Trifluorotoluene	*98.6*			*80.0-120*
(S) 4-Bromofluorobenzene	*99.3*			*67.0-138*
(S) 1,2-Dichloroethane-d4	*121*			*70.0-130*

Laboratory Control Sample (LCS)

(LCS) R3398783-1 04/04/19 14:58

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCS Rec. %	Rec. Limits %	LCS Qualifier
Methyl Acetate	0.0250	0.0239	95.6	70.0-130	
(S) Toluene-d8			*100*	*75.0-131*	
(S) α,α,α-Trifluorotoluene			*97.3*	*80.0-120*	
(S) 4-Bromofluorobenzene			*99.0*	*67.0-138*	
(S) 1,2-Dichloroethane-d4			*126*	*70.0-130*	

Method Blank (MB)

(MB) R3398954-3 04/05/19 10:14

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
Acetone	U		0.0100	0.0500
Methyl Acetate	U		0.00610	0.0200
(S) Toluene-d8	*121*			*75.0-131*
(S) a,a,a-Trifluorotoluene	*107*			*80.0-120*
(S) 4-Bromofluorobenzene	*119*			*67.0-138*
(S) 1,2-Dichloroethane-d4	*104*			*70.0-130*

Method Blank (MB) - TENTATIVELY IDENTIFIED COMPOUNDS

(MB) R3398954-3 04/05/19 10:14

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg	CAS #

Number of TICs found: 0

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3398954-1 04/05/19 09:12 • (LCSD) R3398954-2 04/05/19 09:33

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Acetone	0.125	0.115	0.112	92.3	89.9	40.0-160			2.55	30
Methyl Acetate	0.125	0.241	0.227	192	182	70.0-130	J4	J4	5.86	30
(S) Toluene-d8				*96.4*	*98.1*	*75.0-131*				
(S) a,a,a-Trifluorotoluene				*107*	*102*	*80.0-120*				
(S) 4-Bromofluorobenzene				*99.1*	*99.2*	*67.0-138*				
(S) 1,2-Dichloroethane-d4				*115*	*116*	*70.0-130*				

Method Blank (MB)

(MB) R3397455-1 04/01/19 17:08

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
EPH Screen	U		7.10	500
(S) o-Terphenyl	*87.8*			*40.0-140*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3397455-2 04/01/19 17:24 • (LCSD) R3397455-3 04/01/19 17:41

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
EPH Screen	206	187	188	90.8	91.3	40.0-140			0.533	50
(S) o-Terphenyl				*77.6*	*78.4*	*40.0-140*				

L1083388-10 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1083388-10 04/01/19 18:43 • (MS) R3397455-4 04/01/19 18:58 • (MSD) R3397455-5 04/01/19 19:14

Analyte	Spike Amount mg/kg	Original Result mg/kg	MS Result mg/kg	MSD Result mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
EPH Screen	206	ND	191	192	86.9	87.4	1	40.0-140			0.522	50
(S) o-Terphenyl					*77.4*	*74.8*		*40.0-140*				

Method Blank (MB)

(MB) R3397866-1 04/02/19 20:49

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
C9-C12 Aliphatics	U		3.30	10.0
C12-C16 Aliphatics	U		3.30	10.0
C16-C21 Aliphatics	U		3.30	10.0
C21-C40 Aliphatics	U		3.30	10.0
(S) 1-Chloro-octadecane	*82.9*			*40.0-140*

Method Blank (MB)

(MB) R3397866-4 04/02/19 21:54

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
C10 - C12 Aromatics	U		3.30	10.0
C12-C16 Aromatics	U		3.30	10.0
C16-C21 Aromatics	U		3.30	10.0
C21-C36 Aromatics	U		3.30	10.0
(S) o-Terphenyl	*78.2*			*40.0-140*
(S) 2-Fluorobiphenyl	*83.6*			*40.0-140*
(S) 2-Bromonaphthalene	*77.8*			*40.0-140*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3397866-2 04/02/19 21:11 • (LCSD) R3397866-3 04/02/19 21:32

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
C9-C12 Aliphatics	20.0	12.0	12.4	60.0	62.0	40.0-140			3.28	50
C12-C16 Aliphatics	13.3	10.4	10.6	78.2	79.7	40.0-140			1.90	50
C16-C21 Aliphatics	20.0	16.8	16.7	84.0	83.5	40.0-140			0.597	50
C21-C40 Aliphatics	39.9	32.6	31.9	81.7	79.9	40.0-140			2.17	50
(S) 1-Chloro-octadecane				*85.3*	*84.2*	*40.0-140*				

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3397866-5 04/02/19 22:16 • (LCSD) R3397866-6 04/02/19 22:38

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
C10 - C12 Aromatics	6.65	4.66	4.61	70.1	69.3	40.0-140			1.08	50
C12-C16 Aromatics	20.0	15.5	15.4	77.5	77.0	40.0-140			0.647	50
C16-C21 Aromatics	33.3	29.0	28.8	87.1	86.5	40.0-140			0.692	50
C21-C36 Aromatics	53.2	39.0	38.2	73.3	71.8	40.0-140			2.07	50

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3397866-5 04/02/19 22:16 • (LCSD) R3397866-6 04/02/19 22:38

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
(S) o-Terphenyl				*82.0*	*80.3*	*40.0-140*				
(S) 2-Fluorobiphenyl				*90.0*	*87.0*	*40.0-140*				
(S) 2-Bromonaphthalene				*85.2*	*82.5*	*40.0-140*				

L1083840-04 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1083840-04 04/03/19 00:27 • (MS) R3397866-7 04/03/19 00:49 • (MSD) R3397866-8 04/03/19 01:10

Analyte	Spike Amount (dry) mg/kg	Original Result (dry) mg/kg	MS Result (dry) mg/kg	MSD Result (dry) mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
C9-C12 Aliphatics	21.9	U	12.1	12.1	55.0	55.0	1	40.0-140			0.000	50
C12-C16 Aliphatics	14.6	U	10.9	10.4	74.5	71.1	1	40.0-140			4.75	50
C16-C21 Aliphatics	21.9	U	18.4	17.6	84.0	80.5	1	40.0-140			4.26	50
C21-C40 Aliphatics	43.7	22.3	45.2	47.5	52.4	57.6	1	40.0-140			4.97	50
(S) 1-Chloro-octadecane					*78.4*	*77.3*		*40.0-140*				

L1083840-04 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1083840-04 04/03/19 00:27 • (MS) R3397866-10 04/03/19 03:21 • (MSD) R3397866-9 04/03/19 02:59

Analyte	Spike Amount (dry) mg/kg	Original Result (dry) mg/kg	MS Result (dry) mg/kg	MSD Result (dry) mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
C10 - C12 Aromatics	7.29	U	4.48	4.26	61.5	58.5	1	40.0-140			5.01	50
C12-C16 Aromatics	21.9	U	15.6	15.1	71.0	69.0	1	40.0-140			2.86	50
C16-C21 Aromatics	36.5	6.96	37.3	33.8	83.0	73.4	1	40.0-140			9.88	50
C21-C36 Aromatics	58.3	36.2	63.7	60.4	47.2	41.5	1	40.0-140			5.30	50
(S) o-Terphenyl					*73.9*	*73.1*		*40.0-140*				
(S) 2-Fluorobiphenyl					*83.3*	*83.5*		*40.0-140*				
(S) 2-Bromonaphthalene					*80.8*	*81.0*		*40.0-140*				

Method Blank (MB)

(MB) R3399071-1 04/06/19 03:30

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
EPH Screen	U		7.10	500
(S) o-Terphenyl	*103*			*40.0-140*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3399071-2 04/06/19 03:46 • (LCSD) R3399071-3 04/06/19 04:02

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
EPH Screen	206	216	215	105	104	40.0-140			0.464	50
(S) o-Terphenyl				*100*	*98.3*	*40.0-140*				

Method Blank (MB)

(MB) R3399231-1 04/05/19 15:51

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
C9-C12 Aliphatics	U		3.30	10.0
C12-C16 Aliphatics	U		3.30	10.0
C16-C21 Aliphatics	U		3.30	10.0
C21-C40 Aliphatics	U		3.30	10.0
(S) 1-Chloro-octadecane	*79.9*			*40.0-140*

Method Blank (MB)

(MB) R3399564-1 04/08/19 11:03

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
C10 - C12 Aromatics	U		3.30	10.0
C12-C16 Aromatics	U		3.30	10.0
C16-C21 Aromatics	U		3.30	10.0
C21-C36 Aromatics	U		3.30	10.0
(S) o-Terphenyl	*82.7*			*40.0-140*
(S) 2-Fluorobiphenyl	*89.8*			*40.0-140*
(S) 2-Bromonaphthalene	*88.7*			*40.0-140*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3399231-2 04/05/19 16:13 • (LCSD) R3399231-3 04/05/19 16:35

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
C9-C12 Aliphatics	20.0	12.8	12.4	64.0	62.0	40.0-140			3.17	50
C12-C16 Aliphatics	13.3	11.5	10.4	86.5	78.2	40.0-140			10.0	50
C16-C21 Aliphatics	20.0	17.4	16.5	87.0	82.5	40.0-140			5.31	50
C21-C40 Aliphatics	39.9	32.9	31.8	82.5	79.7	40.0-140			3.40	50
(S) 1-Chloro-octadecane				*91.2*	*82.0*	*40.0-140*				

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3399564-2 04/08/19 11:27 • (LCSD) R3399564-3 04/08/19 11:51

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
C10 - C12 Aromatics	6.65	4.33	4.40	65.1	66.2	40.0-140			1.60	50
C12-C16 Aromatics	20.0	14.3	14.1	71.5	70.5	40.0-140			1.41	50
C16-C21 Aromatics	33.3	30.0	29.3	90.1	88.0	40.0-140			2.36	50
C21-C36 Aromatics	53.2	40.9	39.3	76.9	73.9	40.0-140			3.99	50

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3399564-2 04/08/19 11:27 • (LCSD) R3399564-3 04/08/19 11:51

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
(S) o-Terphenyl				*82.5*	*79.1*	*40.0-140*				
(S) 2-Fluorobiphenyl				*91.2*	*89.7*	*40.0-140*				
(S) 2-Bromonaphthalene				*91.0*	*89.3*	*40.0-140*				

L1083840-31 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1083840-31 04/05/19 18:46 • (MS) R3399231-4 04/05/19 19:08 • (MSD) R3399231-5 04/05/19 19:30

Analyte	Spike Amount (dry) mg/kg	Original Result (dry) mg/kg	MS Result (dry) mg/kg	MSD Result (dry) mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
C9-C12 Aliphatics	20.9	U	13.4	13.3	64.0	63.5	1	40.0-140			0.784	50
C12-C16 Aliphatics	13.9	U	11.4	11.4	82.0	82.0	1	40.0-140			0.000	50
C16-C21 Aliphatics	20.9	U	18.1	18.0	86.5	86.0	1	40.0-140			0.580	50
C21-C40 Aliphatics	41.8	U	35.0	33.9	83.7	81.2	1	40.0-140			3.04	50
(S) 1-Chloro-octadecane					*86.3*	*83.5*		*40.0-140*				

L1083840-31 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1083840-31 04/08/19 13:04 • (MS) R3399564-4 04/08/19 13:28 • (MSD) R3399564-5 04/08/19 13:52

Analyte	Spike Amount (dry) mg/kg	Original Result (dry) mg/kg	MS Result (dry) mg/kg	MSD Result (dry) mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
C10 - C12 Aromatics	6.96	U	4.69	4.73	67.4	68.0	1	40.0-140			0.889	50
C12-C16 Aromatics	20.9	U	15.1	14.9	72.0	71.0	1	40.0-140			1.40	50
C16-C21 Aromatics	34.9	5.01	27.5	30.2	64.6	72.1	1	40.0-140			9.07	50
C21-C36 Aromatics	55.7	U	42.6	40.6	76.5	72.9	1	40.0-140			4.78	50
(S) o-Terphenyl					*80.1*	*77.1*		*40.0-140*				
(S) 2-Fluorobiphenyl					*92.9*	*91.0*		*40.0-140*				
(S) 2-Bromonaphthalene					*92.9*	*89.3*		*40.0-140*				

Method Blank (MB)

(MB) R3397413-3 04/02/19 09:05

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Aldrin	U		0.00813	0.0400
Alpha BHC	U		0.0166	0.0200
Beta BHC	U		0.0184	0.0400
Delta BHC	U		0.0197	0.0500
Gamma BHC	U		0.0176	0.0300
Chlordane	U		0.0977	0.500
4,4-DDD	U		0.0170	0.0500
4,4-DDE	U		0.0164	0.0500
4,4-DDT	U		0.0177	0.0500
Dieldrin	U		0.00751	0.0500
Endosulfan I	U		0.0179	0.0500
Endosulfan II	U		0.0176	0.0500
Endosulfan sulfate	U		0.0196	0.0500
Endrin	U		0.0189	0.0500
Endrin aldehyde	U		0.0142	0.0500
Endrin ketone	U		0.0170	0.0500
Hexachlorobenzene	U		0.0134	0.0500
Heptachlor	U		0.0108	0.0500
Heptachlor epoxide	U		0.0175	0.0500
Methoxychlor	U		0.0193	0.0500
Toxaphene	U		0.168	0.500
alpha-Chlordane	U		0.0149	0.0500
gamma-Chlordane	U		0.0137	0.0500
(S) Decachlorobiphenyl	*103*			*30.0-150*
(S) Tetrachloro-m-xylene	*92.8*			*30.0-150*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3397413-1 04/02/19 08:40 • (LCSD) R3397413-2 04/02/19 08:53

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Aldrin	1.00	1.00	0.855	100	85.5	40.0-140			15.6	20
Alpha BHC	1.00	1.03	0.895	103	89.5	40.0-140			14.0	20
Beta BHC	1.00	1.05	0.918	105	91.8	40.0-140			13.4	20
Delta BHC	1.00	1.07	0.925	107	92.5	40.0-140			14.5	20
Gamma BHC	1.00	1.01	0.882	101	88.2	40.0-140			13.5	20
4,4-DDD	1.00	1.03	0.889	103	88.9	40.0-140			14.7	20
4,4-DDE	1.00	1.03	0.889	103	88.9	40.0-140			14.7	20
4,4-DDT	1.00	1.11	0.973	111	97.3	40.0-140			13.2	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3397413-1 04/02/19 08:40 • (LCSD) R3397413-2 04/02/19 08:53

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Dieldrin	1.00	1.06	0.918	106	91.8	40.0-140			14.4	20
Endosulfan I	1.00	1.07	0.929	107	92.9	40.0-140			14.1	20
Endosulfan II	1.00	1.02	0.882	102	88.2	40.0-140			14.5	20
Endosulfan sulfate	1.00	1.14	0.985	114	98.5	40.0-140			14.6	20
Endrin	1.00	1.07	0.922	107	92.2	40.0-140			14.9	20
Endrin aldehyde	1.00	1.04	0.910	104	91.0	40.0-140			13.3	20
Endrin ketone	1.00	1.14	0.994	114	99.4	40.0-140			13.7	20
Heptachlor	1.00	1.05	0.902	105	90.2	40.0-140			15.2	20
Heptachlor epoxide	1.00	1.09	0.951	109	95.1	40.0-140			13.6	20
Hexachlorobenzene	1.00	0.881	0.763	88.1	76.3	40.0-140			14.4	20
Methoxychlor	1.00	1.04	0.914	104	91.4	40.0-140			12.9	20
alpha-Chlordane	1.00	1.09	0.947	109	94.7	40.0-140			14.0	20
gamma-Chlordane	1.00	1.06	0.914	106	91.4	40.0-140			14.8	20
(S) Decachlorobiphenyl				*104*	*89.5*	*30.0-150*				
(S) Tetrachloro-m-xylene				*98.3*	*84.5*	*30.0-150*				

Method Blank (MB)

(MB) R3397890-3 04/03/19 09:46

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Aldrin	U		0.00813	0.0400
Alpha BHC	U		0.0166	0.0200
Beta BHC	U		0.0184	0.0400
Delta BHC	U		0.0197	0.0500
Gamma BHC	U		0.0176	0.0300
Chlordane	U		0.0977	0.500
4,4-DDD	U		0.0170	0.0500
4,4-DDE	U		0.0164	0.0500
4,4-DDT	U		0.0177	0.0500
Dieldrin	U		0.00751	0.0500
Endosulfan I	U		0.0179	0.0500
Endosulfan II	U		0.0176	0.0500
Endosulfan sulfate	U		0.0196	0.0500
Endrin	U		0.0189	0.0500
Endrin aldehyde	U		0.0142	0.0500
Endrin ketone	U		0.0170	0.0500
Hexachlorobenzene	U		0.0134	0.0500
Heptachlor	U		0.0108	0.0500
Heptachlor epoxide	U		0.0175	0.0500
Methoxychlor	U		0.0193	0.0500
Toxaphene	U		0.168	0.500
alpha-Chlordane	U		0.0149	0.0500
gamma-Chlordane	U		0.0137	0.0500
(S) Decachlorobiphenyl	*92.8*			*30.0-150*
(S) Tetrachloro-m-xylene	*93.3*			*30.0-150*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3397890-1 04/03/19 09:21 • (LCSD) R3397890-2 04/03/19 09:33

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Aldrin	1.00	0.944	0.997	94.4	99.7	40.0-140			5.46	20
Alpha BHC	1.00	1.04	1.06	104	106	40.0-140			1.90	20
Beta BHC	1.00	1.06	1.07	106	107	40.0-140			0.939	20
Delta BHC	1.00	1.09	1.10	109	110	40.0-140			0.913	20
Gamma BHC	1.00	1.01	1.03	101	103	40.0-140			1.96	20
4,4-DDD	1.00	0.993	1.01	99.3	101	40.0-140			1.70	20
4,4-DDE	1.00	1.03	1.04	103	104	40.0-140			0.966	20
4,4-DDT	1.00	1.04	1.03	104	103	40.0-140			0.966	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3397890-1 04/03/19 09:21 • (LCSD) R3397890-2 04/03/19 09:33

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Dieldrin	1.00	1.04	1.05	104	105	40.0-140			0.957	20
Endosulfan I	1.00	1.06	1.07	106	107	40.0-140			0.939	20
Endosulfan II	1.00	0.990	1.01	99.0	101	40.0-140			2.00	20
Endosulfan sulfate	1.00	1.11	1.12	111	112	40.0-140			0.897	20
Endrin	1.00	1.03	1.05	103	105	40.0-140			1.92	20
Endrin aldehyde	1.00	1.03	1.03	103	103	40.0-140			0.000	20
Endrin ketone	1.00	1.08	1.09	108	109	40.0-140			0.922	20
Heptachlor	1.00	0.964	16.4	96.4	1640	40.0-140		E J3 J4 P	178	20
Heptachlor epoxide	1.00	1.09	1.09	109	109	40.0-140			0.000	20
Hexachlorobenzene	1.00	0.833	0.870	83.3	87.0	40.0-140			4.35	20
Methoxychlor	1.00	0.973	0.979	97.3	97.9	40.0-140			0.615	20
alpha-Chlordane	1.00	1.08	1.09	108	109	40.0-140			0.922	20
gamma-Chlordane	1.00	1.04	1.04	104	104	40.0-140			0.000	20
(S) Decachlorobiphenyl				*98.8*	*99.2*	*30.0-150*				
(S) Tetrachloro-m-xylene				*97.4*	*103*	*30.0-150*				

Method Blank (MB)

(MB) R3398027-3 04/03/19 12:33

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
Aldrin	U		0.00135	0.0200
Alpha BHC	U		0.00136	0.00250
Beta BHC	U		0.00160	0.00250
Delta BHC	U		0.00143	0.0200
Gamma BHC	U		0.00145	0.00250
Chlordane	U		0.0390	0.200
4,4-DDD	U		0.00156	0.0200
4,4-DDE	U		0.00154	0.0200
4,4-DDT	U		0.00200	0.0200
Dieldrin	U		0.00152	0.00300
Endosulfan I	U		0.00149	0.0200
Endosulfan II	U		0.00160	0.0200
Endosulfan sulfate	U		0.00151	0.0200
Endrin	U		0.00157	0.0200
Endrin aldehyde	U		0.00129	0.0200
Endrin ketone	U		0.00165	0.0200
Hexachlorobenzene	U		0.00124	0.0200
Heptachlor	U		0.00154	0.0200
alpha-Chlordane	U		0.00141	0.0200
Heptachlor epoxide	U		0.00161	0.0100
gamma-Chlordane	U		0.00196	0.0200
Methoxychlor	U		0.00178	0.0200
Toxaphene	U		0.0360	0.400
(S) Decachlorobiphenyl	*71.6*			*30.0-150*
(S) Tetrachloro-m-xylene	*77.0*			*30.0-150*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3398027-1 04/03/19 12:08 • (LCSD) R3398027-2 04/03/19 12:21

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Aldrin	0.0666	0.0363	0.0399	54.5	59.9	40.0-140			9.45	30
Alpha BHC	0.0666	0.0364	0.0397	54.7	59.6	40.0-140			8.67	30
Beta BHC	0.0666	0.0328	0.0358	49.2	53.8	40.0-140			8.75	30
Delta BHC	0.0666	0.0360	0.0396	54.1	59.5	40.0-140			9.52	30
Gamma BHC	0.0666	0.0349	0.0380	52.4	57.1	40.0-140			8.50	30
4,4-DDD	0.0666	0.0356	0.0394	53.5	59.2	40.0-140			10.1	30
4,4-DDE	0.0666	0.0353	0.0390	53.0	58.6	40.0-140			9.96	30
4,4-DDT	0.0666	0.0357	0.0395	53.6	59.3	40.0-140			10.1	30

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3398027-1 04/03/19 12:08 • (LCSD) R3398027-2 04/03/19 12:21

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Dieldrin	0.0666	0.0357	0.0399	53.6	59.9	40.0-140			11.1	30
Endosulfan I	0.0666	0.0339	0.0375	50.9	56.3	40.0-140			10.1	30
Endosulfan II	0.0666	0.0322	0.0355	48.3	53.3	40.0-140			9.75	30
Endosulfan sulfate	0.0666	0.0353	0.0390	53.0	58.6	40.0-140			9.96	30
Endrin	0.0666	0.0385	0.0423	57.8	63.5	40.0-140			9.41	30
Endrin aldehyde	0.0666	0.0312	0.0341	46.8	51.2	40.0-140			8.88	30
Endrin ketone	0.0666	0.0341	0.0377	51.2	56.6	40.0-140			10.0	30
Heptachlor	0.0666	0.0357	0.0392	53.6	58.9	40.0-140			9.35	30
Heptachlor epoxide	0.0666	0.0350	0.0384	52.6	57.7	40.0-140			9.26	30
Hexachlorobenzene	0.0666	0.0323	0.0356	48.5	53.5	40.0-140			9.72	30
Methoxychlor	0.0666	0.0363	0.0396	54.5	59.5	40.0-140			8.70	30
alpha-Chlordane	0.0666	0.0344	0.0378	51.7	56.8	40.0-140			9.42	30
gamma-Chlordane	0.0666	0.0336	0.0370	50.5	55.6	40.0-140			9.63	30
(S) Decachlorobiphenyl				*60.5*	*63.5*	*30.0-150*				
(S) Tetrachloro-m-xylene				*65.5*	*69.5*	*30.0-150*				

L1083840-31 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1083840-31 04/03/19 12:46 • (MS) R3398027-4 04/03/19 12:58 • (MSD) R3398027-5 04/03/19 13:11

Analyte	Spike Amount (dry) mg/kg	Original Result (dry) mg/kg	MS Result (dry) mg/kg	MSD Result (dry) mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Aldrin	0.0697	U	0.0785	0.0716	113	103	1	30.0-150			9.21	30
Alpha BHC	0.0697	U	0.0785	0.0720	113	103	1	30.0-150			8.62	30
Beta BHC	0.0697	U	0.0697	0.0637	100	91.3	1	30.0-150			9.11	30
Delta BHC	0.0697	U	0.0782	0.0717	112	103	1	30.0-150			8.66	30
Gamma BHC	0.0697	U	0.0754	0.0693	108	99.4	1	30.0-150			8.39	30
4,4-DDD	0.0697	U	0.0763	0.0700	109	100	1	30.0-150			8.58	30
4,4-DDE	0.0697	U	0.0738	0.0679	106	97.4	1	30.0-150			8.27	30
4,4-DDT	0.0697	U	0.0786	0.0717	113	103	1	30.0-150			9.19	30
Dieldrin	0.0697	U	0.0774	0.0705	111	101	1	30.0-150			9.35	30
Endosulfan I	0.0697	U	0.0723	0.0660	104	94.6	1	30.0-150			9.24	30
Endosulfan II	0.0697	U	0.0693	0.0630	99.4	90.4	1	30.0-150			9.49	30
Endosulfan sulfate	0.0697	U	0.0759	0.0689	109	98.8	1	30.0-150			9.69	30
Endrin	0.0697	U	0.0850	0.0768	122	110	1	30.0-150			10.1	30
Endrin aldehyde	0.0697	U	0.0715	0.0645	103	92.5	1	30.0-150			10.3	30
Endrin ketone	0.0697	U	0.0721	0.0654	103	93.8	1	30.0-150			9.74	30
Heptachlor	0.0697	U	0.0761	0.0701	109	101	1	30.0-150			8.16	30
Heptachlor epoxide	0.0697	U	0.0741	0.0674	106	96.7	1	30.0-150			9.47	30
Hexachlorobenzene	0.0697	U	0.0670	0.0610	96.1	87.5	1	30.0-150			9.32	30

L1083840-31 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1083840-31 04/03/19 12:46 • (MS) R3398027-4 04/03/19 12:58 • (MSD) R3398027-5 04/03/19 13:11

Analyte	Spike Amount (dry)	Original Result (dry)	MS Result (dry)	MSD Result (dry)	MS Rec.	MSD Rec.	Dilution	Rec. Limits	MS Qualifier	MSD Qualifier	RPD	RPD Limits
	mg/kg	mg/kg	mg/kg	mg/kg	%	%		%			%	%
Methoxychlor	0.0697	U	0.0773	0.0704	111	101	1	30.0-150			9.36	30
alpha-Chlordane	0.0697	U	0.0726	0.0666	104	95.5	1	30.0-150			8.58	30
gamma-Chlordane	0.0697	U	0.0714	0.0655	102	94.0	1	30.0-150			8.56	30
(S) Decachlorobiphenyl					*96.2*	*90.8*		*30.0-150*				
(S) Tetrachloro-m-xylene					*104*	*100*		*30.0-150*				

Method Blank (MB)

(MB) R3398435-3 04/04/19 09:05

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
Aldrin	U		0.00135	0.0200
Alpha BHC	U		0.00136	0.00250
Beta BHC	U		0.00160	0.00250
Delta BHC	U		0.00143	0.0200
Gamma BHC	U		0.00145	0.00250
Chlordane	U		0.0390	0.200
4,4-DDD	U		0.00156	0.0200
4,4-DDE	U		0.00154	0.0200
4,4-DDT	U		0.00200	0.0200
Dieldrin	U		0.00152	0.00300
Endosulfan I	U		0.00149	0.0200
Endosulfan II	U		0.00160	0.0200
Endosulfan sulfate	U		0.00151	0.0200
Endrin	U		0.00157	0.0200
Endrin aldehyde	U		0.00129	0.0200
Endrin ketone	U		0.00165	0.0200
Hexachlorobenzene	U		0.00124	0.0200
Heptachlor	U		0.00154	0.0200
alpha-Chlordane	U		0.00141	0.0200
Heptachlor epoxide	U		0.00161	0.0100
gamma-Chlordane	U		0.00196	0.0200
Methoxychlor	U		0.00178	0.0200
Toxaphene	U		0.0360	0.400
(S) Decachlorobiphenyl	*86.5*			*30.0-150*
(S) Tetrachloro-m-xylene	*86.6*			*30.0-150*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3398435-1 04/04/19 08:40 • (LCSD) R3398435-2 04/04/19 08:53

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Aldrin	0.0666	0.0417	0.0447	62.6	67.1	40.0-140			6.94	30
Alpha BHC	0.0666	0.0416	0.0448	62.5	67.3	40.0-140			7.41	30
Beta BHC	0.0666	0.0413	0.0442	62.0	66.4	40.0-140			6.78	30
Delta BHC	0.0666	0.0389	0.0420	58.4	63.1	40.0-140			7.66	30
Gamma BHC	0.0666	0.0403	0.0433	60.5	65.0	40.0-140			7.18	30
4,4-DDD	0.0666	0.0368	0.0395	55.3	59.3	40.0-140			7.08	30
4,4-DDE	0.0666	0.0385	0.0413	57.8	62.0	40.0-140			7.02	30
4,4-DDT	0.0666	0.0372	0.0400	55.9	60.1	40.0-140			7.25	30

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3398435-1 04/04/19 08:40 • (LCSD) R3398435-2 04/04/19 08:53

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Dieldrin	0.0666	0.0422	0.0451	63.4	67.7	40.0-140			6.64	30
Endosulfan I	0.0666	0.0381	0.0404	57.2	60.7	40.0-140			5.86	30
Endosulfan II	0.0666	0.0358	0.0381	53.8	57.2	40.0-140			6.22	30
Endosulfan sulfate	0.0666	0.0399	0.0430	59.9	64.6	40.0-140			7.48	30
Endrin	0.0666	0.0385	0.0410	57.8	61.6	40.0-140			6.29	30
Endrin aldehyde	0.0666	0.0359	0.0382	53.9	57.4	40.0-140			6.21	30
Endrin ketone	0.0666	0.0397	0.0426	59.6	64.0	40.0-140			7.05	30
Heptachlor	0.0666	0.0382	0.0410	57.4	61.6	40.0-140			7.07	30
Heptachlor epoxide	0.0666	0.0390	0.0417	58.6	62.6	40.0-140			6.69	30
Hexachlorobenzene	0.0666	0.0366	0.0387	55.0	58.1	40.0-140			5.58	30
Methoxychlor	0.0666	0.0366	0.0389	55.0	58.4	40.0-140			6.09	30
alpha-Chlordane	0.0666	0.0411	0.0441	61.7	66.2	40.0-140			7.04	30
gamma-Chlordane	0.0666	0.0409	0.0439	61.4	65.9	40.0-140			7.08	30
(S) Decachlorobiphenyl				*74.9*	*76.6*	*30.0-150*				
(S) Tetrachloro-m-xylene				*75.8*	*76.9*	*30.0-150*				

L1083840-04 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1083840-04 04/04/19 09:30 • (MS) R3398435-4 04/04/19 09:43 • (MSD) R3398435-5 04/04/19 09:55

Analyte	Spike Amount (dry) mg/kg	Original Result (dry) mg/kg	MS Result (dry) mg/kg	MSD Result (dry) mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Aldrin	0.0730	U	0.0694	0.0548	95.0	75.1	1	30.0-150			23.5	30
Alpha BHC	0.0730	U	0.0759	0.0623	104	85.3	1	30.0-150			19.7	30
Beta BHC	0.0730	U	0.0733	0.0607	100	83.2	1	30.0-150		P	18.8	30
Delta BHC	0.0730	U	0.0686	0.0570	94.0	78.1	1	30.0-150			18.5	30
Gamma BHC	0.0730	U	0.0742	0.0611	102	83.6	1	30.0-150			19.4	30
4,4-DDD	0.0730	U	0.301	0.180	413	246	1	30.0-150	J5	J3 J5	50.6	30
4,4-DDE	0.0730	0.0624	0.474	0.0891	563	36.6	1	30.0-150	E J5	J3	137	30
4,4-DDT	0.0730	0.386	2.62	0.231	3060	0.000	1	30.0-150	E V	J3 V	168	30
Dieldrin	0.0730	0.0156	0.230	0.0698	294	74.3	1	30.0-150	J5	J3	107	30
Endosulfan I	0.0730	U	0.0791	0.0500	108	68.5	1	30.0-150		J3	45.2	30
Endosulfan II	0.0730	U	0.0641	0.0524	87.8	71.8	1	30.0-150			20.1	30
Endosulfan sulfate	0.0730	U	0.0719	0.0596	98.5	81.7	1	30.0-150			18.7	30
Endrin	0.0730	U	0.0733	0.0549	100	75.2	1	30.0-150			28.7	30
Endrin aldehyde	0.0730	U	0.0698	0.0568	95.6	77.8	1	30.0-150			20.6	30
Endrin ketone	0.0730	U	0.0787	0.0581	108	79.6	1	30.0-150		J3	30.1	30
Heptachlor	0.0730	U	0.0664	0.0536	91.0	73.4	1	30.0-150			21.4	30
Heptachlor epoxide	0.0730	U	0.0674	0.0547	92.3	74.9	1	30.0-150			20.8	30
Hexachlorobenzene	0.0730	U	0.0611	0.0503	83.6	68.9	1	30.0-150			19.3	30

L1083840-04 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1083840-04 04/04/19 09:30 • (MS) R3398435-4 04/04/19 09:43 • (MSD) R3398435-5 04/04/19 09:55

Analyte	Spike Amount (dry)	Original Result (dry)	MS Result (dry)	MSD Result (dry)	MS Rec.	MSD Rec.	Dilution	Rec. Limits	MS Qualifier	MSD Qualifier	RPD	RPD Limits
	mg/kg	mg/kg	mg/kg	mg/kg	%	%		%			%	%
Methoxychlor	0.0730	U	0.0673	0.0560	92.2	76.7	1	30.0-150			18.3	30
alpha-Chlordane	0.0730	U	0.0943	0.0646	129	88.4	1	30.0-150		J3	37.4	30
gamma-Chlordane	0.0730	U	0.110	0.0586	150	80.3	1	30.0-150		J3	60.5	30
(S) Decachlorobiphenyl					*115*	*110*		*30.0-150*				
(S) Tetrachloro-m-xylene					*95.5*	*79.1*		*30.0-150*				

Method Blank (MB)

(MB) R3398079-1 04/02/19 10:32

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
PCB 1016	U		0.100	0.500
PCB 1221	U		0.0730	0.500
PCB 1232	U		0.0420	0.500
PCB 1242	U		0.0470	0.500
PCB 1248	U		0.0860	0.500
PCB 1254	U		0.0470	0.500
PCB 1260	U		0.120	0.500
(S) Decachlorobiphenyl	*98.6*			*30.0-150*
(S) Tetrachloro-m-xylene	*86.6*			*30.0-150*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3398079-2 04/02/19 10:46 • (LCSD) R3398079-3 04/02/19 11:00

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
PCB 1260	2.50	2.27	2.30	90.8	92.0	40.0-140			1.31	20
PCB 1016	2.50	2.48	2.49	99.2	99.6	40.0-140			0.402	20
(S) Decachlorobiphenyl				*96.9*	*98.8*	*30.0-150*				
(S) Tetrachloro-m-xylene				*90.0*	*92.1*	*30.0-150*				

Method Blank (MB)

(MB) R3398326-1 04/03/19 11:48

Analyte	MB Result	MB Qualifier	MB MDL	MB RDL
	ug/l		ug/l	ug/l
PCB 1016	U		0.100	0.500
PCB 1221	U		0.0730	0.500
PCB 1232	U		0.0420	0.500
PCB 1242	U		0.0470	0.500
PCB 1248	U		0.0860	0.500
PCB 1254	U		0.0470	0.500
PCB 1260	U		0.120	0.500
(S) Decachlorobiphenyl	*114*			*30.0-150*
(S) Tetrachloro-m-xylene	*96.3*			*30.0-150*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3398326-2 04/03/19 12:02 • (LCSD) R3398326-3 04/03/19 12:16

Analyte	Spike Amount	LCS Result	LCSD Result	LCS Rec.	LCSD Rec.	Rec. Limits	LCS Qualifier	LCSD Qualifier	RPD	RPD Limits
	ug/l	ug/l	ug/l	%	%	%			%	%
PCB 1260	2.50	2.06	2.27	82.4	90.8	40.0-140	P	P	9.70	20
PCB 1016	2.50	2.26	2.50	90.4	100	40.0-140	P		10.1	20
(S) Decachlorobiphenyl				*96.1*	*107*	*30.0-150*				
(S) Tetrachloro-m-xylene				*85.5*	*94.5*	*30.0-150*				

Method Blank (MB)

(MB) R3398407-1 04/03/19 12:19

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
PCB 1016	U		0.00350	0.0170
PCB 1221	U		0.00537	0.0170
PCB 1232	U		0.00417	0.0170
PCB 1242	U		0.00318	0.0170
PCB 1248	U		0.00315	0.0170
PCB 1254	U		0.00472	0.0170
PCB 1260	U		0.00494	0.0170
(S) Decachlorobiphenyl	*78.1*			*30.0-150*
(S) Tetrachloro-m-xylene	*74.0*			*30.0-150*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3398407-2 04/03/19 12:32 • (LCSD) R3398407-3 04/03/19 12:44

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
PCB 1260	0.167	0.123	0.0787	73.7	47.1	40.0-140		J3	43.9	30
PCB 1016	0.167	0.130	0.0844	77.8	50.5	40.0-140	P	J3 P	42.5	30
(S) Decachlorobiphenyl				*67.3*	*58.4*	*30.0-150*				
(S) Tetrachloro-m-xylene				*72.5*	*62.0*	*30.0-150*				

L1083840-31 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1083840-31 04/03/19 13:22 • (MS) R3398407-4 04/03/19 13:34 • (MSD) R3398407-5 04/03/19 13:47

Analyte	Spike Amount (dry) mg/kg	Original Result (dry) mg/kg	MS Result (dry) mg/kg	MSD Result (dry) mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
PCB 1260	0.175	U	0.129	0.124	73.7	70.7	1	30.0-150	P	P	4.15	30
PCB 1016	0.175	U	0.155	0.152	88.6	86.8	1	30.0-150	P	P	2.05	30
(S) Decachlorobiphenyl					*84.4*	*78.4*		*30.0-150*				
(S) Tetrachloro-m-xylene					*102*	*96.7*		*30.0-150*				

Method Blank (MB)

(MB) R3398916-1 04/04/19 12:13

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
PCB 1016	U		0.00350	0.0170
PCB 1221	U		0.00537	0.0170
PCB 1232	U		0.00417	0.0170
PCB 1242	U		0.00318	0.0170
PCB 1248	U		0.00315	0.0170
PCB 1254	U		0.00472	0.0170
PCB 1260	U		0.00494	0.0170
(S) Decachlorobiphenyl	*66.5*			*30.0-150*
(S) Tetrachloro-m-xylene	*66.1*			*30.0-150*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3398916-2 04/04/19 12:28 • (LCSD) R3398916-3 04/04/19 12:42

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
PCB 1260	0.167	0.0973	0.0930	58.3	55.7	40.0-140			4.52	30
PCB 1016	0.167	0.0992	0.0947	59.4	56.7	40.0-140			4.64	30
(S) Decachlorobiphenyl				*67.6*	*62.8*	*30.0-150*				
(S) Tetrachloro-m-xylene				*67.7*	*61.3*	*30.0-150*				

L1083840-04 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1083840-04 04/04/19 12:57 • (MS) R3398916-4 04/04/19 13:12 • (MSD) R3398916-5 04/04/19 13:26

Analyte	Spike Amount (dry) mg/kg	Original Result (dry) mg/kg	MS Result (dry) mg/kg	MSD Result (dry) mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
PCB 1260	0.183	U	0.600	0.411	328	225	1	30.0-150	J5	J3 J5	37.3	30
PCB 1016	0.183	U	0.128	0.115	70.1	62.9	1	30.0-150			10.8	30
(S) Decachlorobiphenyl					*85.9*	*77.2*		*30.0-150*				
(S) Tetrachloro-m-xylene					*69.7*	*73.1*		*30.0-150*				

Method Blank (MB)

(MB) R3397719-3 04/02/19 15:16

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Acetophenone	U		2.71	10.0
Atrazine	U		0.260	10.0
Benzaldehyde	U		1.40	10.0
Bis(2-chlorethoxy)methane	U		0.329	10.0
Bis(2-chloroethyl)ether	U		1.62	7.00
Bis(2-chloroisopropyl)ether	U		0.445	10.0
4-Bromophenyl-phenylether	U		0.335	10.0
Biphenyl	U		0.325	10.0
4-Chlorophenyl-phenylether	U		0.303	10.0
Caprolactam	U		2.59	10.0
Carbazole	U		0.260	10.0
4-Chloroaniline	U		0.382	10.0
3,3-Dichlorobenzidine	U		2.02	10.0
2,4-Dinitrotoluene	U		1.65	10.0
2,6-Dinitrotoluene	U		0.279	10.0
Dibenzofuran	U		0.338	10.0
Hexachloro-1,3-butadiene	U		0.329	10.0
Hexachlorocyclopentadiene	U		2.33	10.0
Hexachloroethane	U		0.365	7.00
Isophorone	U		0.272	10.0
Nitrobenzene	U		0.367	6.00
n-Nitrosodiphenylamine	U		1.19	10.0
n-Nitrosodi-n-propylamine	U		0.403	10.0
Benzylbutyl phthalate	U		0.275	10.0
Bis(2-ethylhexyl)phthalate	U		0.709	10.0
Di-n-butyl phthalate	U		0.266	10.0
Diethyl phthalate	U		0.282	10.0
Dimethyl phthalate	U		0.283	10.0
Di-n-octyl phthalate	U		0.278	10.0
2-Nitroaniline	U		1.90	10.0
3-Nitroaniline	U		0.308	10.0
4-Nitroaniline	U		0.349	10.0
4-Chloro-3-methylphenol	U		0.263	10.0
2-Chlorophenol	U		0.283	10.0
2-Nitrophenol	U		0.320	10.0
4-Nitrophenol	U		2.01	10.0
Pentachlorophenol	U		0.313	10.0
Phenol	U		0.334	10.0
2,4,6-Trichlorophenol	U		0.297	10.0
2,4-Dichlorophenol	U		0.284	10.0

Method Blank (MB)

(MB) R3397719-3 04/02/19 15:16

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
2,4-Dimethylphenol	U		0.264	10.0
2-Methylphenol	U		0.312	10.0
3&4-Methyl Phenol	U		0.266	10.0
4,6-Dinitro-2-methylphenol	U		2.62	10.0
2,4-Dinitrophenol	U		3.25	10.0
1,2,4,5-Tetrachlorobenzene	U		2.41	10.0
2,4,5-Trichlorophenol	U		0.236	10.0
(S) Nitrobenzene-d5	*44.3*			*30.0-130*
(S) 2-Fluorobiphenyl	*50.3*			*30.0-130*
(S) p-Terphenyl-d14	*79.2*			*30.0-130*
(S) Phenol-d5	*15.6*			*15.0-110*
(S) 2-Fluorophenol	*31.2*			*15.0-110*
(S) 2,4,6-Tribromophenol	*45.8*			*15.0-110*

Method Blank (MB) - TENTATIVELY IDENTIFIED COMPOUNDS

(MB) R3397719-3 04/02/19 15:16

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l	CAS #

Number of TICs found: 0

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3397719-1 04/02/19 14:29 • (LCSD) R3397719-2 04/02/19 14:52

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Biphenyl	50.0	31.3	31.6	62.6	63.2	70.0-130	J4	J4	0.954	20
Bis(2-chlorethoxy)methane	50.0	29.7	28.9	59.4	57.8	70.0-130	J4	J4	2.73	20
Bis(2-chloroethyl)ether	50.0	30.1	29.3	60.2	58.6	70.0-130	J4	J4	2.69	20
Bis(2-chloroisopropyl)ether	50.0	29.5	29.4	59.0	58.8	70.0-130	J4	J4	0.340	20
4-Bromophenyl-phenylether	50.0	39.3	39.4	78.6	78.8	70.0-130			0.254	20
Carbazole	50.0	59.4	59.4	119	119	70.0-130			0.000	20
4-Chlorophenyl-phenylether	50.0	34.2	36.0	68.4	72.0	70.0-130	J4		5.13	20
3,3-Dichlorobenzidine	100	70.7	68.5	70.7	68.5	70.0-130		J4	3.16	20
2,4-Dinitrotoluene	50.0	41.1	42.6	82.2	85.2	70.0-130			3.58	20
2,6-Dinitrotoluene	50.0	38.8	38.5	77.6	77.0	70.0-130			0.776	20
Atrazine	50.0	40.4	40.8	80.8	81.6	70.0-130			0.985	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3397719-1 04/02/19 14:29 • (LCSD) R3397719-2 04/02/19 14:52

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Hexachloro-1,3-butadiene	50.0	27.2	29.1	54.4	58.2	70.0-130	J4	J4	6.75	20
Benzaldehyde	50.0	44.7	44.5	89.4	89.0	20.0-160			0.448	20
Hexachlorocyclopentadiene	50.0	19.4	20.1	38.8	40.2	20.0-160			3.54	20
Hexachloroethane	50.0	28.8	28.9	57.6	57.8	20.0-160			0.347	20
Isophorone	50.0	31.9	32.2	63.8	64.4	70.0-130	J4	J4	0.936	20
Nitrobenzene	50.0	28.5	28.7	57.0	57.4	70.0-130	J4	J4	0.699	20
n-Nitrosodiphenylamine	50.0	35.3	34.3	70.6	68.6	20.0-160			2.87	20
n-Nitrosodi-n-propylamine	50.0	37.2	37.6	74.4	75.2	70.0-130			1.07	20
Benzylbutyl phthalate	50.0	41.3	42.2	82.6	84.4	70.0-130			2.16	20
Bis(2-ethylhexyl)phthalate	50.0	44.5	45.7	89.0	91.4	70.0-130			2.66	20
Caprolactam	50.0	12.0	12.3	24.0	24.6	20.0-160			2.47	20
Di-n-butyl phthalate	50.0	45.5	46.7	91.0	93.4	70.0-130			2.60	20
Diethyl phthalate	50.0	40.8	41.7	81.6	83.4	70.0-130			2.18	20
Dimethyl phthalate	50.0	38.9	39.6	77.8	79.2	70.0-130			1.78	20
Di-n-octyl phthalate	50.0	41.6	42.8	83.2	85.6	70.0-130			2.84	20
4-Chloroaniline	50.0	31.9	30.4	63.8	60.8	70.0-130	J4	J4	4.82	20
4-Chloro-3-methylphenol	50.0	33.6	33.2	67.2	66.4	70.0-130	J4	J4	1.20	20
2-Chlorophenol	50.0	28.1	26.2	56.2	52.4	70.0-130	J4	J4	7.00	20
Dibenzofuran	50.0	34.3	34.9	68.6	69.8	70.0-130	J4	J4	1.73	20
2,4-Dichlorophenol	50.0	29.9	29.9	59.8	59.8	70.0-130	J4	J4	0.000	20
2,4-Dimethylphenol	50.0	29.4	28.6	58.8	57.2	70.0-130	J4	J4	2.76	20
4,6-Dinitro-2-methylphenol	50.0	43.8	43.4	87.6	86.8	70.0-130			0.917	20
2,4-Dinitrophenol	50.0	22.6	21.8	45.2	43.6	20.0-160			3.60	20
2-Methylphenol	50.0	27.9	25.9	55.8	51.8	70.0-130	J4	J4	7.43	20
3&4-Methyl Phenol	50.0	29.7	28.3	59.4	56.6	20.0-160			4.83	20
2-Nitroaniline	50.0	39.5	40.0	79.0	80.0	70.0-130			1.26	20
3-Nitroaniline	50.0	41.3	41.1	82.6	82.2	70.0-130			0.485	20
4-Nitroaniline	50.0	54.6	53.9	109	108	70.0-130			1.29	20
2-Nitrophenol	50.0	32.0	31.5	64.0	63.0	70.0-130	J4	J4	1.57	20
4-Nitrophenol	50.0	15.7	15.9	31.4	31.8	20.0-160			1.27	20
Pentachlorophenol	50.0	29.8	29.1	59.6	58.2	20.0-160			2.38	20
Phenol	50.0	12.6	11.8	25.2	23.6	20.0-160			6.56	20
2,4,6-Trichlorophenol	50.0	34.7	34.1	69.4	68.2	70.0-130	J4	J4	1.74	20
Acetophenone	50.0	34.3	33.9	68.6	67.8	70.0-130	J4	J4	1.17	20
1,2,4,5-Tetrachlorobenzene	50.0	31.7	32.4	63.4	64.8	70.0-130	J4	J4	2.18	20
2,4,5-Trichlorophenol	50.0	34.0	33.4	68.0	66.8	70.0-130	J4	J4	1.78	20
(S) Nitrobenzene-d5				*53.1*	*50.8*	*30.0-130*				
(S) 2-Fluorobiphenyl				*64.7*	*64.2*	*30.0-130*				
(S) p-Terphenyl-d14				*77.2*	*77.7*	*30.0-130*				
(S) Phenol-d5				*22.7*	*21.8*	*15.0-110*				

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3397719-1 04/02/19 14:29 • (LCSD) R3397719-2 04/02/19 14:52

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
(S) 2-Fluorophenol				*39.4*	*35.5*	*15.0-110*				
(S) 2,4,6-Tribromophenol				*73.5*	*72.0*	*15.0-110*				

L1083914-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1083914-01 04/03/19 00:16 • (MS) R3397719-4 04/03/19 00:39 • (MSD) R3397719-5 04/03/19 01:03

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Acetophenone	50.0	U	33.5	36.3	67.0	72.6	1	70.0-130	J6		8.02	34.9
Atrazine	50.0	U	41.8	42.8	83.6	85.6	1	70.0-130			2.36	20
Benzaldehyde	50.0	U	42.3	49.4	84.6	98.8	1	20.0-160			15.5	37.7
Biphenyl	50.0	U	31.4	32.6	62.8	65.2	1	70.0-130	J6	J6	3.75	20
Caprolactam	50.0	U	13.7	12.9	27.4	25.8	1	20.0-160			6.02	37.3
Carbazole	50.0	U	59.6	60.0	119	120	1	70.0-130			0.669	20
4-Chloroaniline	50.0	U	30.9	31.1	61.8	62.2	1	70.0-130	J6	J6	0.645	21.9
Dibenzofuran	50.0	U	35.2	35.8	70.4	71.6	1	70.0-130			1.69	20
Bis(2-chlorethoxy)methane	50.0	U	28.6	30.0	57.2	60.0	1	70.0-130	J6	J6	4.78	25.8
Bis(2-chloroethyl)ether	50.0	U	28.2	31.9	56.4	63.8	1	70.0-130	J6	J6	12.3	40
Bis(2-chloroisopropyl)ether	50.0	U	28.7	32.0	57.4	64.0	1	70.0-130	J6	J6	10.9	37.2
4-Bromophenyl-phenylether	50.0	U	39.6	40.8	79.2	81.6	1	70.0-130			2.99	23.2
4-Chlorophenyl-phenylether	50.0	U	36.2	36.8	72.4	73.6	1	70.0-130			1.64	20
2-Nitroaniline	50.0	U	39.8	39.5	79.6	79.0	1	70.0-130			0.757	21.8
3-Nitroaniline	50.0	U	42.0	41.7	84.0	83.4	1	70.0-130			0.717	23
3,3-Dichlorobenzidine	100	U	64.8	67.6	64.8	67.6	1	70.0-130	J6	J6	4.23	26.9
4-Nitroaniline	50.0	U	53.2	54.5	106	109	1	70.0-130			2.41	22.4
2,4-Dinitrotoluene	50.0	U	42.1	43.3	84.2	86.6	1	70.0-130			2.81	20.6
2,6-Dinitrotoluene	50.0	U	38.2	39.5	76.4	79.0	1	70.0-130			3.35	22.2
Hexachloro-1,3-butadiene	50.0	U	25.0	27.5	50.0	55.0	1	70.0-130	J6	J6	9.52	37.6
Hexachlorocyclopentadiene	50.0	U	19.9	21.9	39.8	43.8	1	20.0-160			9.57	27.8
Hexachloroethane	50.0	U	24.5	28.2	49.0	56.4	1	20.0-160			14.0	40
Isophorone	50.0	U	31.3	32.4	62.6	64.8	1	70.0-130	J6	J6	3.45	22.9
Nitrobenzene	50.0	U	27.3	30.0	54.6	60.0	1	70.0-130	J6	J6	9.42	29
n-Nitrosodiphenylamine	50.0	U	34.0	35.4	68.0	70.8	1	20.0-160			4.03	20
n-Nitrosodi-n-propylamine	50.0	U	36.9	38.7	73.8	77.4	1	70.0-130			4.76	29.7
2-Methylphenol	50.0	U	27.0	28.6	54.0	57.2	1	70.0-130	J6	J6	5.76	40
Benzylbutyl phthalate	50.0	U	42.5	42.3	85.0	84.6	1	70.0-130			0.472	21.2
3&4-Methyl Phenol	50.0	U	29.6	30.6	59.2	61.2	1	20.0-160			3.32	27.7
Bis(2-ethylhexyl)phthalate	50.0	U	46.0	46.1	92.0	92.2	1	70.0-130			0.217	27.6
Di-n-butyl phthalate	50.0	U	46.7	47.2	93.4	94.4	1	70.0-130			1.06	20

L1083914-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1083914-01 04/03/19 00:16 • (MS) R3397719-4 04/03/19 00:39 • (MSD) R3397719-5 04/03/19 01:03

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Diethyl phthalate	50.0	U	41.0	41.9	82.0	83.8	1	70.0-130			2.17	20
Dimethyl phthalate	50.0	U	39.4	39.7	78.8	79.4	1	70.0-130			0.759	20
Di-n-octyl phthalate	50.0	U	43.1	43.1	86.2	86.2	1	70.0-130			0.000	22.9
2,4,5-Trichlorophenol	50.0	U	33.7	33.9	67.4	67.8	1	70.0-130	J6	J6	0.592	33.8
1,2,4,5-Tetrachlorobenzene	50.0	U	31.7	33.4	63.4	66.8	1	70.0-130	J6	J6	5.22	29.8
4-Chloro-3-methylphenol	50.0	U	34.0	34.2	68.0	68.4	1	70.0-130	J6	J6	0.587	20
2-Chlorophenol	50.0	U	26.4	29.7	52.8	59.4	1	70.0-130	J6	J6	11.8	32.4
2,4-Dichlorophenol	50.0	U	29.1	31.4	58.2	62.8	1	70.0-130	J6	J6	7.60	27.3
2,4-Dimethylphenol	50.0	U	29.8	30.7	59.6	61.4	1	70.0-130	J6	J6	2.98	35.4
4,6-Dinitro-2-methylphenol	50.0	U	43.5	44.8	87.0	89.6	1	70.0-130			2.94	37.4
2,4-Dinitrophenol	50.0	U	28.6	30.0	57.2	60.0	1	20.0-160			4.78	40
2-Nitrophenol	50.0	U	30.5	33.4	61.0	66.8	1	70.0-130	J6	J6	9.08	34
4-Nitrophenol	50.0	U	15.9	15.3	31.8	30.6	1	20.0-160			3.85	40
Pentachlorophenol	50.0	U	35.4	36.7	70.8	73.4	1	20.0-160			3.61	40
Phenol	50.0	U	12.8	13.1	25.6	26.2	1	20.0-160			2.32	40
2,4,6-Trichlorophenol	50.0	U	34.2	34.8	68.4	69.6	1	70.0-130	J6	J6	1.74	29.9
(S) Nitrobenzene-d5					*49.2*	*54.6*		*30.0-130*				
(S) 2-Fluorobiphenyl					*64.5*	*64.0*		*30.0-130*				
(S) p-Terphenyl-d14					*74.4*	*69.6*		*30.0-130*				
(S) Phenol-d5					*24.1*	*24.0*		*15.0-110*				
(S) 2-Fluorophenol					*38.8*	*40.9*		*15.0-110*				
(S) 2,4,6-Tribromophenol					*73.0*	*72.0*		*15.0-110*				

Method Blank (MB)

(MB) R3398228-3 04/03/19 19:44

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Acetophenone	U		2.71	10.0
Atrazine	U		0.260	10.0
Benzaldehyde	U		1.40	10.0
Bis(2-chlorethoxy)methane	U		0.329	10.0
Bis(2-chloroethyl)ether	U		1.62	7.00
Bis(2-chloroisopropyl)ether	U		0.445	10.0
4-Bromophenyl-phenylether	U		0.335	10.0
Biphenyl	U		0.325	10.0
Carbazole	U		0.260	10.0
4-Chlorophenyl-phenylether	U		0.303	10.0
Caprolactam	U		2.59	10.0
3,3-Dichlorobenzidine	U		2.02	10.0
2,4-Dinitrotoluene	U		1.65	10.0
2,6-Dinitrotoluene	U		0.279	10.0
Hexachloro-1,3-butadiene	U		0.329	10.0
Hexachlorocyclopentadiene	U		2.33	10.0
Hexachloroethane	U		0.365	7.00
Isophorone	U		0.272	10.0
Nitrobenzene	U		0.367	6.00
n-Nitrosodiphenylamine	U		1.19	10.0
n-Nitrosodi-n-propylamine	U		0.403	10.0
Benzylbutyl phthalate	U		0.275	10.0
Bis(2-ethylhexyl)phthalate	U		0.709	10.0
Di-n-butyl phthalate	U		0.266	10.0
Diethyl phthalate	U		0.282	10.0
Dimethyl phthalate	U		0.283	10.0
Di-n-octyl phthalate	U		0.278	10.0
4-Chloroaniline	U		0.382	10.0
4-Chloro-3-methylphenol	U		0.263	10.0
2-Chlorophenol	U		0.283	10.0
2-Nitrophenol	U		0.320	10.0
4-Nitrophenol	U		2.01	10.0
Pentachlorophenol	U		0.313	10.0
Phenol	U		0.334	10.0
2,4,6-Trichlorophenol	U		0.297	10.0
Dibenzofuran	U		0.338	10.0
2,4-Dichlorophenol	U		0.284	10.0
2,4-Dimethylphenol	U		0.264	10.0
4,6-Dinitro-2-methylphenol	U		2.62	10.0
2,4-Dinitrophenol	U		3.25	10.0

Method Blank (MB)

(MB) R3398228-3 04/03/19 19:44

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
2-Methylphenol	U		0.312	10.0
3&4-Methyl Phenol	U		0.266	10.0
2-Nitroaniline	U		1.90	10.0
3-Nitroaniline	U		0.308	10.0
4-Nitroaniline	U		0.349	10.0
1,2,4,5-Tetrachlorobenzene	U		2.41	10.0
2,4,5-Trichlorophenol	U		0.236	10.0
(S) Nitrobenzene-d5	*28.9*	J2		*30.0-130*
(S) 2-Fluorobiphenyl	*32.9*			*30.0-130*
(S) p-Terphenyl-d14	*65.6*			*30.0-130*
(S) Phenol-d5	*15.6*			*15.0-110*
(S) 2-Fluorophenol	*25.1*			*15.0-110*
(S) 2,4,6-Tribromophenol	*41.8*			*15.0-110*

Method Blank (MB) - TENTATIVELY IDENTIFIED COMPOUNDS

(MB) R3398228-3 04/03/19 19:44

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l	CAS #

Number of TICs found: 0

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Method Blank (MB)

(MB) R3398717-1 04/04/19 17:48

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
Anthracene	U		0.00728	0.0330
Acenaphthene	U		0.00737	0.0330
Acenaphthylene	U		0.00751	0.0330
Benzo(a)anthracene	U		0.00428	0.0330
Benzo(a)pyrene	U		0.00502	0.0330
Benzo(b)fluoranthene	U		0.00695	0.0330
Benzo(g,h,i)perylene	U		0.00721	0.0330
Benzo(k)fluoranthene	U		0.00506	0.0330
Chrysene	U		0.00785	0.0330
Dibenz(a,h)anthracene	U		0.00591	0.0330
Fluoranthene	U		0.00708	0.0330
Fluorene	U		0.00719	0.0330
Indeno(1,2,3-cd)pyrene	U		0.00561	0.0330
Naphthalene	U		0.00513	0.0330
Phenanthrene	U		0.00710	0.0330
Pyrene	U		0.00776	0.0330
(S) Nitrobenzene-d5	*78.5*			*31.0-146*
(S) 2-Fluorobiphenyl	*96.4*			*31.0-130*
(S) p-Terphenyl-d14	*105*			*20.0-127*

Method Blank (MB) - TENTATIVELY IDENTIFIED COMPOUNDS

(MB) R3398717-1 04/04/19 17:48

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg	CAS #

Number of TICs found: 0

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Method Blank (MB)

(MB) R3398837-1 04/05/19 09:43

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
Anthracene	U		0.00728	0.0330
Acenaphthene	U		0.00737	0.0330
Acenaphthylene	U		0.00751	0.0330
Benzo(a)anthracene	U		0.00428	0.0330
Benzo(a)pyrene	U		0.00502	0.0330

Method Blank (MB)

(MB) R3398837-1 04/05/19 09:43

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
Benzo(b)fluoranthene	U		0.00695	0.0330
Benzo(g,h,i)perylene	U		0.00721	0.0330
Benzo(k)fluoranthene	U		0.00506	0.0330
Chrysene	U		0.00785	0.0330
Dibenz(a,h)anthracene	U		0.00591	0.0330
Fluoranthene	U		0.00708	0.0330
Fluorene	U		0.00719	0.0330
Indeno(1,2,3-cd)pyrene	U		0.00561	0.0330
Naphthalene	U		0.00513	0.0330
Phenanthrene	U		0.00710	0.0330
Pyrene	U		0.00776	0.0330
(S) Nitrobenzene-d5	*75.9*			*31.0-146*
(S) 2-Fluorobiphenyl	*94.8*			*31.0-130*
(S) p-Terphenyl-d14	*105*			*20.0-127*

Method Blank (MB) - TENTATIVELY IDENTIFIED COMPOUNDS

(MB) R3398837-1 04/05/19 09:43

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg	CAS #

Number of TICs found: 0

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3398717-4 04/04/19 19:03 • (LCSD) R3398717-5 04/04/19 19:27

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Acenaphthene	0.400	0.371	0.365	92.7	91.3	70.0-130			1.63	30
Acenaphthylene	0.400	0.357	0.347	89.3	86.8	70.0-130			2.84	30
Anthracene	0.400	0.367	0.362	91.8	90.5	70.0-130			1.37	30
Benzo(a)anthracene	0.400	0.352	0.343	88.0	85.7	70.0-130			2.59	30
Benzo(b)fluoranthene	0.400	0.392	0.380	98.0	95.0	70.0-130			3.11	30
Benzo(k)fluoranthene	0.400	0.400	0.386	100	96.5	70.0-130			3.56	30
Benzo(g,h,i)perylene	0.400	0.429	0.413	107	103	70.0-130			3.80	30
Benzo(a)pyrene	0.400	0.390	0.369	97.5	92.2	70.0-130			5.53	30
Chrysene	0.400	0.365	0.361	91.3	90.3	70.0-130			1.10	30
Dibenz(a,h)anthracene	0.400	0.462	0.441	116	110	70.0-130			4.65	30

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3398717-4 04/04/19 19:03 • (LCSD) R3398717-5 04/04/19 19:27

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Fluoranthene	0.400	0.386	0.376	96.5	94.0	70.0-130			2.62	30
Fluorene	0.400	0.382	0.367	95.5	91.8	70.0-130			4.01	30
Indeno(1,2,3-cd)pyrene	0.400	0.436	0.411	109	103	70.0-130			5.90	30
Naphthalene	0.400	0.358	0.346	89.5	86.5	70.0-130			3.41	30
Phenanthrene	0.400	0.369	0.373	92.2	93.3	70.0-130			1.08	30
Pyrene	0.400	0.342	0.336	85.5	84.0	70.0-130			1.77	30
(S) Nitrobenzene-d5				*80.9*	*79.9*	*31.0-146*				
(S) 2-Fluorobiphenyl				*100*	*101*	*31.0-130*				
(S) p-Terphenyl-d14				*101*	*103*	*20.0-127*				

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Method Blank (MB)

(MB) R3399893-3 04/09/19 09:52

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
Acenaphthene	U		0.00642	0.0330
Acenaphthylene	U		0.00671	0.0330
Acetophenone	U		0.0752	0.150
Anthracene	U		0.00632	0.0330
Atrazine	U		0.0938	0.150
Benzaldehyde	U		0.0532	0.150
Benzo(a)anthracene	U		0.00428	0.0330
Benzo(b)fluoranthene	U		0.00695	0.0330
Benzo(k)fluoranthene	U		0.00582	0.0330
Benzo(g,h,i)perylene	U		0.00721	0.0330
Biphenyl	U		0.00588	0.150
Benzo(a)pyrene	U		0.00548	0.0330
Bis(2-chlorethoxy)methane	U		0.00770	0.150
Bis(2-chloroethyl)ether	U		0.00896	0.150
Bis(2-chloroisopropyl)ether	U		0.00760	0.150
Caprolactam	U		0.104	0.150
4-Bromophenyl-phenylether	U		0.0114	0.150
Carbazole	U		0.00524	0.150
4-Chloroaniline	U		0.0352	0.150
2-Chloronaphthalene	U		0.00639	0.0330
4-Chlorophenyl-phenylether	U		0.00627	0.150
Chrysene	U		0.00555	0.0330
Dibenzofuran	U		0.00518	0.150
Dibenz(a,h)anthracene	U		0.00821	0.0330
3,3-Dichlorobenzidine	U		0.0794	0.150
2,4-Dinitrotoluene	U		0.00607	0.150
2,6-Dinitrotoluene	U		0.00737	0.150
Fluoranthene	U		0.00496	0.0330
Fluorene	U		0.00682	0.0330
Hexachlorobenzene	U		0.00856	0.150
2-Methylnaphthalene	U		0.00861	0.0330
Hexachloro-1,3-butadiene	U		0.0100	0.150
Hexachlorocyclopentadiene	U		0.0587	0.150
2-Nitroaniline	U		0.00755	0.150
Hexachloroethane	U		0.0134	0.150
3-Nitroaniline	U		0.00850	0.150
Indeno(1,2,3-cd)pyrene	U		0.00772	0.0330
4-Nitroaniline	U		0.00639	0.150
Isophorone	U		0.00522	0.150
Naphthalene	U		0.00889	0.0330

Method Blank (MB)

(MB) R3399893-3 04/09/19 09:52

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
Nitrobenzene	U		0.00695	0.150
n-Nitrosodiphenylamine	U		0.00594	0.150
n-Nitrosodi-n-propylamine	U		0.00906	0.150
Phenanthrene	U		0.00528	0.0330
1,2,4,5-Tetrachlorobenzene	U		0.0762	0.150
Benzylbutyl phthalate	U		0.0103	0.150
Bis(2-ethylhexyl)phthalate	U		0.0120	0.150
Di-n-butyl phthalate	U		0.0109	0.150
Diethyl phthalate	U		0.00691	0.150
Dimethyl phthalate	U		0.00540	0.150
Di-n-octyl phthalate	U		0.00907	0.150
Pyrene	U		0.0123	0.0330
4-Chloro-3-methylphenol	U		0.00477	0.150
2-Chlorophenol	U		0.00831	0.150
2-Methylphenol	U		0.00986	0.150
3&4-Methyl Phenol	U		0.00783	0.150
2,4-Dichlorophenol	U		0.00746	0.150
2,4-Dimethylphenol	U		0.0471	0.150
4,6-Dinitro-2-methylphenol	U		0.124	0.200
2,4-Dinitrophenol	U		0.0980	0.200
2-Nitrophenol	U		0.0130	0.150
4-Nitrophenol	U		0.0525	0.150
Pentachlorophenol	U		0.0480	0.150
Phenol	U		0.00695	0.150
2,4,5-Trichlorophenol	U		0.0104	0.150
2,4,6-Trichlorophenol	U		0.00779	0.150
(S) Nitrobenzene-d5	*68.2*			*30.0-130*
(S) 2-Fluorobiphenyl	*68.5*			*30.0-130*
(S) p-Terphenyl-d14	*75.4*			*30.0-130*
(S) Phenol-d5	*69.5*			*30.0-130*
(S) 2-Fluorophenol	*79.1*			*30.0-130*
(S) 2,4,6-Tribromophenol	*70.3*			*30.0-130*

Method Blank (MB) - TENTATIVELY IDENTIFIED COMPOUNDS

(MB) R3399893-3 04/09/19 09:52

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg	CAS #

Number of TICs found: 0

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3399893-1 04/09/19 09:13 • (LCSD) R3399893-2 04/09/19 09:32

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Acenaphthene	0.666	0.469	0.340	70.4	51.1	70.0-130		J3 J4	31.9	30
Acenaphthylene	0.666	0.503	0.367	75.5	55.1	70.0-130		J3 J4	31.3	30
Acetophenone	0.666	0.465	0.277	69.8	41.6	70.0-130	J4	J3 J4	50.7	30
Anthracene	0.666	0.489	0.434	73.4	65.2	70.0-130		J4	11.9	30
Atrazine	0.666	0.548	0.469	82.3	70.4	70.0-130			15.5	30
Benzaldehyde	0.666	0.549	0.341	82.4	51.2	20.0-160		J3	46.7	30
Benzo(a)anthracene	0.666	0.535	0.483	80.3	72.5	70.0-130			10.2	30
Benzo(b)fluoranthene	0.666	0.533	0.496	80.0	74.5	70.0-130			7.19	30
Benzo(k)fluoranthene	0.666	0.513	0.476	77.0	71.5	70.0-130			7.48	30
Benzo(g,h,i)perylene	0.666	0.511	0.476	76.7	71.5	70.0-130			7.09	30
Benzo(a)pyrene	0.666	0.526	0.491	79.0	73.7	70.0-130			6.88	30
Biphenyl	0.666	0.461	0.323	69.2	48.5	70.0-130	J4	J3 J4	35.2	30
Bis(2-chlorethoxy)methane	0.666	0.372	0.259	55.9	38.9	70.0-130	J4	J3 J4	35.8	30
Bis(2-chloroethyl)ether	0.666	0.451	0.250	67.7	37.5	70.0-130	J4	J3 J4	57.3	30
Bis(2-chloroisopropyl)ether	0.666	0.435	0.228	65.3	34.2	70.0-130	J4	J3 J4	62.4	30
4-Bromophenyl-phenylether	0.666	0.489	0.427	73.4	64.1	70.0-130		J4	13.5	30
Caprolactam	0.666	0.516	0.456	77.5	68.5	20.0-160			12.3	30
Carbazole	0.666	0.519	0.473	77.9	71.0	70.0-130			9.27	30
4-Chloroaniline	0.666	0.361	0.266	54.2	39.9	70.0-130	J4	J3 J4	30.3	30
2-Chloronaphthalene	0.666	0.462	0.326	69.4	48.9	70.0-130	J4	J3 J4	34.5	30
4-Chlorophenyl-phenylether	0.666	0.501	0.382	75.2	57.4	70.0-130		J4	27.0	30
Chrysene	0.666	0.496	0.449	74.5	67.4	70.0-130		J4	9.95	30
Dibenz(a,h)anthracene	0.666	0.529	0.480	79.4	72.1	70.0-130			9.71	30
Dibenzofuran	0.666	0.486	0.357	73.0	53.6	70.0-130		J3 J4	30.6	30
3,3-Dichlorobenzidine	1.33	1.02	0.934	76.7	70.2	70.0-130			8.80	30
2,4-Dinitrotoluene	0.666	0.528	0.459	79.3	68.9	70.0-130		J4	14.0	30
2,6-Dinitrotoluene	0.666	0.541	0.433	81.2	65.0	70.0-130		J4	22.2	30
Fluoranthene	0.666	0.528	0.475	79.3	71.3	70.0-130			10.6	30
Fluorene	0.666	0.490	0.394	73.6	59.2	70.0-130		J4	21.7	30
Hexachlorobenzene	0.666	0.504	0.432	75.7	64.9	70.0-130		J4	15.4	30

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3399893-1 04/09/19 09:13 • (LCSD) R3399893-2 04/09/19 09:32

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Hexachloro-1,3-butadiene	0.666	0.389	0.251	58.4	37.7	70.0-130	J4	J3 J4	43.1	30
Hexachlorocyclopentadiene	0.666	0.389	0.231	58.4	34.7	20.0-160		J3	51.0	30
Hexachloroethane	0.666	0.419	0.237	62.9	35.6	20.0-160		J3	55.5	30
Indeno(1,2,3-cd)pyrene	0.666	0.535	0.488	80.3	73.3	70.0-130			9.19	30
Isophorone	0.666	0.374	0.274	56.2	41.1	70.0-130	J4	J3 J4	30.9	30
2-Methylnaphthalene	0.666	0.379	0.266	56.9	39.9	70.0-130	J4	J3 J4	35.0	30
Naphthalene	0.666	0.390	0.252	58.6	37.8	70.0-130	J4	J3 J4	43.0	30
2-Nitroaniline	0.666	0.543	0.413	81.5	62.0	70.0-130		J4	27.2	30
3-Nitroaniline	0.666	0.525	0.439	78.8	65.9	70.0-130		J4	17.8	30
4-Nitroaniline	0.666	0.532	0.455	79.9	68.3	70.0-130		J4	15.6	30
Nitrobenzene	0.666	0.385	0.251	57.8	37.7	70.0-130	J4	J3 J4	42.1	30
n-Nitrosodiphenylamine	0.666	0.502	0.435	75.4	65.3	20.0-160			14.3	30
n-Nitrosodi-n-propylamine	0.666	0.442	0.278	66.4	41.7	70.0-130	J4	J3 J4	45.6	30
Phenanthrene	0.666	0.499	0.437	74.9	65.6	70.0-130		J4	13.2	30
Benzylbutyl phthalate	0.666	0.518	0.485	77.8	72.8	70.0-130			6.58	30
Bis(2-ethylhexyl)phthalate	0.666	0.515	0.485	77.3	72.8	70.0-130			6.00	30
Di-n-butyl phthalate	0.666	0.523	0.478	78.5	71.8	70.0-130			8.99	30
Diethyl phthalate	0.666	0.513	0.435	77.0	65.3	70.0-130		J4	16.5	30
Dimethyl phthalate	0.666	0.506	0.406	76.0	61.0	70.0-130		J4	21.9	30
Di-n-octyl phthalate	0.666	0.539	0.494	80.9	74.2	70.0-130			8.71	30
Pyrene	0.666	0.516	0.478	77.5	71.8	70.0-130			7.65	30
4-Chloro-3-methylphenol	0.666	0.438	0.357	65.8	53.6	70.0-130	J4	J4	20.4	30
2-Chlorophenol	0.666	0.521	0.302	78.2	45.3	70.0-130		J3 J4	53.2	30
2-Methylphenol	0.666	0.497	0.308	74.6	46.2	70.0-130		J3 J4	47.0	30
3&4-Methyl Phenol	0.666	0.541	0.355	81.2	53.3	20.0-160		J3	41.5	30
2,4-Dichlorophenol	0.666	0.452	0.330	67.9	49.5	70.0-130	J4	J3 J4	31.2	30
2,4-Dimethylphenol	0.666	0.438	0.316	65.8	47.4	70.0-130	J4	J3 J4	32.4	30
4,6-Dinitro-2-methylphenol	0.666	0.431	0.345	64.7	51.8	70.0-130	J4	J4	22.2	30
2,4-Dinitrophenol	0.666	0.290	0.202	43.5	30.3	20.0-160		J3	35.8	30
2-Nitrophenol	0.666	0.418	0.293	62.8	44.0	70.0-130	J4	J3 J4	35.2	30
4-Nitrophenol	0.666	0.518	0.470	77.8	70.6	20.0-160			9.72	30
Pentachlorophenol	0.666	0.493	0.430	74.0	64.6	20.0-160			13.7	30
Phenol	0.666	0.507	0.308	76.1	46.2	20.0-160		J3	48.8	30
1,2,4,5-Tetrachlorobenzene	0.666	0.500	0.368	75.1	55.3	70.0-130		J3 J4	30.4	30
2,4,5-Trichlorophenol	0.666	0.567	0.439	85.1	65.9	70.0-130		J4	25.4	30
2,4,6-Trichlorophenol	0.666	0.532	0.390	79.9	58.6	70.0-130		J3 J4	30.8	30
(S) Nitrobenzene-d5				*57.7*	*39.9*	*30.0-130*				
(S) 2-Fluorobiphenyl				*70.6*	*48.6*	*30.0-130*				
(S) p-Terphenyl-d14				*75.1*	*69.4*	*30.0-130*				
(S) Phenol-d5				*73.7*	*45.3*	*30.0-130*				

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3399893-1 04/09/19 09:13 • (LCSD) R3399893-2 04/09/19 09:32

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
(S) 2-Fluorophenol				*85.0*	*48.6*	*30.0-130*				
(S) 2,4,6-Tribromophenol				*75.8*	*65.9*	*30.0-130*				

L1083840-31 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1083840-31 04/09/19 10:53 • (MS) R3399893-4 04/09/19 11:12 • (MSD) R3399893-5 04/09/19 11:32

Analyte	Spike Amount (dry) mg/kg	Original Result (dry) mg/kg	MS Result (dry) mg/kg	MSD Result (dry) mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Acetophenone	0.697	U	0.271	0.385	38.9	55.3	1	70.0-130	J6	J3 J6	34.8	30
Atrazine	0.697	U	0.470	0.545	67.4	78.2	1	70.0-130	J6		14.8	30
Benzaldehyde	0.697	U	0.299	0.267	42.9	38.3	1	20.0-160			11.5	30
Biphenyl	0.697	U	0.236	0.392	33.8	56.2	1	70.0-130	J6	J3 J6	49.7	30
Caprolactam	0.697	U	0.474	0.520	68.0	74.6	1	20.0-160			9.26	30
Carbazole	0.697	U	0.463	0.500	66.4	71.8	1	70.0-130	J6		7.83	30
4-Chloroaniline	0.697	U	0.291	0.322	41.7	46.2	1	70.0-130	J6	J6	10.2	30
Dibenzofuran	0.697	U	0.272	0.416	39.0	59.6	1	70.0-130	J6	J3 J6	41.7	30
2-Methylnaphthalene	0.697	U	0.214	0.347	30.6	49.7	1	70.0-130	J6	J3 J6	47.5	30
2-Nitroaniline	0.697	U	0.398	0.483	57.1	69.2	1	70.0-130	J6	J6	19.3	30
3-Nitroaniline	0.697	U	0.430	0.492	61.7	70.6	1	70.0-130	J6		13.4	30
4-Nitroaniline	0.697	U	0.462	0.513	66.2	73.6	1	70.0-130	J6		10.5	30
1,2,4,5-Tetrachlorobenzene	0.697	U	0.266	0.456	38.1	65.5	1	70.0-130	J6	J3 J6	52.8	30
Acenaphthene	0.697	U	0.258	0.391	36.9	56.0	1	70.0-130	J6	J3 J6	41.0	30
Acenaphthylene	0.697	U	0.283	0.430	40.5	61.7	1	70.0-130	J6	J3 J6	41.4	30
Anthracene	0.697	U	0.380	0.459	54.5	65.8	1	70.0-130	J6	J6	18.7	30
Benzo(a)anthracene	0.697	U	0.464	0.498	66.5	71.5	1	70.0-130	J6		7.18	30
Benzo(b)fluoranthene	0.697	U	0.456	0.484	65.5	69.4	1	70.0-130	J6	J6	5.79	30
Benzo(k)fluoranthene	0.697	U	0.437	0.478	62.6	68.6	1	70.0-130	J6	J6	9.15	30
Benzo(g,h,i)perylene	0.697	U	0.440	0.462	63.1	66.2	1	70.0-130	J6	J6	4.88	30
Benzo(a)pyrene	0.697	U	0.452	0.481	64.9	68.9	1	70.0-130	J6	J6	6.06	30
Bis(2-chlorethoxy)methane	0.697	U	0.254	0.344	36.5	49.4	1	70.0-130	J6	J3 J6	30.1	30
Bis(2-chloroethyl)ether	0.697	U	0.250	0.389	35.9	55.9	1	70.0-130	J6	J3 J6	43.5	30
Bis(2-chloroisopropyl)ether	0.697	U	0.223	0.354	32.0	50.8	1	70.0-130	J6	J3 J6	45.4	30
4-Bromophenyl-phenylether	0.697	U	0.324	0.426	46.4	61.1	1	70.0-130	J6	J6	27.4	30
2-Chloronaphthalene	0.697	U	0.238	0.384	34.1	55.1	1	70.0-130	J6	J3 J6	47.1	30
4-Chlorophenyl-phenylether	0.697	U	0.292	0.446	41.9	64.0	1	70.0-130	J6	J3 J6	41.7	30
Chrysene	0.697	U	0.427	0.464	61.3	66.5	1	70.0-130	J6	J6	8.23	30
Dibenz(a,h)anthracene	0.697	U	0.433	0.487	62.2	69.8	1	70.0-130	J6	J6	11.6	30
3,3-Dichlorobenzidine	1.39	U	0.911	0.957	65.4	68.7	1	70.0-130	J6	J6	4.93	30
2,4-Dinitrotoluene	0.697	U	0.426	0.491	61.1	70.4	1	70.0-130	J6		14.2	30

L1083840-31 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1083840-31 04/09/19 10:53 • (MS) R3399893-4 04/09/19 11:12 • (MSD) R3399893-5 04/09/19 11:32

Analyte	Spike Amount (dry) mg/kg	Original Result (dry) mg/kg	MS Result (dry) mg/kg	MSD Result (dry) mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
2,6-Dinitrotoluene	0.697	U	0.356	0.499	51.1	71.6	1	70.0-130	J6	J3	33.5	30
Fluoranthene	0.697	U	0.472	0.493	67.7	70.7	1	70.0-130	J6		4.34	30
Fluorene	0.697	U	0.310	0.441	44.4	63.2	1	70.0-130	J6	J3 J6	34.9	30
Hexachlorobenzene	0.697	U	0.367	0.440	52.7	63.1	1	70.0-130	J6	J6	17.9	30
Hexachloro-1,3-butadiene	0.697	U	0.178	0.339	25.5	48.6	1	70.0-130	J6	J3 J6	62.3	30
Hexachlorocyclopentadiene	0.697	U	0.150	0.313	21.5	44.9	1	20.0-160		J3	70.6	30
Hexachloroethane	0.697	U	0.166	0.343	23.9	49.2	1	20.0-160		J3	69.4	30
Indeno(1,2,3-cd)pyrene	0.697	U	0.446	0.478	64.0	68.6	1	70.0-130	J6	J6	7.02	30
Isophorone	0.697	U	0.263	0.349	37.7	50.0	1	70.0-130	J6	J6	28.1	30
Naphthalene	0.697	U	0.211	0.338	30.3	48.5	1	70.0-130	J6	J3 J6	46.1	30
Nitrobenzene	0.697	U	0.231	0.332	33.2	47.6	1	70.0-130	J6	J3 J6	35.7	30
n-Nitrosodiphenylamine	0.697	U	0.367	0.448	52.7	64.3	1	20.0-160			19.8	30
n-Nitrosodi-n-propylamine	0.697	U	0.283	0.382	40.5	54.8	1	70.0-130	J6	J6	29.9	30
Phenanthrene	0.697	U	0.376	0.449	53.9	64.4	1	70.0-130	J6	J6	17.8	30
Benzylbutyl phthalate	0.697	U	0.442	0.482	63.4	69.1	1	70.0-130	J6	J6	8.62	30
Bis(2-ethylhexyl)phthalate	0.697	U	0.450	0.483	64.6	69.2	1	70.0-130	J6	J6	6.96	30
Di-n-butyl phthalate	0.697	U	0.453	0.476	65.0	68.3	1	70.0-130	J6	J6	4.95	30
Diethyl phthalate	0.697	U	0.381	0.480	54.7	68.8	1	70.0-130	J6	J6	22.9	30
Dimethyl phthalate	0.697	U	0.359	0.453	51.5	65.0	1	70.0-130	J6	J6	23.2	30
Di-n-octyl phthalate	0.697	U	0.462	0.498	66.2	71.5	1	70.0-130	J6		7.63	30
Pyrene	0.697	U	0.437	0.474	62.6	68.0	1	70.0-130	J6	J6	8.28	30
4-Chloro-3-methylphenol	0.697	U	0.328	0.418	47.0	59.9	1	70.0-130	J6	J6	24.2	30
2-Chlorophenol	0.697	U	0.317	0.419	45.5	60.1	1	70.0-130	J6	J6	27.6	30
2-Methylphenol	0.697	U	0.366	0.425	52.6	61.0	1	70.0-130	J6	J6	14.8	30
3&4-Methyl Phenol	0.697	U	0.408	0.473	58.6	67.9	1	20.0-160			14.7	30
2,4-Dichlorophenol	0.697	U	0.311	0.398	44.6	57.1	1	70.0-130	J6	J6	24.5	30
2,4-Dimethylphenol	0.697	U	0.326	0.420	46.7	60.2	1	70.0-130	J6	J6	25.3	30
4,6-Dinitro-2-methylphenol	0.697	U	0.470	0.449	67.4	64.4	1	70.0-130	J6	J6	4.56	30
2,4-Dinitrophenol	0.697	U	0.447	0.462	64.1	66.2	1	20.0-160			3.23	30
2-Nitrophenol	0.697	U	0.272	0.378	39.0	54.2	1	70.0-130	J6	J3 J6	32.5	30
4-Nitrophenol	0.697	U	0.499	0.536	71.6	76.9	1	20.0-160			7.08	30
Pentachlorophenol	0.697	U	0.458	0.441	65.6	63.2	1	20.0-160			3.73	30
Phenol	0.697	U	0.369	0.427	52.9	61.3	1	20.0-160			14.7	30
2,4,5-Trichlorophenol	0.697	U	0.361	0.519	51.8	74.5	1	70.0-130	J6	J3	35.9	30
2,4,6-Trichlorophenol	0.697	U	0.308	0.438	44.1	62.8	1	70.0-130	J6	J3 J6	34.8	30
(S) Nitrobenzene-d5					*34.8*	*52.3*		*30.0-130*				
(S) 2-Fluorobiphenyl					*35.4*	*59.5*		*30.0-130*				
(S) p-Terphenyl-d14					*61.6*	*71.2*		*30.0-130*				
(S) Phenol-d5					*53.9*	*67.3*		*30.0-130*				

L1083840-31 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1083840-31 04/09/19 10:53 • (MS) R3399893-4 04/09/19 11:12 • (MSD) R3399893-5 04/09/19 11:32

Analyte	Spike Amount (dry) mg/kg	Original Result (dry) mg/kg	MS Result (dry) mg/kg	MSD Result (dry) mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
(S) 2-Fluorophenol					*53.0*	*71.6*		*30.0-130*				
(S) 2,4,6-Tribromophenol					*56.0*	*66.8*		*30.0-130*				

Method Blank (MB)

(MB) R3398662-3 04/04/19 09:30

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Anthracene	U		0.00800	0.0500
Acenaphthene	U		0.0100	0.0500
Acenaphthylene	U		0.0120	0.0500
Benzo(a)anthracene	U		0.00410	0.0500
Benzo(a)pyrene	U		0.0116	0.0500
Benzo(b)fluoranthene	U		0.00212	0.0500
Benzo(g,h,i)perylene	U		0.00227	0.0500
Benzo(k)fluoranthene	U		0.0136	0.0500
Chrysene	U		0.0108	0.0500
Dibenz(a,h)anthracene	U		0.00396	0.0500
Fluoranthene	U		0.0157	0.0500
Fluorene	U		0.00850	0.0500
Hexachlorobenzene	U		0.00670	0.0200
Indeno(1,2,3-cd)pyrene	U		0.0148	0.0500
Naphthalene	U		0.0198	0.250
Phenanthrene	U		0.00820	0.0500
Pyrene	U		0.0117	0.0500
1-Methylnaphthalene	U		0.00821	0.250
2-Methylnaphthalene	U		0.00902	0.250
2-Chloronaphthalene	U		0.00647	0.250
(S) Nitrobenzene-d5	*85.0*			*31.0-160*
(S) 2-Fluorobiphenyl	*85.0*			*48.0-148*
(S) p-Terphenyl-d14	*87.0*			*37.0-146*

Method Blank (MB) - TENTATIVELY IDENTIFIED COMPOUNDS

(MB) R3398662-3 04/04/19 09:30

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l	CAS #

Number of TICs found: 0

Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TICs are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TICs are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3398662-1 04/04/19 08:46 • (LCSD) R3398662-2 04/04/19 09:08

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Anthracene	2.00	1.80	1.80	90.0	90.0	70.0-130			0.000	20
Acenaphthene	2.00	1.77	1.74	88.5	87.0	70.0-130			1.71	20
Acenaphthylene	2.00	1.77	1.74	88.5	87.0	70.0-130			1.71	20
Benzo(a)anthracene	2.00	1.70	1.70	85.0	85.0	70.0-130			0.000	20
Benzo(a)pyrene	2.00	1.76	1.74	88.0	87.0	70.0-130			1.14	20
Benzo(b)fluoranthene	2.00	1.72	1.72	86.0	86.0	70.0-130			0.000	20
Benzo(g,h,i)perylene	2.00	1.78	1.74	89.0	87.0	70.0-130			2.27	20
Benzo(k)fluoranthene	2.00	1.82	1.75	91.0	87.5	70.0-130			3.92	20
Chrysene	2.00	1.72	1.71	86.0	85.5	70.0-130			0.583	20
Dibenz(a,h)anthracene	2.00	1.77	1.72	88.5	86.0	70.0-130			2.87	20
Fluoranthene	2.00	1.88	1.86	94.0	93.0	70.0-130			1.07	20
Fluorene	2.00	1.78	1.75	89.0	87.5	70.0-130			1.70	20
Hexachlorobenzene	2.00	1.70	1.68	85.0	84.0	70.0-130			1.18	20
Indeno(1,2,3-cd)pyrene	2.00	1.78	1.76	89.0	88.0	70.0-130			1.13	20
Naphthalene	2.00	1.66	1.66	83.0	83.0	70.0-130			0.000	20
Phenanthrene	2.00	1.79	1.78	89.5	89.0	70.0-130			0.560	20
Pyrene	2.00	1.72	1.72	86.0	86.0	70.0-130			0.000	20
1-Methylnaphthalene	2.00	1.77	1.77	88.5	88.5	70.0-130			0.000	20
2-Methylnaphthalene	2.00	1.74	1.73	87.0	86.5	70.0-130			0.576	20
2-Chloronaphthalene	2.00	1.72	1.71	86.0	85.5	70.0-130			0.583	20
(S) Nitrobenzene-d5				*87.5*	*85.5*	*31.0-160*				
(S) 2-Fluorobiphenyl				*83.0*	*81.0*	*48.0-148*				
(S) p-Terphenyl-d14				*84.5*	*84.5*	*37.0-146*				

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Abbreviations and Definitions

(dry)	Results are reported based on the dry weight of the sample. [this will only be present on a dry report basis for soils].
MDL	Method Detection Limit.
MDL (dry)	Method Detection Limit.
ND	Not detected at the Reporting Limit (or MDL where applicable).
RDL	Reported Detection Limit.
RDL (dry)	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
(S)	Surrogate (Surrogate Standard) - Analytes added to every blank, sample, Laboratory Control Sample/Duplicate and Matrix Spike/Duplicate; used to evaluate analytical efficiency by measuring recovery. Surrogates are not expected to be detected in all environmental media.
U	Not detected at the Reporting Limit (or MDL where applicable).
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
B	The same analyte is found in the associated blank.
E	The analyte concentration exceeds the upper limit of the calibration range of the instrument established by the initial calibration (ICAL).
J	The identification of the analyte is acceptable; the reported value is an estimate.
J0	J0: The identification of the analyte is acceptable, but the reported concentration is an estimate. The calibration met method criteria.
J1	Surrogate recovery limits have been exceeded; values are outside upper control limits.
J2	Surrogate recovery limits have been exceeded; values are outside lower control limits.
J3	The associated batch QC was outside the established quality control range for precision.
J4	The associated batch QC was outside the established quality control range for accuracy.
J5	The sample matrix interfered with the ability to make any accurate determination; spike value is high.
J6	The sample matrix interfered with the ability to make any accurate determination; spike value is low.

Qualifier	Description
J7	Surrogate recovery cannot be used for control limit evaluation due to dilution.
N	The analyte is tentatively identified and the associated numerical value may not be consistent with the actual concentration present in the sample.
P	RPD between the primary and confirmatory analysis exceeded 40%.
P1	RPD value not applicable for sample concentrations less than 5 times the reporting limit.
V	The sample concentration is too high to evaluate accurate spike recoveries.

Pace National is the only environmental laboratory accredited/certified to support your work nationwide from one location. One phone call, one point of contact, one laboratory. No other lab is as accessible or prepared to handle your needs throughout the country. Our capacity and capability from our single location laboratory is comparable to the collective totals of the network laboratories in our industry. The most significant benefit to our one location design is the design of our laboratory campus. The model is conducive to accelerated productivity, decreasing turn-around time, and preventing cross contamination, thus protecting sample integrity. Our focus on premium quality and prompt service allows us to be YOUR LAB OF CHOICE.
* Not all certifications held by the laboratory are applicable to the results reported in the attached report.
* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace National.

State Accreditations

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN-03-2002-34
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	n/a
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO00356
Kentucky [1 6]	90010	South Carolina	84004
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana [1]	LA180010	Texas	T104704245-18-15
Maine	TN0002	Texas [5]	LAB0152
Maryland	324	Utah	TN00003
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	460132
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	9980939910
Montana	CERT0086	Wyoming	A2LA

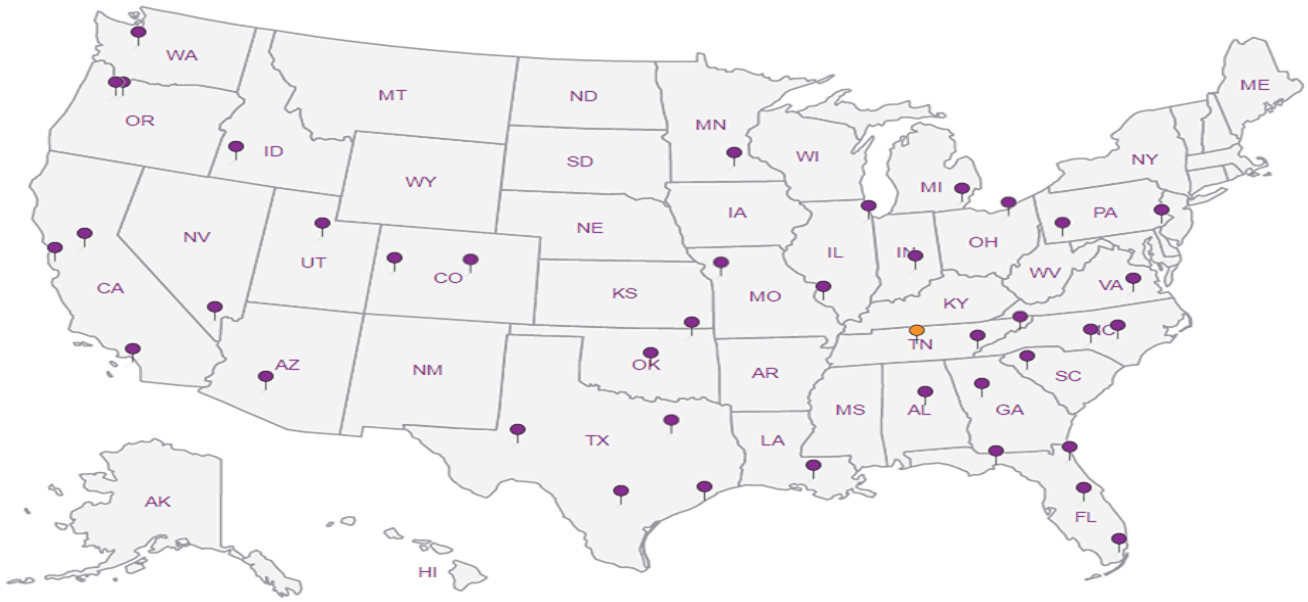
Third Party Federal Accreditations

A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

Our Locations

Pace National has sixty-four client support centers that provide sample pickup and/or the delivery of sampling supplies. If you would like assistance from one of our support offices, please contact our main office. Pace National performs all testing at our central laboratory.



Chain of Custody Page 1 of 4

Pace Analytical® National Center for Testing & Innovation

12065 Lebanon Rd
Mount Juliet, TN 37122
Phone: 615-758-5858
Phone: 800-767-5859
Fax: 615-758-5859

L# 1053540

H229

Acctnum: TTIENVMNJ
Template: T148174
Prelogin: P700694
TSR: 364 - T. Alan Harvill
PB:
Shipped Via: FedEX Ground

TTI Environmental, Inc. - NJ

1253 North Church Street
Moorestown, NJ 08057

Billing Information:
Attn: Accounts Payable
1253 N Church St
Moorestown, NJ 08057

Pres Chk

Report to: Mr. Andy Basehoar

Email To: andyb@ttienv.com

Project Description: CRA

City/State Collected: Camden, NJ

Phone: 856-840-8800
Fax:

Client Project # 19-408

Lab Project #

Collected by (print): Dave DiPascale

Site/Facility ID #

P.O. # 027670

Collected by (signature): Dave M DiPascale

Immediately Packed on Ice N ___ Y ✓

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day

Quote #

Date Results Needed

Analysis / Container / Preservative

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	8270TCLDNJTIC,8082NJ 4ozAmb-NoPres	EPH CAT 1 4ozAmb-NoPres	EPH CAT 2 4ozAmb-NoPres	SV8270PAHDNJTIC 4ozAmb-NoPres	TAL Mtls, TS 2ozClr-NoPres	V8260TCLNJTIC 40ml/NaHSO4/Syr/MeOH	PAHs	TCL/TAL	Naphthalene & 2-methyl naphthalene	SVOCs + Base Neutrals	Remarks	Sample # (lab only)
TP2 C 2-2.5	Grab	SS	2-2.5	3/27/19	9:25	2					X		X					01
TP3 C 3.5-4.0	Grab	SS	3.5-4	3/27/19	10:00	8			X					X				02
SB1 C 9-9.5	Grab	SS	9-9.5	3/27/19	10:35	3		X					Hold		Hold	Hold		03
TP5 C 6.5-7	Grab	SS	6.5-7	3/27/19	11:30	8			X					X				04
TP6 C 0.5-1.0	Grab	SS	0.5-1	3/27/19	12:00	2					X		X					05
SB5 C 9.0-9.5	Grab	SS	9.0-9.5	3/27/19	12:25	3		X					Hold		Hold	Hold		06
TP7 C 8.0-8.5	Grab	SS	8.0-8.5	3/27/19	12:30	1		X					Hold		Hold	Hold		07
TP8 C 8.0-8.5	Grab	SS	8.0-8.5	3/27/19	12:45	1		X					Hold		Hold	Hold		08
TP9 C 8.0-8.5	Grab	SS	8.0-8.5	3/27/19	13:00	1		X					Hold		Hold	Hold		09
SB6 C 4.5-5.0	Grab	SS	4.5-5.0	3/27/19	13:10	6								X				10

* Matrix:
SS - Soil AIR - Air F - Filter
GW - Groundwater B - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other_____

Remarks: for EPH Cat. 1 - Hold PAHs, SVOCs, Naph+2MN pending EPH results. Report all chlordane (cis, trans, total) per TCL/TAL pesticides

pH _____ Temp _____
Flow _____ Other _____

Samples returned via: ___ UPS ___ FedEx ___ Courier SVA

Tracking # Cat 2 - do not fractionate until received by lab

Sample Receipt Checklist
COC Seal Present/Intact: NP Y N
COC Signed/Accurate: Y N
Bottles arrive intact: Y N
Correct bottles used: Y N
Sufficient volume sent: Y N
If Applicable
VOA Zero Headspace: Y N
Preservation Correct/Checked: Y N

Trip Blank Received: Yes / No HCl / MeoH TBR
3

Temp: A3BF°C 2.6-.2=2.4
Bottles Received: 173

If preservation required by Login: Date/Time

Hold:

Condition: NCF / OK

	Date:	Time:	
Relinquished by: (Signature) Dave M DiPascale	3/28/19	1715	Received by: (Signature)
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)
Relinquished by: (Signature)	Date:	Time:	Received for lab by: (Signature) Date: 3/29/19 Time: 1100

TTI Environmental, Inc. - NJ

1253 North Church Street
Moorestown, NJ 08057

Billing Information:
Attn: Accounts Payable
1253 N Church St
Moorestown, NJ 08057

Pres Chk

Report to: Mr. Andy Basehoar

Email To: andyb@ttienv.com

Project Description: CRA

City/State Collected: Camden, NJ

Phone: 856-840-8800
Fax:

Client Project # 19-408

Lab Project #

Collected by (print): Dave D.Pascale

Site/Facility ID #

P.O. # 027670

Collected by (signature): Dave D.Pascale

Immediately Packed on Ice N ___ Y ✓

Rush? (Lab MUST be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day

Quote #

Date Results Needed

Analysis / Container / Preservative

Chain of Custody Page 2 of 4

Pace Analytical®
National Center for Testing & Innovation

12065 Lebanon Rd
Mount Juliet, TN 37122
Phone: 615-758-5858
Phone: 800-767-5859
Fax: 615-758-5859

L #

Table #

Acctnum: TTIENVMNJ
Template: T148174
Prelogin: P700694
TSR: 364 - T. Alan Harvill
PB:

Shipped Via: FedEX Ground

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	8270TCLDNJTIC,8082NJ 4ozAmb-NoPres	EPH CAT 1 4ozAmb-NoPres	EPH CAT 2 4ozAmb-NoPres	SV8270PAHDNJTIC 4ozAmb-NoPres	TAL Mtls, TS 2ozClr-NoPres	V8260TCLNJTIC 40ml/NaHSO4/Syr/MeOH	TCL/TAL	SVOCs SIM Base Neutrals	Naph thru 2 Methylnaphthalene		Remarks	Sample # (lab only)
SB7C 7.5-8.0	Grab	SS	7.5-8.0	3/27/19	13:30	6							X					11
BD032719B	Grab	SS	7.5-8.0	3/27/19	1200	6							X					12
TP10C 8.0-8.5	Grab	SS	8.0-8.5	3/27/19	13:30	1		X		Hold				Hold	Hold			13
BD032719A	Grab	SS	8.0-8.5	3/27/19	1200	1		X		Hold				Hold	Hold			14
SB8C 7.5-8.0	Grab	SS	7.5-8.0	3/27/19	14:00	6							X					15
SB9C 3-3.5	Grab	SS	3.0-3.5	3/27/19	14:15	6							X					16
SB10C 3-3.5	Grab	SS	3.0-3.5	3/27/19	14:35	6							X					17
SB11C 4-4.5	Grab	SS	4.0-4.5	3/27/19	15:15	6							X					18
Field Blank	Grab	SSGW	—	3/27/19	1500	12							X					19
Equipment Blank	Grab	SSGW	—	3/27/19	1530	12							X					20

* Matrix:
SS - Soil AIR - Air F - Filter
GW - Groundwater B - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other_____

Remarks: For EPH cat. 1 - Hold PAHs, SVOCs, Naph thru 2MN pending EPH results. Report all chlordane (cis, trans, total) for TCL/TAL pesticides

pH _____ Temp _____

Flow _____ Other _____

Samples returned via: __ UPS __ FedEx __ Courier SVA

Tracking # EPHL- don't fractionate until received by TTI

Sample Receipt Checklist
COC Seal Present/Intact: ✓NP __Y __N
COC Signed/Accurate: __Y __N
Bottles arrive intact: __Y __N
Correct bottles used: __Y __N
Sufficient volume sent: __Y __N
If Applicable
VOA Zero Headspace: __Y __N
Preservation Correct/Checked: __Y __N

Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)
Dave D.Pascale	3/28/19	1715	
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature)

Trip Blank Received: Yes / No HCL / MeoH TBR
3

Temp: A3 BF °C 2.0-.2=2.4 Bottles Received: 173

Date: 3/29/19 Time: 1100

If preservation required by Login: Date/Time

Hold:

Condition: NCF / OK

TTI Environmental, Inc. - NJ

1253 North Church Street
Moorestown, NJ 08057

Billing Information:
Attn: Accounts Payable
1253 N Church St
Moorestown, NJ 08057

Pres Chk

Report to: Mr. Andy Basehoar

Email To: andyb@ttienv.com

Project Description: CRA

City/State Collected: Camden, NJ

Phone: 856-840-8800
Fax:

Client Project # 19-408

Lab Project #

Collected by (print): Dave DiPascale

Site/Facility ID #

P.O. # 027670

Collected by (signature): Dave M DiPascale

Immediately Packed on Ice N ___ Y ✓

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day

Quote #

Date Results Needed

Analysis / Container / Preservative

Chain of Custody Page 3 of 4

Pace Analytical® National Center for Testing & Innovation

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Mount Juliet, TN 37122
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Fax: 615-758-5859

L #

Table #

Acctnum: TTIENVMNJ
Template: T148174
Prelogin: P700694
TSR: 364 - T. Alan Harvill
PB:
Shipped Via: FedEX Ground

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	8270TCLDNJTIC,8082NJ 4ozAmb-NoPres	EPH CAT 1 4ozAmb-NoPres	EPH CAT 2 4ozAmb-NoPres	SV8270PAHDNJTIC 4ozAmb-NoPres	TAL Mtls, TS 2ozClr-NoPres	V8260TCLNJTIC 40ml/NaHSO4/Syr/MeOH	TCL VOCs	TCL/TAL	SVOC Base Neutrals	PCBs	Remarks	Sample # (lab only)
Trip Blank	Grab	SS	—	—	—	2 BF							X					21
SB12C 9.5-10	Grab	SS	9.5-10	3/28/19	8:30	6								X				22
SB13C 5.5-6	Grab	SS	5.5-6	3/28/19	10:00	6 BF			X	HOLD	HOLD		HOLD		HOLD	HOLD		31
MS/MSD	Grab	SS	5.5-6	3/28/19	10:00	8 BF 1/6							X	X				31
Field Blank	Grab	SS	—	3/28/19	10:45	8 BF 2			X					X				23 25
Equipment blank	Grab	SS	—	3/28/19	11:00	12			X					X				24 26
SB16C 8.5-9.0	Grab	SS	8.5-9	3/28/19	12:10	6			X					X				25 27
SB17C 8.5-9.0	Grab	SS	8.5-9	3/28/19	12:25	6			X	HOLD	HOLD		HOLD		HOLD	HOLD		26 28
BD 032819	Grab	SS	8.5-9	3/28/19	12:00	6			X	HOLD	HOLD		HOLD		HOLD	HOLD		27 29
SB18C 8.5-9	Grab	SS	8.5-9	3/28/19	13:00 BF	6			X					X				28 30

19 3/29

* Matrix:
SS - Soil AIR - Air F - Filter
GW - Groundwater B - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other_____

Remarks:

pH _____ Temp _____

Flow _____ Other _____

Sample Receipt Checklist
COC Seal Present/Intact: ✓NP ___Y ___N
COC Signed/Accurate: ___Y ___N
Bottles arrive intact: ___Y ___N
Correct bottles used: ___Y ___N
Sufficient volume sent: ___Y ___N
If Applicable
VOA Zero Headspace: ___Y ___N
Preservation Correct/Checked: ___Y ___N

Samples returned via: ___UPS ___FedEx ___Courier SVA

Tracking #

Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)
Dave M DiPascale	3/28/19	1715	
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)
Relinquished by: (Signature)	Date:	Time:	Received for lab by: (Signature)

Trip Blank Received: Yes / No
HCL / MeoH
TBR
3

Temp: A3BF °C
2.6-.2=2.4

Bottles Received: 173

Date: 3/29/19 Time: 1100

If preservation required by Login: Date/Time

Hold:

Condition: NCF / OK

TTI Environmental, Inc. - NJ

1253 North Church Street
Moorestown, NJ 08057

Billing Information:
Attn: Accounts Payable
1253 N Church St
Moorestown, NJ 08057

Pres Chk

Report to: Mr. Andy Basehoar

Email To: andyb@ttienv.com

Project Description: CLA

City/State Collected: Camden, NJ

Phone: 856-840-8800
Fax:

Client Project # 19-406

Lab Project #

Collected by (print): Dave DiPascale

Site/Facility ID #

P.O. # 027670

Collected by (signature): David M DiPascale

Immediately Packed on Ice N ___ Y ✓

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day

Date Results Needed

Quote #

No. of Cntrs: 1

Analysis / Container / Preservative

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	8270TCLDNJTIC,8082NJ 4ozAmb-NoPres	EPH CAT 1 4ozAmb-NoPres	EPH CAT 2 4ozAmb-NoPres	SV8270PAHDNJTIC 4ozAmb-NoPres	TAL Mtls, TS 2ozClr-NoPres	V8260TCLNJTIC 40ml/NaHSO4/Syr/MeOH	Naphthalene & 2 Methyl naphthalene	TCL VOCs +15	Base Neutrals		Remarks	Sample # (lab only)
SB 20C 2.0-2.5	Grab	SS	2-2.5	3/28/19	1315		X					HOLD		HOLD			29 3/1 MS
Trip Blank	—	SS	—		—								X				30 3/2 3/29
		SS															
		SS															
		SS															

* Matrix:
SS - Soil AIR - Air F - Filter
GW - Groundwater B - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other_____

Remarks:

pH _____ Temp _____

Flow _____ Other _____

Samples returned via: __ UPS __ FedEx __ Courier SVA

Tracking #

Sample Receipt Checklist
COC Seal Present/Intact: ✓NP __Y __N
COC Signed/Accurate: __Y __N
Bottles arrive intact: __Y __N
Correct bottles used: __Y __N
Sufficient volume sent: __Y __N
If Applicable
VOA Zero Headspace: __Y __N
Preservation Correct/Checked: __Y __N

Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)
David M DiPascale	3/28/19	1715	
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature)

Trip Blank Received: Yes / No
HCl / MeoH
TBR
3

Temp: A3BF°C 2.6-.2=2.4

Bottles Received: 173

Date: 3/29/19 Time: 1100

If preservation required by Login: Date/Time

Hold:

Condition: NCF / OK

Chain of Custody Page 4 of 4

Pace Analytical®
National Center for Testing & Innovation

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Mount Juliet, TN 37122
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Phone: 800-767-5859
Fax: 615-758-5859

L #

Table #

Acctnum: TTIENVMNJ
Template: T148174
Prelogin: P700694
TSR: 364 - T. Alan Harvill
PB:

Shipped Via: FedEx Ground

Kelsey Stephenson

Pace Analytical®
National Center for Testing & Innovation

Login #:L1083840	Client:TTIENVMNJ	Date:03/29	Evaluated by:Kelsey S

Non-Conformance (check applicable items)

	Sample Integrity		Chain of Custody Clarification		
	Parameter(s) past holding time	X	Login Clarification Needed		**If Broken Container:**
	Temperature not in range		Chain of custody is incomplete		Insufficient packing material around container
	Improper container type		Please specify Metals requested.		Insufficient packing material inside cooler
	pH not in range.		Please specify TCLP requested.		Improper handling by carrier (FedEx / UPS / Courie
	Insufficient sample volume.		Received additional samples not listed on coc.		Sample was frozen
	Sample is biphasic.		Sample ids on containers do not match ids on coc		Container lid not intact
	Vials received with headspace.		Trip Blank not received.		**If no Chain of Custody:**
	Broken container		Client did not "X" analysis.		Received by:
	Broken container:		Chain of Custody is missing		Date/Time:
	Sufficient sample remains				Temp./Cont. Rec./pH:
					Carrier:
					Tracking#

Login Comments: Need clarification that SB13 5.5-6 is the sample being MS/MSD'd. The analysis are different.

Client informed by:	x	Call		Email		Voice Mail		Date: 4/1/19	Time: 11:26
TSR Initials: TAH	Client Contact: David DiPascale								

Login Instructions:

Log SB-13 5.5-6 for TALTCL and EPHNJ- MS/MSD for these analyses.

Andy Vann

From: Alan Harvill
Sent: Friday, April 05, 2019 9:53 AM
To: Login; SOIL PREPREP; Wet Lab
Subject: L1083840 TTIENVMNJ ** ADD ANALYSES**

Per client instruction, please add CR6 and CR3 to L1083840-02, -05, -16, -18

Change due date for L1083840 to 4/12

Thanks,

Alan Harvill
Project Manager

Pace Analytical National Center for Testing & Innovation
12065 Lebanon Road | Mt. Juliet, TN 37122
615.773.9787 | Cell 615.924.6783
aharvill@pacenational.com | pacenational.com ESC Lab Sciences is now Pace Analytical National Center for Testing & Innovation! Please make note of my new email address and website.

-----Original Message-----
From: Andy Basehoar [mailto:andyb@ttienv.com]
Sent: Friday, April 05, 2019 8:32 AM
To: Alan Harvill
Cc: David DiPascale
Subject: RE: Pace Analytical National Login for 19-408 CRA L1083840

Hi Alan,

We are going to need both tri and hex chromium run for TP2 @2-2.5, TP3@3.5-4, TP6@0.5-1.0, SB9@3-3.5, SB-11@4-4.5.

Thanks!

--
Andy Basehoar, PG
Project Manager
TTI ENVIRONMENTAL, INC.
1253 North Church Street, Moorestown, NJ 08057

p 856-840-8800 x 27 | f 856-840-8815 |

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----Original Message-----
From: T. Alan Harvill <aharvill@pacenational.com>
Sent: Tuesday, April 2, 2019 5:23 PM

To: Andy Basehoar <andyb@ttienv.com>
Subject: Pace Analytical National Login for 19-408 CRA L1083840

Thank you for choosing Pace National! Please find enclosed PDF files containing your laboratory login confirmation and chain of custody.

Pace National is leading the laboratory industry with our On-line Data Management tools. Please contact your Project Manager to learn how to create historical Excel tables or access data in real time using powerful and intuitive software that is only available at https://www.pacenational.com.

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T. Alan Harvill
Technical Service Representative
615-773-9787

Pace Analytical National
12065 Lebanon Rd.
Mt. Juliet, TN 37122

DATA OF KNOWN QUALITY CONFORMANCE/NON-CONFORMANCE SUMMARY QUESTIONNAIRE

Laboratory Name: Pace National

Client: TTI Environmental, Inc.

Project Location: Camden, NJ

Project Number: 19-408

Laboratory Sample ID(s): L1083840-01-31

Sampling Date(s): 3/27-3/28/19

List DKQP Methods Used (e.g., 8260, 8270, et cetera) 7471,6010,7196,9012,8260,8270,8082 EPH

1	For each analytical method referenced in this laboratory report package, were all specified QA/QC performance criteria followed, including the requirement to explain any criteria falling outside of acceptable guidelines, as specified in the NJDEP Data of Known Quality performance standards?	x Yes ☐ No
1A	Were the method specified handling, preservation, and holding time requirements met?	x Yes ☐ No
1B	*EPH Method*: Was the EPH method conducted without significant modifications (see Section 11.3 of respective DKQ methods)	☐ Yes ☐ No x N/A
2	Were all samples received by the laboratory in a condition consistent with that described on the associated chain-of-custody document(s)?	x Yes ☐ No
3	Were samples received at an appropriate temperature (4±2° C)?	x Yes ☐ No ☐ N/A
4	Were all QA/QC performance criteria specified in the NJDEP DKQP standards achieved?	☐ Yes x No
5	a) Were reporting limits specified or referenced on the chain-of-custody or communicated to the laboratory prior to sample receipt? b) Were these reporting limits met?	x Yes ☐ No ☐ Yes x No ☐ NA
6	For each analytical method referenced in this laboratory report package, were results reported for all constituents identified in the method-specific analyte lists presented in the DKQP documents and/or site-specific QAPP?	x Yes ☐ No
7	Are project-specific matrix spikes and/or laboratory duplicates included in this data set?	☐ Yes x No

Notes: For all questions to which the response was "No" (with the exception of question #7), additional information should be provided in an attached narrative. If the answer to question #1, #1A, or #1B is "No", the data package does not meet the requirements for "Data of Known Quality."

782823, LSR190001, 19-04-16-1539-53, HB241999, (Directory: L1083840) - Passed

DEP SRPEDD <SRPEDD@dep.nj.gov>

Tue 6/4/2019 3:38 PM

To: Alec Halbruner <alech@ttienv.com>

9 attachments (534 KB)

DTST.TXT; EDSA_Error_Log.html; erdtst-7-1-8.txt; erresult-7-1-8.txt; ersample-7-1-8.txt; HZRESULT.TXT; HZSAMPLE.TXT; rstp-7-1-8.txt; SampleLoc-7-1-8.KML;

The EDD submission via email from (alech@ttienv.com) on (5/31/2019 3:50:44 PM) with the subjectline "[EXTERNAL] PI 782823, LSR190001"

The following identifiers were in the DTST file:

- Directory: L1083840
- DESC: CRA MARCH 2019 SOIL SAMPLING
- SRPID: 782823
- Submit Date: 5/31/2019

This submission has been issued an SRP Catalog ID: HB241999

Submission status: Passed.

Please do **not** resubmit.

EDD data deliverable must be submitted only once.
- To fulfill Key Document requirements attach only a copy of this email as an appendix to the document.
- Do **not** resubmit any approved EDD deliverable as part of a portal submission.

Email ID: OEM_32111

Sub ID:SUB_337159